TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

AGENDA ITEM REQUEST

for Final Approval of an Implementation Plan

AGENDA REQUESTED: August 19, 2015

DATE OF REQUEST: July 31, 2015

NAME & NUMBER OF PERSON TO CONTACT REGARDING CHANGES TO THIS REQUEST, IF NEEDED: Derek Baxter, (512) 239-2613

CAPTION: Docket No. 2014-1279-TML. Consideration for final approval of a draft Implementation Plan for Eleven Total Maximum Daily Loads for Bacteria in Waters of the Upper Gulf Coast in Brazoria, Chambers, Galveston, and Harris Counties.
(Ron Stein, Robert Brush) (Project No. 2014-035-TML-NR.)

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Texas Commission on Environmental Quality
Interoffice Memorandum

To: Commissioners **Date:** July 31, 2015

Thru: Bridget C. Bohac, Chief Clerk
Richard A. Hyde, P.E., Executive Director

From: L'Oreal W. Stepney, P.E., Deputy Director
Office of Water

Docket No. 2014-1279-TML

Subject: Final Commissioner approval of a draft *Implementation Plan for Eleven Total Maximum Daily Loads for Bacteria in Waters of the Upper Gulf Coast in Brazoria, Chambers, Galveston, and Harris Counties*
Rule Project No. 2014-035-TML-NR

Requested Action:
The executive director requests the Commissioners' final approval of a draft *Implementation Plan for Eleven Total Maximum Daily Loads for Bacteria in Waters of the Upper Gulf Coast in Brazoria, Chambers, Galveston, and Harris Counties.*

Background and Current Practice:
The document *Six Total Maximum Daily Loads for Bacteria in Waters of the Upper Gulf Coast* was prepared as required by federal Clean Water Act, Section 303(d). The Texas Commission on Environmental Quality (TCEQ or commission) adopted the TMDL on August 20, 2008, and the United States Environmental Protection Agency (EPA) approved the TMDL on February 4, 2009. Subsequent amendments to the State of Texas Water Quality Management Plan (WQMP) added newly listed water bodies within the original TMDL watershed, bringing the total number of assessment units (AUs) involved to eleven. These amendments to the WQMP were approved by the EPA in April and August of 2012, respectively.

The Implementation Plan (I-Plan) describes the strategy and activities the TCEQ and watershed partners will carry out to improve water quality in the affected watersheds. The next step is to request that the commission consider approval of the final I-Plan. The I-Plan, combined with the TMDL, provides local, regional, and state organizations with a comprehensive strategy for improving and maintaining water quality in an impaired watershed.

Comments on the Implementation Plan Document:
Thirteen comments were received from residents and entities concerned about issues within the project watershed. The comments were addressed in a response to comments table and did not result in changes to the I-Plan document.

Docket No. 2014-1279-TML

Consideration:
Consideration for final approval of an I-Plan for eleven TMDLs corresponding to AUs in nine segments for bacteria in Upper Galveston Bay, Trinity Bay, East Bay, West Bay, Chocolate Bay, Bastrop Bay/Oyster Lake, Christmas Bay, Drum Bay, and Lower Galveston Bay (Segments 2421OW – 2424OW, 2432OW – 2435OW, and 2439OW) in Brazoria, Chambers, Galveston, and Harris Counties.

Effect on the Regulated Community:
Efforts delineated in the Management Measures would assist the operators of wastewater treatment facilities with renewal of and compliance with permits. Facilities in the project area (within one stream mile of the listed segments) will be encouraged to participate in the Sanitary Sewer Overflow Initiative developed by the TCEQ. Marinas will be encouraged to make boaters aware of regulations prohibiting the discharge of raw or treated sewage in area waterways and appropriate agencies will be encouraged to enforce existing regulations.

Stakeholder Involvement:
The Upper Gulf Coast Oyster Waters Coordination Committee, facilitated by the Galveston Bay Foundation, began working on the I-Plan in February 2010. The Coordination Committee is a diverse group of concerned citizens, agencies, industries, and businesses concerned with the quality of water in the Galveston Bay area.

Five work groups were formed to draft the I-Plan. The work groups included: Wastewater Treatment Facilities, On-site Sewage Facilities, Boater Waste, Policy and Outreach, and Science and Monitoring. The work groups met regularly for two years to complete the draft of the I-Plan and continue to meet in order to move forward with implementation of the plan. In 2013, the Science and Monitoring Work Group was absorbed into other work groups as a result of the need for stakeholders to discuss the information integrally instead of separately from other groups. The Science and Monitoring Work Group may be reformed in the future if the stakeholders deem it appropriate.

The members of the five work groups developed sections of the I-Plan, which were then compiled into a single document by the Stakeholder Advisory Group. The I-Plan has three Management Measures:

1. Wastewater Treatment Facilities - Improve guidance and training to owners and operators for sampling bacteria, provide technical assistance, increase compliance and enforcement in consultation with the TCEQ regional offices, reduce collection system overflow events, and encourage facilities to ensure compliance with bacteria sampling requirements.

2. On-Site Sewage Facilities - Create a regional plan to identify, prioritize, and address failing systems in the Upper Gulf Oyster Waters area.

3. Boater Waste - Increase the number of pump-out stations, better enforce existing regulations through collaboration with the United States Coast Guard and area Texas Parks and Wildlife Department Game Wardens, enhance education and outreach in the Galveston Bay and Clear Lake areas, and investigate having Galveston Bay designated as a No Discharge Zone by the EPA.

Information on past and future meetings for the Upper Gulf Coast Oyster Waters I-Plan is posted on the TCEQ website at: *http://www.tceq.texas.gov/waterquality/tmdl/74-uppercoastoyster.html*.

Potential Controversial Concerns and Legislative Interest:
There are no controversial concerns or legislative interest at this time.

Key Dates in the TMDL I-Plan Schedule:
The I-Plan identifies responsible parties, technical and financial needs, monitoring and outreach efforts, and a schedule of activities for each of the Management Measures. The plan describes the process that the TCEQ and stakeholders will use to assess progress and adjust the plan periodically. The TCEQ will participate in annual stakeholder meetings, for a maximum time of five years, so that the group can evaluate their progress. The TCEQ and stakeholders will track the progress of the I-Plan using both programmatic and water quality indicators. The TCEQ will report results and evaluations from implementation tracking to stakeholders as needed.

Key Points in the TMDL Approval Schedule:
***Texas Register* publication date:** April 17, 2015
Public meeting dates: April 27-28, 2015
Public comment period: April 17, 2015 - May 18, 2015
Anticipated approval date: August 19, 2015

Agency contacts:
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Robert Brush, Staff Attorney, (512) 239-5600, Environmental Law Division
Derek Baxter, Texas Register Coordinator, (512) 239-2613

Attachments

cc: Chief Clerk, 7 copies

Response to Public Comments

Implementation Plan for Eleven Total Maximum Daily Loads for Bacteria in Waters of the Upper Gulf Coast

Tracking Number	Date Received	Affiliation of Commenter	Summary of Request or Comment	Summary of TCEQ Action, or Explanation
001	4/23/15	Citizen	Commenter urges support of measure to protect Galveston Bay and its oysters to the fullest extent possible.	The TCEQ appreciates the supportive comment and encourages the commenter to participate in the Coordination Committee activities to support the Implementation Plan.
002	4/24/15	Citizen	As a long-time boater, commenter supports measures to increase enforcement of present regulations on operation and maintenance of Marine Sanitation Devices (MSDs) and efforts to eliminate discharges from MSDs.	The TCEQ appreciates the supportive comment and encourages the commenter to participate in the Coordination Committee activities to support the Implementation Plan.
003	4/22/15	Citizen	Commenter is supportive of all proposals to help the oyster harvests and mentions a problem in San Leon of ditch dumping of garbage that is running into the bay.	The TCEQ appreciates the supportive comment and encourages the commenter to participate in the Coordination Committee activities to support the Implementation Plan.
004	4/23/15	Citizen	As a Clear Lake and Galveston Bay boater, commenter strongly supports all the recommendations of the Galveston Bay Bacteria Reduction Plan.	The TCEQ appreciates the supportive comment and encourages the commenter to participate in the Coordination Committee activities to support the Implementation Plan.
005	4/23/15	Citizen	Commenter supports the plan for a cleaner Galveston Bay noting her family has lived on the Island since 1841. She cites oyster production and other shellfish harvesting as benefits to Texans.	The TCEQ appreciates the supportive comment and encourages the commenter to participate in the Coordination Committee activities to support the Implementation Plan.

Tracking Number	Date Received	Affiliation of Commenter	Summary of Request or Comment	Summary of TCEQ Action, or Explanation
006	4/24/15	Citizen	Commenter lives on Galveston Bay and indicated she can see the changes in water quality over time. She says the plan is well thought out and would benefit everyone in the area.	The TCEQ appreciates the supportive comment and encourages the commenter to participate in the Coordination Committee activities to support the Implementation Plan.
007	4/23/15	Citizen	Commenter supports the plan, expecially measures dealing with runoff from Houston and the other cities. Commenter says we need to find out what's being sent into the Bay.	The TCEQ appreciates the supportive comment and encourages the commenter to participate in the Coordination Committee activities to support the Implementation Plan.
008	4/24/15	Citizen	Commenter grew up in the area, frequently sails Galveston Bay, and indicates she has seen the decline in both the health and appearance of the local waters. She is saddened that future generations may never have the opportunity to enjoy the prosperity and leisure that the bay offers. Together, she says, we can make a difference and preserve our natural resources.	The TCEQ appreciates the supportive comment and encourages the commenter to participate in the Coordination Committee activities to support the Implementation Plan.
009	4/23/15	Citizen	Commenter states she recently moved back to Bolivar, where her family has lived since the mid-1800s. She praises measures which have increased the number of birds, dolphins, crabs, and fish. She laments the “encroachment of slime” and increased levels of bacteria in the waters. She calls for more education and will support any legislation to improve area waters for residents and numerous visitors.	The TCEQ appreciates the supportive comment and encourages the commenter to participate in the Coordination Committee activities to support the Implementation Plan.

Tracking Number	Date Received	Affiliation of Commenter	Summary of Request or Comment	Summary of TCEQ Action, or Explanation
010	4/23/15	Citizen	Commenter commends and supports the plan to improve the Bays.	The TCEQ appreciates the supportive comment and encourages the commenter to participate in the Coordination Committee activities to support the Implementation Plan.
011	4/26/15	Sierra Club	At the April 27, 2015, public meeting in League City, commenter read a letter containing comments on nine specific parts of the plan, referenced by page number. The letter expresses support of all plan measures referenced, but wishes Management Measures were required rather than voluntary. The letter recommends that "Field Days" and "Roundtables" be strategies used under Guidance and Training. The letter called for education to avoid degradation of riparian areas.	The TCEQ appreciates the supportive comments and encourages the commenter to participate in the Coordination Committee activities to support the Implementation Plan. The Committee will seriously consider all the suggestions given.
012	5/18/15	Harris County Pollution Control Services Department (HCPCSD)	The HCPCSD plays an active role in regulating bacteria sources in Harris County that may impact upper Galveston Bay. The HCPCSD expressed support of the proposed I-Plan.	The TCEQ appreciates the supportive comment and encourages Harris County to participate in the Coordination Committee activities to support the Implementation Plan.
013	4/28/15	Citizen	The commenter called on the group to direct the Texas Park and Wildlife Department to propose rules to govern the cultivation of oysters by local landowners while protecting the waters used for such cultivation.	The TCEQ appreciates the supportive comment and encourages the commenter to participate in the Coordination Committee activities to support the Implementation Plan.

Tracking Number	Date Received	Affiliation of Commenter	Summary of Request or Comment	Summary of TCEQ Action, or Explanation
Summary			TCEQ appreciates the comments received in regards to this project.	No changes were made to the document in response to any of the public comments.

Approved August 19, 2015

Implementation Plan for Eleven Total Maximum Daily Loads for Bacteria in Waters of the Upper Gulf Coast

Segments: 2421OW, 2422OW, 2423OW, 2424OW, 2432OW, 2433OW, 2434OW, 2435OW, and 2439OW

Assessment Units: 2421OW_01, 2421OW_02, 2422OW_01, 2423OW_01, 2424OW_02, 2432OW_01, 2433OW_02, 2434OW_01, 2435OW_01, 2435OW_02, 2439OW_01

Produced by the Galveston Bay Oyster Waters TMDL Stakeholders

In cooperation with the Galveston Bay Foundation
and the TMDL Team, Water Quality Planning Division, TCEQ

This plan was produced by the Coordination Committee of the Galveston Bay Oyster Waters TMDL Stakeholders and the five stakeholder Workgroups organized by the Galveston Bay Foundation.

In compliance with the Americans with Disabilities Act, this document may be requested in alternate formats by contacting the TCEQ at 512/239-0028, Fax 239-4488, or 1-800-RELAY-TX (TDD), or by writing P.O. Box 13087, Austin, TX 78711-3087.

Distributed by the
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TMDL Implementation Plans are also available on the TCEQ website at:
www.tceq.texas.gov/waterquality/tmdl/

In photo: Community-based oyster reef restoration on Sweetwater Preserve – Galveston, TX

GALVESTON BAY FOUNDATION

www.galvbay.org

Galveston Bay Bacteria Reduction Plan

Funded by: TCEQ

This plan was produced by the Coordination Committee of the Galveston Bay Oyster Waters TMDL Stakeholders and the five stakeholder Workgroups organized by the Galveston Bay Foundation.

Organizations engaged in the development of this document include:

City of Galveston
City of La Porte
City of League City
City of Seabrook
Clear Lake City Water Authority
Clear Lake Marina Association
Galveston Bay Estuary Program
Galveston County Health District
Gulf Coast Waste Disposal Authority
Harris County Pollution Control Services
Houston-Galveston Area Council
Houston Sail and Power Squadron
Marina Association of Texas
Maritime Sanitation
Texas AgriLife Extension Service
Texas Coastal Watershed Program
Texas Department of State Health Services
Texas Parks and Wildlife Department
Texas Sea Grant College Program
Texas Water Utilities Association – Gulf Coast Chapter
University of Houston – Clear Lake
U.S. Coast Guard
U.S. Coast Guard Auxiliary

The Texas Commission on Environmental Quality approved this plan on August 19, 2015.

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Acronyms and Abbreviations

AU	assessment unit
BMP	best management practice
CFU	colony forming units
CMOM	Capacity, Management, Operation, and Maintenance
CVA	Clean Vessel Act
CWA	Clean Water Act
DBWP	Dickinson Bayou Watershed Partnership
E. coli	*Escherichia coli*
EIH	Environmental Institute of Houston
FOG	fats, oil, and grease
GBF	Galveston Bay Foundation
GIS	geographic information system
GLO	Texas General Land Office
GPS	Global Positioning System
H-GAC	Houston-Galveston Area Council
HOA	Home Owners Association
I-Plan	implementation plan
LA	load allocation
LID	low impact development
mL	milliliter
MGD	million gallons per day
MM	management measure
MOS	margin of safety
MSD	marine sanitation device
MS4	municipal separate storm sewer system
NDZ	No Discharge Zone
NPDES	National Pollutant Discharge Elimination System
OSSF	on-site sewage facility
PCS	Harris County Pollution Control Services Department
PHZ	Prohibited Harvest Zone
RHZ	Restricted Harvest Zone
SBLGA	Small Business and Local Government Assistance
SSO	sanitary sewer overflow
SSOI	Sanitary Sewer Overflow Initiative
TAES	Texas AgriLife Extension Service
TCEQ	Texas Commission on Environmental Quality
TDSHS	Texas Department of State Health Services
TEEX	Texas Engineering Extension Service
TMDL	Total Maximum Daily Load
TPDES	Texas Pollutant Discharge Elimination System
TPWD	Texas Parks and Wildlife Department
TSSWCB	Texas State Soil and Water Conservation Board
TWUA	Texas Water Utilities Association
UGCOW	Upper Gulf Coast Oyster Waters
U.S. EPA	U.S. Environmental Protection Agency
WEAT	Water Environment Association of Texas
WLA	wasteload allocation
WQMP	Water Quality Management Plan
WWTF	wastewater treatment facility

Implementation Plan for Eleven TMDLs for Bacteria in Waters of the Upper Gulf Coast

Executive Summary

Six Total Maximum Daily Loads (TMDL) for Bacteria in Waters of the Upper Gulf Coast (Segments 2421OW, 2422OW, 2423OW, 2424OW, 2432OW, 2433OW, 2434OW, 2435OW, 2439OW) were adopted by the Texas Commission on Environmental Quality (TCEQ) on August 20, 2008, and approved by the U.S. Environmental Protection Agency (U.S. EPA) on February 4, 2009. Subsequent amendments to the State of Texas Water Quality Management Plan (WQMP) added newly listed water bodies within the original TMDL watershed, bringing the total number of assessment units (AUs) involved to eleven. Therefore, this Implementation Plan (I-Plan) addresses bacteria impairments for oyster waters use in eleven AUs of nine segments in Galveston Bay:

- Upper Galveston Bay, Segment 2421OW (AU 2421OW_01 and 2421OW_02)
- Trinity Bay, Segment 2422OW (AU 2422OW_01)
- East Bay, Segment 2423OW (AU 2423OW_01)
- West Bay, Segment 2424OW (AU 2424OW_02)
- Chocolate Bay, Segment 2432OW (AU 2432OW_01)
- Bastrop Bay/Oyster Lake, Segment 2433OW (AU 2433OW_02)
- Christmas Bay, Segment 2434OW (AU 2434OW_01)
- Drum Bay, Segment 2435OW (AU 2435OW_01 and 2435OW_02)
- Lower Galveston Bay Segment 2439OW (AU 2439OW_01)

With the desired levels of water quality established by the TMDL, the second part of the process is an I-Plan which describes the strategy and activities the watershed partners will carry out to improve water quality in the affected watershed.

The TMDL identified potential regulated and unregulated sources of fecal coliform. For instance, seventeen domestic wastewater treatment facilities (WWTFs) discharge directly into or near the project-area segments. Potential unregulated bacteria sources identified in the TMDL include urban stormwater runoff, malfunctioning on-site sewage facilities (OSSFs), and boater waste.

The goal of this I-Plan is to reduce bacteria concentrations in Waters of the Upper Gulf Coast to levels that meet the oyster waters use as defined in the Texas Surface Water Quality Standards. This plan documents three stakeholder-developed management measures that will be used to reduce bacteria contributions.

Management Measures (voluntary activities)

1) Wastewater Treatment Facilities – Improve guidance and training to owners and operators for sampling bacteria, provide technical assistance, increase

enforcement, reduce collection system overflow events, and encourage facilities to ensure compliance before bacteria sampling is required.

2) On-Site Sewage Facilities – Create a regional plan to identify, prioritize, and address failing systems in the Upper Gulf Coast area.
3) Boater Waste – Increase the number of pump-out stations, raise the level of enforcement, enhance education and outreach in the Galveston Bay and Clear Lake areas, and ultimately have Galveston Bay designated as a No Discharge Zone (NDZ).

This I-Plan identifies the responsible parties, technical and financial needs, monitoring and outreach efforts, and a schedule of activities for each of the management measures. It describes the process that will be used to assess progress and how to adjust the plan periodically based on results. The TCEQ will post stakeholder progress in conducting implementation activities, along with other successes toward improving water quality, on the TCEQ web page for the I-Plan.

Introduction

To restore and maintain water quality in impaired rivers, lakes, and bays, the TCEQ works with stakeholders to facilitate the development of an I-Plan for each adopted TMDL. A TMDL is a technical analysis that:

- determines the amount of a particular pollutant that a water body can receive and still meet applicable water quality standards, and
- establishes water quality goals for different categories of sources that will result in achieving water quality standards.

This I-Plan is designed to guide activities that will achieve the water quality goals for Waters of the Upper Gulf Coast as defined in the adopted TMDLs. This I-Plan is a flexible tool that governmental and nongovernmental organizations involved in implementation can use to guide their activities to reduce bacteria loads. The participating partners may accomplish the activities described in this I-Plan through rule, order, guidance, or other appropriate formal or informal action.

This I-Plan contains the following components:

1) A description of the management measures that will be implemented to achieve the water quality target.
2) A schedule for implementing activities (Appendix A).
3) A follow-up tracking and monitoring plan to determine the effectiveness of the management measures undertaken.
4) Identification of measurable outcomes and other considerations the stakeholders will use to determine whether the I-Plan activities are on schedule, water quality is improving, or the plan needs to be modified.

5) Identification of the communication strategies that will be used to disseminate information to stakeholders.
6) A review strategy that stakeholders will use to periodically review and revise the plan to ensure there is continued progress in improving water quality.

This I-Plan also includes causes and sources of the bacterial impairment, management measure descriptions, estimated potential load reductions, technical and financial assistance needed, educational components for each measure, schedule of implementation, measurable milestones, indicators to measure progress, monitoring components, and responsible entities as referenced in the *Nonpoint Source Program Grants Guidelines for States and Territories* (U.S. EPA, 2013). Consequently, projects developed to implement unregulated (nonpoint) source elements of this plan that meet the grant program conditions may be eligible for funding under the U.S. EPA's Section 319(h) grant program.

Summary of the TMDL

The following sections summarize key parts of the TMDLs for Bacteria in Waters of the Upper Gulf Coast, as stated by TCEQ. Additional background information, including the problem definition, endpoint identification, source analysis, linkages between sources and receiving waters, and seasonal variation can be found in the full TMDL document (TCEQ, 2008a). In-depth monitoring by TCEQ and the Texas Department of State Health Services (TDSHS) is continuously carried out in the segments of the Upper Gulf Coast Oyster Waters (UGCOW) for water body assessment, which can also be used to further refine source identification.

Watershed Overview

Galveston Bay is 56 kilometers long and 31 kilometers wide at its extreme points. It has a total surface area of more than 1,300 square kilometers (TCEQ, 2008a). Contiguous land use around Galveston Bay ranges from wetlands and undisturbed pasture to agricultural use and urban development (Figure 1). Greater detail of land use surrounding each of the nine segments can be found in the TMDLs. Restricted Harvest Zones (RHZs) are areas where oyster harvesting is allowed, but not for direct marketing. The percentage of each segment designated as RHZs varies from 25 percent of East Bay to 100 percent of Chocolate Bay (TCEQ, 2008a). Table 1 shows the original listing date for each of the impairments and the area included in the RHZ.

The criteria for oyster waters use are based on fecal coliform concentrations. If the minimum sample requirement is met (ten samples during the previous five years), then the oyster waters use is not supported when median fecal coliform concentrations in bay and gulf waters, exclusive of 1,000-foot buffer zones along shorelines where oyster harvesting is always prohibited:

- exceed 14 colonies per 100 mL; and/or

- the 90th percentile of all samples exceeds 43 colonies per 100 mL

The 1,000-foot buffer zone provides public health protection against runoff from the watershed and human use of the beaches. Within the 1,000-foot buffer, the oyster water bacteria standard does not apply because oyster harvesting is prohibited.

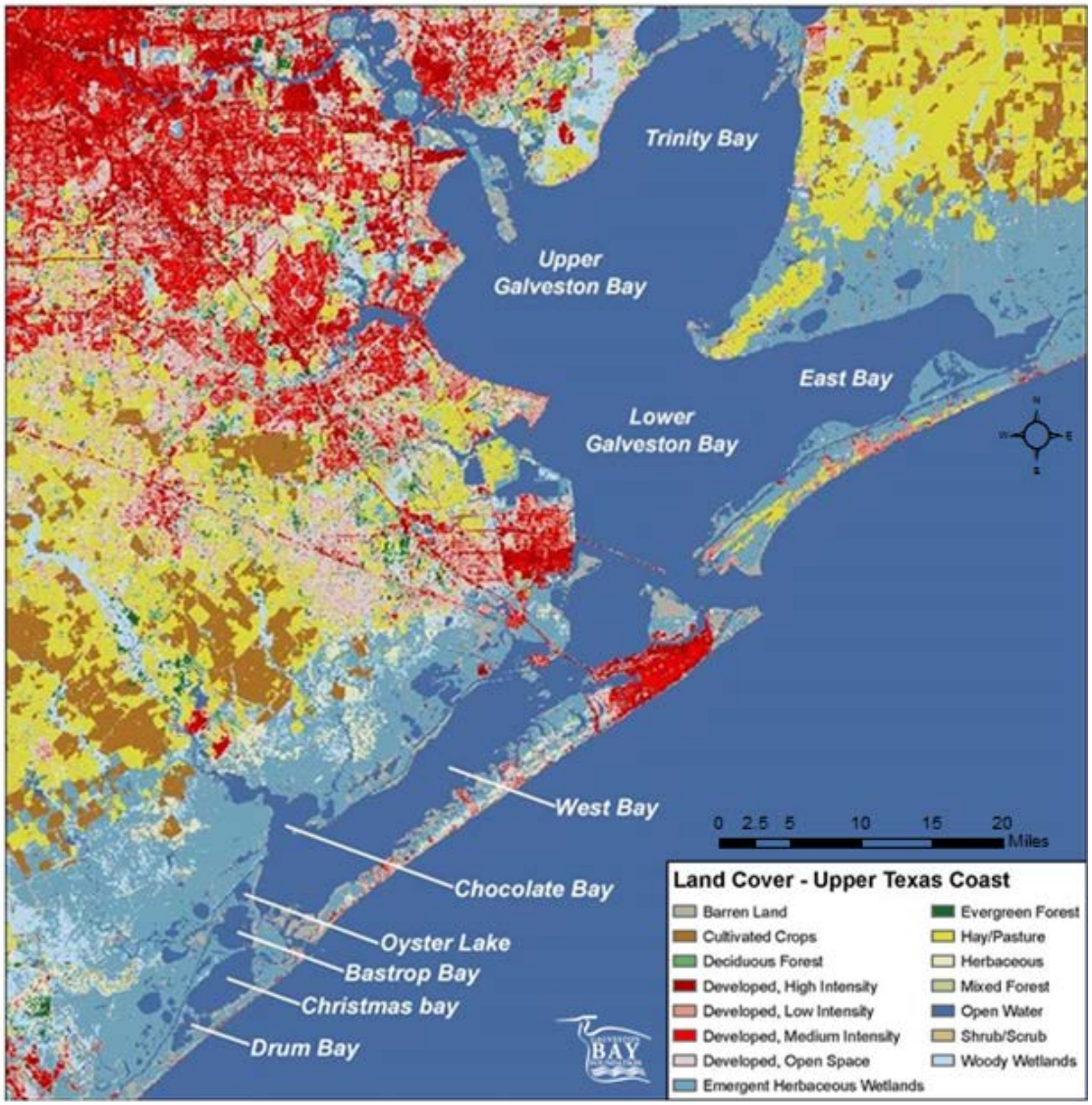

Figure 1. USGS Land Use Categories in the Project Watershed

Table 1. Characteristics of Impaired Segments of Galveston Bay

Segment Name Segment Number	Year Listed	Area (square kilometers)	Percent Area in the RHZ
Upper Galveston Bay 2421OW (AU 2421OW_01 & 2421OW_02)	1996	299.1	47%
Trinity Bay 2422OW (AU 2422OW_01)	2000	317.5	48%
East Bay 2423OW (AU 2423OW_01)	1998	148.9	25%
West Bay 2424OW (AU 2424OW_02)	1996	195.3	37%
Chocolate Bay 2432OW (AU 2432OW_01)	1996	21.1	100%
Bastrop Bay/Oyster Lake 2433OW (AU 2433OW_02)	2006	1.9[b]	100%
Christmas Bay 2434OW (AU 2434OW_01)	2006	1.8[b]	100%
Drum Bay 2435OW (AU 2435OW_01 & 2435OW_02)	2010	5.1	100%
Lower Galveston Bay 2439OW (AU 2439OW_01)	1996	362.4	27%

[b] These numbers are based on the impaired AUs, not the segments as a whole.

