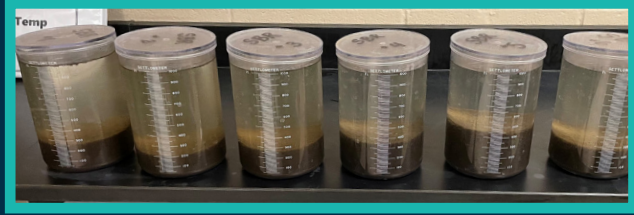
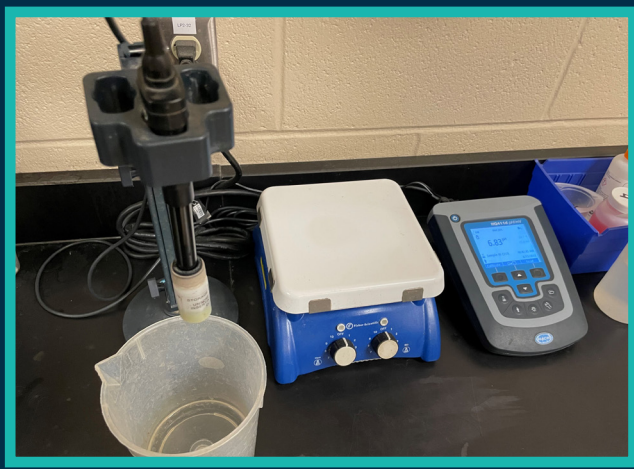
Houston-Galveston Area Council

2022 Water Quality Management Plan Update





City of Galveston Main Wastewater Treatment Plant, TX0047309

Houston-Galveston Area Council

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

EPA United States Environmental Protection Agency

Funding for this project was provided by the Environmental Protection Agency through a Clean Water Act Section 604(b) grant to the Houston-Galveston Area Council, administered by the Texas Commission on Environmental Quality

FINAL REPORT for CONTRACT NO. 582-22-30193

This Page Intentionally Blank

WATER QUALITY MANAGEMENT PLAN UPDATE
Fiscal Year 2022

PREPARED IN COOPERATION WITH THE TEXAS
COMMISSION ON ENVIRONMENTAL QUALITY AND
U.S. ENVIRONMENTAL PROTECTION AGENCY

This project has been funded wholly or in part by the United States Environmental Protection Agency (EPA) under assistance agreement 48000058 to the Texas Commission on Environmental Quality (TCEQ). The contents of this document do not necessarily reflect views and policies of the EPA, nor does the EPA endorse trade names or recommend the use of commercial products mentioned in this document.

Prepared by the Houston-Galveston Area Council, in coordination with the Texas Commission on Environmental Quality. This project was funded under a Clean Water Act Section 604(b) grant; TCEQ contract number 582-22-30193.

Houston-Galveston Area Council
3555 Timmons Lane, Suite 120
Houston, TX 77027

For further information, please contact:

Brian Sims
Senior Planner
Community & Environmental Planning
Houston-Galveston Area Council
713-993-2438
brian.sims@h-gac.com

TABLE OF CONTENTS

This Page Intentionally Blank

ABBREVIATIONS AND ACRONYMS

BIG	Bacteria Implementation Group
CCN	Certificate of Convenience and Necessity
CWA	Clean Water Act
CWSRF	Clean Water State Revolving Fund
DMR	Discharge Monitoring Report
DQO	Data Quality Objective
ECHO	Enforcement and Compliance History Online
EPA	United States Environmental Protection Agency
FOG	Fats/Oils/Grease
FY	Fiscal Year
GBEP	Galveston Bay Estuary Program
GIS	Geographic Information System
GPS	Global Positioning System
H-GAC	Houston-Galveston Area Council
HCPCS	Harris County Pollution Control Services
I&I	Inflow and Infiltration
I-Plan	Implementation Plan
MGD	Million gallons per day
MPN	Most Probable Number
MUD	Municipal Utility District
NRAC	Natural Resources Advisory Committee
NRCS	Natural Resources Conservation Service
OSSF	On-Site Sewage Facility
PUC	Public Utility Commission of Texas
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RCI	Regional Conservation Initiative
SAB	Service Area Boundary
SEP	Supplemental Environmental Project
SSO	Sanitary Sewer Overflow
TCEQ	Texas Commission on Environmental Quality
TMDL	Total Maximum Daily Load
TPDES	Texas Pollutant Discharge Elimination System
TSWQS	*Texas Surface Water Quality Standards*
TWC	Texas Water Code
TWDB	Texas Water Development Board
USDA	United States Department of Agriculture
WCID	Water Control and Improvement District
WPP	Watershed Protection Plan
WQMP	Water Quality Management Plan
WWTF	Wastewater Treatment Facility

PHOTO: Water Quality Monitoring on Horsepen Creek at FM 529 (Station 20465)

INTRODUCTION

Within the Houston metropolitan region and surrounding counties there are a variety of water quality issues, with elevated levels of bacteria being the most prevalent. Contaminants from both point and nonpoint sources continue to impair the region's streams, rivers, lakes, and bays. To address water quality impairments and concerns and develop and implement watershed-based plans, it is important to have current and accessible data, including geospatial data of regional wastewater infrastructure. Evaluating effluent discharge quality and quantity, as well as the frequency, amounts, and potential causes of unauthorized discharges, is also an important component of planning efforts to address water quality in the region.