Many factors are considered in making use evaluations of oyster waters including water quality data, high rainfall and runoff, flooding, hurricanes, major spills, red tides, as well as proximity to marinas, wastewater treatment facilities, stormwater runoff, and drainage areas near livestock and wildlife areas (TCEQ, 2010). Thus, meeting the criteria for bacteria in water does not necessarily result in the TDSHS removing a restricted classification.

This I-Plan is designed for nine segments in the Galveston Bay system along the Texas Upper Gulf Coast near Houston and Galveston. Nine segments and eleven AUs have concentrations of bacteria that exceed the criteria used to evaluate the attainment of the designated oyster waters use, as identified in the state's *Texas Water Quality Inventory and 303(d) List* (TCEQ, 2008b). Listings for oyster waters are based on information developed by the TDSHS (formerly the Texas Department of Health), which classify harvesting areas according to their potential health risks from human consumption of oysters. Some of these risks can include the effect of red tide events, as well as fecal coliform inputs to the water body.

For this project, calculations and reductions of bacteria loads were completed using a concentration-based approach. Concentration-based calculations compare water quality to both the median and the 90th percentile criteria. Initially, the median and 90th percentiles are calculated for each sampling location and are then compared to the water quality standards. Reductions in loading are based on the criterion that would require the largest reduction. At all sampling locations, the largest reduction would be achieved when applying the 90th percentile criterion.

Data show that samples collected within the RHZ for Upper Galveston Bay, Trinity Bay, East Bay, Lower Galveston Bay, Chocolate Bay, West Bay, Drum Bay, Christmas Bay, and Bastrop Bay/Oyster Lake exceed the 90th percentile criterion. Within the nine water bodies, the 90th percentile criterion was exceeded at 35 of the 52 locations routinely

sampled within the RHZs; the median criterion was exceeded at only two of the 52 sample locations. The TMDL identified probable sources of the impairment as marinas and boat sewage, failing OSSFs, treatment facility discharges of untreated waste, stormwater runoff, migratory birds, wildlife refuges, and unmanaged animals (those that are free-living in open space lands adjacent to the Bay and its tributaries and not subject to livestock husbandry, but whose control is determined by the land owner). The magnitude of exceedance of the bacteria criteria varies widely throughout all the bays. Analysis indicates that high bacteria concentrations occur more often near shorelines, rather than occurring evenly throughout the bays.

TMDL Calculations

Updates to TMDLs are made quarterly through the State of Texas' WQMP. The WQMP identifies long-range planning and technical data for management activities as required under the Texas Water Code and the federal Clean Water Act. Quarterly updates can be accessed on the TCEQ's website. The following section summarizes the TMDL calculation for the Wasteload Allocation (WLA) and Load Allocation (LA). A more detailed explanation can be found in the TMDL report.

U.S. EPA protocol (U.S. EPA, 2001) for developing pathogen TMDLs defines the total maximum daily load as the allowable loadings for specific pollutants that a water body can receive without exceeding water quality standards. TMDLs are the sum of individual wasteload allocations for point sources and load allocations for nonpoint sources for a given water body. MOS is the Margin of Safety, a factor to account for uncertainty and future growth. To express load-based allocations the TMDL equation is used:

$$TMDL = \Sigma WLA + \Sigma LA + MOS \quad \text{(Equation 1)}$$

Where:

WLA = wasteload allocation (permitted or point source contributions)

LA = load allocation (non-permitted or nonpoint source contributions)

MOS = margin of safety

For most pollutants, TMDLs are expressed on a mass-loading basis (e.g., pounds per day). The Code of Federal Regulations, Title 40, Section 130.2(i) allows the state to establish a concentration-based TMDL for a pollutant that is not readily controllable on a mass basis. Flows in the Galveston Bay watershed (Figure 2) are highly variable and difficult to measure; consequently, a load-based analysis would add to uncertainty in the load allocations. Because shellfish harvesting is the most sensitive beneficial use of the Upper Gulf Coast project watershed, shellfish harvesting criteria are used as the TMDL for the Bays' oyster waters, expressed as the concentration of an indicator bacteria, in this case, fecal coliform organisms. For indicator bacteria, it is the number of organisms in a given volume of water (i.e., their concentration), and not their mass or total number, that is significant with respect to public health risk and protection of beneficial uses.

Therefore, the TMDL plan established concentration-based TMDLs and pollutant load allocations, expressed in terms of fecal coliform concentrations. Using a concentration-based method, the TMDL term in Equation 1 becomes the target water-quality concentration and the WLA and LA terms are the concentration limits placed on the sources belonging to each type of source.

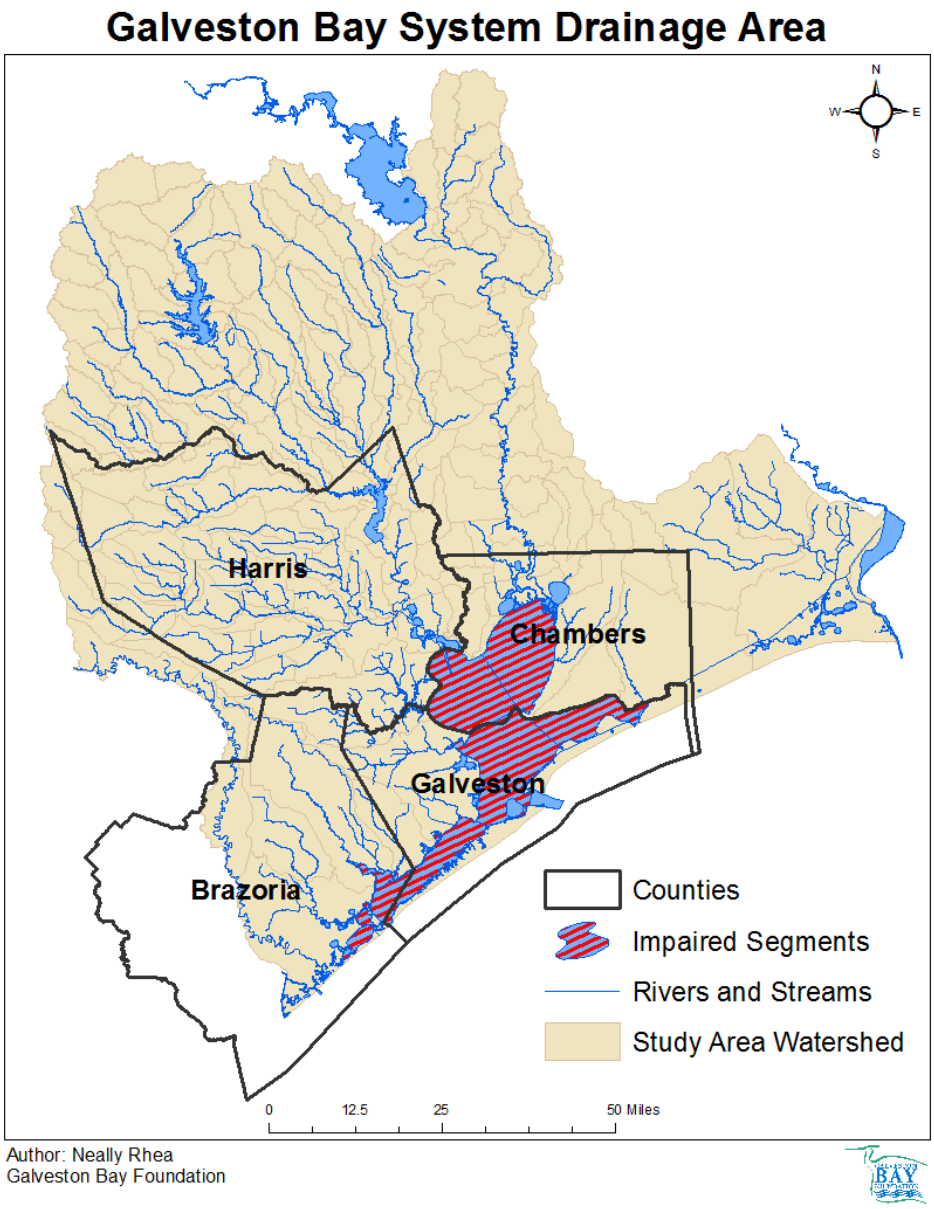

Figure 2. The Galveston Bay System Drainage Area

Unlike the load-based TMDL method, the concentration-based pollutant loads do not add up to equal the TMDL because the concentrations of individual pollution sources are not additive. Rather, in order to achieve the concentration-based target, it is simply necessary to ensure that each concentration limit is met. Table 2 presents concentration-based limits (load allocations) for indicator bacteria in the source categories associated with the Upper Gulf Coast project. These load allocations will apply year-round to each source category of pollution in the watershed (e.g., urban runoff, OSSFs, WWTFs, boat discharges). Compliance with these load allocations will ensure protection of the water quality and beneficial uses of the Bay.

Wasteload Allocation (WLA)

The WLA is the wasteload allocation for regulated source contributions including WWTF discharges and storm water runoff from areas covered by a Phase I or Phase II municipal separate storm sewer system (MS4) permit. Contact recreation standards for indicator bacteria apply to these sources. While fecal coliform is the indicator used to evaluate oyster waters, bacteria used to evaluate contact recreation may be either *E. coli* for discharges to freshwater bodies or *Enterococcus* for saline water bodies.

Load Allocation (LA)

The LA is the load allocation for unregulated source contributions. Contact recreation standards for indicator bacteria apply to sources that enter the bay system at the shoreline. As previously stated, bacteria used to evaluate contact recreation may be either *E. coli* for discharges to freshwater bodies or *Enterococcus* for saline water bodies. Discharges of untreated human waste into the State's waters from any source are prohibited. Unregulated sources can significantly affect compliance with oyster waters standards.

Table 2. Concentration-Based Pollutant Wasteload and Load Allocations for Upper Gulf Coast Segments

Pollutant Wasteload Allocations[a]		
	Fecal coliform Densities for Discharges to the RHZ	**For Discharges to Adjacent Watersheds and the 1,000 foot Buffer Zone[b]**
Mechanical WWTFs[c]	Discharges directly to the RHZ are not possible[d]	Fecal coliform 200 per 100 mL or *Escherichia coli (E. coli)* 126 per 100 mL or *Enterococcus* 35 per 100 mL
Wetland WWTFs	Discharges directly to the RHZ are not possible[d]	Fecal coliform 200 per 100 mL or *Escherichia coli (E. coli)* 126 per 100 mL or *Enterococcus* 35 per 100 mL
Municipal Separate Storm Sewer Systems (MS4s[c])	Discharges directly to the RHZ are not possible[e]	Numerical concentrations requirements are unreasonable for storm water runoff. This TMDL will require MS4s to follow implementation of bacteria reduction efforts and best management practices.
Pollutant Load Allocations[a]		
OSSFs	Discharges directly to the RHZ are not possible[e]	0 per 100 mL
Recreational Boat and Ship Discharges		0 per 100 mL
Marina	Discharges directly to the RHZ are not possible[d]	0 per 100 mL
Non-regulated Municipal Runoff	Discharges directly to the RHZ are not possible[e]	Numerical concentrations requirements are unreasonable for storm water runoff. Incentive based options will be developed for municipalities with non-regulated runoff. Bacteria reductions will be achieved through the implementation of the resulting I-plan.
Direct Deposition into Segment[f]	The reduction of wildlife or changing natural background conditions is not the intended goal of a TMDL.	

a. Allocations are applicable year-round. WLAs apply to any source (existing or future) subject to regulation by a Texas Pollutant Discharge Elimination System (TPDES) permit.

b. All concentrations limits within the 1,000-foot buffer zone will be based on the geometric means of the applicable indicator bacteria.

c. Regulated entities may use indicator bacteria other than fecal coliform, as listed in individual TPDES permits. Indicator bacteria concentrations for each permit must be consistent with the applicable water quality standard for the receiving water. Dischargers releasing effluent into a segment buffer zone shall meet those water quality standards.

d. Discharges to RHZ are not possible for WWTFs and Marinas because TDSHS implements safety perimeters known as Prohibited Harvest Zones around this source to protect against any unauthorized discharges of raw sewage.

e. Discharges to RHZ are not possible because TCEQ implements a 1,000-foot buffer zone around this source designated as contact recreation.

f. The listed segments contain wildlife and unmanaged animals and are therefore potential sources.

Implementation Strategy

This I-Plan documents three management measures to reduce bacteria loads. Management measures are voluntary activities, such as increasing public outreach or implementing stormwater best management practices. Any mention of permits, regulations, or enforcement in this I-Plan is in support of, or requesting improvements to, existing regulatory policies in collaboration with the appropriate regulatory agency. The management measures were selected based on feasibility, costs, support, and timing. Activities can be implemented in phases based on the needs of the stakeholders and the progress made in improving water quality.

Adaptive Implementation

All I-Plans use an adaptive management approach in which measures are periodically assessed for efficiency and effectiveness. This adaptive management approach is one of the most important elements of the I-Plan. The iterative process of evaluation and adjustment ensures continuing progress toward achieving water quality goals, and expresses stakeholder commitment to the process.

The TCEQ or other knowledgeable source will host annual meetings for up to the first five years. At the annual meetings, the stakeholders will assess progress using the schedule of implementation, interim measurable milestones, water quality data, and the communication plan included in this document. The implementation strategy will be adjusted based on the periodic assessments of progress.

Activities and Milestones

The Galveston Bay Foundation organized and facilitated the Upper Gulf Coast Stakeholder Advisory Group, which began working on the I-Plan in February 2010. Five Workgroups were formed to draft the I-Plan including Wastewater Treatment Facilities, On-site Sewage Facilities, Boater Waste, Policy and Outreach, and Science and Monitoring. The Workgroups met regularly for two years to complete the draft of this I-Plan and continue to meet in order to move forward with implementation of the plan. In 2013, the Science and Monitoring Workgroup was absorbed into the other Workgroups as a result of stakeholders needing to discuss this information integrally instead of separately from the other groups. The Science and Monitoring Workgroup may be reformed in the future if the stakeholders deem it appropriate.

Each Workgroup considered bacteria loading sources in the oyster waters project area and developed detailed, consensus-based action plans. The management measures contained in this I-Plan are the products of the Workgroups. Their primary focus was on sources within one stream mile of impaired oyster water segments; however, boater waste loading extends to all marinas and boats with direct access to Galveston Bay due to the transient nature of this source. In terms of the greater watershed, the stakeholders' goal is to collaborate with all of the surrounding groups working on I-Plans and Watershed Protection Plans to ensure that all sources are being accounted for that

could influence bacteria in the oyster waters. It was determined that this would be the most cost-effective strategy for reaching environmental improvements.

The Waters of the Upper Gulf Coast I-Plan includes three stakeholder developed management measures described in the following sections.

Management Measures

1) Wastewater Treatment Facilities – Improve guidance and training to owners and operators for sampling bacteria, provide technical assistance, increase enforcement by TCEQ, reduce collection system overflow events, and encourage facilities to ensure compliance before bacteria sampling is required.
2) On-site Sewage Facilities – Create or use an existing regional plan to identify, prioritize, and address failing systems in the Upper Gulf Oyster Waters area.
3) Boater Waste – Increase access to pump-out facilities, enforce existing regulations, enhance outreach and marketing in the Galveston Bay and Clear Lake areas, designate Galveston Bay as a federal NDZ, and conduct water quality monitoring in marinas.

Management Measure 1.0: Wastewater Treatment Facilities

One of the main purposes of domestic WWTFs is to control the levels of bacteria discharged into the environment from domestic sources. Until recently, WWTFs in Texas were monitored by measurement of operating parameters such as chlorine residual to determine effectiveness of control and were not required to test for bacteria, with the exception of facilities using an ultraviolet disinfection system. However, in November 2009, TCEQ's Commission approved Rule Project No. 2009-005-309-PR, which added bacteria limits for either *E. coli* for freshwater discharges or Enterococci for saltwater discharges to TPDES domestic permits in 30 Texas Administrative Code (TAC) Chapter 309. To ensure compliance with the standards, WWTFs will be required to do routine monitoring of their treated wastewater discharges for bacteria. The frequency of testing for bacteria is established in 30 TAC Chapter 319 (see Table 3).

Table 3. Frequency of Bacteria Measurement

Minimum Required Frequency			
Flow (mgd)	**Chlorine Systems**	**Ultraviolet Systems**	**Natural Systems**
>10	5/week	Daily	Daily
>5-10	3/week	Daily	5/week
>1-5	1/week	Daily	3/week
>0.5-1.0	2/month	Daily	1/week
0.1-0.5	1/month	5/week	2/month
<0.1	1/quarter	5/week	1/month

The TMDL and this I-Plan for the UGCOW cover only those facilities discharging within one stream mile of the listed segments. As of January 2014, 17 domestic WWTFs discharge directly into or near the project area. Sixteen have been issued permits that include bacteria limits, and one is under development (Table 4). Figures 3, 4, and 5 show the location of permitted domestic WWTFs (denoted 'selected municipal outfalls' in the legend) that discharge to the Galveston Bay segments and the project sampling stations (denoted 'project stations' in the legend) located within the impaired segments of the UGCOW. There are no permitted discharges of untreated human waste from the WWTFs to the impaired segments.

The most common causes of elevated bacteria discharges from WWTFs are insufficiently treated effluent or accidental discharges. The management measures in this I-Plan are intended to reduce bacteria loading by reducing or eliminating these occurrences.

Table 4. Wastewater Treatment Facilities - Permit Numbers, Permitted Flow, and Bacteria Compliance Records (n = total samples collected)

Segment	Permittee	NPDES Permit	TCEQ Permit	Flow (MGD)	Bacteria limit in permit? (Y or N)	2010		2011		2012		2013	
						# samples compliant	n	# samples compliant	n	# samples compliant	n	# samples compliant	n
2421OW	CITY OF LA PORTE	TX0022799	10206-001	7.56	Y	12	12	12	12	12	12	10	10
2421OW	CITY OF SEABROOK	TX0022250	10671-001	2.5	Y	12	12	12	12	13	13	7	7
2421OW	BAYVIEW MUD	TX0021822	10770-001	0.9	Y	n/a*	---	n/a*	---	2	2	6	8
2421OW	GALVESTON COUNTY WCID 12	TX0078441	12039-001	1.0	Y	n/a*	---	12	12	12	12	8	8
2422OW	TRINITY BAY CONSERV. DISTRICT	TX0128988	14734-001	0.1	Y	n/a**	---	n/a**	---	n/a**	---	n/a**	---
2422OW	TRINITY BAY CONSERV. DISTRICT	TX0054917	11537-001	0.1	Y	n/a*	---	n/a*	---	n/a*	---	2	2
2422OW	GULF UTILITY SERVICE INC	TX0042081	13643-001	0.1	Y	11	13	9	12	10	12	1	2
2424OW	GALVESTON COUNTY MUD 12	TX0020311	10435-002	0.4	Y	n/a*	---	n/a*	---	DNR***	0	7	7
2424OW	CITY OF GALVESTON	TX0027791	10688-002	4.76	Y	11	12	8	12	4	12	3	4
2424OW	CITY OF GALVESTON	TX0066125	10688-005	1.0	Y	11	12	10	12	11	12	7	8
2424OW	GALVESTON COUNTY FWSD 6	TX0020079	10879-001	0.32	Y	n/a*	---	n/a*	---	1	1	7	7
2424OW	CITY OF JAMAICA BEACH	TX0020061	11033-001	0.36	Y	3	3	10	10	0	1	9	10
2424OW	GALVESTON COUNTY MUD 1	TX0126977	11477-001	0.624	Y	n/a*	---	n/a*	---	n/a*	---	DNR***	0
2439OW	CITY OF GALVESTON	TX0047309	10688-001	13.0	Y	6	13	8	12	10	12	5	8
2439OW	MARTIN OPERATING PARTNERSHIP LP	TX0057258	10931-001	0.0085	Y	1	1	4	4	4	4	3	3
2439OW	TEXAS A&M UNIV. AT GALVESTON	TX0063231	11085-001	0.3	Y	11	12	10	12	10	11	7	8
2439OW	HALLIBURTON ENERGY SERVICES	TX0119482	14113-001	0.0035	Drafted	n/a*	---	n/a*	---	n/a*	---	n/a*	---
				Totals:		78	90	95	110	89	104	82	92
				% Compliance for all WWTFs in project area:		**86.7%**		**86.4%**		**85.6%**		**89.1%**	

* No bacteria limit during this year
** Wetland treatment plant – no effluent discharged to date
*** Did not report

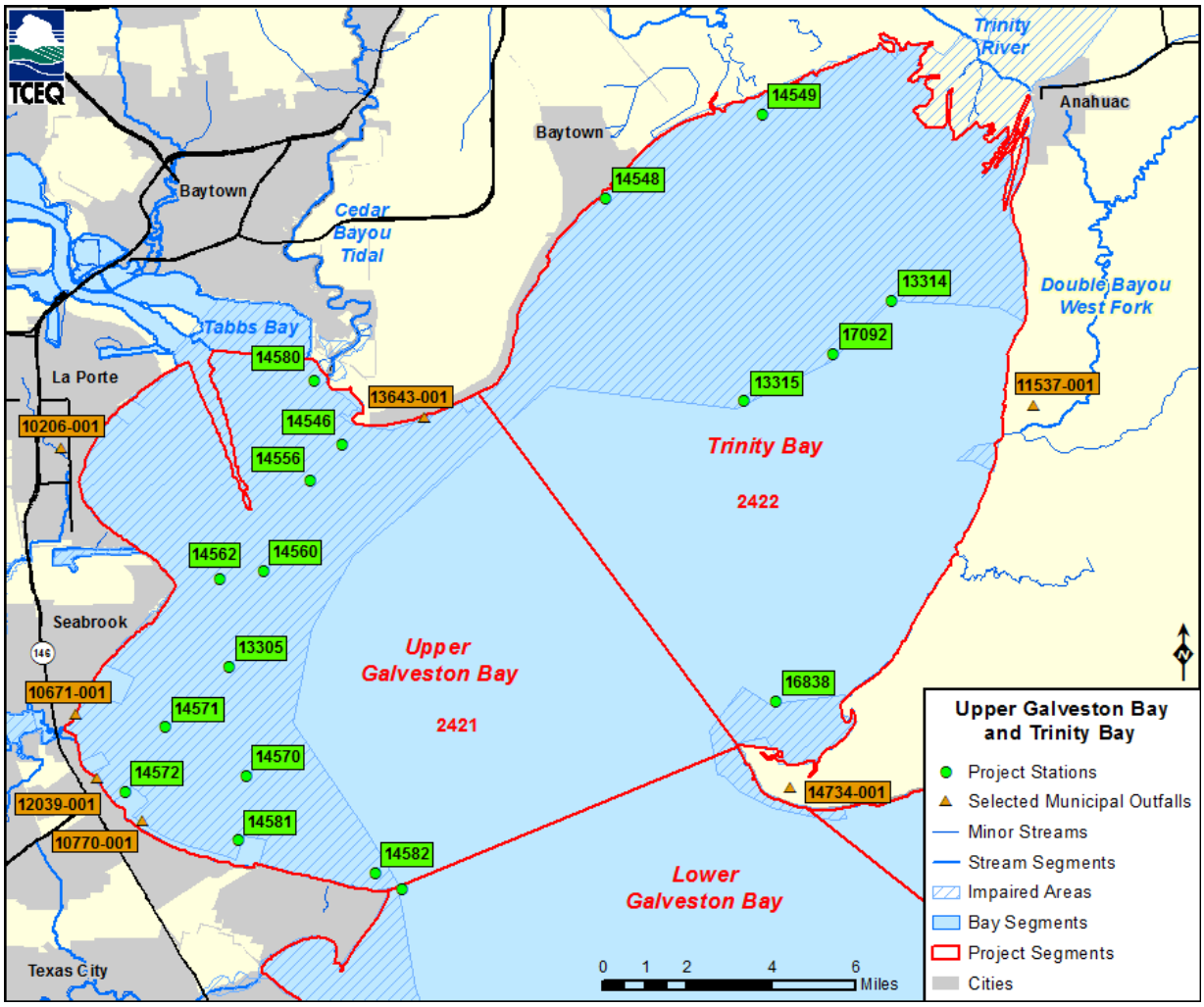

Figure 3. Upper Galveston and Trinity Bays - Wastewater Treatment Facilities and Sampling Stations

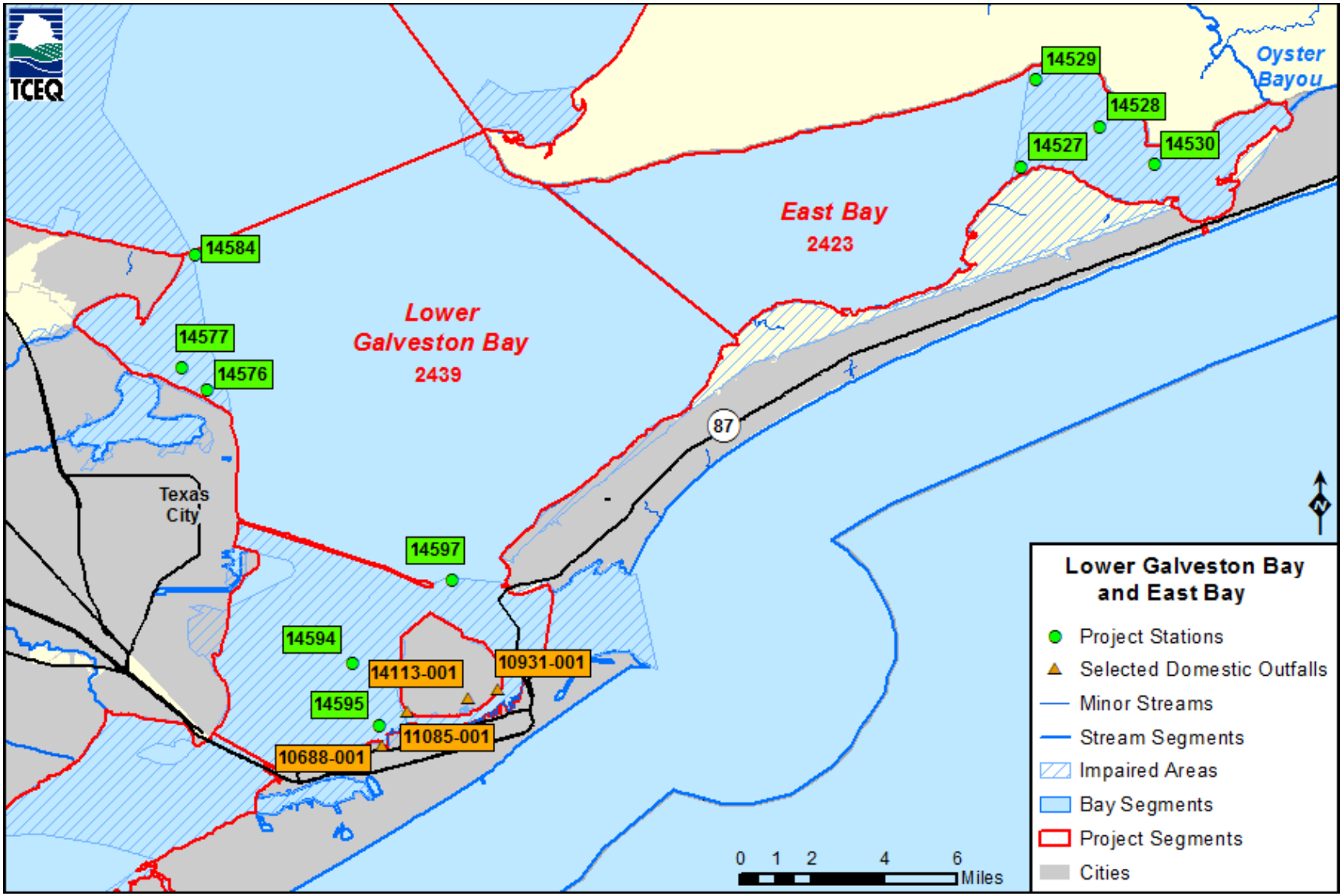

Figure 4. Lower Galveston and East Bays - Wastewater Treatment Facilities and Sampling Station

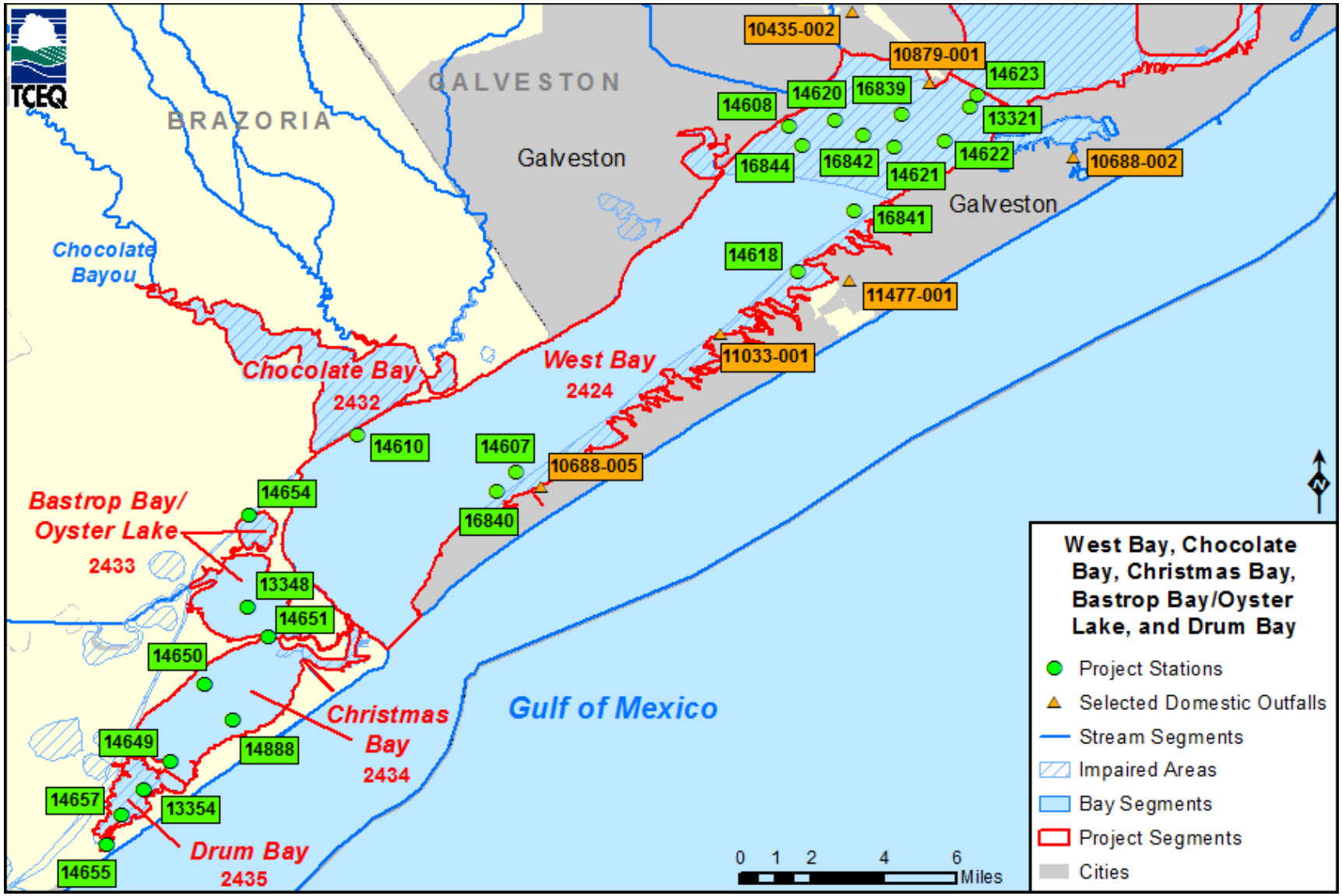

Figure 5. West Bay, Chocolate Bay, Drum Bay, Bastrop Bay/Oyster Lake, and Christmas Bay - Wastewater Treatment Facilities and Sampling Stations

Management Measure 1.1: Guidance and Training

In order to increase attainment of oyster waters use in local waters of the Upper Gulf Coast, it is imperative that the public works managers and operators of WWTFs receive the training and guidance necessary to sample properly for bacteria and troubleshoot plant operations if they are not meeting bacteria permit limits. Bacterial monitoring requires the mastery of unique sample collection and handling techniques beyond those used for all other water quality parameters tested at WWTFs. If problems exist with plant operations or in the sampling process, plant managers and operators must have the knowledge to be able to resolve these issues as quickly as possible. An overview of the bacteria compliance history for facilities in the UGCOW project area from 2010 to 2013 is presented in Table 4. This information shows that overall, bacteria samples taken at facilities in this project area were 85 – 90% compliant from 2010 through 2013, but that individual facilities may struggle to meet standards at times. For example, the three City of Galveston facilities' compliance ranged from 33% to 92%, with no increasing or decreasing trend over time. This information can aid the Workgroup in knowing where to concentrate efforts on guidance and training.

The WWTF Workgroup believes it is important to provide increased training and guidance to permittees through the permit renewal process and beyond. Because most permit renewals have already taken place with the new bacteria standards, it is recommended that a high priority be placed on providing these training and guidance materials to permittees immediately. Continuing education for existing permittees and new facilities added to the project area will be the focus for training and guidance. The WWTF Workgroup worked with the TCEQ to develop a guidance document for WWTF operators (Troubleshooting Bacteria Effluent from Wastewater Treatment Plants RG-515) and will work with them in the future if further guidance documents or revisions are needed. The WWTF Workgroup requests that the TCEQ consider distributing this document with permit renewal documents and at Texas Water Utilities Association (TWUA) meetings. As recommended by the Workgroup, the guidance document includes an explanation of potential bacteria issues as a result of plant operations, why bacteria sampling is important, sampling techniques, equipment needs and changes, as well as resources and mentors that the facilities can turn to for guidance and mentorship. Additionally, a web page on GBF's website will be established with resources for the public works managers/operators. The WWTF Workgroup also recommends that the laboratories that process samples communicate best practices for sample collection with the operators. This information is being communicated to laboratories by the WWTF Workgroup through continuing education workshops, as discussed below.

In addition to print resources, the WWTF Workgroup believes it will be beneficial to provide technical assistance to individual WWTFs. If a facility begins sampling for bacteria and identifies problems with meeting discharge criteria, they will be encouraged to seek help from EnviroMentors. EnviroMentors is a volunteer program that can help small businesses and local governments with technical or legal advice to help comply with state environmental rules. EnviroMentor assistance is handled by the Small

Business and Local Government Assistance (SBLGA) program. SBLGA is entirely separate from the TCEQ's enforcement program. Therefore, the EnviroMentor assistance is confidential and does not lead to inspections, citations, or fines. The Workgroup requests that TCEQ consider presenting the information about the EnviroMentors program at an operator's association meeting in each of the districts within the TMDL. The WWTF Workgroup would also like a facility that has used the EnviroMentors program and had success to present their experience at association meetings. Written materials describing the EnviroMentors program will be distributed at association meetings, and the Workgroup recommends including an EnviroMentors Web address within bacteria guidance documents.

Continuing education workshops including, but not limited to the Texas Engineering Extension Service (TEEX) Effluent Bacteria Loading Workshop, will be offered at least two times a year to public works managers, operators, and laboratory personnel. The classes should be close to the facilities and help the operators keep their knowledge and practices current in terms of bacterial compliance issues. To date, the TCEQ has updated the TEEX and TWUA training manuals, and the operator certification tests so that they include sections on proper operation and maintenance of WWTFs to help maintain bacteria compliance. The WWTF Workgroup will coordinate with TEEX and TWUA to offer these classes more often and in more convenient locations throughout the Upper Gulf Coast project area. To date, the Workgroup arranged for TEEX to offer two Effluent Bacteria Loading Workshops in 2012 and one in 2013, free of charge to WWTF managers, operators, and lab personnel. Each workshop had around 40 – 50 people in attendance and received positive reviews from participants.

Responsible Parties and Funding

The following parties are responsible for carrying out various components of this management measure:

- Galveston Bay Foundation (GBF)
- TCEQ (EnviroMentors)
- TEEX
- TWUA
- WWTFs
- WWTF Workgroup

The WWTF Workgroup will seek grants for financial assistance to support the development and distribution of guidance documents and workshops, and use existing local funding as available. Potential funding sources include the U.S. EPA Environmental Education Grant Program, Urban Waters Grant Program, Gulf of Mexico Grant Program, and Section 319 Nonpoint Source Pollution Grant Program, Five Star and Urban Waters Restoration Grant Program, Texas General Land Office – Coastal Management Program Grant Program, Galveston Bay Estuary Program, and Supplemental Environmental Projects.

Measurable Milestones

In Year One, the WWTF Workgroup will work with the TCEQ to distribute bacteria guidance documents and EnviroMentors information with permit renewal packets and at association meetings in the TMDL watershed. The EnviroMentors program will be requested to offer their assistance to facilities with discharge violations if they call and ask for help. The WWTF Workgroup will coordinate with TEEX/TWUA to offer training classes specializing in bacterial issues at least twice a year in the TMDL area. GBF, with the assistance of the Workgroup will develop a web page for permittees with links to training resources, mentors, training options, etc. GBF will maintain the web page on their website with help from the WWTF Workgroup. Contingent upon available resources, partners will update the larger stakeholder group at an annual stakeholder meeting.

In Year Two, bacteria guidance and EnviroMentors information will continue to be distributed during training sessions and operator association meetings. GBF will continue to maintain the web page for permittees. Partners will update the larger stakeholder group at an annual stakeholder meeting.

In Years Three and Four, the Workgroup will work with the TCEQ to continue to distribute guidance documents and GBF will continue to maintain the Web page for permittees. The Workgroup recommends that TEEX/TWUA continue offering training classes relevant to bacterial compliance issues. Partners will continue to update stakeholders at an annual meeting.

In Year Five, partners will evaluate the effectiveness of the management measures and make appropriate adjustments. Outreach materials will continue to be distributed, and relevant, conveniently located workshops will be offered.

Table 5 provides additional details for Management Measure 1.1. Appendix A provides the schedule of implementation.

Table 5. Wastewater Treatment Facilities Management Measure 1.1

(1) Management Measure	(2) Potential Load Reduction	(3) Technical and Financial Assistance Needed	(4) Education Component	(5) Schedule of Implementation	(6) Interim, Measurable Milestones	(7) Progress Indicators	(8) Monitoring Component	(9) Responsible Organization
Wastewater Treatment Facility Effluent								
Management Measure 1.1: Guidance and Training	This TMDL calls for compliance with concentration based limits: -Fecal coliform 200 CFU per 100 mL -*E. coli* 126 CFU per 100 mL -*Enterococcus* 35 CFU per 100 mL	**Technical:** WWTF Workgroup will write the guidance document **Financial:** Grants and existing local funding as available to support the development of educational materials and holding training events	Guidance documents Webpage with resources for owners and operators on GBF's website Educational materials to promote the EnviroMentors Program	**Year 1:** Distribute guidance document at association meetings and with permit renewal packets Develop WWTF resources webpage on GBF's website Promote the EnviroMentors Program Offer two training sessions per year **Years 2 - 5:** Distribute guidance document at association meetings and with permit renewal packets Maintain the guidance document, website and promotion of EnviroMentors Program Offer two training sessions per year Evaluate the effectiveness of the MM	Guidance document is written and being distributed Website is developed Two training sessions will be offered per year in the project area	Within 5 years, all permittees will have received the guidance document Webpage is active and number of webpage visits Number of WWTFs that receive guidance document Number of training sessions being offered in the project area Number of participants in workshops	WWTF Workgroup will request bacteria sampling results for permittees from TCEQ Attendance records from training events Conduct follow up calls to determine effectiveness of training events Conduct written evaluations at training events to determine knowledge change Track outreach distribution	WWTF Workgroup will work with TCEQ to ensure that guidance documents remain up-to-date The Workgroup will work with the TCEQ to present the EnviroMentors Program and distribute guidance document at association meetings in each TMDL watershed and with permit renewal packets GBF and WWTF Workgroup will develop a resource webpage to be posted on GBF's website TEEX/TWUA will offer two training sessions per year in project area

Management Measure 1.2: Pre-Permit Renewal Sampling

- Dischargers were encouraged to sample and test for bacteria before their actual permit renewal to ensure the facility was in compliance. Sampling early gave the facility time to make the necessary repairs before they received a permit limit for bacteria, thus reducing their bacteria inputs to the UGCOW sooner. It also allowed the samplers to perfect their collection technique. During this pre-permitted phase, bacteria samples were not reportable and EnviroMentors could assist the permittees with any problems that arose from the early testing.
- The WWTF Workgroup also recommended sending a letter to the superintendent or the operator (whoever signs the report) of each of the facilities in the TMDL area, 18 months prior to their permit renewal to encourage them to test early, to explain why the testing is important, and to offer assistance if necessary. The same letter could also be sent again six months before renewal as a reminder. The information was also sent to the officers of each operator's associations within the TMDL area to present at their monthly meeting.
- The WWTF Workgroup developed this management measure prior to most of the facilities in the UGCOW project area receiving a bacteria limit on their permit; however, this measure is now mostly complete due to the fact that all but one facility has received their bacteria limit. Members of the Workgroup carried out this management measure by distributing guidance documents, postcards, and other educational materials to several facilities throughout the project area, as well as recommending pre-permit renewal sampling through personal communications and at presentations to the Texas Water Utilities Association – Gulf Coast Chapter monthly meetings and industry-related meetings and workshops. Even though this measure has been completed, the stakeholders recommended leaving it in the I-Plan document so that future groups could benefit from it when writing management measures for other impaired water bodies. The Workgroup will carry out this measure if new permit holders are added to the project area.

Responsible Parties and Funding

The following parties are responsible for carrying out various components of this management measure:

- GBF
- TCEQ (EnviroMentors)
- WWTFs
- WWTF Workgroup

No additional funding is required for this management measure.

Measurable Milestones

- **In Year One,** the WWTF Workgroup drafted and sent letters to facilities before their permit was due to encourage them to begin testing early for bacteria. They recommend doing this 18 months and six months before permits are due. The letter was also sent to the operators' association officers in this TMDL watershed to be presented at their association meeting.
- In Years Two through Four, the WWTF Workgroup recommends following-up with WWTFs to determine which facilities tested for indicator bacteria prior to permit renewal. The Workgroup recommends that EnviroMentors assist permittees with any problems that arose during pre-permit testing. Letters and other forms of communication were sent to the operators' association officers in the TMDL watersheds and/or a presentation was given at their association meetings once a year.

By Year Five, all of the facilities had submitted their permit renewal applications. The WWTF Workgroup sent letters to any new facilities in the TMDL watersheds. Partners evaluated the effectiveness of the management measures and made appropriate adjustments.

Table 6 provides additional details for Management Measure 1.2. Appendix A provides the schedule of implementation.

Table 6. Wastewater Treatment Facilities Management Measure 1.2

(1) Management Measure	(2) Potential Load Reduction	(3) Technical and Financial Assistance Needed	(4) Education Component	(5) Schedule of Implementation	(6) Interim, Measurable Milestones	(7) Progress Indicators	(8) Monitoring Component	(9) Responsible Organization
Wastewater Treatment Facility Effluent								
Management Measure 1.2: Pre-permit Renewal Sampling	This TMDL calls for compliance with concentration based limits: -Fecal coliform 200 CFU per 100 mL -*E. coli* 126 CFU per 100 mL -*Enterococcus* 35 CFU per 100 mL	**Technical:** TCEQ and laboratories to advise the operators on new sampling requirements and techniques **Financial:** Grants and existing local funding as available, and if necessary	Letters will be sent to permittees and associations encouraging pre-permit sampling	**Year 1:** Sent letters and info to permittees and operators' associations before permit renewal **Year 2-4:** Sent letters and info to permittees and operators' associations before permit renewal Recommended follow up to determine which WWTFs carried out pre-permit testing Assisted permittees with any problems that arose during pre-permit testing **Year 5:** Sent letter and info to any new WWTFs in the TMDL project area. Evaluated the effectiveness of the MM	Pre-permit renewal letter drafted, approved, and sent to permittees	Number of permittees that are sampling for bacteria before their permit is renewed Number of permittees in compliance at the time of permit renewal Reduction in bacteria concentrations	WWTF Workgroup will request bacteria sampling results for permittees from TCEQ	WWTF Workgroup drafted and sent letters to facilities The Workgroup worked with the TCEQ and laboratories to advise operators on new sampling requirements and techniques WWTFs in the project area began testing for indicator bacteria EnviroMentors were available to assist permittees with any problems that arose during pre-permit testing

Management Measure 1.3: Increase Compliance and Enforcement

Stakeholders are concerned that there is an insufficient quantity of investigations, reviews, and enforcement being performed. They are further concerned that some of the smaller plants have difficulty in maintaining optimal operations. The Workgroup recommends that the TCEQ modify their inspection procedures in order to better maximize limited staffing and increase compliance. Specifically, they recommend conducting unannounced inspections and focused investigations, which may include a focus on bacterial discharge issues, or sampling, at the WWTFs in the project area. Focused investigations on a specific aspect(s) of a facility allows investigators to place increased time and effort on problem areas that may pose a significant risk to human health and the environment. Conducting focused investigations at regulated entities with good compliance records allows TCEQ more time to focus on those regulated entities either with a history of non-compliance, or with the potential to negatively affect human health and/or the environment. The compliance history of plants in the UGCOW project area can aid the TCEQ in determining where to concentrate efforts on inspections. TCEQ prepares specific compliance histories for regulated entities in Consolidated Compliance and Enforcement Data. Table 4 identifies the number of samples meeting the permit limit in the UGCOW project area from 2010 to 2013. The WWTF Workgroup believes that conducting focused investigations will free the TCEQ to conduct inspections at a larger number of facilities, and thus lead to increased compliance with bacteria limits. There are multiple methods to address the low numbers of investigations and reviews performed. The request from the WWTF Workgroup will be that the TCEQ modify their operating procedures to allow for increased focused investigations and unannounced inspections.

Currently under the TCEQ procedures, unannounced inspections can be performed at WWTFs that have been designated as a poor performer or in response to complaints and other similar situations. Unannounced inspections have been shown to increase compliance. For example, Harris County Pollution Control Services Department (PCS) carries out unannounced inspections on all of the WWTFs in their jurisdiction, both municipal and industrial. If a violation is determined, a violation notice is sent, documenting that violation and requesting a response inclusive of corrective actions. Approximately 96 percent of violations are resolved by that process. If violations continue, PCS will request an enforcement meeting to discuss the cause of the violations and the resolution provided by the WWTF owners, operators, and engineers. In most cases, issues are resolved without having to forward a case for enforcement. When efforts to correct the violations are unsuccessful and violations continue, an enforcement action may be pursued through the County Attorney or the District Attorney's office. Unannounced inspections and good communication between the enforcement agency and the subject has provided a pathway to compliance that has proven to be very effective (D. Hall, personal communication, January 23, 2014). The WWTF Workgroup believes that if TCEQ were able to increase the number of unannounced WWTF inspections, which could include a focus on bacteria as needed, it would yield similar results. However, U.S. EPA requirements on the types of investigations required to be performed severely limit the number of inspections that are feasible to complete. For example, Comprehensive Compliance Inspections are

required for major facilities (permitted flow of 1 MGD or greater) - which can take days to complete - and mandatory minor facilities (<1 MGD, with compliance issues). The Workgroup recommends that the TCEQ and the U.S. EPA instead allow for and conduct focused investigations for major and mandatory minor facilities, enabling investigators to conduct numerous inspections in a single day. Currently, focused investigations are permitted only at discretionary minor facilities (in general those with a permitted discharge of less than 1 MGD). The Workgroup recommends that the TCEQ consider developing and approving focused investigation types, which will include a sampling focused investigation, and increase the number of focused investigations conducted, with the goal of inspecting every WWTF once every two years through a comprehensive compliance inspection, focused inspection, or some other type of inspection.

Responsible Parties and Funding

The following parties are responsible for carrying out various components of this management measure:

- U.S. EPA
- TCEQ
- WWTFs

The Workgroup will continue to explore ways to increase the frequency and effectiveness of WWTF inspections."

Measurable Milestones

In Year One, the Workgroup requests that the TCEQ consider developing and gaining approval for focused investigations at major and mandatory minor facilities, and developing and gaining approval for a sampling focused investigation for all facilities. Contingent upon available resources, the TCEQ staff may participate in training in order to add the unannounced inspections and focused investigations. The focused investigations will emphasize bacterial monitoring and disinfection system inspections as needed. Partners will update the larger stakeholder group at an annual stakeholder meeting.

In Year Two, the Workgroup requests that the TCEQ continue making an effort toward increasing the number of unannounced inspections and focused investigations conducted each year. Partners will update the larger stakeholder group at an annual stakeholder meeting.

In Years Three through Five, the Workgroup recommends that the TCEQ consider continuing to conduct the unannounced inspections and aim to conduct focused investigations with the goal to reach each facility every two years. Partners will update the larger stakeholder group at an annual stakeholder meeting and evaluate the effectiveness of the management measures in order to make appropriate adjustments.
Table 7 provides additional details for Management Measure 1.3. Appendix A provides the schedule of implementation.

Table 7. Wastewater Treatment Facilities Management Measure 1.3

(1) Management Measure	(2) Potential Load Reduction	(3) Technical and Financial Assistance Needed	(4) Education Component	(5) Schedule of Implementation	(6) Interim, Measurable Milestones	(7) Progress Indicators	(8) Monitoring Component	(9) Responsible Organization
Wastewater Treatment Facility Effluent								
Management Measure 1.3: Increase Compliance and Enforcement	This TMDL calls for compliance with concentration based limits: -Fecal coliform 200 CFU per 100 mL -*E. coli* 126 CFU per 100 mL -*Enterococcus* 35 CFU per 100 mL	**Technical:** Offering training for new types of inspections and investigations will be requested of TCEQ U.S. EPA will need to approve new type of focused investigations **Financial:** State funding for additional inspections, if needed	Offering training for new types of inspections and investigations will be requested of TCEQ	**Year 1 :** Work to develop and approve focused investigations relating to bacterial sampling **Year 2 :** Continue working to increase the number of unannounced inspections and begin focused investigations **Year 3-5:** Continue unannounced inspections and aim to conduct focused investigations on each facility every two years Evaluate the effectiveness of the MM	Development of sampling focused investigations Development and approval of focused investigations at major and mandatory minor facilities	Number of unannounced and focused investigations The progress achieved in developing and getting approval for focused investigations at major/ mandatory minor facilities	WWTF Workgroup will collect reports from TCEQ regarding the number and type of investigations each year	The Workgroup recommends that TCEQ develops and gains approval for focused investigations, and increase the number of focused investigations WWTF Workgroup will collect information concerning the number and types of inspections and investigations conducted

Management Measure 1.4: Decrease Sanitary Sewer Overflows (SSOs)

Sanitary sewer systems transport waste from homes and businesses to WWTFs. Breaks, leaks, and overflows in these systems, collectively referred to as SSOs, create a stream of untreated sewage that travels through the stormwater system into surrounding water bodies. The impacts of SSOs can include beach and recreational area closings, public health issues from raw sewage in roadways, ditches, basements and surface waters, closing of fishing and shellfish harvesting, sewer connection moratoriums, and financial effects from negative public relations (U.S. EPA, 2008). As infrastructure continues to age and deteriorate, while growing populations increase usage, the WWTF Workgroup believes it is important to address key policy and outreach measures in order to reduce bacteria levels in the UGCOW project area.

The overall SSO history for permit holders in this project area from 2001 to 2011 is listed in Table 8. In general, it is expected that facilities will have some SSOs due to aging infrastructure. However, the reported data did not necessarily reflect the number of SSOs that the Workgroup would expect based on their professional knowledge. Detecting overflows can be very staff-dependent, which may explain the limited number of reports from some of the facilities (Table 8). For example, the City of Galveston has a dedicated inspection team whereas a smaller permit holder may not. This could be one reason for their disproportionately high number of SSOs compared to other facilities. The most common causes of overflows indicated were infiltration of rainfall, grease clogs, power failures, debris clogs (sand, mud, toilet paper, etc.), broken sewer lines, broken pumps and equipment, and hurricanes. The breakdown of percent number and percent volume of SSO reports by cause in the UGCOW project area is displayed in Figures 6 and 7, respectively. If the cause was listed as unknown or something that occurred infrequently, it was accounted for in the "other" category. This data shows that the highest number of SSO reports was overwhelmingly due to grease clogs (54%), while the highest percentage of overflow volume was due to equipment malfunctions (37.8%) and rainfall infiltration (35.4%). However, if a major portion of staff time is spent responding to unexpected overflows from grease clogs in lieu of repairing and maintaining wastewater lines and equipment, then addressing grease could be a cost effective option for decreasing SSOs overall. Additionally, overflows not caused by rainfall infiltration will intuitively have a higher concentration of pathogens than the diluted rainfall overflows, causing them to have an increased negative impact on water quality.

Based on the professional knowledge of the Workgroup and survey responses from facilities in the project area, the measures described below were recommended for addressing SSOs.