The Houston-Galveston Area Council's (H-GAC) Regional Water Quality Management Plan (WQMP) Update helps to address the water quality issues affecting the region by acquiring, compiling, and analyzing water and wastewater data and subsequently making this data accessible to various programs, projects, and stakeholder groups who use the data for planning purposes. The WQMP is updated annually, and these updates are used to guide planning and implementation measures to support current and future efforts and inform decision-makers in their evaluations.

This WQMP Update is a report from the Houston-Galveston Area Council on the Fiscal Year (FY) 2022 activities conducted under Contract 582-22-30193, with funding through a Clean Water Act (CWA) § 604(b) grant by the Texas Commission on Environmental Quality (TCEQ). This report will focus on the progress achieved in the primary task objectives set forth in the Project Scope of Work. These tasks are:

1. Project Administration
2. Quality Assurance
3. Wastewater Infrastructure, Data and Permit Update
4. Conformance Review for Clean Water State Revolving Fund Projects
5. Support Watershed Planning
6. On-Site Sewage Facility (OSSF) Planning, Coordination, and Outreach Activities
7. WQMP Coordination
8. Final Report

The H-GAC's WQMP Update Report will become part of the State's Water Quality Management Plan after completion of its public participation process, acceptance by the H-GAC's Board of Directors, and certification by the TCEQ.

PROJECT BACKGROUND

The Houston-Galveston Area Council is a voluntary association of local governments in the Houston-Galveston region, an area that covers approximately 12,500 square miles and is home to more than 7 million people. H-GAC's service area encompasses 13 counties: Austin, Brazoria, Chambers, Colorado, Fort Bend, Galveston, Harris, Liberty, Matagorda, Montgomery, Walker, Waller, and Wharton (Map 1). H-GAC is the designated water quality planning agency for the region and is responsible for the development of the regional WQMP.

The annual WQMP Updates are used to guide planning for implementation measures that control and/or prevent water quality problems. The purpose of this WQMP Update is to support current and future planning decisions concerning water quality efforts, wastewater infrastructure development, watershed management, and related issues on both a regional and state level.

Development of the WQMP Update involves acquiring, compiling, and evaluating water and wastewater data, as well as a series of special studies and coordination activities, as requested by the State. The data and information compiled by H-GAC are combined with data from the TCEQ to form a series of integrated data sets to allow for meaningful evaluation of infrastructure and water quality decisions. The Clean Water Act (CWA) requires the WQMP to be updated as needed to fill information gaps and to revise earlier approved and certified plans. Any updates to the plan need include only the elements of the plan that are new or require modification. This update revises only the information specifically addressed in the included sections. Previously certified and approved WQMPs remain in effect.

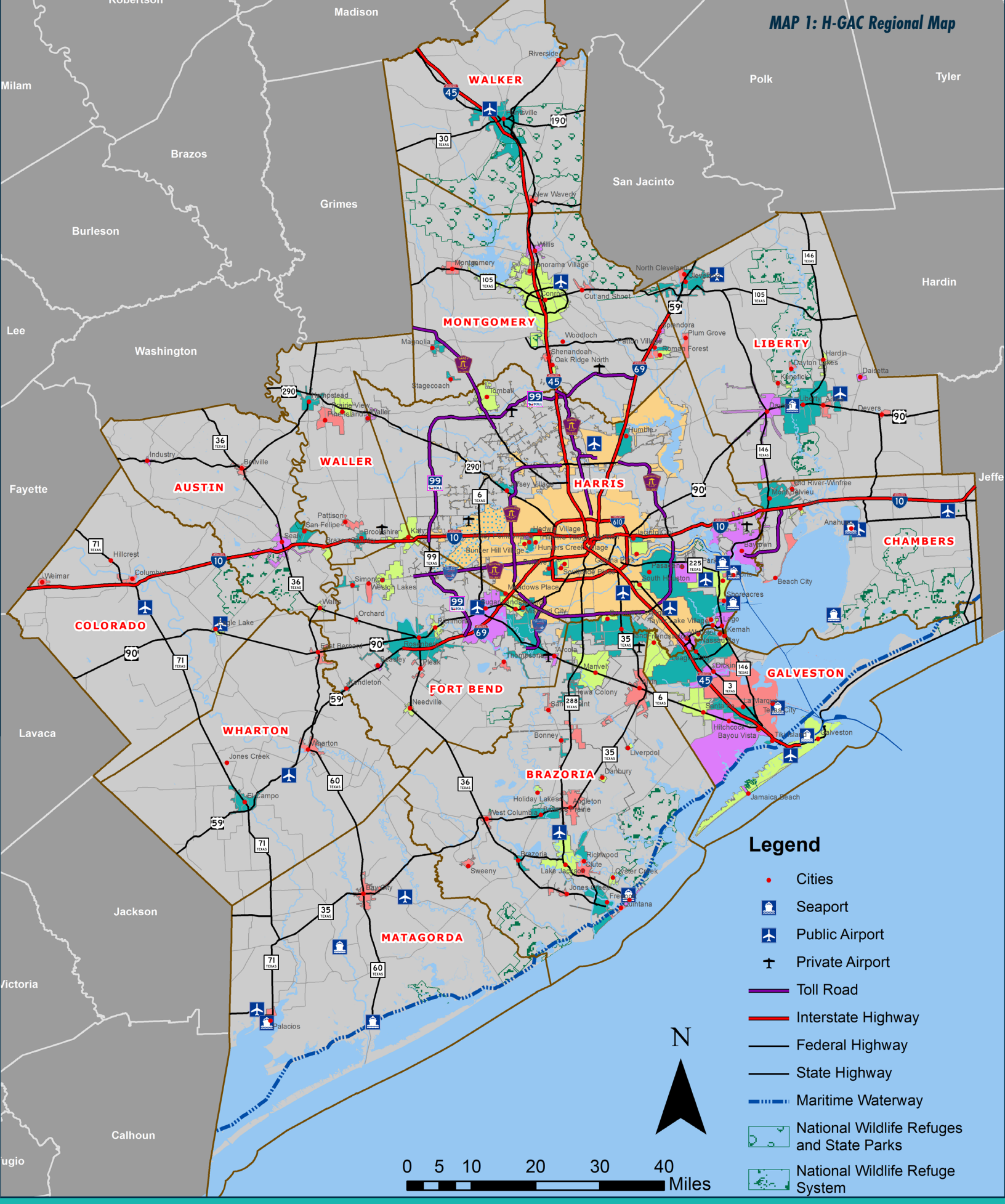
The annual WQMP Update is reviewed by the Natural Resources Advisory Committee (NRAC), a policy and technical advisory committee that advises H-GAC's Board of Directors on issues related to natural resources. Its membership includes diverse representatives from local governments, natural resource management agencies, environmental organizations, and the private sector. An opportunity is provided to both the NRAC and the public to review and submit comments on the WQMP Update before the report is finalized. After review, comments are incorporated into the report to produce the final plan, which is submitted to H-GAC's Board of Directors. Once accepted by the Board, the report is submitted to the TCEQ for review and approval. H-GAC's WQMP Update will become part of the State WQMP after it is certified by the TCEQ.