Table 8. MS4 Permit Status and Sanitary Sewer Overflow Reports

Segment	Permittee	NPDES Permit	TCEQ Permit	MS4 Permit Issued? (Y or N)	Total SSO Reports (2001 – 2011)	
					Reports (number)	Volume (gallons)
2421OW	CITY OF LA PORTE	TX0022799	10206-001	Y	77	916,412
2421OW	CITY OF SEABROOK	TX0022250	10671-001	Y	4	26,000
2421OW	BAYVIEW MUD	TX0021822	10770-001	N	2	380
2421OW	GALVESTON COUNTY WCID 12	TX0078441	12039-001	Y	38	217,630
2422OW	TRINITY BAY CONSERVATION DISTRICT	TX0128988	14734-001	N	0	0
2422OW	TRINITY BAY CONSERVATION DISTRICT	TX0054917	11537-001	N	0	0
2422OW	GULF UTILITY SERVICE INC	TX0042081	13643-001	N	12	9,710
2424OW	GALVESTON COUNTY MUD 12	TX0020311	10435-002	Y	0	0
2424OW	CITY OF GALVESTON	TX0047309	10688-002	Y	110	985,609
2424OW	CITY OF GALVESTON	TX0066125	10688-005	Y	7	4,065
2424OW	GALVESTON COUNTY FWSD 6	TX0020079	10879-001	N	1	45
2424OW	CITY OF JAMAICA BEACH	TX0020061	11033-001	N	7	17,675
2424OW	GALVESTON COUNTY MUD 1	TX0126977	11477-001	N	9	1,175
2439OW	CITY OF GALVESTON	TX0047309	10688-001	Y	691	87,770
2439OW	MARTIN OPERATING PARTNERSHIP LP	TX0057258	10931-001	N	1	100
2439OW	TEXAS A&M UNIVERSITY AT GALVESTON	TX0063231	11085-001	N	1	3
2439OW	HALLIBURTON ENERGY SERVICES INC	TX0119482	14113-001	N	0	0
				Totals:	960	2,266,574

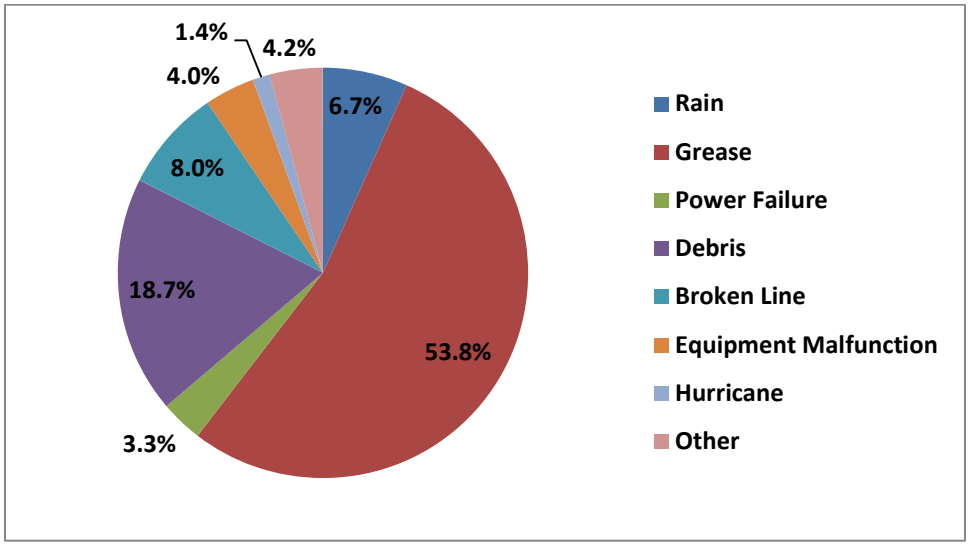

Figure 6. Percent Number of SSO Reports by Cause in the UGCOW from 2001 - 2011

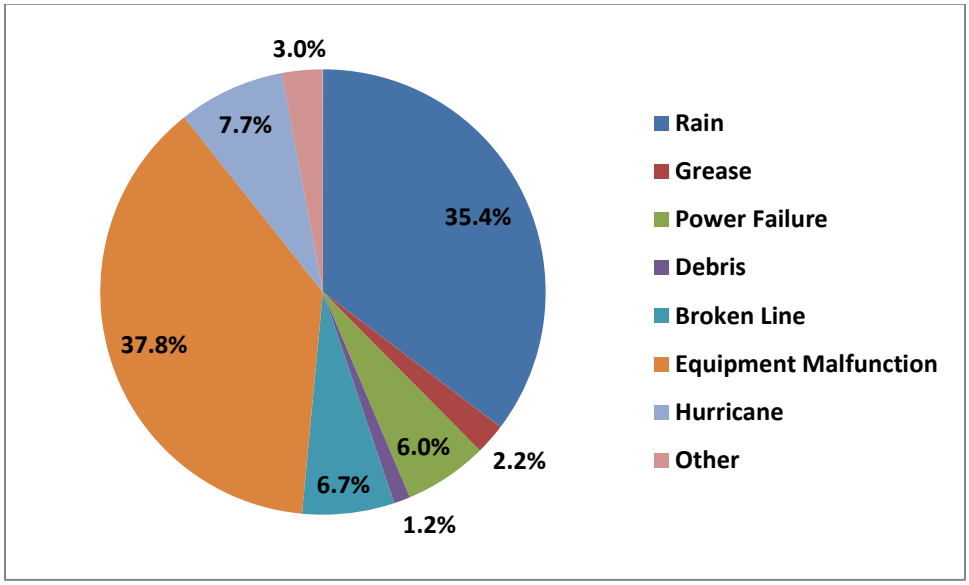

Figure 7. Percent Volume of SSO Reports by Cause in the UGCOW from 2001 - 2011

1.4a Participation in Sanitary Sewer Overflow Initiative

Overflows of untreated wastewater into the receiving stream from a domestic sewage system can be a significant source of bacteria. Facilities in the project area (within one stream mile of the listed segments) will be encouraged to participate in the Sanitary Sewer Overflow Initiative (SSOI). The SSOI is a program developed by the TCEQ, which provides WWTFs with a structured methodology to identify and address sanitary sewer overflows. As of June 2013, only 3 of the 17 WWTFs in this project area were participating in the SSOI program including two facilities run by the City of Galveston and one run by the City of La Porte. The Workgroup will work with the TCEQ to present information about the SSOI at association meetings and invite facilities that are in the project area and that qualify to participate in the SSOI program. The WWTF Workgroup will work with the TCEQ or other knowledgeable source to give one or two presentations in the first year of the I-Plan, contingent upon available resources. The Workgroup will coordinate with adjacent watersheds in the region to bring additional utility management workshops to the project area as necessary. These efforts will be coupled with an outreach campaign to the managers and operators to make them aware of the program and its advantages. Technical assistance may be requested from the TCEQ, U.S. EPA, Water Environment Association of Texas (WEAT) and private consultants. U.S. EPA's Capacity, Management, Operation and Maintenance (CMOM) program and the TCEQ's SSOI program could be used for guidance. The Workgroup will continue monitoring and collecting SSO data within the project area. When the I-Plan comes up for review, if the data indicates that collection systems are still a problem for a particular facility, then the Workgroup may focus outreach efforts on these select facilities.

1.4b Address Fat, Oil, Grease, and Roots

Fat, oil, and grease (FOG) are produced through everyday activities such as food preparation and cleaning at the household and commercial level. The accumulation of these materials in sanitary sewer systems can reduce their capacity and result in SSOs. As with the *Implementation Plan for Seventy-Two Total Maximum Daily Loads for Bacteria in the Houston-Galveston Region,* this WWTF Workgroup would like to encourage local governments and utilities to adopt ordinances or other controls that require entities (i.e. restaurants and other businesses) to have properly sized grease traps and to require grease traps to be properly cleaned and maintained. Based on a preliminary survey of local governments and utilities, about 50% of the permit holders in this project area have their own ordinances and proactive inspection programs, while the remaining facilities reference state or national standards and carry out inspections less frequently. The Workgroup will continue to network with all of the facilities in the project area to compile their strengths or needs and will offer resources to those that do not already have a proactive grease abatement program in place. The Workgroup can provide them with local examples and additional supporting information as necessary. In addition, the Policy and Outreach Workgroup, with the assistance of the WWTF Workgroup, will develop an education campaign concerning FOG and distribute materials as necessary to the public, government agencies, and the private sector, as well as include them on the GBF website. This campaign will consist of currently available materials that will be tailored to our region, as well as newly created items as necessary. A distribution plan will be developed in order to reach targeted audiences. The WWTF Workgroup recommends targeting school-age children as part of the campaign, as in their experience with the younger audience, the impact on behavior change is greater and transfers up to the adults. The Policy and Outreach Workgroup reviewed various FOG campaigns across Texas and the greater U.S. and decided to adopt the highly successful *Cease the Grease* campaign from the City of Dallas Water Utilities. The City of Dallas has granted GBF permission to adapt their creative concepts and graphic materials for use in the Galveston Bay region.

In addition to FOG, roots that work their way into cracks and grow inside pipes can in some cases cause over 50% of SSOs, along with a combination of corrosion, soil movement, and inadequate construction (U.S. EPA, 2008). The Workgroup recommends providing outreach materials to municipalities on addressing root issues in their wastewater infrastructure maintenance plans. Technical assistance may be requested from the TCEQ, U.S. EPA, WEAT, and private consultants.

1.4c Address Lateral Line Maintenance

Sewer lateral lines are the underground pipes that connect homes and businesses to a city sewer system. In the state of Texas, it is the responsibility of the property owner to assure that the lateral line on their property is properly maintained. The issue of FOG and root infiltration, as well as corrosion and cracking from age and weather conditions can lead to lateral line damage. The Policy and Outreach Workgroup, with the assistance of the WWTF Workgroup, will develop an education campaign concerning lateral line maintenance responsibilities of home and business owners, and distribute as necessary to the public, government agencies, and the private sector, as well as include

them on the GBF website. This campaign will consist of currently available materials that will be tailored to our region, as well as newly created items as necessary. A distribution plan will be developed in order to reach targeted audiences.

Responsible Parties and Funding

The following parties are responsible for carrying out various components of this management measure:

- GBF
- Policy and Outreach Workgroup
- TCEQ
- WWTFs
- WWTF Workgroup

The Policy and Outreach Workgroup, WWTF Workgroup and GBF will seek financial assistance to support the various activities proposed in this management measure. To date, GBF has received funding to facilitate the Cease the Grease campaign with the Policy and Outreach Workgroup through FY 2016. Funding sources include the Galveston Bay Estuary Program and the Texas General Land Office (GLO) Coastal Management Program. Other potential funding sources include the U.S. EPA Environmental Education Grant Program, Urban Waters Grant Program, Gulf of Mexico Grant Program, and Section 319 Nonpoint Source Pollution Grant Program, Five Star Urban Waters Grants and Supplemental Environmental Projects. The Clean Water State Revolving Fund is a possible source of funding for WWTFs to repair or replace aging infrastructure or increase capacity. This funding program is authorized by the CWA and provides low-interest financial assistance for planning, design, and construction of WWTF infrastructure.

Measureable Milestones

In Year One, the Workgroup will work with the TCEQ or other knowledgeable source to present information about the SSOI at association meetings and distribute educational materials to the owners and operators. Permittees who qualify to participate in the SSOI can then request a meeting with the TCEQ to begin setting up a plan to reduce sanitary sewer overflows. The WWTF Workgroup will contact local governments to determine what enforcement tools they utilize and offer supporting information to those who do not already have ordinances in place for enforcing proper grease trap size, cleaning and maintenance. The Policy and Outreach Workgroup, with assistance from the WWTF Workgroup will develop an education campaign and distribute materials on FOG and lateral line maintenance as necessary, as well as develop an outreach campaign with the TCEQ to promote SSOI. Partners will update the larger stakeholder group at an annual stakeholder meeting.

In Year Two, the Workgroup recommends that the TCEQ continue to work with permittees to follow through on their SSOI and make additional presentations at association meetings to encourage additional permittees to participate in a SSOI, as

resources permit. The WWTF Workgroup will continue to provide information to local governments that request assistance with ordinances. Facilitation of the education campaign will continue, as well as updating stakeholders at the annual meeting.

In Years Three and Four, the Workgroup requests that the TCEQ continue to work with permittees with regards to their SSOIs and encourage non-participants to participate in the program. The WWTF Workgroup will contact local jurisdictions again to determine if any new ordinances have been implemented and to offer support to those who request it. Distribution of educational materials will continue, as well as updating stakeholders at the annual meeting.

In Year Five, partners will evaluate the effectiveness of the management measures and make appropriate adjustments.

Tables 8, 9 and 10 provide additional details for Management Measure 1.4. Appendix A provides the schedule of implementation.

Recommendations

The Workgroups developed three fully supported sets of management measures to target WWTFs, OSSFs, and Boater Waste. The management measures from the Workgroups are voluntary best management practices (BMPs) that the stakeholders came to a consensus on in order to reduce bacteria in the bay. In the WWTF Workgroup, a survey was sent to many of the permittees within the project area to determine the kind of ideas that would be supported in the I-Plan. The ideas that were fully supported by the permittees and the Workgroup became management measures. The ideas that did not have 100 percent support but that the Workgroup believed were important to reduce bacteria in the bay are presented below as recommendations.

Recommendations for WWTFs:

- Increase the monitoring frequency at WWTFs in the project area, particularly the smaller facilities. The Workgroup believes that the minimum sampling frequency required in the TCEQ permits should be once per week.
- Require a minimum of a C license for operators of facilities impacted by the oyster waters TMDL.
- After a specified number of bacteria violations, the facility should be required to seek assistance to reach compliance. It would be up to the facility to decide the type of assistance to pursue. Options might be to ask for help from the TCEQ Small Business and Government Assistance Program, neighboring cities, a qualified engineer, or from a recommended peer group (a list of qualified professionals chosen by the Workgroup.)
- Require redundancy in the chlorine feed system and auto switch over capabilities. Include this training in basic operator training class curriculum. Offer training classes in the TMDL area on a regular basis.

- Notwithstanding the TCEQ and local enforcement authority, WWTFs that are chronically or severely out of compliance with the bacteria limits set in their TPDES permit shall be encouraged to address the problems through operational improvements and/or capital improvements. If the plant continues violating bacteria limits set in their TPDES permit, the Workgroup encourages the TCEQ or any local government with jurisdictional authority to work with the WWTF to evaluate plant regionalization and implement as appropriate. Regionalization is essentially the construction and operation of a small number of large, continuously staffed facilities in lieu of a larger number of smaller, intermittently staffed facilities. Because of their size, regional facilities can often make use of more advanced treatment technologies and control systems, which can result in higher reliability. However, in some cases regionalization is not practical and thus must be evaluated on case-by-case basis. If regionalization is not a viable alternative, the plant should be required to make modifications in order to meet permit limits. This might include designs that conform to higher standards than the minimum required design criteria (30 TAC 217). Existing WWTFs in the area contemplating expansion, and entities considering construction of new WWTFs are encouraged to consider regionalization options.

Table 9. Wastewater Treatment Facilities Management Measure 1.4a

(1) Management Measure	(2) Potential Load Reduction	(3) Technical and Financial Assistance Needed	(4) Education Component	(5) Schedule of Implementation	(6) Interim, Measurable Milestones	(7) Progress Indicators	(8) Monitoring Component	(9) Responsible Organization
Sanitary Sewer Systems								
Management Measure 1.4a: Decrease Sanitary Sewer Overflows	This TMDL calls for compliance with concentration based limits: -Fecal coliform 200 CFU per 100 mL -*E. coli* 126 CFU per 100 mL -*Enterococcus* 35 CFU per 100 mL	**Technical:** Assistance from TCEQ EnvironMentor Program, U.S. EPA, WEAT, and private consultants. U.S. EPA's CMOM program and TCEQ's SSOI program could be used for guidance **Financial:** Existing local funding and grant funding as available	Outreach campaign materials to promote the SSOI TCEQ's presentations and other utility management workshops	**Year 1:** Request that TCEQ present information on participating in a SSOI at association meetings Develop outreach campaign to promote SSOIs **Years 2- 5:** Request that TCEQ continue to work with participating permittees and continue to make presentations to encourage others to participate Evaluate the effectiveness of the MM	Outreach campaign plan created Outreach campaign launched	Number of permittees participating in an SSOI Number of presentations given by TCEQ (one or two suggested in the first year) Number of additional utility management workshops Number in attendance at additional utility management workshops Number of owners/operators reached in the outreach campaign	Reports collected from TCEQ and WWTFs regarding progress and/or participation in the SSOI	The Workgroup recommends that TCEQ give presentations at owner and operator association meetings GBF will coordinate with adjacent watersheds to offer additional utility management workshops Policy and Outreach Workgroup and WWTF Workgroup will work with TCEQ to develop an outreach campaign and collect reports and review data in order to focus outreach efforts WWTFs will initiate participation in the SSOI

Table 10. Wastewater Treatment Facilities Management Measure 1.4b

(1) Management Measure	(2) Potential Load Reduction	(3) Technical and Financial Assistance Needed	(4) Education Component	(5) Schedule of Implementation	(6) Interim, Measurable Milestones	(7) Progress Indicators	(8) Monitoring Component	(9) Responsible Organization
Sanitary Sewer Systems								
Management Measure 1.4b: Address Fats, Roots, Oils, and Grease	This TMDL calls for compliance with concentration based limits: -Fecal coliform 200 CFU per 100 mL -*E. coli* 126 CFU per 100 mL -*Enterococcus* 35 CFU per 100 mL	**Technical:** Legal assistance may be needed for individual communities. Some assistance from U.S. EPA, TCEQ, WEAT, and other organizations. **Financial:** Grants and existing local funding as available	Educational campaign related to FOG Education materials posted on the GBF website Permittees will need to educate the public and have public comments on any new or revised ordinances	**Year 1:** Compile existing inspection and enforcement tools and provide support to entities without formal grease trap programs Develop regional Cease the Grease campaign to be distributed and posted on GBF website **Year 2:** Continue to provide information to local governments and refine and distribute campaign materials **Years 3 and 4:** Contact local jurisdictions to determine if new grease trap controls have been implemented Continue to refine and distribute campaign materials **Year 5:** Evaluate the effectiveness of the MM	Target areas identified for providing technical support and FOG outreach Educational materials developed Compile and share all existing FOG controls in watershed Local governments begin discussions regarding new FOG controls and outreach campaign	Outreach campaign plan created Outreach campaign launched Number of educational materials distributed Number of local governments contacted Number of governments assisted Education materials posted and number of web page visits	WWTF Workgroup will collect reports from stakeholders	GBF and Workgroups will contact local governments and offer assistance with ordinances, carry out the education campaign and post materials on the GBF website WWTF Workgroup will collect and review reports from stakeholders

Table 11. Wastewater Treatment Facilities Management Measure 1.4c

(1) Management Measure	(2) Potential Load Reduction	(3) Technical and Financial Assistance Needed	(4) Education Component	(5) Schedule of Implementation	(6) Interim, Measurable Milestones	(7) Progress Indicators	(8) Monitoring Component	(9) Responsible Organization
Sanitary Sewer Systems								
Management Measure 1.4c: Address Lateral Line Maintenance	This TMDL calls for compliance with concentration based limits: -Fecal coliform 200 CFU per 100 mL -*E. coli* 126 CFU per 100 mL -*Enterococcus* 35 CFU per 100 mL	**Technical:** Some assistance from the WWTF Workgroup, U.S. EPA, TCEQ, WEAT, and other organizations. **Financial:** Grants and existing local funding as available	Educational campaign related to lateral line maintenance in print and on the GBF website	**Year 1:** Develop and/or compile existing education materials; distribute and post on GBF website **Year 2-5:** Continue distribution of materials and evaluate the effectiveness of the MM	Educational materials developed Distribution plan for materials created	Number of educational materials distributed Education materials posted and number of web page visits	WWTF Workgroup will collect reports from stakeholders	GBF, WWTF and Policy/Outreach Workgroup will help develop and distribute educational campaign materials and post on the GBF website WWTF Workgroup will collect and review reports from stakeholders

Management Measure 2.0: On-site Sewage Facilities

Management Measure 2.1: Create Regional Plan to Identify, Prioritize, and Address Failing OSSFs

On-site sewage facilities (OSSFs) are a potential contributor of bacteria to the UGCOW. Proper operation of these systems is critical to removal of contaminants from wastewater. According to the U.S. Census Bureau, the failure rate of OSSFs nationwide is at least ten percent. A study sponsored by the Texas On-Site Wastewater Treatment Research Council indicated that the OSSF failure rate in this region is at least 12 to 20 percent (Reed, Stowe & Yanke, 2001) and the U.S. EPA states that the nationwide failure rate ranges from 10 to 20 percent (U.S. EPA, 2002).

The purpose of this management measure is to identify failing systems and create a plan to repair or replace malfunctioning systems. The Houston-Galveston Area Council (H-GAC) has created and continuously updates a map and database with permitted and unpermitted OSSFs and reported OSSF violations. A map of permitted OSSFs in the UGCOW can be seen in Figure 8. The Workgroup will focus on addressing the one-mile buffer since this is the specified project area in the UGCOW TMDL. In this area, there are 922 identified OSSFs (indicated by red dots). Additionally, H-GAC has estimated that there could be up to 5,251 additional unknown or unpermitted OSSFs in the UGCOW project area based on the number of residential land parcels that are not within the boundaries of a municipal wastewater service area.

Areas to be investigated will be prioritized by the OSSF Workgroup based on the highest potential impact to water quality in Galveston Bay. The overall numbers of identified versus potential OSSFs by county are displayed in Figure 9. The counties listed in order from highest to lowest number of unidentified OSSFs are Galveston, Chambers, Harris, and Brazoria County, respectively. The Workgroup recommends that Authorized Agents conduct initial inspections of septic systems in the watershed that are within half a mile from the coastal boundary or half a mile from the tributaries in order to survey the overall status of OSSFs in this project area, and be able to reduce the number of unidentified OSSFs. Table 12 lists the Authorized Agents in this project area. Within those boundaries, the Workgroup will identify OSSFs with a higher potential to malfunction based on age of the system, existence of a maintenance contract, tract size, and soils in the area. The Workgroup recommends that the appropriate Authorized Agents walk the OSSF's disposal areas to look for obvious signs of a malfunctioning system, add any failing systems to a general global positioning system (GPS) database, and address failing systems with appropriate actions. In addition to this method of identifying and prioritizing failing OSSFs, the Workgroup will identify existing sources of funding, partner with organizations already leading efforts (i.e. Dickinson Bayou Watershed Partnership (DBWP), Texas AgriLife Extension Service (TAES), Galveston County Health District, H-GAC, or seek additional funding and research partnerships to carry out a focused study of OSSF bacteria loads to the watershed. The Workgroup believes that the ability to present reputable local data will aid in motivating homeowners and legislators to take a closer look at the impacts of

failing systems, as well as aid in prioritizing areas to focus on repairing and replacing systems. OSSFs outside of the project area boundary are also important to address, however they are not covered under this plan. As with all management measures, the Workgroup will communicate with adjacent watersheds in order to coordinate efforts in reaching as many systems as possible.

The OSSF Workgroup has identified existing sources of funding, (i.e. Section 319 grant Coastal Zone Act Reauthorization Amendments project with TAES), and will partner with organizations already leading efforts (i.e. TAES, H-GAC), or seek additional funding, if necessary, for low income homeowners to repair identified malfunctioning or failing systems. The OSSF Workgroup will develop an improved process for determining and identifying low-income homeowners through collaboration with organizations that have carried out this task in the past. The plan will be used to prioritize homeowners who do not have the resources to pay for repairs or replacements. The OSSF Workgroup will also seek funding, if necessary, to support additional staff to increase the number of inspections. Currently, TAES is actively inspecting, pumping out, repairing, and replacing OSSFs throughout the coastal zone, which includes the UGCOW project area. In 2012, they pumped out and inspected 24 anaerobic systems. In 2013, they pumped out and inspected 15 systems, replaced six systems, and scheduled seven additional systems for replacement within Galveston and Brazoria County. They have additional funding to continue this work through at least 2015. Additionally, H-GAC is actively seeking Supplemental Environmental Project funds to repair and replace malfunctioning systems region-wide.

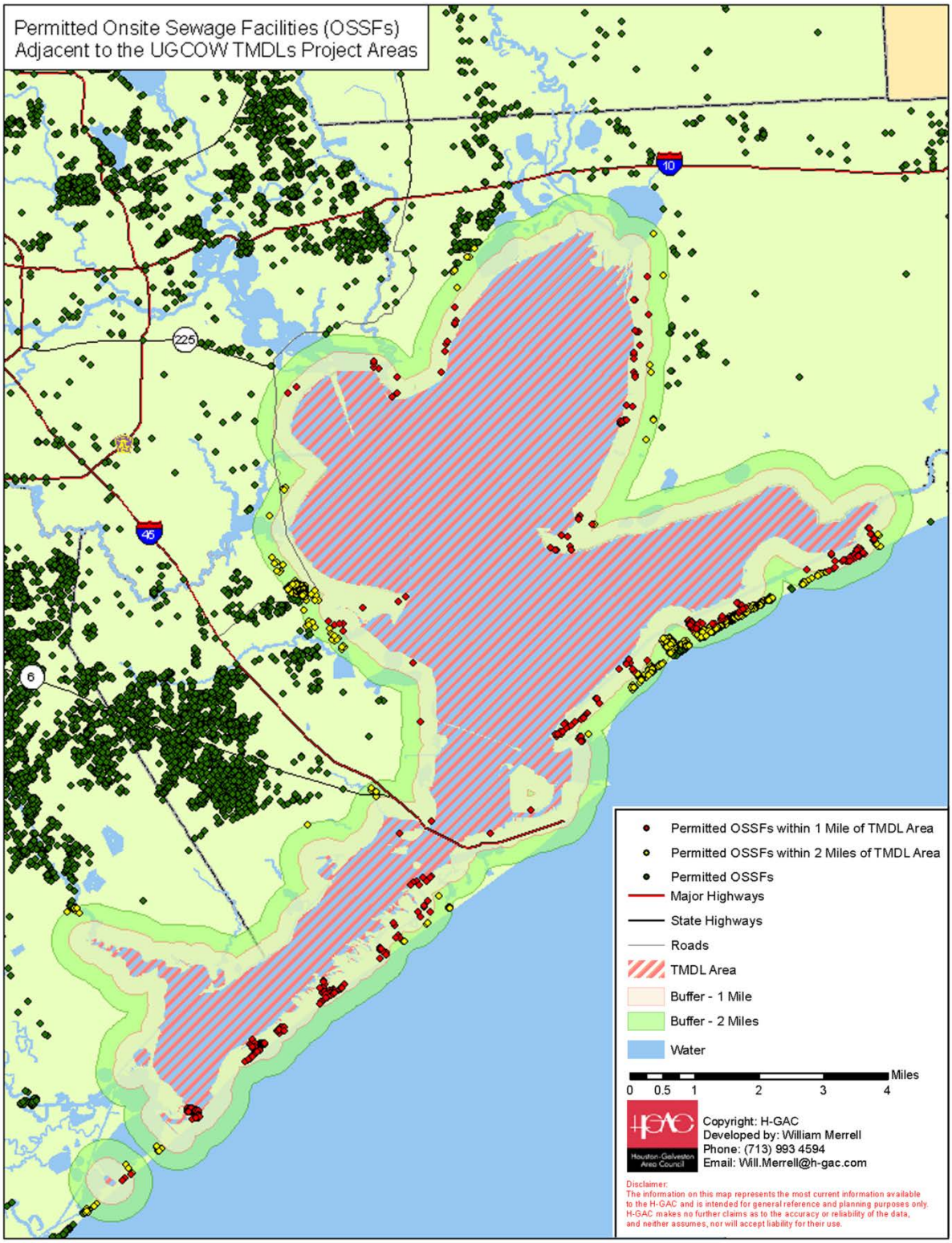

Figure 8. Permitted OSSFs adjacent to the UGCOW project area*

*922 OSSFs within 1 mile and >1400 within 2 miles

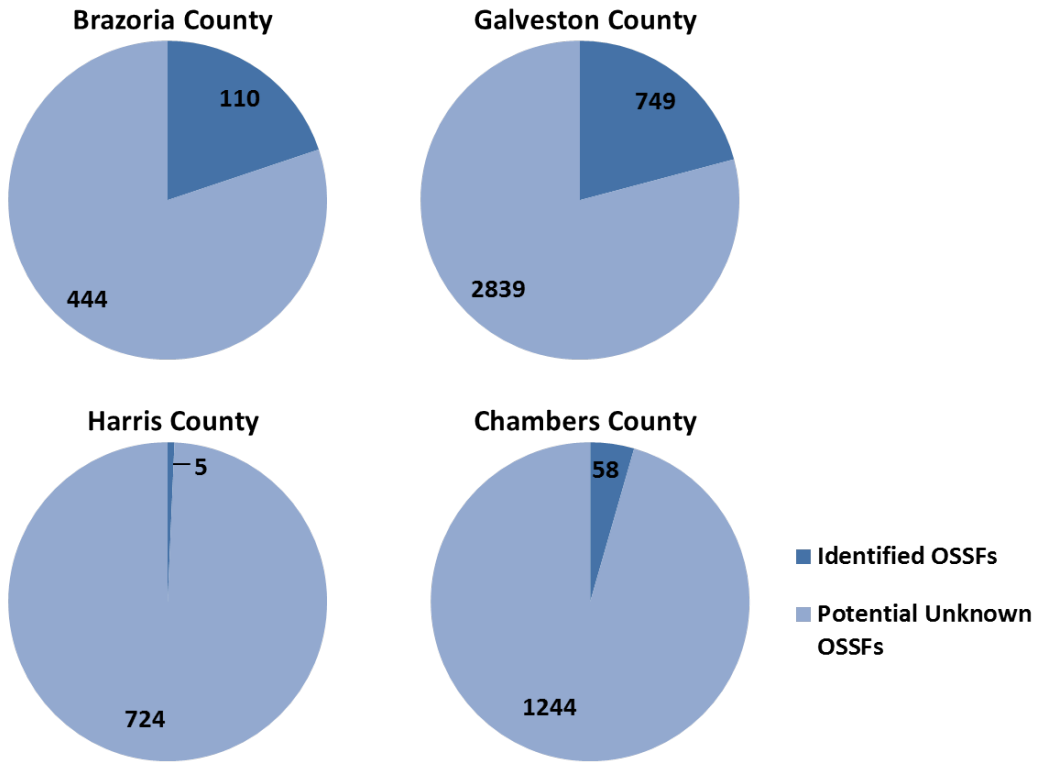

Figure 9. Number of identified and potential unknown OSSFs in the UGCOW by county

Table 12. Authorized Agents for OSSFs in or adjacent to the UGCOW Project Area

Location	Authorized Agents*
Brazoria County	• County of Brazoria – Environmental Health Services • Village of Surfside Beach
Galveston County	• Galveston County Health District – Consumer Health Services
Harris County	• Harris County Public Infrastructure Department – Permits • City of Baytown
Chambers County	• County of Chambers – Environmental Health and Permitting • City of Beach City
TCEQ Region 12 (all four counties)	• TCEQ Region 12, Houston Office

*Contact information can be found at either the H-GAC or TCEQ websites:
http://www.h-gac.com/community/water/ossf.aspx
https://www6.tceq.texas.gov/oars/index.cfm?fuseaction=search.county

Another key factor in reducing failing OSSFs is increased education and outreach at all levels of the supply chain. The TAES will develop and offer workshops to real estate agents, installers, inspectors, and homebuyers to raise more awareness of the shortfalls of most inspections and the importance of having a thorough inspection of the septic system. Although lending institutions require home inspections at the point of sale, OSSFs are not required to be inspected. Currently there is no standardized point of sale inspection procedure for conventional septic systems. Without a standardized procedure, the methods to determine a system's operational status may vary among inspector's knowledge of OSSFs. Factsheets written by TAES and a list of individuals who have completed the inspector training course will be provided to the participants of the workshop. Real estate agents can use this information to recommend inspectors.

The TAES will also continue to offer workshops to homeowners as part of the education and outreach of the management measure. The workshops will focus on general system use, maintenance, and identification of problems. TAES has agreed to offer similar workshops for several watershed protection groups in the area. To minimize overlap between these watershed protection groups and to maximize coordination, the groups will work to rotate the workshops among the various watersheds. Not only will this provide efficiency, it will also drive collaboration.

Currently available education and outreach materials will be distributed in the project area, such as those developed by the Texas Coastal Watershed Program for the DBWP (http://dickinsonbayou.org/septic-systems/), and by TAES (http://ossf.tamu.edu/). New materials will be developed as necessary, and the Workgroup will create a distribution plan in order to reach targeted audiences. Partners will host an annual meeting with stakeholders to update them on progress with the management measures.

Responsible Parties and Funding

The following parties are responsible for carrying out various components of this management measure:

- GBF
- Authorized Agents in the project area
- H-GAC
- OSSF owners of malfunctioning systems
- OSSF Workgroup
- Policy and Outreach Workgroup
- Research partners
- TCEQ
- TAES

The OSSF Workgroup will utilize existing local funds and projects, as described above and will continue to research additional funding opportunities, as necessary, for fixing failing systems, increasing the number of inspections, carrying out an impact study, and holding workshops and other outreach activities. Potential funding sources include the

U.S. EPA Environmental Education Grant Program, Urban Waters Grant Program, Gulf of Mexico Grant Program, Section 319 Nonpoint Source Pollution Grant Program, Five Star and Urban Waters Restoration Grant Program, Texas GLO – Coastal Management Program Grant Program, Galveston Bay Estuary Program, and Supplemental Environmental Projects. The Clean Water State Revolving Fund is a possible source of funding to repair or replace aging infrastructure. This funding program is authorized by the Clean Water Act and provides low-interest financial assistance, which can be utilized for nonpoint source pollution abatement projects. Additionally, the USDA Rural Development Loan Assistance program can provide loans and grants to low-income homeowners in order to remediate health and safety hazards.

Measurable Milestones

In Year One, the OSSF Workgroup will examine the most current data and maps to prioritize locations for initial inspections. TAES will conduct one workshop for OSSF homeowners in the watershed and one workshop for real estate agents, installers, inspectors, and homebuyers in the area. The OSSF Workgroup will partner with organizations leading efforts or apply for additional funding, if necessary, to repair failing OSSFs for low income homeowners with the highest priority. The Workgroup will also identify research partnerships and funding needs in order to carry out a local impact study on malfunctioning OSSFs. TAES and DBWP will maintain their websites that provide resources for proper maintenance, licensed installers, training centers, etc. Educational materials will be developed and distributed as needed. Partners will update the larger stakeholder group at an annual stakeholder meeting.

In Year Two, Authorized Agents will begin to increase the number of inspections of OSSFs beginning with the prioritized areas. They will inspect 25 percent of the highest priority OSSFs in the project area. TAES will continue to hold one workshop a year each for OSSF homeowner's maintenance and the real estate industry. The OSSF Workgroup will begin facilitating funding efforts for the OSSF impact study and for OSSF homeowners and more inspections, as necessary. Malfunctioning systems will begin to be repaired or replaced. Partners will update the larger stakeholder group at an annual stakeholder meeting.

In Year Three, Authorized Agents will inspect the next highest 25 percent priority OSSFs. Workshops by TAES will be held for homeowners and the real estate industry. The OSSF Workgroup will continue to facilitate funding efforts for the OSSF impact study, for OSSF homeowners and for additional inspections, as necessary. Systems will continue to be repaired or replaced. Partners will continue to update stakeholders.

In Year Four, Authorized Agents will inspect the next highest 25 percent priority OSSFs. Workshops by TAES will be held for homeowners and the real estate industry. Systems will continue to be repaired or replaced. Results from the OSSF impact study will be analyzed and presented to stakeholders. Partners will continue to update stakeholders.

In Year Five, Authorized Agents will inspect the next highest 25 percent. Partners will evaluate the effectiveness of implementing this management measure and make appropriate adjustments.

Table 11 provides additional details for Management Measure 2.1. Appendix A provides the schedule of implementation.

Recommendations

The following recommendations suggested by the OSSF Workgroup have both merit and support, however, they require either change in legislation or in regulatory rules. These changes would take longer than the current five-year window of the Upper Gulf Coast I-Plan and therefore are put forward as recommendations rather than management measures. The OSSF Workgroup will begin an ongoing conversation with the entire OSSF community (i.e. regulators, inspectors, installers, builders, authorized agents) in order to move toward achieving these recommendations.

- *Require a licensed maintenance provider for OSSFs* -- According to Table XII of 30 TAC Chapter 285, there are no testing or reporting requirements for septic tanks with subsurface distribution. A licensed professional should inspect these systems to determine operational status and maintenance requirements. They should assess the risk of inadequate treatment by evaluating system loading, site conditions, property size, depth to groundwater, and distance to surface waters. The risk assessment would then be used to determine the frequency of inspection and maintenance required to ensure a system is operational and adequately treating wastewater.
- *Require point of sale inspections* -- Currently, when buying a home, there is no standardized point of sale inspection procedure for conventional septic systems. Without a standardized procedure, the methods to determine a system's operational status may vary among inspector's knowledge of OSSFs. Buyers may not be aware of an improperly functioning system or system that does not fit their lifestyle. Legislation needs to be enacted to require a point of sale inspection that is standardized at the sale of the home. A thorough inspection will provide the homebuyer the information needed to determine if their lifestyle and water usage is within the capabilities of the current OSSF. Until legislation is passed, the TAES is currently developing an inspection manual for conventional OSSFs. The manual provides step-by-step guidance for inspecting the septic tank and soil treatment area. A checklist will be used to determine the operational status and required inspection and maintenance frequencies. It is recommended in this plan that all inspectors follow the manual until it is required by law to perform a standard inspection on OSSFs. The UGCOW Workgroup will coordinate efforts on this measure with the DBWP OSSF Workgroup.

Table 13. On-Site Sewage Facilities Management Measure 2.1

(1) Management Measure	(2) Potential Load Reduction	(3) Technical and Financial Assistance Needed	(4) Education Component	(5) Schedule of Implementation	(6) Interim, Measurable Milestones	(7) Progress Indicators	(8) Monitoring Component	(9) Responsible Organization
Nonpoint Sources from Malfunctioning On-Site Sewage Facilities								
Management Measure 2.1: Create Regional Plan to Identify, Prioritize, and Address Failing OSSFs	This TMDL calls for a concentration-based target of 0 CFU per 100 mL	**Technical:** Data and cooperation from H-GAC, authorized agents, TAES, TCWP, and TCEQ will be requested **Financial:** Grant funding and existing local funding as available	Workshop to educate OSSF homeowners about maintenance and malfunctioning systems Workshop for real estate agents, property inspectors, and consumers about the importance of proper point of sale inspections Develop educational materials as necessary Existing TAES website resources	**Year 1:** Prioritize areas to focus inspections Hold workshops and identify low income candidates Identify research partners or existing local studies **Year 2:** Inspect 25% of highest priority and continue offering workshops Begin OSSF impact study and fixing systems for low income candidates **Year 3 and 4:** Inspect 25% of the systems and offer workshops as necessary Complete OSSF impact study; analyze and present results **Year 5:** Inspect final 25% of systems Offer workshops as necessary Evaluate the effectiveness of the MM	Criteria for prioritizing target areas established Identification of prioritized areas Begin education, inspections, and upgrades in high priority target areas GIS points collected at inspections added to H-GAC's OSSF database	A reduction in fecal coliform concentrations Contributions reduced due to repair or replacement of malfunctioning OSSFs Criteria identified and areas prioritized Number of OSSFs inspected Number of repaired or replaced systems Number of workshops offered, attendees and educational materials created and disseminated	Routine water quality monitoring by TDSHS and TCEQ Reports from authorized agents, TCEQ, TAES, TCWP, and H-GAC to OSSF Workgroup Local OSSF impact study	H-GAC will provide maps/data for the project area TAES will conduct workshops/inspections, repair/replace OSSFs, and maintain education materials TCWP and DBWP will maintain existing education materials Authorized agents will perform inspections Workgroups will distribute education materials OSSF owners will repair/replace malfunctioning systems

Management Measure 3.0: Boater Waste

Management Measure 3.1: Increase Access to Pump-Out Facilities, Enforce Existing Regulations, Enhance Outreach and Marketing, Designate Galveston Bay as Federal NDZ, Conduct Water Quality Monitoring in Marinas

The goal of this management measure is to reduce the amount of treated and untreated boater sewage discharged into Galveston Bay and its tributaries. While the focus of this I-Plan is on impaired oyster water segments, the Boater Waste Workgroup recommends broadening the efforts of this management measure to include Clear Lake and other tributaries heavily used by boaters. This source of pollution is transient in nature, so the Workgroup believes that targeting a broader audience through cohesive efforts will result in increased success. This includes collaboration among outreach groups (i.e. U.S. Coast Guard Auxiliary, Sail and Power Squadrons, TPWD Boater Education, etc.), environmental groups (H-GAC, GBEP, GBF, etc.), and government/enforcement agencies (U.S. Coast Guard, TPWD Game Wardens, city managers, etc.).

There are currently 32 marinas in the Galveston Bay/Clear Lake area (Table 14). Most marinas are located in the Clear Lake area, which has the third highest concentration of privately owned marinas in the United States (GBEP, 2004). This includes recreational boats and live-aboard boats. At this time, the Workgroup's best estimate is that marinas in the project area have a total capacity of 7,903 boats, including 6,695 wet slips and 1,208 dry boat storage slips (Clean Texas Marina Program, 2013). This number does not include the many canal communities that would add many more boats to that total. Specifically related to boats with the potential of having a marine sanitation device (MSD), 2013 Texas Parks and Wildlife boater registration data captures a total of 8,771 boats greater than 25 feet long in the counties surrounding Galveston Bay. Improper handling of human waste at any of the marinas can result in unauthorized discharges. This can cause elevated bacteria concentrations both within the marina area and in oyster water areas through the transport of bacteria by currents or boating activity. In addition, elevated bacteria concentrations could result from a large number of boaters discharging sewage into the bay itself, which directly affects the oyster waters. The Workgroup found that the extent to which boat sewage contributes to bacteria levels in the UGCOW is difficult to calculate due to the lack of data available regarding this source. In order to better understand this issue, the Workgroup will develop methods to collect data in order to determine boater waste impact on bacteria inputs to the project area.

The following is a summary of regulations and penalties that are applicable to the boater waste issue in Clear Lake and Galveston Bay. The full code references and language can be found in Appendix C.

- It is illegal to discharge untreated waste into any surface water in the state.
- It is illegal to discharge untreated or treated waste into Clear Lake or any other state or federally recognized no discharge zone.

- Treated and untreated sewage may be discharged into coastal waters from a point three nautical miles or further into the Gulf of Mexico.
- Boats equipped with a Type I or II MSD (those with some level of treatment and no holding tank) must secure their y-valve and/or main discharge valve to prevent discharge of sewage while in a no discharge zone.
- Boats equipped with a Type III MSD (those with no treatment and a holding tank) must secure their y-valve and/or main discharge valve unless located three or more nautical miles in the Gulf of Mexico, and dispose of sewage at an approved pump-out facility.
- All MSDs and pump-out facilities must be certified every two years through the TCEQ's Clean Water Certification Program: (https://www.tceq.texas.gov/field/cleanwatercert/boatsdisposalrule.html)
- Violating or failing to comply with these rules is a Class C Parks and Wildlife Code misdemeanor and a separate offense is committed each day a violation continues. Violators may be assessed a fine of up to $500 per day.
- A game warden or any peace officer certified as a marine safety enforcement officer may enforce these rules.
- If a marine safety officer reasonably suspects that a boat is illegally discharging sewage, they may (if the owner or operator is aboard) board the boat to inspect the MSD and test the system for compliance by flushing a dye tablet.

Increase Access to Pump-Out Facilities

The Workgroup and local boating community widely agree that Galveston Bay and Clear Lake need more pump-out facilities. Local government entities will be encouraged to pass an ordinance requiring marinas to provide a pump-out if certain conditions are met. Those conditions will be determined as more research is done and information becomes available. One example would be to require a pump-out station for every 200 boats in a marina that are 26 feet or larger (U.S. EPA, 1985). Another example is an ordinance that the City of Seabrook passed in 2010. Section 80-269 states, "every marina with more than ten slips, or with more than 200 linear feet of mooring at bulkheads or piers, shall provide an approved dump station for sanitary sewage. Approved dump stations include mobile facilities." A mobile facility refers to a piece of on-site equipment (i.e. limited capacity pump-out cart) at the marina, not to mobile pump-out companies. Seabrook has expressed their support of improving water quality and their intent to collaborate with GBF and the Workgroup to ensure that this ordinance is being followed. Moving into the future, the city anticipates researching and working toward formulating ordinances that will help protect water quality, such as requiring that new marina developments install stationary pump-out facilities (not allowing mobile facilities to be the only pump-out on-site), and requiring visible signage throughout marinas to educate boaters of discharge regulations, enforcement contact information, and available pump-out facilities. The Workgroup will collaborate with the City of Seabrook by providing supporting information as they work to enforce their existing

ordinance, as well as make recommendations as they develop new ordinances. The Workgroup will use the City of Seabrook as a positive local example of how municipalities can assist in reducing bacteria in Galveston Bay and encourage other local governments to follow suit.

To date, there are thirteen public and three private pump-out facilities, only six of which are located in Galveston Bay. Additionally, there are three mobile pump-out companies (Figure 10). With the potential of having over 8,000 vessels traveling throughout the Clear Lake/Galveston Bay area, the Workgroup and local boating community overwhelmingly believe that more pump-out facilities are needed. The asterisks in the "Pump-Out" column of Table 14 indicate the marinas and other waterfront locations at which the Workgroup recommends installing pump-out stations based on the number and size of boats in the marina, and/or its navigability. If accomplished, this would result in ten new pump-out stations across the Galveston Bay system. The Boater Waste Workgroup will open discussions with the local jurisdictions and marinas to solicit their support to add pump-out facilities where they are most needed. An effort will be made to seek funding to increase the number of pump-out facilities in the area. For example, the Workgroup will assist these entities in applying for Clean Vessel Act (CVA) grants that are available through TPWD, which can fund up to 75% of installation of the public pump-out facilities. This grant funding comes directly from taxes on fishing and boating supplies to the Sport Fish Restoration and Boating Trust Fund. The taxes go back into improving the environments that support these recreational activities. Additionally, the Workgroup recommends that marinas build the cost of installing and maintaining pump-out facilities into their slip fees, which many already do in order to provide this “free” service to their tenants.

Enforce Existing Regulations

The Workgroup believes that enforcement of existing laws and regulations needs to become a local priority, particularly in Clear Lake, where a federal NDZ designation already exists (Figure 10). An increase in enforcement will help decrease the amount of sewage discharged from boats. One recommended effort is to capture data from the U.S. Coast Guard, as well as Galveston and Harris County TPWD Game Wardens regarding their current inspection activities and coordinate with them for increased inspection efforts in marinas. Additionally, the Workgroup recommends facilitating training for Galveston and Harris County TPWD Game Wardens on marine sanitation devices and how to easily incorporate this knowledge into their existing vessel inspection checklist based on successful enforcement efforts by Game Wardens on Lake Texoma. Finally, improved communication between enforcement agencies and those engaged in education and outreach is needed in order to better understand each other’s roles and how their uniquely focused efforts contribute to reducing sewage discharges and improving water quality. GBF is leading this communication effort through a Clean Vessel Committee, which will meet on at least a semi-annual basis.

One issue regarding enforcement that has been identified is that many of these agencies receive very few, if any reported complaints of boat sewage dumping,

whereas GBF, marina management, mobile pump-out companies and those on the water see evidence and reports of non-compliant MSD equipment and dumping on a regular basis. The lack of reporting is likely due to citizens not being sure of where to report or how to submit useful reports, resulting in limited success in the follow-up response to their reports. GBF launched a beta Web tool in August 2012 called Galveston Bay Action Network (www.galvbay.org/gban) in order to help facilitate reporting and, based on lessons learned, is in the process of creating an improved application that will directly link reports via Web, Android, or iPhone applications to the appropriate authorities. The Workgroup believes that simplifying the reporting process through this app and educating citizens on how to report through available materials such as TCEQ's publication "Do You Want to Make an Environmental Complaint?" (GI-278), will lead to increased reporting and successful enforcement.

Enhance Outreach and Marketing

For each of these tasks, a strong education and outreach program is necessary for success. GBF has led a region-wide Boater Waste Education Campaign (Pump Don't Dump) since 2008, which began as a social marketing campaign and now consists of many on-the-ground components including hands-on volunteer and outreach programs for boaters of all ages. GBF will continue to collaborate with the Boater Waste and Policy and Outreach Workgroups on this outreach campaign and increase collaboration with GBEP's Back the Bay campaign on social marketing efforts. The Workgroup will also increase their communication with commercial boating operations to determine their concerns and needs in preparation for the NDZ. Partnerships will continue to be formed with marinas, in the project area as well as the U.S. Coast Guard Auxiliary, Houston Sail and Power Squadron, Galveston Bay Sail and Power Squadron, TPWD Boater Education, and Houston Safe Boating Council in order to build relationships and implement the Pump Don't Dump campaign through enhanced education efforts. More widespread and collaborative participation is needed in order to educate boaters about where public pump-out stations are located, to increase awareness of applicable marine sanitation codes and fines, and to capture more extensive data of outreach activities carried out by campaign partners. Finally, GBF staff will attend city council meetings, Rotary Club meetings, as well as other government entities, environmental organizations, and civic associations to present information about this management measure and will develop new educational materials for the campaign when necessary.

Designate Galveston Bay as Federal No Discharge Zone (NDZ)

The Boater Waste Workgroup will explore the possibility of submitting an application to the U.S. EPA to designate Galveston Bay as a federal NDZ (both treated and untreated sewage) (Figure 10). Under Section 312 of the CWA, U.S. EPA or States may establish no discharge zones in which the discharge of both treated and untreated sewage from all vessels into specified waters is prohibited. It is still legal to discharge treated boat sewage into Galveston Bay so it is not yet a NDZ, by definition.

The Workgroup believes that the most appropriate NDZ application for Galveston Bay is for waters that have environmental importance (CWA Section 312 (f)(4)(A)). Historically,

Galveston Bay accounted for about 90 percent of oysters produced in the state of Texas. This production has decreased over the years due to increasing salinities caused by droughts, making the oysters more prone to predation and parasites. Additionally, bacteria impairments in several segments and negative impacts from Hurricane Ike in 2008 have put pressure on Galveston Bay oyster fisheries. Currently, Galveston Bay supplies only about one-third of Texas' oysters, but they are still a key economic asset for the region (TPWD, 2013). In addition, oysters serve an important ecological role as filter feeders in the estuary influencing conditions such as water clarity and phytoplankton abundance. Oysters create reef habitats utilized by many other species and serve as an important indicator of the overall health of a bay ecosystem. However, only a few federal NDZ designations have been made under CWA Section 312 (f)(4)(A), so the Workgroup will also consider applying under Section 312 (f)(3), which is based on the water body having an adequate number of pump-out facilities.

Conduct Water Quality Monitoring in Marinas

The Boater Waste Workgroup recommends that baseline and long-term trend data be collected, and that focused sampling be carried out in marinas in order to determine the effectiveness of implementation efforts over time. The Environmental Institute of Houston (EIH) carried out a baseline study for TCEQ in 1993 in several marinas throughout Clear Lake and Galveston Bay, but no other data was collected in marinas until recently when GBF launched their volunteer Water Monitoring Team (a partner with Texas Stream Team) in 2012 and a volunteer sampling program for Enterococci in 2013. GBF will continue to run these programs in order to collect monthly ambient data, as well as conduct focused bacteria studies in several marinas. These studies will look at a variety of bacteria sources and variables (i.e. stormwater, birds, boat activity, marina design, etc.) in order to better understand the complex water quality challenges that can exist in marinas. Additionally, the Workgroup will seek funding in collaboration with EIH in order to repeat their 1993 study, if further data are needed.

Responsible Parties and Funding

The following parties are responsible for carrying out various components of this management measure:

- Boater Waste Workgroup
- Clean Texas Marina Program
- Clean Vessel Committee
- Clear Lake Marina Association
- Environmental Institute of Houston
- Galveston Bay Foundation
- Galveston Bay Sail and Power Squadron
- Galveston County Health District
- Harris County Pollution Control Services
- Houston Safe Boating Council
- Houston Sail and Power Squadron
- Individual boaters in the project area

- Individual marinas in the Clear Lake/Galveston Bay area
- Marina Association of Texas
- Marine Safety Officers
- Maritime Sanitation
- Maximum Marine Services
- Policy and Outreach Workgroup
- Redfish Island Marine
- Texas Commission on Environmental Quality
- Texas Department of State Health Services
- Texas Parks and Wildlife (Boater Education and Enforcement Division)
- U.S. Coast Guard Auxiliary
- U.S. Coast Guard Marine Safety Units

The Boater Waste Workgroup will seek financial assistance to support the proposed outreach activities and to assist with installing additional pump-out stations throughout the project area. Potential funding sources include the Texas General Land Office Coastal Management Program, Galveston Bay Estuary Program, Clean Vessel Act pump-out funds, Clean Water Act Section 319 Nonpoint Source Grant Program, Five Star and Urban Waters Restoration Grant Program, U.S. EPA - Gulf of Mexico Program, Supplemental Environmental Project funds, and foundation grants or corporate sponsorships.