HISTORICAL WATER QUALITY MANAGEMENT PLAN UPDATES

Under previous WQMP projects, H-GAC sought to address aspects of the information and data needs related to water quality issues facing the region. These projects typically have been a mix of both ongoing efforts and short-term special studies. Some of the project efforts have been continuous, such as wastewater data collection and maintenance and development of an online on-site sewage facility (OSSF) mapping tool. Other efforts have been stand-alone research relating to specific data needs or questions, such as Geographic Information System (GIS) analyses for infrastructure consolidation, Phase II stormwater permit implementation, and support for the Coastal Communities project. This balance of continuous and stand-alone efforts allows for the long-term accumulation of data while retaining flexibility to address specific issues.

The ongoing efforts in the FY 22 WQMP project focused on:

- Updating and improving existing regional wastewater infrastructure databases (wastewater treatment facility outfalls and service area boundaries)
- Improving spatial datasets of potential unpermitted OSSF locations using 9-1-1 addressing,
- Support of local watershed-based plans,
- Coordination and public outreach in support of a Supplemental Environmental Project (SEP) to repair or replace failing OSSFs within the region, and
- Outreach and education related to H-GAC's OSSF Mapping Tool


MAP 1: H-GAC Regional Map
WALKER
MONTGOMERY
LIBERTY
HARDIN
WALLER
HARRIS
CHAMBERS
AUSTIN
COLORADO
FORT BEND
GALVESTON
WHARTON
BRAZORIA
MATAGORDA
Madison
Brazos
Grimes
San Jacinto
Polk
Tyler
Burleson
Lee
Washington
Fayette
Lavaca
Jackson
Calhoun
Legend
Cities
Seaport
Public Airport
Private Airport
Toll Road
Interstate Highway
Federal Highway
State Highway
Maritime Waterway
National Wildlife Refuges and State Parks
National Wildlife Refuge System
N
0 5 10 20 30 40
Miles

PROJECT SIGNIFICANCE

Already one of the largest metropolitan statistical areas in the United States, the Houston-Galveston region continues to grow at a rapid pace, resulting in a proportional increase in population growth and land development. Development, and its accompanying utility infrastructure, continues into counties beyond the urban core. Existing water and wastewater infrastructure systems continue to age and face challenges related to drought and flooding events. With the region expected to gain several million additional residents by 2040, these challenges will only be exacerbated in the future.