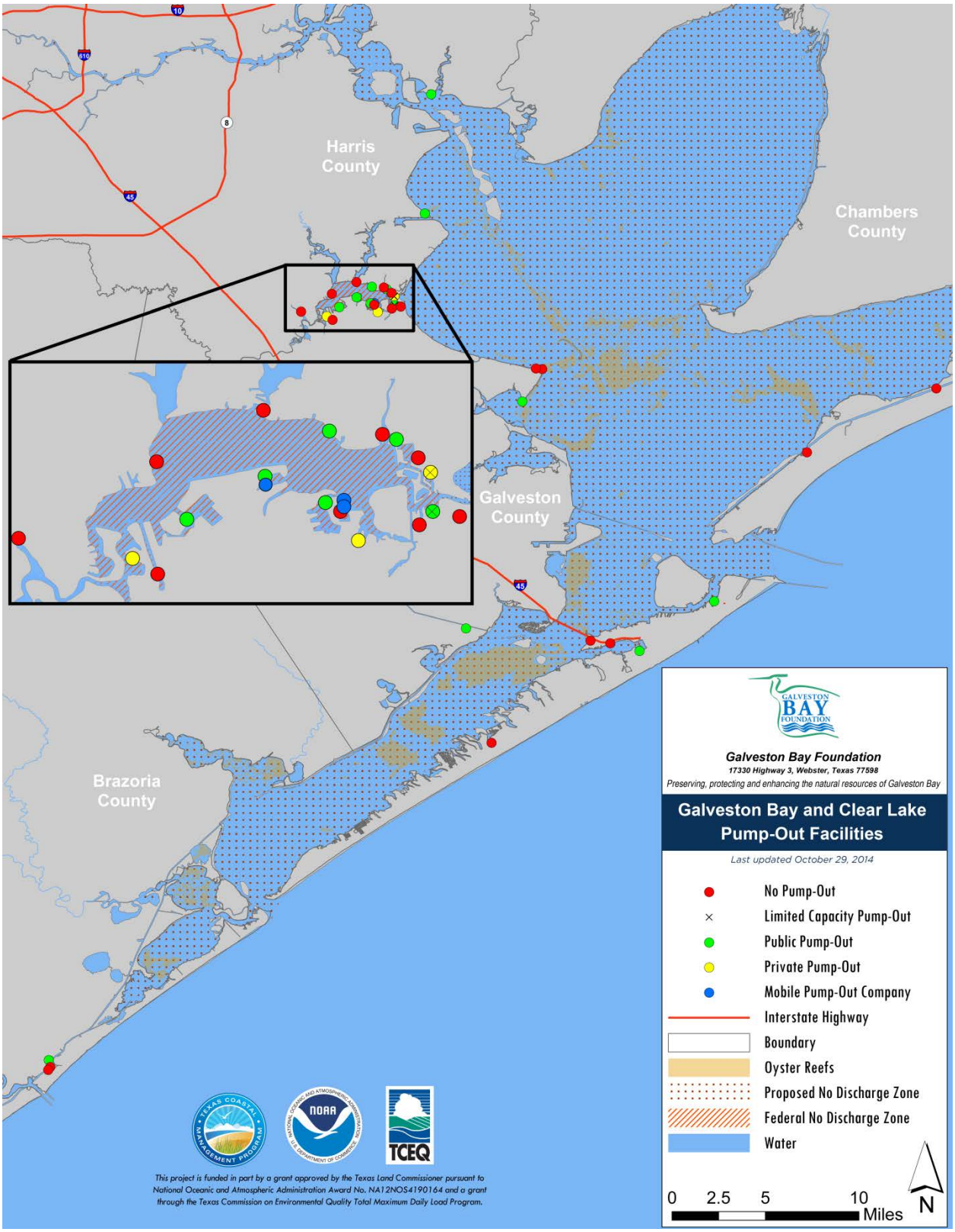

Figure 10. Galveston Bay and Clear Lake boat pump-out facilities (13 public, 3 private, 3 mobile)

Table 14. Marinas and Other Waterfront Locations in the Galveston Bay Area (Clean Texas Marina Program, 2013)

Marina Name and Location						**Slips and Ramps**			
Clear Lake						**Wet Slips**	**Dry Slips**	**Ramp**	**Pump Out**
Bal Harbor Marina	123 Lakeside Lane	Nassau Bay	TX	77058	(281) 333-5168	133	0	No	No*
Blue Dolphin Yachting Center, Inc.	P.O. Box 123	Seabrook	TX	77586	(281) 474-4450	237	0	No	No*
Clear Lake Marine Center, Inc.	P.O. Box 716	Seabrook	TX	77586	(281) 326-4426	161	0	No	No*
Constellation Point and Marina	451 Constellation	League City	TX	77573	(281) 334-2527	48	0	No	No
Endeavour Marina	3101 NASA Parkway	Seabrook	TX	77586	(832) 864-4000	0	380	No	Yes
Kemah Boardwalk Marina	555 Bradford Street	Kemah	TX	77565	(281) 334-2284	424	0	No	No*
Lakeside Yachting Center, Inc.	2511- B Nasa Rd. 1, Ste. 101	Seabrook	TX	77586	(281) 326-5547	75	0	No	No
Lakewood Yacht Club	2425 Nasa Parkway	Seabrook	TX	77586	(281) 474-2511	300	0	Yes	Yes
Legend Point (private)	1300 Marina Bay Drive	Clear Lake Shores	TX	77565	(281) 334-3811	254	0	No	Yes
Marina Bay Harbor Yacht Club	P.O. Box 478	Kemah	TX	77565	(281) 535-2222	0	280	No	No
Marina Del Sol	1203 Twin Oaks Boulevard	Kemah	TX	77565	(281) 334-3909	265	195	No	Yes
Nassau Bay Yacht Club	1120 Nasa Pkwy, Ste. 109	Nassau Bay	TX	77058	(281) 333-2570	40	55	Yes	No
Portofino Harbour	One Portofino Plaza	Clear Lake Shores	TX	77565	(281) 334-6007	212	0	No	Yes
Seabrook Marina Inc.(private)	1900 Shipyard Drive	Seabrook	TX	77586	(281) 474-2586	500	135	No	Yes
South Shore Harbour	2551 South Shore Blvd., Ste B	League City	TX	77573	(281) 334-0515	858	0	No	Yes
Waterford Harbor Marina	800 Mariners Drive	Kemah	TX	77565	(281) 334-4400	640	0	No	Yes
Watergate Yachting Center	1500 Marina Bay Drive	Clear Lake Shores	TX	77565	(281) 334-1511	1000	0	No	No*
Wharf at Clear Lake (WSMA) (private)	P.O. Box 1208	League City	TX	77574	(281) 334-5976	205	0	Yes	Yes

*Workgroup recommends pump-out facility be installed based on the number and size of boats in the marina, and/or its convenient access

Marina Name and Location						Slips and Ramps			
Galveston Bay						**Wet Slips**	**Dry Slips**	**Ramp**	**Pump Out**
Bayland Marina	2651 S. Highway 146	Baytown	TX	77520	(281) 422-8900	150	0	Yes	Yes
Eagle Point Fishing Camp, Inc.	Route 1 Box 1718	San Leon	TX	77539	(281) 339-1131	37	46	Yes	No
Galveston Yacht Basin	715 North Holiday Dr.	Galveston	TX	77550	(409) 762-9689	500	300	Yes	Yes
Harborwalk Marina	P.O. Box 2328	League City	TX	77574	(409) 935-3737	156	0	Yes	Yes
Houston Yacht Club	3260 Miramar Drive	Shoreacres	TX	77571	(281) 471-1255	187	100	Yes	Yes
Payco, Inc.	501 Blume Drive	Galveston	TX	77554	(409) 744-7428	150	0	No	No*
Pelican Rest Marina	7819 Broadway	Galveston	TX	77554	(409) 744-2618	33	0	No	No*
Pirates Beach Bait & Tackle	14302 Steward Road	Galveston	TX	77554	(409) 737-3635	25	0	Yes	No
Ray's Marina	6310 Herds Lane	Galveston	TX	77551	(409) 744-2111	26	0	No	Yes
Gulf Intracoastal Waterway						**Wet Slips**	**Dry Slips**	**Ramp**	**Pump Out**
Bolivar Yacht Basin	1283 West Boyt Road	Port Bolivar	TX	77650	(409) 684-7777	35	0	Yes	No
Bridge Harbor Yacht Club	411 Sailfish Avenue	Freeport	TX	77541	(979) 233-2101	300	0	No	Yes
Gulf Coast Marina	135 Shark Lane	Surfside Beach	TX	77541	(979) 239-1502	0	100	No	No
Stingaree Marina	1297 N. Stingaree Drive	Crystal Beach	TX	77650	(409) 684-9530	8	0	Yes	No
Surfside Marina	827 Gulf Road	Surfside Beach	TX	77541	(979) 230-9400	34	245	No	No*

*Workgroup recommends pump-out facility be installed based on the number and size of boats in the marina, and/or its convenient access

Other Waterfront Locations						Slips and Ramps			
Clear Lake						**Wet Slips**	**Dry Slips**	**Ramp**	**Pump Out**
Blue Marlin Fuel Dock	1900 Shipyard Drive	Seabrook	TX	77586	(281) 291-7497	6	0	No	No*
Star Fleet Yachts	280 Grove Road	Kemah	TX	77565	(281) 334-4692	0	0	No	No*
Galveston Bay						**Wet Slips**	**Dry Slips**	**Ramp**	**Pump Out**
Topwater Grill	815 Avenue O	San Leon	TX	77539	(281) 339-1232	20	0	Yes	Yes

*Workgroup recommends pump-out facility be installed based on the number and size of boats in the marina, and/or its convenient access

Measurable Milestones

In Year One, the Workgroup will continue to survey and collect data in order to determine boater waste impact on bacteria inputs to the project area. This information will be compiled and submitted in a request to the TCEQ to apply to the U.S. EPA to make Galveston Bay a federal NDZ. Discussions will continue with local municipalities, enforcement agencies, marinas, and boaters in order to get support for the effort to make Galveston Bay a federal NDZ, to encourage installing more pump-out stations, and to pass an ordinance requiring pump-out stations in at least one municipality. The Boater Waste Workgroup will continue collaborating with the Clean Vessel Committee, and seek funding for additional pump-out stations, additional training workshops for marine officers, and additional educational and outreach materials. Partners will update the larger stakeholder group at an annual stakeholder meeting.

In Years Two, Three, and Four, the Workgroup will continue to garner support for the federal NDZ designation and get it approved, gain support to pass another ordinance in a different local government entity, and add one new pump-out at another key location. The Boater Waste Workgroup will continue collaborating with the Clean Vessel Committee, and seek funding for additional pump-out stations, additional training workshops for marine officers, and additional educational and outreach materials. Partners will update the larger stakeholder group at an annual stakeholder meeting.

In Year Five, partners will evaluate the effectiveness of implementing this management measure and make appropriate adjustments.

Table 13 provides additional details for Management Measure 3.1. Appendix A provides the schedule of implementation.

Table 15. Boater Waste Management Measure 3.1

(1) Management Measure	(2) Potential Load Reduction	(3) Technical and Financial Assistance Needed	(4) Education Component	(5) Schedule of Implementation	(6) Interim, Measurable Milestones	(7) Progress Indicators	(8) Monitoring Component	(9) Responsible Organization
Nonpoint Sources from Boater Waste								
Management Measure 3.1: Increase Access to Pump-Out Facilities, Enforce Existing Regulations, Enhance Outreach and Marketing, Designate Galveston Bay as Federal NDZ, and Conduct Water Quality Monitoring in Marinas	This TMDL calls for a concentration-based target of 0 CFU per 100 mL	**Technical:** Assistance from the Coast Guard Auxiliary/Game Wardens to train marine officers Work with the TCEQ to develop an application for federal NDZ designation **Financial :** Grant funding, loans, and existing local funding as available	Education and outreach to marinas to install pump-outs, adopt BMPs and participate in volunteer water quality monitoring Education and outreach to jurisdictions to require pump-out stations at marinas with certain conditions Workshop to train marine officers	**Year 1:** Survey/collect data to determine impacts Continue promoting NDZ and adding pump-out stations through education and outreach Discussions with marina owners and various jurisdictions Marine officers increase enforcement efforts Begin federal NDZ application process **Years 2, 3 and 4:** Final approval of application for federal NDZ Pass one ordinance and add one pump-out per year Marine officers increase enforcement efforts **Year 5:** Evaluate the effectiveness of the MM	Plan of action created to facilitate establishment of federal NDZ Discussions being held with local governments to establish new ordinance Discussions being held with marinas to install pump-outs Volunteer monitoring carried out in marinas Continued tracking and improvement of outreach campaign	Reduction in fecal coliform concentrations Establishment of federal NDZ Number of new pump-out stations and ordinances Increased enforcement efforts Quantity of educational materials distributed Volunteer monitoring sampling plan or QAPP Number of marinas monitored for water quality	Routine water quality monitoring by TDSHS and TCEQ Volunteer monitoring in marinas via GBF Water Monitoring Team (through Texas Stream Team program)	Recommend that TCEQ assist in applying for federal NDZ Recommend that local jurisdictions develop new ordinances and marinas increase pump-out stations GBF will meet with stakeholders and public officials to get support for federal NDZ Workgroup will continue outreach campaign Recommend that TPWD provides increased training to local Game Wardens and that all enforcement agencies increase enforcement efforts

Other Recommendations

Stormwater Runoff

Stormwater in the project area originates from regulated discharges from Phase I and Phase II MS4s, and from non-regulated runoff. Runoff from shorelines and adjacent watersheds is a potential source of bacteria to the bay segments; it flows directly into the adjacent segment and subsequently to the UGCOW project area's impaired waters. Because the UGCOW project area only encompasses one stream-mile inland from the coast and overlaps with many other watershed-planning efforts, the stakeholders recommend that GBF and Workgroup members coordinate with watershed planning groups in adjacent watersheds in order to provide input on strategies for reducing their bacteria inputs from storm water into Galveston Bay. Stakeholders believe that this strategy will maximize the benefits downstream in the oyster waters.

There are several BMPs that stakeholders recommend adjacent watersheds adopt near the bay shorelines in order to reduce the impacts of stormwater runoff. For example:

- Vegetated riparian zones can provide functional and esthetic value. Vegetated shorelines minimize soil erosion and naturally increase filtration of surface water runoff. Adequate filtration is typically achieved when a riparian buffer of 50 feet or more exists along surface waterways. There are programs available that assist landowners in evaluating their property and installing a natural alternative to bulk heads, often called a "living shoreline." Additionally, these living shorelines provide areas for fish to spawn and safe spots for fry to hide and grow, improving fisheries in the areas where they are installed. GBF is a leader in local living shoreline programs, typically working with homeowners or Home Owners Association (HOA) groups to plan, fund and execute smaller scale projects. Larger scale restoration on public lands requires development of extensive partnerships between cities, counties, drainage districts, and agencies.
- Low impact development (LID) is an alternative approach to stormwater management that mimics the natural hydrology of an area, allowing water to soak into the soil and reduce runoff. Low impact development consists of both large and small-scale projects and can include rain gardens, constructed wetlands, bioswales, permeable pavement, green roofs, and rainwater harvesting. The design of these BMPs is site-specific and many are small-scale projects that can easily be incorporated into a new or existing yard, parking lot, or landscape.
- Outreach can continue to be carried out in order to increase local government and public familiarity with low impact development. Efforts such as the Urban BMP Initiative in the TCEQ Nonpoint Source Management Program can be utilized to raise awareness of the benefits and successes, as well as funding opportunities for LID practices.

The Workgroups will collaborate with adjacent watersheds to encourage that BMPs that benefit the UGCOW be incorporated into their Watershed Protection Plans and TMDL I-Plans, and provide technical and financial support as needed.

Sustainability

The stakeholders in the TMDL implementation projects will meet annually to assess the results of the planned activities and other sources of information to evaluate the efficiency of the I-Plan. Stakeholders and the TCEQ will facilitate a meeting to evaluate several factors, such as the pace of implementation, the effectiveness of BMPs, load reductions, and progress toward meeting water quality standards. The TCEQ will post stakeholder progress in conducting implementation activities, along with other successes toward water quality improvement, on the TCEQ web page for the I-Plan.
The TCEQ and stakeholders will track the progress of the I-Plan using both implementation milestones and water quality indicators. These terms are defined as:

- **Water Quality Indicator** – A measure of water quality conditions for comparison to pre-existing conditions, constituent loadings, and water quality standards.
- **Implementation Milestones** – A measure of administrative actions undertaken to effect an improvement in water quality.

Water Quality Indicators

Water quality data will need to be evaluated on a regular basis in order to determine if changes need to be made to this I-Plan to ensure its effectiveness, and whether or not the UGCOW are meeting standards for bacteria. The results can identify trends of improvement and/or degradation that need to be addressed. Listings for oyster waters are based on information developed by the TDSHS to classify oyster waters according to the potential risk to consumers of eating oysters harvested in a particular area. The National Shellfish Sanitation Program drives their activities, which is a program of the U.S. Food and Drug Administration. As previously stated, TDSHS considers many factors in making use evaluations of oyster waters; water quality is only one factor. Meeting the criteria for bacteria in water does not necessarily result in removal of a restricted classification. The TDSHS may or may not remove the RHZ classification because of other factors, such as high rainfall and runoff, flooding, hurricanes, major spills, red tides, as well as proximity to marinas, wastewater treatment facilities, stormwater runoff, and drainage areas near livestock and wildlife areas (TCEQ, 2010). The primary goal of this I-Plan is to improve water quality so that the oyster waters meet the indicator bacteria standard.

The TDSHS currently has 124 active sampling stations throughout the UGCOW project area (Figure 11, 12, and 13). They sample at least once per month per classified area, regardless of its status (open or closed), totaling an average of 1,100 water samples per year. They may sample more frequently when conditions warrant. The sampling stations

are strategically located where impacts from stormwater runoff, tidal mixing, and known and unknown point and nonpoint sources of pollution (industrial discharges, WWTF outfalls, OSSFs, etc.) can provide an indication of how they might be impacting classified oyster waters, as well as within harvest areas themselves (G. Heideman, personal communication, March 3, 2014).

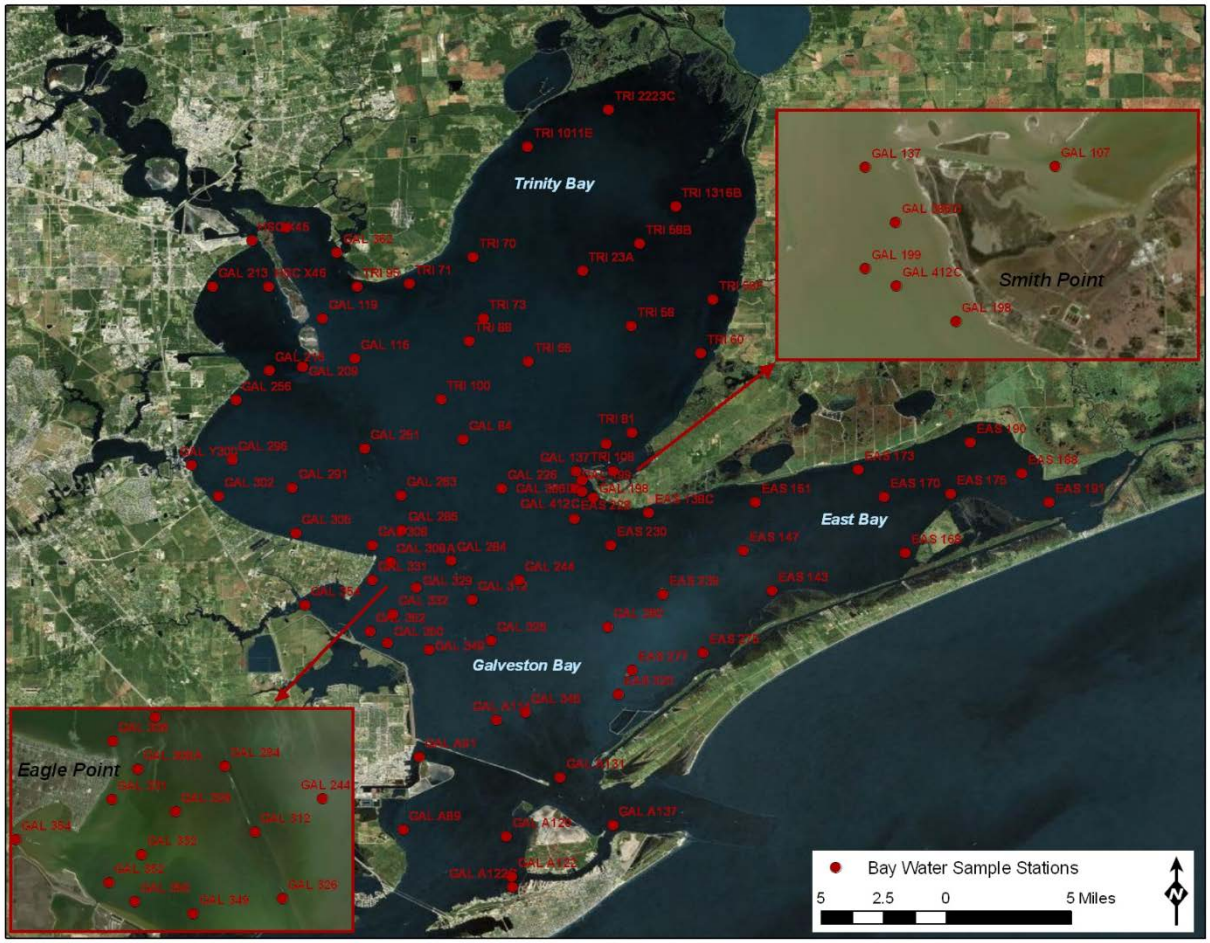

Figure 11. TDSHS Sampling Stations in Upper and Lower Galveston Bay, East Bay, and Trinity Bay

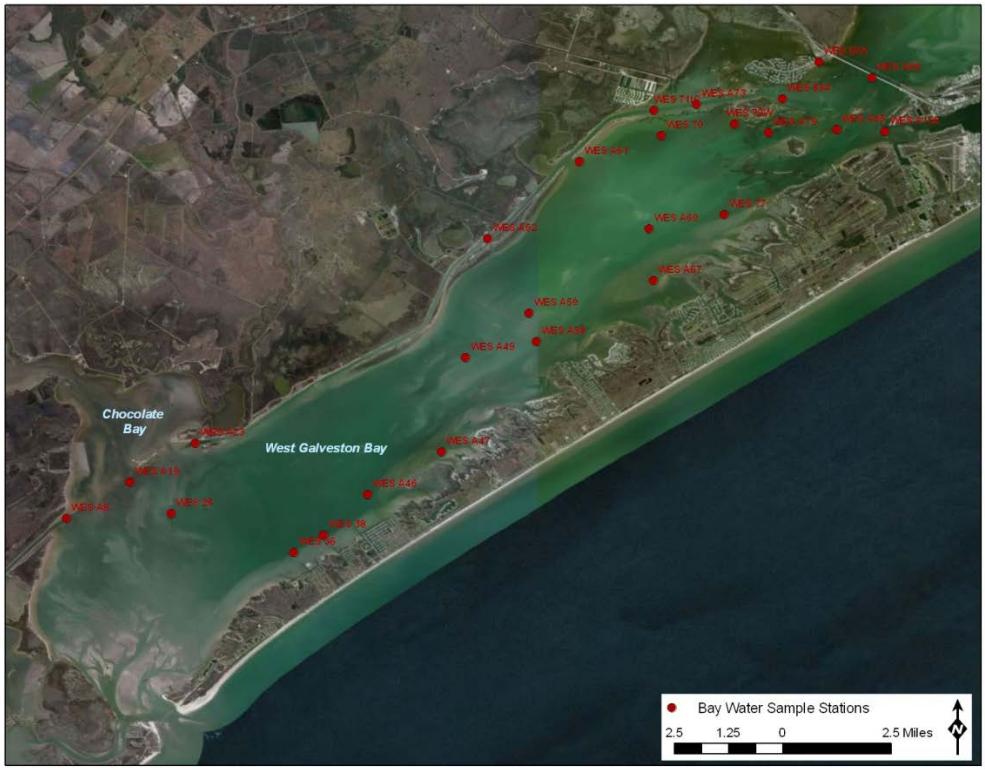

Figure 12. TDSHS Sampling Stations in West Bay and Chocolate Bay

Figure 13.TDSHS Sampling Stations in Christmas Bay, Bastrop Bay, and Oyster Lake

The TCEQ also samples quarterly at approximately 45 stations in Galveston Bay. They do not sample for fecal coliform but for Enterococci, so this data cannot be used for a direct comparison to oyster water standards, but can assist in identifying trends and locating hotspots in the project area that may require more focused efforts to achieve water quality improvements.

The TCEQ assesses waters of the Upper Gulf Coast at least every two years as part of updating the Integrated Report, but ultimately the TDSHS defines the status of oyster harvesting zones. If the TDSHS criteria for oyster waters are revised or changes in the bay's water quality are observed, this I-Plan will be modified. Additionally, the UGCOW Workgroups will communicate with adjacent watershed groups regarding their water quality assessments to determine how these tributaries may be influencing the oyster waters assessments. This management strategy allows stakeholders to learn and adapt the plan as it progresses. The ultimate goal is for the AUs of the Upper Gulf Coast to have sufficiently low indicator bacteria concentrations so that they meet water quality standards set for oyster waters.

Implementation Milestones

Implementation tracking provides information that can be used to determine if progress is being made toward meeting the goals of the TMDL. Tracking also allows stakeholders to evaluate the actions taken, identify those which may not be working, and make any changes that may be necessary to get the plan back on target. Schedules of implementation activities and milestones for this I-Plan are included in Appendix A.

Communication Strategy

Communication is necessary to ensure stakeholders understand the I-Plan and its progress in restoring water quality conditions. The Workgroups will work with the TCEQ to disseminate information derived from tracking I-Plan activities to interested parties, including watershed stakeholders, state leadership, government agencies, non-governmental organizations, and individuals. Additionally, the Workgroups will coordinate with the TCEQ to report results and evaluations from implementation tracking to stakeholders for up to the next five years or as needed. The stakeholders will facilitate annual meetings with guidance from the TCEQ to review progress on the I-Plan activities, discuss successes and lessons learned, review water quality, and determine if the Plan needs to be revised. Responsible parties are committed to providing appropriate information to the TCEQ to update these progress assessments and communicating information at the annual meetings. Regionally, the progress and results of the Plan will be presented in annual reports prepared by the GBF, and the TCEQ will post stakeholder progress in conducting implementation activities along with other water quality improvement successes on the TCEQ web page for the Plan.

In accordance with CWA Section 319, the state must annually report to U.S. EPA on success in achieving the goals and objectives of the *Texas Nonpoint Source*

Management Program, including progress in implementing the NPS portion of TMDLs. The TCEQ and Texas State Soil and Water Conservation Board (TSSWCB) jointly publish *Managing Nonpoint Source Water Pollution in Texas: Annual Report*, which highlights the state's efforts during each fiscal year to collect data, assess water quality, implement projects that reduce or prevent NPS pollution, and educate and involve the public to improve the quality of water resources. Information derived from tracking and review activities of this I-Plan can be reported in the annual report. Previously published annual reports are available at <www.tceq.texas.gov/waterquality/nonpoint-source/mgmt-plan/annual-reports.html>.

Stakeholders will continue to take part in annual meetings to evaluate implementation efforts. At the completion of the scheduled I-Plan activities, stakeholders will assemble and evaluate the actions, overall impacts, and results of their implementation efforts.