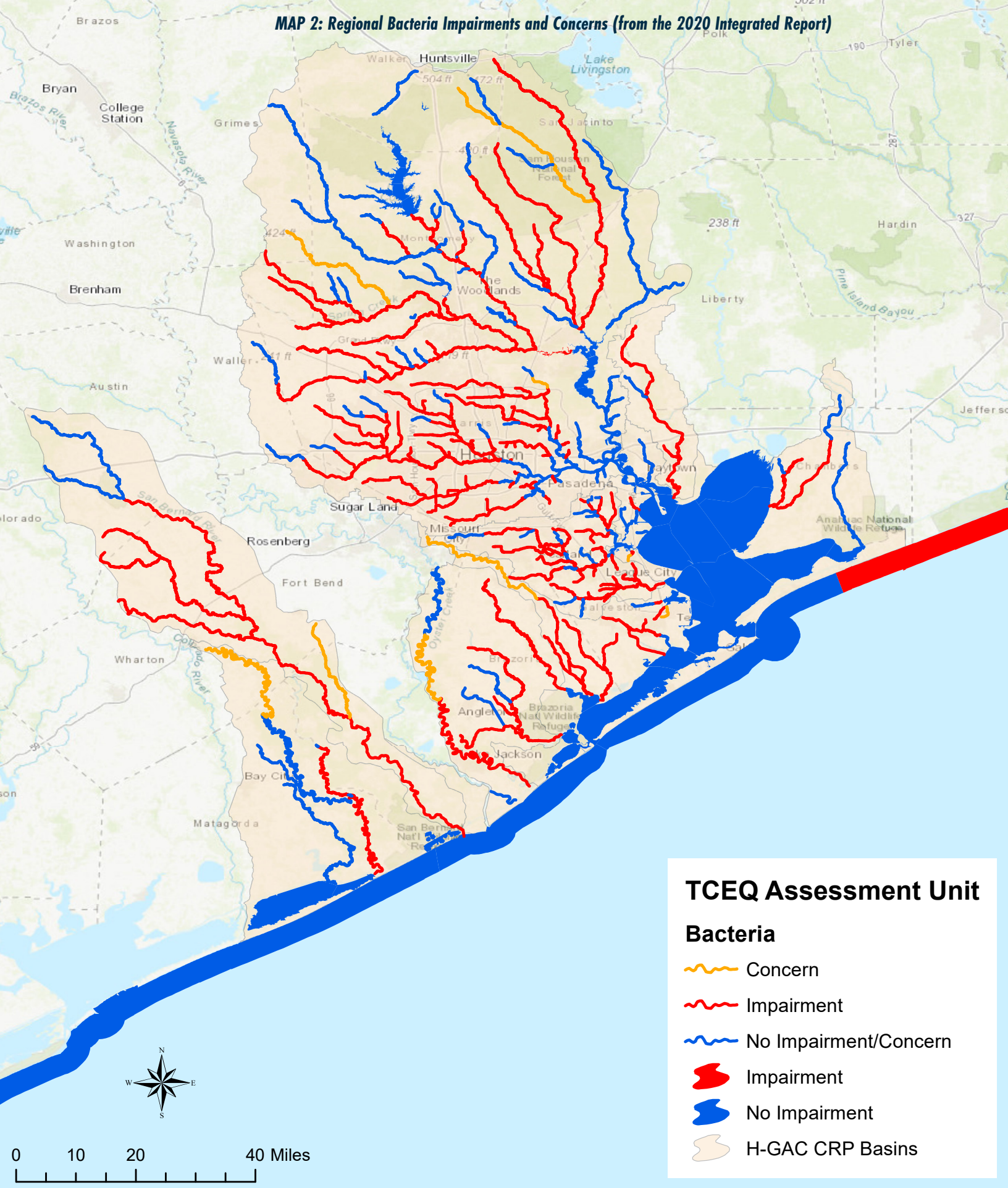
Within the region, there are a variety of water quality impairments and concerns. The majority of stream segments in the region fail to meet the criteria as defined in the *Texas Surface Water Quality Standards* (TSWQS). Many of those water bodies are listed with impairments or concerns in the EPA-approved 2020 T*exas Integrated Report of Surface Water Quality*. Approximately 80 percent of the region's streams are unable to meet one or more state water quality standards, with the most pervasive issue being elevated bacteria levels in exceedance of the primary contact recreation standard (Map 2). The bacteria in the region's lakes, creeks, streams, and bayous come from a variety of sources, including human waste, domestic animal waste, pet waste, and wildlife. These wastes may enter the water through point sources (discrete "end-of-pipe" discharges, such as wastewater effluent) or diffusely through nonpoint sources, carried by precipitation runoff flowing over the land. While some bacteria are naturally occurring, development brings additional bacterial sources and a greater potential impact to water bodies. Careful planning is necessary to address these additional sources.

In addition to the identified water quality issues, numerous developmental challenges exist in the region as well. The wastewater infrastructure that serves the region's increasing population has expanded and developed much like the region itself. As the population has expanded and spread into less urban areas, there has been a proliferation of smaller-sized wastewater treatment facilities (WWTFs) and the creation of a diffuse network of infrastructure to provide utility service to this population. This is partially due to the area's flat topography, as larger centralized WWTFs would require a significant number of costly lift stations to consolidate flow. Due to the availability to fund infrastructure through political subdivisions like Municipal Utility Districts (MUDs) and other special districts, many areas of the region have a wastewater treatment network that is relatively widespread rather than limited by the bounds of a traditional, centralized model. Development through this model has created a patchwork of wastewater infrastructure, which offers both future challenges and opportunities for local decision-makers.

One of the primary objectives of this WQMP is to collect and analyze data related to wastewater infrastructure in the region. Wastewater infrastructure is a potential contributor of bacteria into area waterways through improperly treated effluent discharges, or through sanitary sewer overflows (SSOs) from the treatment facilities or throughout the collection systems. Self-reported data from WWTF Discharge Monitoring Reports (DMRs) and SSO violation reports can be analyzed to better evaluate the potential impacts these sources have on bacteria impairments throughout the region. As the population continues to increase at a rapid pace and the infrastructure continues to age, the integrity of these treatment and collection systems may be harmed. It is important to continuously monitor these systems over time to ensure decision-makers and water resource managers have the necessary information to implement best management practices, repairs, or system replacements in areas with the most need.

The population is expected to continue to rapidly grow in the coming decades, and the ability to make informed decisions regarding water quality and wastewater infrastructure development will be crucial in planning for the region's future. The accumulation, maintenance, and analysis of regional wastewater and effluent quality data can help inform regional solutions to water quality issues.

MAP 2: Regional Bacteria Impairments and Concerns (from the 2020 Integrated Report)



In areas that are not served by a sanitary sewer collection system, which includes a sizable portion of the region, wastewater is treated through use of decentralized on-site sewage facilities (OSSFs), such as aerobic treatment units or conventional septic systems. These OSSFs collect, treat, and disperse wastewater generated by a home or business at the site where it was generated (hence the name "on-site"). The use of an OSSF is allowable to treat up to 5,000 gallons of wastewater per day. For volumes above that threshold, a wastewater discharge permit from TCEQ is required.

When properly designed, sited, and maintained, these systems are an effective form of wastewater treatment. However, if an OSSF fails, which can occur for numerous reasons (improper design, system overload, improper operation, mechanical failure, lack of proper maintenance, etc.), it can contribute to groundwater or surface water contamination through the release of untreated or partially-treated wastewater.

One of the primary objectives of the WQMP is to maintain a geospatial database of permitted OSSFs and an estimation of the number and locations of unpermitted OSSFs. Typically, these unpermitted OSSFs are those "grandfathered" systems that were installed prior to 1989, when the State began requiring that these systems be permitted. For the FY 2022 Water Quality Management Plan Update, H-GAC developed a new methodology using 9-1-1 addressing for estimating the potential locations of these unpermitted systems.

From a regional perspective, the water quality and wastewater infrastructure decisions facing the region are more effectively considered on a watershed basis, as contaminants do not adhere to political boundaries along waterways. This is particularly important for watersheds that serve as significant sources of drinking water, such as Lake Houston. H-GAC maintains a large store of relevant and accessible data to provide useful information, analysis, and viable recommendations. The data collection and analysis tasks completed under this WQMP Update project have significant value for a variety of efforts in the region, such as the development of watershed protection plans (WPPs) or Total Maximum Daily Loads (TMDLs) to address known water quality issues in local waterways.

One of the ways the region is addressing bacteria issues is through projects such as the **Bacteria Implementation Group** (BIG). The BIG is a partnership between H-GAC, local governments, businesses, and community leaders who developed and implement a shared plan to reduce bacteria. The BIG Project area (Map 3) is a combination of more than 100 TMDLs in adjacent watersheds. The BIG heavily relies on the information acquired and analyzed under this project.

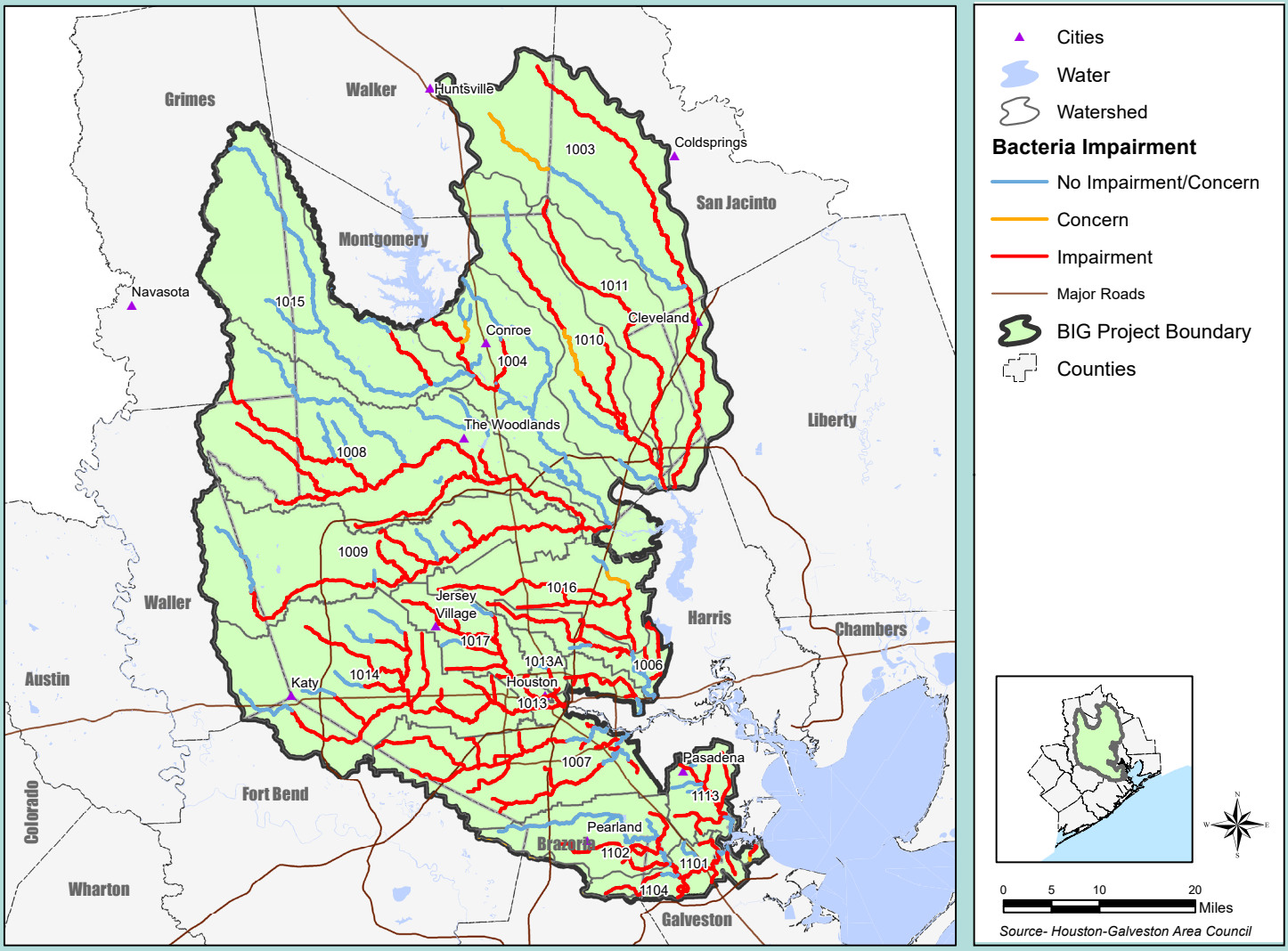
HOW DOES H-GAC UTILIZE THE DATA ACQUIRED THROUGH THE WATER QUALITY MANAGEMENT PLAN PROJECT?