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Appendix A.
I-Plan Matrix

Table A - 1. Wastewater Treatment Facilities Measure 1.1: Guidance and Training - Implementation Schedule and Tasks

Plan Year	Responsible Parties	Implementation Measure	Implementation Milestones
Year 1			
	TCEQ, TEEX, TWUA	• Distribute and maintain guidance document *	• Number of WWTFs that received materials
	GBF, WWTF Workgroup	• Develop WWTF resources web page on the GBF website	• Web page developed and active online
	TCEQ	• Promote the EnviroMentors Program	• Number of participants in EnviroMentors Program
	TEEX, TWUA	• Offer two training sessions*	• Number of training sessions held • Number in attendance at training sessions
	WWTF Workgroup, TCEQ, WWTFs	• Update larger stakeholder group at annual meeting	• Number of sustained and new stakeholders participating • Feedback from meeting incorporated into plan
Years 2-5			
	TCEQ, TEEX, TWUA	• Distribute and maintain guidance document	• Number of WWTFs that received materials
	EnviroMentors, WWTF Workgroup	• Maintain the web page and promotion of EnviroMentors Program	• Number of web page visits • Number of participants in EnviroMentors Program
	TEEX, TWUA	• Offer two training sessions	• Number of training sessions held • Number in attendance at training sessions
	WWTF Workgroup, TCEQ, WWTFs	• Update larger stakeholder group at annual meeting	• Number of sustained and new stakeholders participating • Feedback from meeting incorporated into plan
	WWTF Workgroup, TCEQ	• Evaluate the effectiveness of the management measure	• Review data from TCEQ and reports from WWTF owners • Revisions made based on milestones measured and continued feedback from stakeholders at TCEQ's annual meeting • Corresponding improvements from revisions made

*Indicates measures in which implementation has already begun

Table A - 1. Wastewater Treatment Facilities Measure 1.2: Pre-Permit Renewal Sampling - Implementation Schedule and Tasks

Plan Year	Responsible Parties	Implementation Measure	Implementation Milestones
Year 1			
	WWTF Workgroup	• Draft and send letters to permittees before permit renewal and to association meetings**	• Number of letters sent before permit renewals and to association meetings
	TCEQ	• Advise operators on new sampling requirements**	• Training manuals updated with new sampling requirements • Number of operators who received updated training manuals
	WWTF Workgroup, TCEQ	• Update larger stakeholder group at annual meeting**	• Number of sustained and new stakeholders participating • Feedback from meeting incorporated into plan
Years 2-4			
	WWTFs	• Test for indicator bacteria prior to permit renewal	• Number of WWTFs participating in pre-permit sampling • Review reports from WWTF owners
	EnviroMentors	• Assist permittees with any problems that arise during pre-permit testing	• Number of permittees requesting and receiving assistance
	WWTF Workgroup, TCEQ	• Update larger stakeholder group at annual meeting	• Number of sustained and new stakeholders participating • Feedback from meeting incorporated into plan
Year 5			
	WWTF Workgroup	• Send letters to any new permittees in the TMDL project area	• Number of letters sent to new permittees
	WWTF Workgroup, TCEQ	• Update larger stakeholder group at annual meeting	• Number of sustained and new stakeholders participating • Feedback from meeting incorporated into plan
	WWTF Workgroup, TCEQ	• Evaluate the effectiveness of the management measure	• Review data from the TCEQ and reports from WWTF owners • Revisions made based on milestones measured and continued feedback from stakeholders at the annual meeting • Corresponding improvements from revisions made

**Indicates measures in which implementation was completed

Table A - 2. Wastewater Treatment Facilities Measure 1.3: Increase Compliance and Enforcement - Implementation Schedule and Tasks

Plan Year	Responsible Parties	Implementation Measure	Implementation Milestones
Year 1			
	TCEQ, U.S. EPA	• Develop and gain U.S. EPA approval for focused investigations at major/mandatory minor facilities	• Progress achieved in developing and getting approval for focused investigations
	WWTF Workgroup, TCEQ	• Update larger stakeholder group at annual meeting	• Number of sustained and new stakeholders participating • Feedback from meeting incorporated into plan
Year 2			
	TCEQ	• Increase number of unannounced and focused investigations each year	• Number of staff or contracts needed for additional investigations determined • Number of unannounced and focused investigations carried out each year
	WWTF Workgroup, TCEQ	• Update larger stakeholder group at annual meeting	• Number of sustained and new stakeholders participating • Feedback from meeting incorporated into plan
Years 3-5			
	TCEQ	• Continue unannounced inspections and aim to conduct focused investigations on each facility every two years	• Number of unannounced inspections carried out • Number of focused investigations carried out • Whether or not facilities are being inspected every two years
	WWTF Workgroup, TCEQ	• Update larger stakeholder group at annual meeting	• Number of sustained and new stakeholders participating • Feedback from meeting incorporated into plan
	WWTF Workgroup, TCEQ	• Evaluate the effectiveness of the management measure	• Review data from the TCEQ and reports from WWTF owners • Revisions made based on milestones measured and continued feedback from stakeholders at the annual meeting • Corresponding improvements from revisions made

Table A - 3. Sanitary Sewer Systems Measure 1.4a: Decrease Sanitary Sewer Overflows - Implementation Schedule and Tasks

Plan Year	Responsible Parties	Implementation Measure	Implementation Milestones
Year 1			
	TCEQ	• Present information on participating in SSOIs at owner and operator association meetings	• Number of presentations given by the TCEQ (one or two suggested in the first year) • Number of participants in SSOIs
	GBF	• Coordinate with adjacent watersheds to organize additional utility management workshops*	• Number of workshops held • Number of participants in attendance from project area
	Policy/Outreach Workgroup, WWTF Workgroup	• Develop an outreach campaign to promote SSOIs and post materials on GBF website	• Funding secured • Number of outreach materials distributed • Number of web page visits • Number of owners/operators reached through campaign • Number of participants in SSOIs
	WWTF Workgroup, TCEQ	• Update larger stakeholder group at annual meeting	• Number of sustained and new stakeholders participating • Feedback from meeting incorporated into plan
Year 2-5			
	TCEQ	• Continue to assist participating permittees and to make presentations encouraging participation in SSOIs	• Number of SSOI participants retained • Number of presentations given by the TCEQ (one or two suggested in the first year) • Number of new participants in SSOIs
	Policy/Outreach Workgroup, WWTF Workgroup	• Continue outreach campaign to promote SSOIs and update materials on GBF website	• Number of outreach materials distributed • Number of web page visits • Number of owners/operators reached through campaign • Number of participants in SSOIs
	WWTF Workgroup, TCEQ	• Update larger stakeholder group at annual meeting	• Number of sustained and new stakeholders participating • Feedback from meeting incorporated into plan
	WWTF Workgroup, TCEQ	• Evaluate the effectiveness of the management measure	• Review data from the TCEQ and reports from WWTF owners on water quality data to determine if participation should be required • Revisions made based on milestones measured and continued feedback from stakeholders at the annual meeting • Corresponding improvements from revisions made

*Indicates measures in which implementation has already begun

Table A - 4. Sanitary Sewer Systems Measure 1.4b: Address Fats, Roots, Oils, and Grease - Implementation Schedule and Tasks

Plan Year	Responsible Parties	Implementation Measure	Implementation Milestones
Year 1			
	GBF, WWTF Workgroup	• Contact local governments, identify inspection and enforcement tools used, offer supporting information*	• Number of local governments contacted • Number of ordinances/control measures already in use • Number of jurisdictions provided with assistance
	GBF, Policy/Outreach Workgroup, WWTF Workgroup	• Develop FOG education campaign and post materials on the GBF website*	• Funding secured and education campaign developed • Number of materials distributed • Number of web page visits
	WWTF Workgroup, TCEQ	• Update larger stakeholder group at annual meeting	• Number of sustained and new stakeholders participating • Feedback from meeting incorporated into plan
Year 2			
	GBF, WWTF Workgroup	• Continue providing information/assistance to local governments	• Number of governments engaged in discussions about ordinances
	GBF, Policy/Outreach Workgroup, WWTF Workgroup	• Continue educating public on FOG and refine campaign	• Number of materials distributed • Number of web page visits
	WWTF Workgroup, TCEQ	• Update larger stakeholder group at annual meeting	• Number of sustained and new stakeholders participating • Feedback from meeting incorporated into plan
Year 3-4			
	GBF, WWTF Workgroup	• Contact local jurisdictions again, identify any new ordinances implemented, continue offering support to those who request it	• Number of local governments contacted • Number of new ordinances and/or regulations in use • Number of jurisdictions provided with assistance
	GBF, Policy/Outreach Workgroup, WWTF Workgroup	• Continue educating public on FOG and refine campaign	• Number of materials distributed • Number of web page visits
	WWTF Workgroup, TCEQ	• Update larger stakeholder group at annual meeting	• Number of sustained and new stakeholders participating • Feedback from meeting incorporated into plan
Year 5			
	WWTF Workgroup, TCEQ	• Evaluate the effectiveness of the management measure	• Review data from the TCEQ and reports from stakeholders • Revisions based on milestones measured and continued feedback from stakeholders at the annual meeting • Corresponding improvements from revisions made

*Indicates measures in which implementation has already begun

Table A - 5. Sanitary Sewer Systems Measure 1.4c: Address Lateral Line Maintenance - Implementation Schedule and Tasks

Plan Year	Responsible Parties	Implementation Measure	Implementation Milestones
Year 1			
	Policy/Outreach Workgroup, WWTF Workgroup	• Develop and/or compile existing education materials and post on the GBF website	• Funding secured (if necessary) • Education campaign developed • Number of materials distributed • Number of web page visits
	WWTF Workgroup, TCEQ	• Update larger stakeholder group at annual meeting	• Number of sustained and new stakeholders participating • Feedback from meeting incorporated into plan
Year 2-5			
	Policy/Outreach Workgroup, WWTF Workgroup	• Continue educating public on lateral line maintenance and update materials on the GBF website	• Number of materials distributed • Number of web page visits
	WWTF Workgroup, TCEQ	• Update larger stakeholder group at annual meeting	• Number of sustained and new stakeholders participating • Feedback from meeting incorporated into plan
	WWTF Workgroup, TCEQ	• Evaluate the effectiveness of the management measure	• Review data from the TCEQ and reports from stakeholders • Revisions made based on milestones measured and continued feedback from stakeholders at the annual meeting • Corresponding improvements from revisions made

Table A - 6. On-Site Sewage Facilities Measure 2.1: Create Regional Plan to Identify, Prioritize, and Address Failing OSSFs - Implementation Schedule and Tasks

Plan Year	Responsible Parties	Implementation Measure	Implementation Milestones
Year 1			
	OSSF Workgroup	• Prioritize areas to focus inspections*	• Inspection plan created
	TX AgriLife Extension Service	• Hold workshops for OSSF homeowners, real estate agents, property inspectors and consumers*	• Number of workshops held • Number of participants at workshops
	OSSF Workgroup	• Identify low income candidates and potential funding*	• Collaborate with existing projects to get systems funded
	OSSF Workgroup	• Identify research partners and potential funding*	• Secure funding (if necessary) and research partners • Begin formulating research plan
	OSSF Workgroup, TCEQ	• Update larger stakeholder group at annual meeting	• Number of sustained and new stakeholders participating • Feedback from meeting incorporated into plan
Year 2			
	Authorized agents	• Inspect 25% of highest priority systems	• Number of systems inspected
	TX AgriLife Extension Service	• Continue offering workshops	• Number of workshops held • Number of participants at workshops
	OSSF owners	• Begin fixing systems for low income candidates	• Number of systems repaired or replaced
	Research partners	• Begin OSSF impact study	• Research plan developed and initiated
	OSSF Workgroup, TCEQ	• Update larger stakeholder group at annual meeting	• Number of sustained and new stakeholders participating • Feedback from meeting incorporated into plan
Year 3-4			
	Authorized agents	• Inspect 25% of the priority systems each year	• Number of systems inspected
	TX AgriLife Extension Service	• Offer workshops as necessary	• Number of workshops held • Number of participants at workshops
	Research partners	• Complete OSSF impact study; analyze and present results	• Study on schedule for completion in year 3 • Data analyzed; results written and presented
	OSSF Workgroup, TCEQ	• Update larger stakeholder group at annual meeting	• Number of sustained and new stakeholders participating • Feedback from meeting incorporated into plan

Table A - 7 (continued). On-Site Sewage Facilities Measure 2.1: Create Regional Plan to Identify, Prioritize, and Address Failing OSSFs - Implementation Schedule and Tasks

Year 5			
	Authorized agents	• Inspect final 25% of priority systems	• Number of systems inspected
	TX AgriLife Extension Service	• Offer workshops as necessary	• Number of workshops held • Number of participants at workshops
	OSSF Workgroup, TCEQ	• Update larger stakeholder group at annual meeting	• Number of sustained and new stakeholders participating • Feedback from meeting incorporated into plan
	OSSF Workgroup, TCEQ	• Evaluate the effectiveness of the management measure	• Review data from the TCEQ and reports from stakeholders • Revisions made based on milestones measured and continued feedback from stakeholders at the annual meeting • Corresponding improvements from revisions made

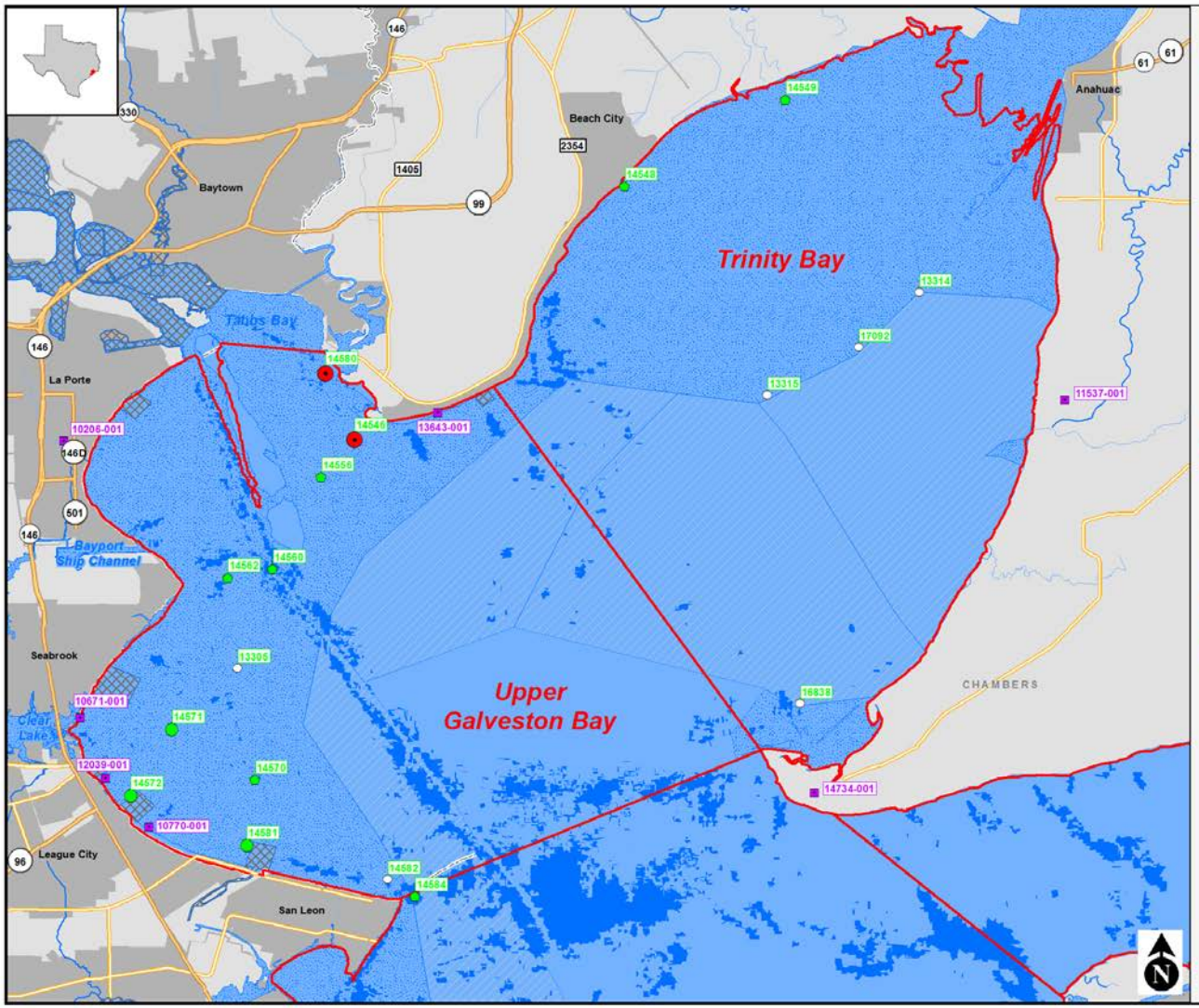
*Indicates measures in which implementation has already begun

Table A - 8. Boater Waste Measure 3.1: Increase Access to Pump-Out Facilities, Enforce Existing Regulations, Enhance Outreach and Marketing, Designate Galveston Bay as Federal NDZ, Conduct Water Quality Monitoring in Marinas - Implementation Schedule and Tasks

Plan Year	Responsible Parties	Implementation Measure	Implementation Milestones
Year 1			
	GBF, BW Workgroup	• Survey and collect data on boater waste impact on bacteria*	• Study plan developed and executed
	GBF, BW Workgroup, Policy/Outreach Workgroup	• Promote federal NDZ establishment and adding pump-out stations through education and outreach*	• # audience reached through education campaign • # materials distributed • Number of pump-out stations installed in project area
	GBF, BW Workgroup	• Hold discussions with marina owners and various jurisdictions*	• # marina owners and jurisdictions contacted directly • # marina owners and jurisdictions on board for new legislation
	TPWD, Coast Guard, BW Workgroup	• Hold workshops to train marine officers on enforcement	• # marine officers participating in workshops
	GBF, BW Workgroup, Policy/Outreach Workgroup	• Begin federal NDZ application process	• Status of application materials and measures taken to ensure its approval
	BW Workgroup, TCEQ	• Update larger stakeholder group at annual meeting	• # sustained and new stakeholders participating • Feedback from meeting incorporated into plan
Year 2-4			
	GBF, Workgroup, TCEQ, U.S. EPA	• Receive final approval of application for federal NDZ	• Approval received from stakeholders and status of application
	GBF, BW Workgroup, Local jurisdictions	• Pass ordinance in one jurisdiction and add at least one pump-out to project area per year	• Status of ordinance • Number of pump-outs installed in project area
	Marine safety officers	• Begin enforcement campaign with an educational approach	• # marine officers/jurisdictions active in enforcement efforts
	BW Workgroup, TCEQ	• Update larger stakeholder group at annual meeting	• # sustained and new stakeholders participating • Feedback from meeting incorporated into plan
Year 5			
	GBF, BW Workgroup, TCEQ	• Evaluate the effectiveness of the management measure	• Review data from the TCEQ and reports from stakeholders • Revisions made based on milestones measured and continued feedback from stakeholders at the annual meeting • Corresponding improvements from revisions made

*Indicates measures in which implementation has already begun

Appendix B.
TMDL Segment Maps



Protecting Texas by Reducing and Preventing Pollution

TCEQ

Upper Gulf Coast
Oyster Waters TMDLs

Trinity Bay (2422) and Upper Galveston Bay (2421)

October 2014

Legend

- Selected Domestic Outfall
- Minor Stream
- Stream Segment
- Impaired Waterbody
- Oyster Reef
- City
- County

DSHS Harvesting Areas

- Approved Area
- Conditionally Approved Area
- Prohibited Area
- Restricted Area

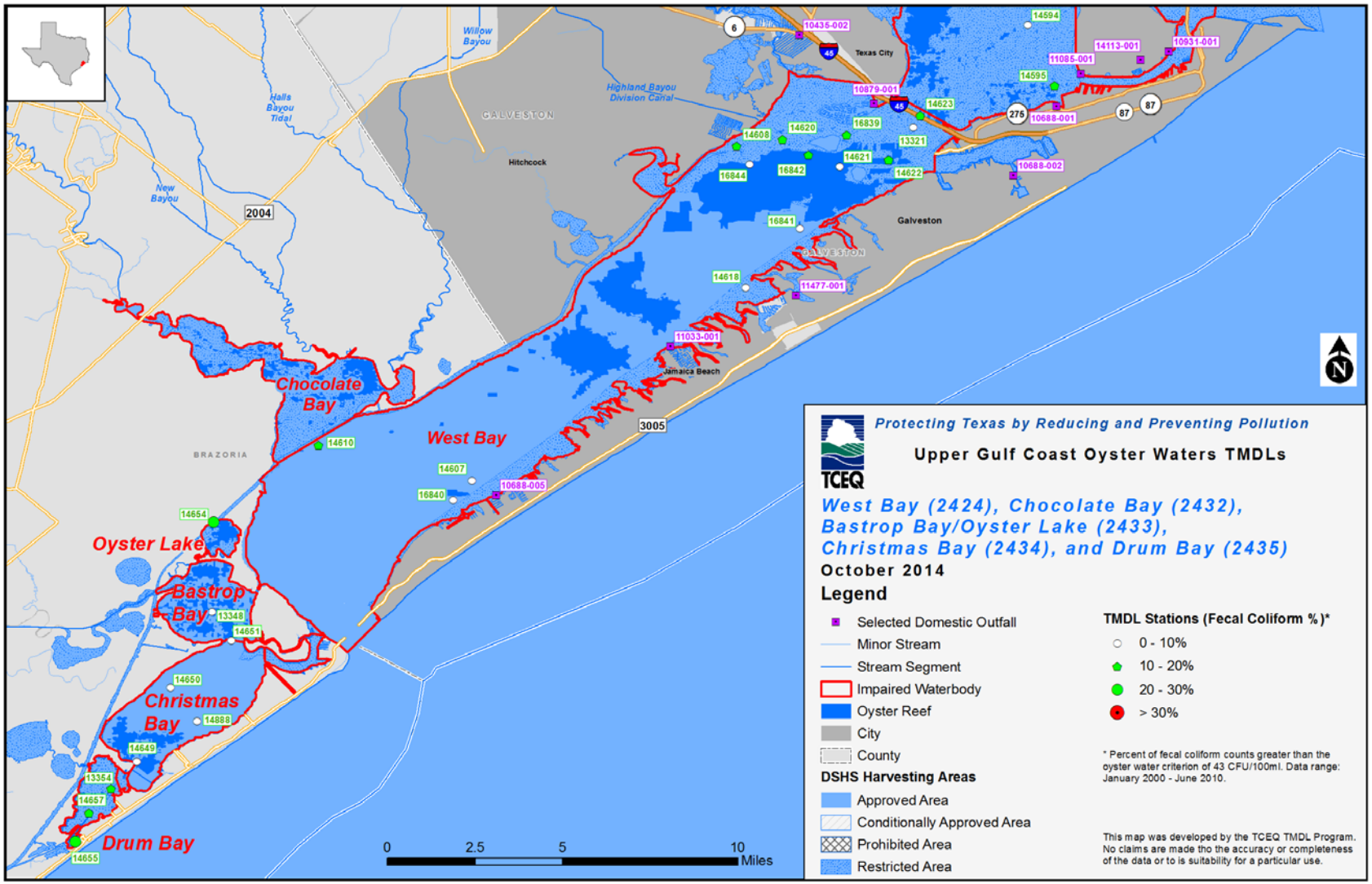
TMDL Stations (Fecal Coliform %)*

- 0 - 10%
- 10 - 20%
- 20 - 30%
- > 30%

* Percent of fecal coliform counts greater than the oyster water criterion of 43 CFU/100ml. Data range: January 2000 - June 2010.

0 1.5 3 6 Miles

This map was developed by the TCEQ TMDL Program. No claims are made tho the accuracy or completeness of the data or to is suitability for a particular use.


Protecting Texas by Reducing and Preventing Pollution
TCEQ
Upper Gulf Coast Oyster Waters TMDLs
West Bay (2424), Chocolate Bay (2432),
Bastrop Bay/Oyster Lake (2433),
Christmas Bay (2434), and Drum Bay (2435)
October 2014
Legend
Selected Domestic Outfall
Minor Stream
Stream Segment
Impaired Waterbody
Oyster Reef
City
County
DSHS Harvesting Areas
Approved Area
Conditionally Approved Area
Prohibited Area
Restricted Area
TMDL Stations (Fecal Coliform %)*
0 - 10%
10 - 20%
20 - 30%
> 30%
* Percent of fecal coliform counts greater than the oyster water criterion of 43 CFU/100ml. Data range: January 2000 - June 2010.
This map was developed by the TCEQ TMDL Program. No claims are made tho the accuracy or completeness of the data or to is suitability for a particular use.
0 2.5 5 10 Miles
Chocolate Bay
West Bay
Oyster Lake
Bastrop Bay
Christmas Bay
Drum Bay
Willow Bayou
Halls Bayou Tidal
New Bayou
Highland Bayou Division Canal
GALVESTON
Hitchcock
Texas City
Galveston
Jamaica Beach
BRAZORIA
2004
3005
6
45
275
87
10435-002
10879-001
11085-001
14113-001
10931-001
10688-001
10688-002
11477-001
11033-001
10688-005
14594
14595
14623
14608
14620
16839
13321
14621
14622
16844
16842
16841
14618
14610
14607
16840
14654
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13354
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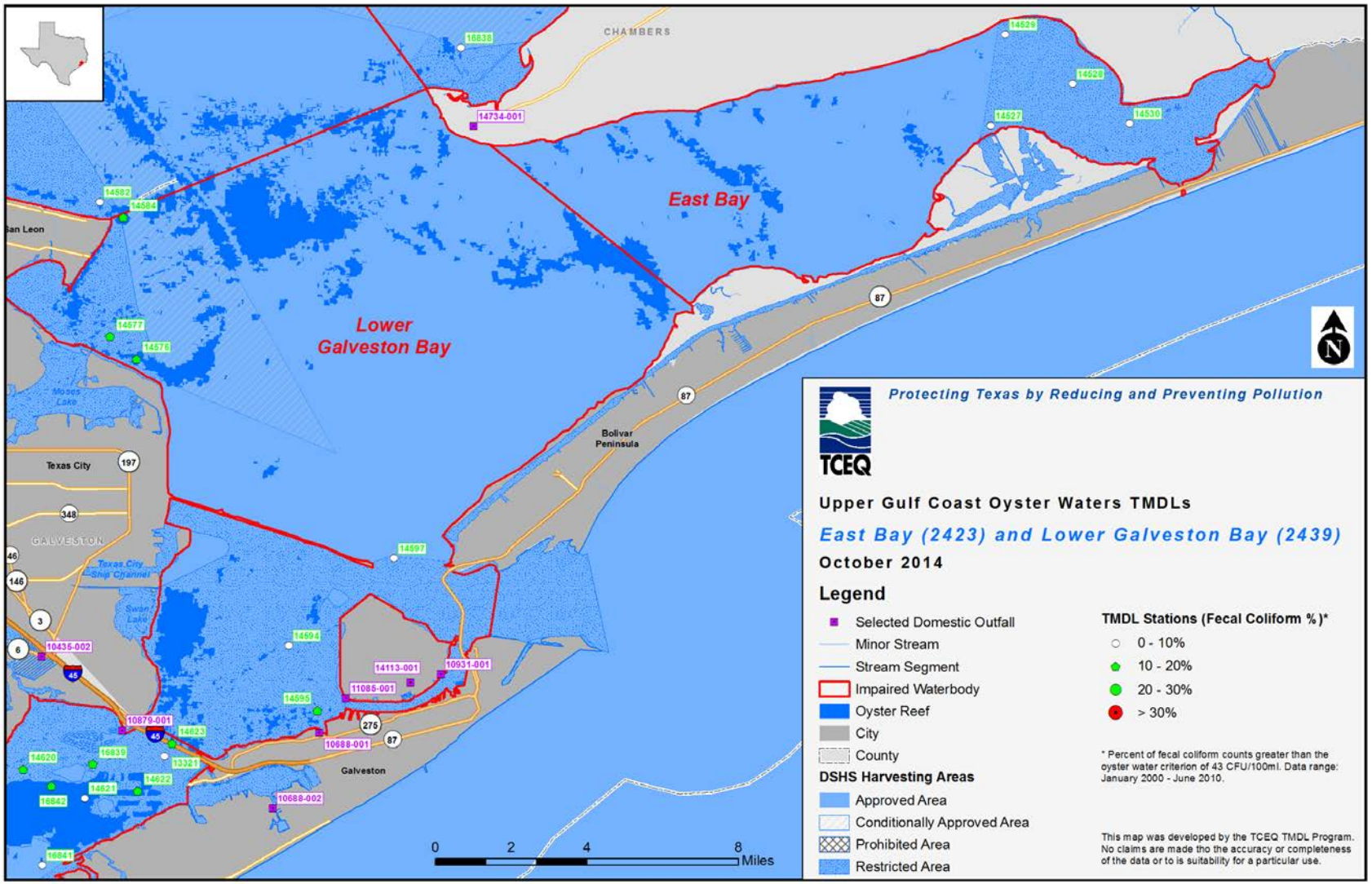
14655


CHAMBERS
East Bay
Lower Galveston Bay
San Leon
Texas City
GALVESTON
Texas City Ship Channel
Swan Lake
Moses Lake
Bolivar Peninsula
Galveston
16838
14734-001
14529
14528
14527
14530
14582
14584
14577
14576
14597
14594
14595
14113-001
11085-001
10931-001
10688-001
10688-002
10435-002
10879-001
14623
13321
14620
16839
14622
14621
16842
16841
197
348
146
3
6
45
275
87
0 2 4 8 Miles
Protecting Texas by Reducing and Preventing Pollution
TCEQ
Upper Gulf Coast Oyster Waters TMDLs
East Bay (2423) and Lower Galveston Bay (2439)
October 2014
Legend
Selected Domestic Outfall
Minor Stream
Stream Segment
Impaired Waterbody
Oyster Reef
City
County
DSHS Harvesting Areas
Approved Area
Conditionally Approved Area
Prohibited Area
Restricted Area
TMDL Stations (Fecal Coliform %)*
0 - 10%
10 - 20%
20 - 30%
> 30%
* Percent of fecal coliform counts greater than the oyster water criterion of 43 CFU/100ml. Data range: January 2000 - June 2010.
This map was developed by the TCEQ TMDL Program. No claims are made tho the accuracy or completeness of the data or to is suitability for a particular use.

Appendix C.
Texas Boat Sewage Discharge Regulations

Texas Administrative Code

30 TAC 321.3(c)(1):

(a) The discharge of sewage which has not been treated in accordance with federal standards specified in 40 Code of Federal Regulations (CFR) Part 140 is prohibited into any surface water in the state.

(b) No person may discharge sewage, treated or untreated, from a boat into:
- any inland freshwater lake, freshwater reservoir, or other freshwater impoundment whose inlets or outlets are as such to prevent the entry or exit of vessel traffic;
- any river not capable of navigation by interstate vessel traffic; or
- Clear Lake or any other state designated and federally recognized no discharge zone.

(c) With the exception of those waterbodies identified in subsection (b) of this section, a person may discharge sewage that has been treated in accordance with federal standards specified in 40 CFR Part 140 from a boat into the following areas:
- coastal waters that begin from any shore of the state moving seaward to a point three nautical miles into the Gulf of Mexico; and
- any river that is accessible from the Gulf of Mexico starting from the mouth of the river moving inland up to the point where navigation by the boat is no longer capable.