Internal Data Collection and Regional Data Sharing

The wastewater permit data, service area boundaries, and OSSF location data acquired and/or collected under this WQMP Update project serve to augment existing data sets, inform project decisions on related efforts, and expand internal capabilities of both the H-GAC and TCEQ to incorporate and produce future data and analyses. For example, data were used by the Houston-area Bacteria Implementation Group and Basins 11 and 13 TMDL efforts, the Galveston Bay Estuary Program (GBEP), the Clean Rivers Program, and others.

Regional Project Coordination

Maintaining and expanding data resources allows the H-GAC and TCEQ to better understand and facilitate regional coordination between parties involved in wastewater infrastructure decisions and general water quality/watershed protection efforts. Participation in regional groups and coordination efforts helps ensure decisions benefit from the resources compiled under the WQMP.



MAP 3: Bacteria Implementation Group (BIG) Total Maximum Daily Load (TMDL) Project Area

Source Water Protection

A large portion of the region's population is served by treated surface water originating in local rivers and lakes. The infrastructure planning and watershed coordination activities of this WQMP Update project help foster a greater understanding of the relationship between water quality issues and steps to help protect drinking water sources.

Clean Water State Revolving Fund Project Review

Data and analyses allow H-GAC staff to assist state and federal granting agencies in the review of regional grant applications. These reviews ensure potential projects concur with regional priorities and regional data projections.

Education and Outreach

Data gathered under this WQMP Update project have been used as a focal point or basis for several education efforts, including the OSSF location database and various facilitated meetings, such as the ongoing Natural Resources Advisory Committee.

PROJECT TASK OBJECTIVES

The WQMP Update is a report from H-GAC on the FY 2022 activities conducted under Contract 582-22-30193, with funding through a Clean Water Act § 604(b) grant by the U.S. EPA and administered through the TCEQ.

This WQMP Update report focuses on the progress achieved in the Task Objectives set forth in the Project Scope of Work. The Task Objectives for this project are:

- Task 1: Project Administration
- Task 2: Quality Assurance
- Task 3: Wastewater Infrastructure, Data and Permit Update
- Task 4: Conformance Review for Clean Water State Revolving Fund (CWSRF) Projects
- Task 5: Support Watershed Planning
- Task 6: On-Site Sewage Facility (OSSF) Planning, Coordination, and Outreach Activities
- Task 7: WQMP Coordination
- Task 8: Final Report

This WQMP Update Report, the contract deliverable for Task 7, will focus on the data acquisition and analysis performed under Tasks 3 – 6. Project-related tasks (Tasks 1 and 2) will be discussed in a separate Project Final Report (Task 8). A description of each project task is provided in Table 1.

Each of the primary data acquisition and analysis Task Objectives serves to maintain, expand, or implement H-GAC's store of water quality and wastewater infrastructure data. Each Task Objective is described in a separate section of the WQMP Update report, and includes methodologies, results and observations, and discussion (as appropriate). Some of the deliverables generated for this project are large electronic data sets unsuitable for full inclusion in a printed version of this Final Report. However, copies of the full electronic data are available, with representative portions of the data included in this report.

For some analyses presented in this report, such as the wastewater treatment facility outfalls, a 15-county area (to include Grimes and San Jacinto counties) is considered due to the location of watersheds of interest. These counties are included in the area monitored by H-GAC as part of its ambient surface water quality monitoring program (known as the Clean Rivers Program).

TABLE 1: WQMP Project Task Objective Descriptions, FY 2022 Workplan

Task #	Task Objective	Task Description
1	Project Administrative	To administer, coordinate, and monitor all work performed under this project including technical and financial supervision and preparation of status reports.
2	Quality Assurance	To refine, document, and implement data quality objectives (DQOs) and quality assurance/quality control (QA/QC) activities that ensure data of known and acceptable quality are generated by this project. This task includes reviews, revisions, and updates to the Quality Assurance Project Plan (QAPP).
3	Wastewater Infrastructure, Data and Permit Update	To collect and integrate wastewater infrastructure and permit data to support planning for wastewater treatment facilities and water quality projects in H-GAC's region, and to support TCEQ in their WQMP Update process.
4	Conformance Review for Clean Water State Revolving Fund (CWSRF) Projects	To review and provide input on CWSRF loan applications in H-GAC's region and ensure conformance with the latest WQMP.
5	Support Watershed Planning	To support watershed planning and sharing of regional information on water quality and related topics in H-GAC's region.
6	On-Site Sewage Facility (OSSF) Planning, Coordination, and Outreach Activities	To administer and coordinate H-GAC's OSSF program activities. These activities include maintaining and continuing to develop H-GAC's existing spatial database of permitted OSSFs and projected unpermitted OSSF locations. These activities will provide coordination in support of an existing Supplemental Environmental Project (SEP) to repair or replace failing OSSFs within the region, coordinate regional water quality and wastewater infrastructure projects, and provide outreach and education activities.
7	WQMP Coordination	To provide TCEQ with a comprehensive report on water quality management planning activities and documentation that H-GAC's Board of Directors has accepted the Final WQMP Update Report.
8	Final Report	To produce a Final Report that summarizes all completed activities and conclusions reached during the project. The Final Report will discuss the extent to which project goals and purposes have been achieved. The Final Report should emphasize successes, failures, and lessons learned. The Final Report will summarize all the Task Reports either in the text or as appendices.