30 TAC 321.4(c)(1):

(a) Any marine sanitation device installed on a boat shall meet the requirements specified in 33 Code of Federal Regulations (CFR) Part 159.

(b) If a Type I or Type II marine sanitation device is installed on any boat, the operator shall secure the device using an acceptable method described in 33 CFR Part 159 to prevent the discharge of treated or untreated sewage while located on a no discharge zone.

(c) A portable marine sanitation device that is designed to facilitate the carry-off of sewage for onshore disposal is acceptable as an additional marine sanitation device on any boat other than a houseboat.

(d) All houseboats, regardless of length, shall be equipped with at least one permanently installed toilet which shall be properly connected to a Type III marine sanitation device. The toilet may be simultaneously connected to both a Type III marine sanitation device and to another approved marine sanitation device only if the valve or other mechanism between the two devices are set to direct all sewage to the Type III marine sanitation device and shall be locked or otherwise secured by the boat operator in a manner that will prevent the discharge of treated or untreated sewage while the vessel is located on a no discharge zone.

(e) Contents of a holding tank, whether permanently installed or portable, may be disposed of only by the following methods:
  (1) discharge into a boat pump-out station approved and certified under this subchapter;
  (2) discharge into an adequately-sized on-site sewage facility permitted to receive boat sewage in accordance with Texas Health and Safety Code,

Chapter 366 and Chapter 285 of this title (relating to On-Site Sewage Facilities); or

(3) pick up and discharge by a transporter registered under Chapter 312, Subchapter G of this title (relating to Transporters and Temporary Storage Provisions), for disposal at a facility permitted or authorized by the commission to receive boat sewage.

Texas Parks & Wildlife Code

§ 31.129. Violation and Enforcement of Sewage Disposal Regulations:

(a) A person who violates or fails to comply with a rule of the Texas Commission on Environmental Quality concerning the disposal of sewage from boats commits an offense that is a Class C Parks and Wildlife Code misdemeanor. A separate offense is committed each day a violation continues.

(b) The enforcement provisions of this subchapter apply to violations punishable by this section.

(c) A game warden or peace officer who is certified as a marine safety enforcement officer under Section 31.121 may enforce a rule of the Texas Commission on Environmental Quality concerning the disposal of sewage from boats.

(d) A marine safety enforcement officer who reasonably suspects that a boat is discharging sewage in an area where discharge is prohibited may, if the owner or operator is aboard, board the boat for the purpose of inspecting the marine sanitation device for proper operation and testing the sanitation and holding devices.

Texas Water Code

Section 26.044. Disposal of Boat Sewage:

(b) The commission shall issue rules concerning the disposal of sewage from boats located or operated on surface water in the state. The rules of the commission shall include provisions for the establishment of standards for sewage disposal devices, the certification of sewage disposal devices, including shoreside and mobile boat pump-out stations, and the visible and conspicuous display of evidence of certification of sewage disposal devices on each boat equipped with such device and on each shoreside and mobile pump-out device.

(c) The commission may delegate the administration and performance of the certification function to the executive director or to another governmental entity. The commission or delegated authority shall collect the following fees from applicants for certification:

Boat Pump-out Station (biennial):

Initial Certificates for Pump-out	$35
Pump-out Renewal	$25

Marine Sanitation Device (biennial):

Boat over 26 Feet or Houseboat	$15
Boat 26 Feet or less with Permanent Device	$15

All certification fees shall be paid to the commission or delegated authority performing the certification function. All fees collected by any state agency shall be deposited to the credit of the water resource management account for use by the commission or delegated authority.

Section 26.045. Pump-Out Facilities for Boat Sewage:

(b) After a public hearing and after making every reasonable effort to bring about the establishment of an adequate number of boat pump-out stations on surface water in the state, the commission may enter an order requiring the establishment of boat pump-out stations by a local government that has any jurisdiction over at least a portion of the surface water in the state or over land immediately adjacent to the water.

(c) If a local government is authorized to issue authorization for the operation of shoreside, mobile, or floating installations, the local government may require the installation and operation of boat pump-out stations where necessary. The local government shall require the installation and operation of boat pump-out stations if required by the commission.

A local government responsible for establishing boat pump-out stations may issue bonds or may use general revenue funds from normal operations to finance the construction and operation of the pump-out facilities. Pump-out stations established as a result of this section will be self-sustaining with respect to costs and revenues collected from users of said facilities, and local governments are authorized to levy reasonable, appropriate charges or fees to recover cost of installation and operation of the pump-out stations. Nothing in this section is to be construed to require any local government to rebate to the State of Texas funds collected pursuant to this program.

Appendix D.
Letters of Support

City of La Porte

Established 1892

Public Works Department

Providing essential public services to the citizens of La Porte in the most efficient and cost effective manner possible.

November 21, 2013

Mr. Ron Stein
Total Maximum Daily Load Program
Texas Commission on Environmental Quality
c/o Galveston Bay Foundation
17330 Highway 3
Webster, TX 77598

Dear Mr. Stein,

The purpose of this letter is to express support for and pledge continued participation in the *Implementation Plan for Eleven Total Maximum Daily Loads for Bacteria in Waters of the Upper Gulf Coast* developed by stakeholders from various specialties in collaboration with the Galveston Bay Foundation. The City of La Porte is committed to preserving, protecting and enhancing our waterways for present and future users.

We encourage businesses, governments, conservation and professional organizations, and individuals to actively participate in making Galveston Bay waters safe for all of its many valuable uses. This Implementation Plan contains diverse measures, allowing everyone the ability to apply it to their lives in one way or another.

I appreciate the opportunity to participate in the Wastewater Treatment Plant workgroup. The combined efforts of all of the workgroups and the Galveston Bay Foundation will certainly have a positive impact on the environment through the reduction of bacteria in the Galveston Bay system.

Sincerely,

Ray Mayo
Assistant Superintendent of Utilities
City of La Porte

2963 N. 23rd St. ▪ La Porte, Texas 77571 ▪ (281)471-9650 ▪ www.laportetx.gov

Environmental Institute of Houston

November 27, 2013

Mr. Ron Stein
Total Maximum Daily Load Program
Texas Commission on Environmental Quality
c/o Galveston Bay Foundation
17330 Highway 3
Webster, TX 77598

Dear Mr. Stein,

The purpose of this letter is to express my organizations support for and pledge continued participation in the *Implementation Plan for Ten Total Maximum Daily Loads for Bacteria in Waters of the Upper Gulf Coast* developed by stakeholders from various specialties in collaboration with the Galveston Bay Foundation. The Environmental Institute of Houston, through our education and research programs is committed to preserving, protecting and enhancing our waterways for present and future users.

We strongly support this Implementation Plan. Numerous technical experts and stake holders were involved with the development of this plan. Moreover the recommended implementation measures were development in coordination with and/or input from other ongoing plans developed by other watershed groups and organizations such as HGAC, Dickinson Bayou etc. and are practical achievable approaches. It is highly likely these measures that include a combination of voluntary and educational programs will results in improvements in water quality.

EIH encourages all individuals, organizations, user groups, and regulatory agencies to actively participate in making the waters of Galveston Bay safe for all users. We believe this Implementation Plan contains sufficient and diverse techniques and measures which will empower everyone with the ability to take measures that will improve the water quality of Galveston Bay.

In closing, we encourage TCEQ to continue supporting and approve this Implementation Plan. This Plan is critically needed to improve the water quality for all user groups of the largest estuary in Texas.

Sincerely,

George J. Guillen

Executive Director- Environmental Institute of Houston
Associate Professor – University of Houston Clear Lake

GALVESTON COUNTY HEALTH DISTRICT

John Zendt
Chair, United Board of Health

Harlan "Mark" Guidry, MD, MPH
Chief Executive Officer

www.gchd.org

Warren J. Holland, III
Chief Operating Officer

Kathy Barroso
Chief Financial Officer

November 6, 2013

Mr. Ron Stein
Total Maximum Daily Load Program
Texas Commission on Environmental Quality
c/o Galveston Bay Foundation
17330 Highway 3
Webster, TX 77598

Dear Mr. Stein:

The purpose of this letter is to express support for and pledge continued participation in the *Implementation Plan for Ten Total Maximum Daily Loads for Bacteria in Waters of the Upper Gulf Coast* developed by stakeholders from various specialties in collaboration with the Galveston Bay Foundation. Galveston County Health District (Health District) is committed to preserving, protecting and enhancing our waterways for present and future users.

As the County of Galveston's public health agency, the Health District is dedicated to providing credible and responsible public health services. These services include protection of the environment and the valuable environmental resources found in Galveston County.

The Health District urges entities in Galveston County and within the Houston-Galveston region to work together to reduce bacteria contributions to our bayous, bays and the Gulf of Mexico. The Health District further supports the development of alternative strategies and best management practices that achieve reductions in bacterial levels generated from both point and non-point sources.

We encourage businesses, governments, conservation and professional organizations, and individuals to actively participate in making Galveston Bay waters safe for all of its many valuable uses. This Implementation Plan contains diverse measures, allowing everyone the ability to apply it to their lives in one way or another.

To that end, the Health District fully supports the *Implementation Plan for Ten Total Maximum Daily Loads for Bacteria in Waters of the Upper Gulf Coast* developed by stakeholders from various specialties in collaboration with the Galveston Bay Foundation.

Sincerely,

Ronnie Schultz
Director of Environmental Health Programs
Galveston County Health District

P.O. BOX 939 • LA MARQUE, TEXAS 77568 • (409) 938-7221

Gulf Coast Waste Disposal Authority
910 Bay Area Boulevard • Houston, Texas 77058
Phone: 281.488.4115 • Fax: 281.488.3331 • www.gcwda.com

November 7, 2013

Mr. Ron Stein
Total Maximum Daily Load Program
Texas Commission on Environmental Quality
c/o Galveston Bay Foundation
17330 Highway 3
Webster, Texas 77598

Dear Mr. Stein:

The purpose of this letter is to express Gulf Coast Waste Disposal Authority's (GCA) support for and pledge continued participation in the *Implementation Plan for Ten Total Maximum Daily Loads for Bacteria in Waters of the Upper Gulf Coast* developed by stakeholders from various specialties in collaboration with the Galveston Bay Foundation.

GCA believes that the Implementation Plan (IP) provides a sound basis for providing means to reduce bacteria levels in affected waterways. The plan addresses key areas of concern and provides practical measures to address each of the areas of concern.

We encourage businesses, governments, conservation and professional organizations, and individuals to actively participate in making Galveston Bay waters safe for all of its many valuable uses. This IP contains diverse measures which empowering citizens the ability to apply it to their everyday lives in one way or another in a common sense way.

GCA is committed to preserving, protecting and enhancing our waterways for present and future users and believes this plan will assist us in our commitment. If you require additional information, please contact Leonard Levine at llevine@gcwda.com or at (281) 226-1124.

Sincerely,

Ricky Clifton
General Manager

RC:LL:lan

cc: GCA File 2000

Protecting the waters of the State of Texas through environmentally sound and economically feasible regional waste management practices.

Houston-Galveston Area Council Office of the Executive Director

November 18, 2013

Mr. Ron Stein
Total Maximum Daily Load Program
Texas Commission on Environmental Quality
c/o Galveston Bay Foundation
17330 Highway 3
Webster, TX 77598

Dear Mr. Stein:

The purpose of this letter is to express support for and pledge continued participation in the Implementation Plan for Ten Total Maximum Daily Loads for Bacteria in Waters of the Upper Gulf Coast developed by stakeholders from various specialties in collaboration with the Galveston Bay Foundation. The Houston-Galveston Area Council is committed to preserving, protecting and enhancing our waterways for present and future users.

We at H-GAC believe this Implementation Plan to be incredibly important to our region. Elevated bacteria levels in Galveston Bay not only threaten the health of recreational users of the water body, they also have a large negative economic impact on the region due to the closure of oyster harvesting. The collaborative approach the GBF has taken within the community and with stakeholders will be the key to successfully implementing this plan, and is a mark of GBF's commitment to seeing a positive change in the watershed.

We encourage businesses, governments, conservation and professional organizations, and individuals to actively participate in making Galveston Bay waters safe for all of its many valuable uses. This Implementation Plan contains diverse measures, allowing everyone the ability to apply it to their lives in one way or another.

Should you have any questions with regard to the benefits we believe this Implementation Plan will provide our region, please do not hesitate to contact Todd Running, Water Resources Program Manager at 713-993-4549.

Sincerely,

Jack Steele

JS/tr

Mailing Address
PO Box 22777
Houston, Texas 77227-2777
Phone 713-627-3200

Recycled

Physical Address
3555 Timmons Lane, Suite 120
Houston, Texas 77027-6466
Phone 713-627-3200

MARINA BAY HARBOR
YACHT ★ CLUB
CLEAR LAKE SHORES

NOVEMBER 21, 2013

MR. RON STEIN
TOTAL MAXIMUM DAILY LOAD PROGRAM
TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
C/O GALVESTON BAY FOUNDATION
17330 HIGHWAY 3
WEBSTER, TX 77598

DEAR MR. STEIN:

THE PURPOSE OF THIS LETTER IS TO EXPRESS SUPPORT FOR AND PLEDGE CONTINUED PARTICIPATION IN THE *IMPLEMENTATION PLAN FOR TEN TOTAL MAXIMUM DAILY LOADS FOR BACTERIA IN WATERS OF THE UPPER GULF COAST* DEVELOPED BY STAKEHOLDERS FROM VARIOUS SPECIALTIES IN COLLABORATION WITH THE GALVESTON BAY FOUNDATION. MARINA BAY HARBOR YACHT CLUB IS COMMITTED TO PRESERVING, PROTECTING AND ENHANCING OUR WATERWAYS FOR PRESENT AND FUTURE USERS.

HAVING BEEN INVOLVED IN THIS PROJECT FROM THE BEGINNING, I HAVE ENJOYED WATCHING THE PARTICIPATION FROM VARIOUS ORGANIZATIONS AND ALSO THE PUBLIC. I FEEL THAT THE HEALTH AND FUTURE OF OUR BAY DEPENDS ON COMMITMENT AND DEDICATION FROM ALL OF US.

WE ENCOURAGE BUSINESSES, GOVERNMENTS, CONSERVATION AND PROFESSIONAL ORGANIZATIONS, AND INDIVIDUALS TO ACTIVELY PARTICIPATE IN MAKING GALVESTON BAY WATERS SAFE FOR ALL OF ITS MANY VALUABLE USES. THIS IMPLEMENTATION PLAN CONTAINS DIVERSE MEASURES, ALLOWING EVERYONE THE ABILITY TO APPLY IT TO THEIR LIVES IN ONE WAY OR ANOTHER.

AS A MEMBER OF THE CLEAR LAKE MARINA ASSOCIATION (CLMA), I WOULD LIKE TO PLEDGE MY SUPPORT FOR THE CONTINUATION OF THIS PROJECT.

SINCERELY,

HELEN PAIGE
GENERAL MANAGER

P.O. BOX 478, KEMAH, TX 77565
323 W. 6TH STREET, CLEAR LAKE SHORES, TX 77565
281-535-2222 VOICE 281-535-2220 FAX
HELEN@MARINABAYHARBOR.COM

Marina Association of Texas
3625 Paesanos Parkway, #101 • San Antonio, Texas 78231
Phone (210) 259-8111 • Cell (817) 300-8870 • Fax (210) 692-3459

November 21, 2013

Mr. Ron Stein
Total Maximum Daily Load Program
Texas Commission on Environmental Quality
c/o Galveston Bay Foundation
17330 Highway 3
Webster, TX 77598

Dear Mr. Stein:

The purpose of this letter is to express support for and pledge continued participation in the *Implementation Plan for Ten Total Maximum Daily Loads for Bacteria in Waters of the Upper Gulf Coast* developed by stakeholders from various specialties in collaboration with the Galveston Bay Foundation. The Marina Association of Texas (MAT), a long-time industry supporter of Texas marinas providing pump-out stations and educational materials on clean boating through no sewage discharge in Texas waters, is committed to preserving, protecting and enhancing our Texas waterways for present and future users.

The Oyster Waters TMDL Implementation Plan has the full support of MAT and our Clean Texas Boating and Clean Texas Marina programs. Over two-thirds of our MAT marina members have participated in the Clean Texas Marina program that encourages them to meet the high standards of operation covered by this I-Plan. Several MAT members are active participants on the Boater Waste Workgroup and support the goals of the Plan. MAT also provides support for educational and outreach efforts funded through joint sponsorship of Clean Vessel Act projects, including the increase of pump-out stations in the project area. Project goals are attainable with support from groups like MAT, who contribute funding, materials and personnel to project activities. MAT's governmental/legislative affairs committee members have worked with Texas legislators to get improvements added to the Texas Water Code creating no-discharge of untreated sewage in all Texas waters, a major goal of this project.

We encourage businesses, governments, conservation and professional organizations, and individuals to actively participate in making Galveston Bay waters safe for all of its many valuable uses. This Implementation Plan contains diverse measures, allowing everyone the ability to apply it to their lives in one way or another.

Mr. Ron Stein
November 21, 2013
Page 2

MAT and MAT members individually have supported both the Clean Texas Marina and Clean Texas Boating programs since their inception in 2000, and sewage management is a big part of these two programs' certification process and educational/outreach efforts to educate boaters about clean water issues. Environmental education is the basic fundamental statewide purpose of these programs. As an industry, we are committed to informing our marina operators and boaters that clean water is essential to our industry's future. We support this project and believe the I-Plan provides our industry the best opportunity for environmental improvements in the Clear Lake/Galveston Bay area, our state's biggest boating area.

Sincerely,

Becky Oliver, Executive Director

Marina Association of Texas (MAT)

Paul Fannin Marine Surveyor
SAMS AMS 767
2951 Marina Bay Dr.
Suite 130-453
League City, TX 77573
November 1, 2013

Mr. Ron Stein
Total Maximum Daily Load Program
Texas Commission on Environmental Quality
c/o Galveston Bay Foundation
17330 Highway 3
Webster, TX 77598

Dear Mr. Stein:

The purpose of this letter is to express support for and pledge continued participation in the *Implementation Plan for Ten Total Maximum Daily Loads for Bacteria in Waters of the Upper Gulf Coast* developed by stakeholders from various specialties in collaboration with the Galveston Bay Foundation. I am committed to preserving, protecting and enhancing our waterways for present and future users.

As an active boater, I am disgusted with the water quality of Clear Lake and Galveston Bay. As a marine surveyor and former manager of a boat pump out, and boat plumbing repair company I am well aware of the high number of boats in our area that do not comply with regulations governing overboard discharge of toilet waste. The boating community (approximately 8,000 boats) in general is well aware that there are no legal ramifications to them for illegal discharge of toilet waste into Clear Lake and Galveston Bay because there is no enforcement of existing laws. The folks who properly dispose of waste are a very small percentage of area boaters. Many marina tenants, even in the largest marinas in the area (Watergate Yachting Center, and Seabrook Marina) do not have permanent pump out facilities, and have to go to considerable expense or trouble to properly dispose of their toilet waste. This sort of situation is not tolerated in more enlightened areas of the U.S.

I believe this Implementation Plan is essential for cleaning up our bay waters and estuaries for recreational and commercial uses, and believe it should be a high priority.

Sincerely,

Paul Fannin

November 19, 2013

Mr. Ron Stein
Total Maximum Daily Load Program
Texas Commission on Environmental Quality
c/o Galveston Bay Foundation
17330 Highway 3
Webster, TX 77598

Dear Mr. Stein:

The purpose of this letter is to express support for and pledge continued participation in the *Implementation Plan for Ten Total Maximum Daily Loads for Bacteria in Waters of the Upper Gulf Coast* developed by stakeholders from various specialties in collaboration with the Galveston Bay Foundation. As an individual citizen, I am committed to preserving, protecting and enhancing our waterways for present and future users.

The Implementation Plan resulted from a collaborative effort of the various stakeholders. The management measures are achievable if sufficiently implemented. Ultimately adoption of the plan and its provisions should result in environmental improvements.

This letter supports encouraging businesses, governments, conservation and professional organizations, and individuals to actively participate in making Galveston Bay waters safe for all of its many valuable uses. This Implementation Plan contains diverse measures, allowing everyone the ability to apply it to their lives in one way or another.

Your approval and support of the *Implementation Plan for Ten Total Maximum Daily Loads for Bacteria in Waters of the Upper Gulf Coast* would be greatly appreciated.

Sincerely,

Rebecca Olson

Rebecca Olson

TEXAS COASTAL WATERSHED
P R O G R A M

December 4, 2013

Mr. Ron Stein
Total Maximum Daily Load Program
Texas Commission on Environmental Quality
c/o Galveston Bay Foundation
17330 Highway 3
Webster, TX 77598

Dear Mr. Stein:

I am writing to express my support for and to pledge continued participation in the *Implementation Plan for Ten Total Maximum Daily Loads for Bacteria in Waters of the Upper Gulf Coast* developed by stakeholders in collaboration with the Galveston Bay Foundation. The Texas Coastal Watershed Program is committed to preserving, protecting and enhancing our waterways for present and future users.

Galveston Bay is important to our community and protecting its water resources is a priority for the Texas Coastal Watershed Program. We believe collaborative planning and implementation efforts like those in the I-Plan are essential to maintain Galveston Bay as a healthy, productive ecosystem. This I-Plan and others like it will help us to protect our valuable coastal resources for years to come.

We encourage businesses, governments, conservation and professional organizations, and individuals to actively participate in making Galveston Bay waters safe for all of its many valuable uses. This Implementation Plan contains diverse measures, providing ways for everyone to apply it to their lives in some way.

The Texas Coastal Watershed Program strongly supports this Implementation plan and associated efforts.

Sincerely,

John Jacob, PhD
Director, Texas Coastal Watershed Program

Texas A&M AgriLife Extension Service / Sea Grant Texas
1250 Bay Area Blvd., Suite C
Houston, TX 77058

Office: (281) 218-0570
Fax: (281) 218-6352
tcwp.tamu.edu

Gulf Area District
Texas Water Utilities Association

November 25, 2013

Mr. Ron Stein
Total Maximum Daily Load Program
Texas Commission on Environmental Quality
c/o Galveston Bay Foundation
17330 Highway 3
Webster, TX 77598

Dear Mr. Stein:

The purpose of this letter is to express support for and pledge continued participation in the *Implementation Plan for Ten Total Maximum Daily Loads for Bacteria in Waters of the Upper Gulf Coast* developed by stakeholders from various specialties in collaboration with the Galveston Bay Foundation. The Gulf Area District is committed to preserving, protecting and enhancing our waterways for present and future users.

As members of the Gulf Area Distinct is essential that we protect our environment. Maintaining water quality and reducing bacteria is a daily task for us as operators in which we are able to achieve through permits and regulations. Implementation of this plan will allow public awareness of the importance of water and of the issues involved in the water industry.

We encourage businesses, governments, conservation and professional organizations, and individuals to actively participate in making Galveston Bay waters safe for all of its many valuable uses. This Implementation Plan contains diverse measures, allowing everyone the ability to apply it to their lives in one way or another.

The management measures will allow wastewater treatment plants to improve water quality that discharge to impaired water bodies. The Gulf Area District is in full support of this I-plan and must strive to assist in producing excellent water quality.

Sincerely,

David Van Riper,
President of the Gulf Area District

November 21, 2013

Mr. Ron Stein
Total Maximum Daily Load Program
Texas Commission on Environmental Quality
c/o Galveston Bay Foundation
17330 Highway 3
Webster, Texas 77598

Dear Mr. Stein:

I am writing to express support for and pledge continued participation in the Implementation Plan for Ten Total Maximum Daily Loads for Bacteria in Waters of the Upper Gulf Coast developed by stakeholders from various specialties in collaboration with the Galveston Bay Foundation. The Texas A&M AgriLife Extension Service is committed to preserving, protecting and enhancing our waterways for present and future users.

GBF and the Texas A&M AgriLife Extension Service have a mutual interest in educating homeowners on proper septic system operation and maintenance in order to improve water quality in the Galveston Bay area. My role at Texas A&M AgriLife Extension Service is to provide leadership and assistance to establish and maintain effective educational programs in water quantity and water quality. Specific to water quality, our outreach programs and materials address nonpoint source pollution associated with urban runoff, specifically onsite wastewater. I believe the Implementation Plan will enhance GBF partnerships with homeowners associations and related community organizations by raising awareness and stressing the importance of maintaining onsite sewage facilities.

We encourage businesses, governments, conservation and professional organizations, and individuals to actively participate in making Galveston Bay waters safe for all of its many valuable uses. This Implementation Plan contains diverse measures, allowing everyone the ability to apply it to their lives in one way or another.

I look forward to participating in this Implementation Plan. Texas A&M AgriLife Extension Service can provide many benefits to the plan, including stakeholder education and outreach. By combining our efforts we will be able to reach a far wider audience and maximize the positive impact our organizations can have on our urban waterways. I will continue to participate in the workgroup meetings, and I look forward to updates on the Implementation Plan status.

Sincerely,

Ryan Gerlich
Extension Program Specialist

Texas A&M AgriLife Extension Service
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Educational programs of the Texas AgriLife Extension Service are open to all people without regard to race, color, sex, disability, religion, age, or national origin.
The Texas A&M University System, U.S. Department of Agriculture, and the County Commissioners Courts of Texas Cooperating

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

A RESOLUTION

Approving the final *Implementation Plan for Eleven Total Maximum Daily Loads for Bacteria in Waters of the Upper Gulf Coast in Brazoria, Chambers, Galveston, and Harris Counties.*
TCEQ Docket No. 2014-1279-TML
TCEQ Project No. 2014-035-TML-NR

WHEREAS, the Executive Director developed six Total Maximum Daily Loads (TMDLs) for Bacteria in Waters of the Upper Gulf Coast (Segments 2421, 2422, 2423, 2424, 2432, and 2439) and presented them for consideration by the Texas Commission on Environmental Quality (commission) during the commission's public meeting on August 20, 2008;

WHEREAS, the commission found that the Six TMDLs for Bacteria in Waters of the Upper Gulf Coast (Segments 2421, 2422, 2423, 2424, 2432, and 2439) complied with all applicable state and federal law and regulations; and accordingly, the commission adopted on August 20, 2008, the TMDLs for Bacteria in Waters of the Upper Texas Coast (Segments 2421, 2422, 2423, 2424, 2432, and 2439) and submitted them to the United States Environmental Protection Agency for approval, where they were approved on February 4, 2009;

WHEREAS, subsequent amendments to the State of Texas Water Quality Management Plan added newly listed water bodies within the original TMDL watershed, bringing the total number of segment involved to nine and the total number of assessment units involved to eleven.

WHEREAS, in order to comply with the "Implementation and Reasonable Assurance" section of the TMDLs, the executive director developed a draft Implementation Plan for the adopted TMDLs for Bacteria in Waters of the Upper Texas Coast (Segments 2421OW, 2422OW, 2423OW, 2424OW, 2432OW, 2433OW, 2434OW, 2435OW, and 2439OW) and presented them for the commission's consideration during its August 19, 2015, public meeting at which the commission approved the Implementation Plan;

NOW, THEREFORE, it is resolved by the commission that the Implementation Plan for Eleven TMDLs for Bacteria in Waters of the Upper Gulf Coast (Segments 2421OW, 2422OW, 2423OW, 2424OW, 2432OW, 2433OW, 2434OW, 2435OW, and 2439OW) is APPROVED.

Issue Date:

TEXAS COMMISSION ON
ENVIRONMENTAL QUALITY

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Bryan W. Shaw, Ph.D., P.E., Chairman

DRAFT