PHOTO: Brays Bayou at South Main Street (Monitoring Station 11139)

WASTEWATER INFRASTRUCTURE, DATA, AND PERMIT UPDATE

The goal of this Task is to collect and integrate wastewater infrastructure and permit data to support planning for wastewater treatment facilities and water quality projects in the Houston-Galveston region and to support TCEQ in their WQMP Update process. The primary components of this task are:

- Wastewater Infrastructure Data Update
- Wastewater Data Analysis

The acquisition and analysis of data collected under this task adhered to approved Quality Assurance Project Plans (QAPPs) and quality assurance/quality control (QA/QC) methods.

WASTEWATER INFRASTRUCTURE DATA UPDATE

For the Wastewater Infrastructure Data Update task, H-GAC acquires data and updates the service area boundaries and related permitted domestic wastewater outfalls for the region's wastewater collection and treatment facilities. The annual updated Geographical Information System (GIS) map layers include the boundaries of the wastewater collection systems within the region and the geographic location of wastewater treatment facility outfalls.

To update the WQMP, H-GAC utilizes a series of data sets related to the Texas Pollutant Discharge Elimination System (TPDES)-permitted wastewater facilities in the region. These are the Service Area Boundary (SAB) data set and the Wastewater Outfalls data set. A primary task under this Project is to update and continue to integrate these data sources.

To approach this task, H-GAC set out to address the following questions:

- Is there a corresponding service area boundary for every domestic outfall?
- What are the differences between the current and previous outfall locations for current domestic permits?
- Are there any data errors that need to be reported to TCEQ?

PHOTO: Wastewater Treatment Facility in League City

Wastewater Outfall GIS Layer Update

The wastewater outfall layer is maintained by TCEQ. This GIS layer identifies the location of TPDES-permitted wastewater treatment facility outfalls for the state. Each year, as part of the WQMP Update process, H-GAC acquires an updated wastewater outfalls GIS data set from TCEQ's GIS website[1].

The data for this year's report were acquired on 1/25/22.

For this Project, H-GAC examined the domestic wastewater outfalls in the 15-county region for the period of 1/1/21 – 12/31/21. In the metadata for the GIS layer provided by TCEQ, the outfalls are classified with descriptors. The outfalls examined for this project include those categorized as "D" or "W" in the data dictionary. The "D" category represents domestic outfalls at <1 MGD (millions of gallons per day) domestic sewage. The "W" category includes wastewater outfalls ≥1 MGD domestic sewage or process water, including water treatment facility discharge.

As the focus of this analysis is on domestic discharges, the "D" category was automatically included in H-GAC's evaluation. To determine which facilities in the "W" category were domestic and which were industrial, the permit numbers were queried using TCEQ's water quality permit registry[2]

Permits in the "W" category identified as Public Domestic Wastewater or Private Domestic Wastewater were included in the domestic wastewater outfall layer. Industrial discharges were excluded from analysis, as these are tied to a single location and not a traditional service area boundary.

Service Area Boundary GIS Layer Update

The SAB data set is a GIS layer maintained by H-GAC. This file contains a spatial representation of the service area boundaries of the permitted domestic wastewater dischargers in the region. Typically, these boundaries include municipalities, Municipal Utility Districts (MUDs), Water Control and Improvement Districts (WCIDs), other public districts, and private utilities that serve an area greater than a single facility. Industrial permittees are not included in the SAB data set as these dischargers typically only serve a single facility.

H-GAC utilizes data from multiple sources (MUD records, EPA and TCEQ permit databases, etc.) to update the service area boundary and outfall layer data sets. In addition, H-GAC also utilized the Public Utility Commission of Texas' (PUC) Certificates of Convenience and Necessity (CCN) data set to match outfalls to service area boundaries. A CCN grants the holder the exclusive right to provide retail water and/or sewer utility service to a defined geographic area. If a CCN is issued, it may serve as a proxy for the service area boundary, as the CCN holder is required to provide continuous and adequate service within its CCN boundary.

A manual review of the GIS outfall layer and service area boundaries was performed to identify outfalls without an associated service area boundary. To address small private systems without an associated service area boundary, and to help develop boundaries for these systems, the SAB data set was compared to other sources of boundary data, such as city boundaries and the CCNs available through the PUC. These city boundaries and CCNs can serve as proxies for the service area boundary until H-GAC staff can receive verification from these individual entities. These proxy boundaries were added to the service area boundary GIS layer.

Updated data sets were submitted to TCEQ in digital format with this report. These data sets created under this project are listed in **Appendix A**. These data sets are too large to include in the report, but are available upon request.

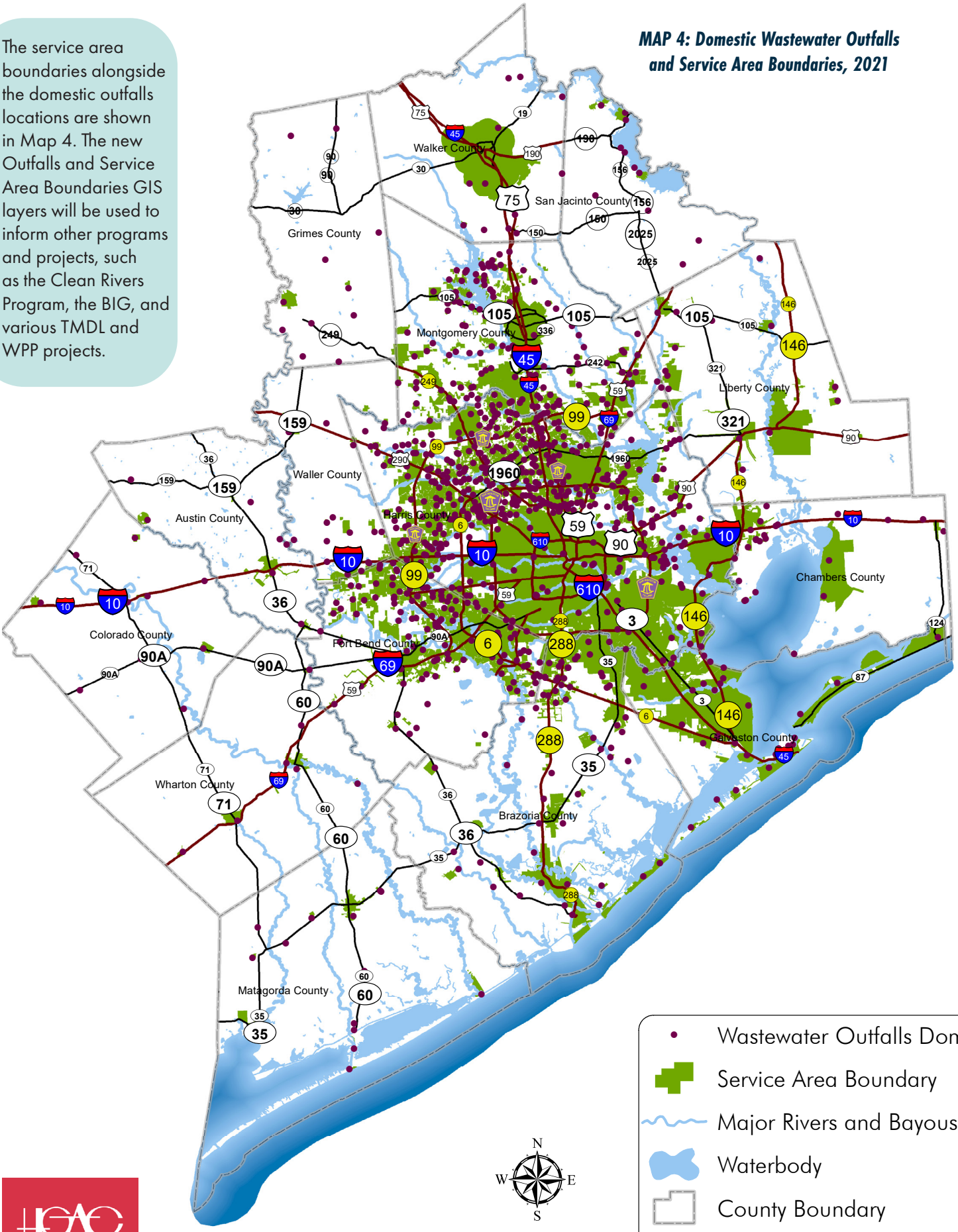
The map of the domestic wastewater outfalls and service area boundaries are shown in Map 4.

---

1 https://gis-tceq.opendata.arcgis.com/datasets/wastewater-outfalls
2 https://www6.tceq.texas.gov/wqpaq/index.cfm

The service area boundaries alongside the domestic outfalls locations are shown in Map 4. The new Outfalls and Service Area Boundaries GIS layers will be used to inform other programs and projects, such as the Clean Rivers Program, the BIG, and various TMDL and WPP projects.

MAP 4: Domestic Wastewater Outfalls and Service Area Boundaries, 2021



Houston-Galveston Area Council

WASTEWATER DATA ANALYSIS

PHOTO: UV Disinfection of Wastewater Effluent

WASTEWATER DISCHARGE MONITORING REPORT DATA ANALYSIS

The Wastewater Discharge Monitoring Report (DMR) Data Analysis for this project involves the acquisition and analysis of self-reported discharge monitoring data for regional permitted facilities. The WQMP Update specifically evaluates bacteria discharges, but other constituents may be evaluated if a water body-specific or facility-specific need is identified, or if requested by stakeholders.

As part of the analysis for the WQMP Update, H-GAC acquired self-reported DMR data for permitted facilities through TCEQ and EPA to evaluate bacteria permit limit exceedances for the period of 2017–2021.

As defined in the *Texas Surface Water Quality Standards*, the *E. coli* geometric mean criterion for primary contact recreation for ambient surface water is 126 most probable number (MPN) per 100 milliliters (mL), and 399 MPN/100 mL for single grab samples. For enterococci, which is the designated indicator organism for tidal segments, the criterion for the geometric mean is 35 MPN/100 mL, with a single sample criterion of 89 MPN/100 mL. TCEQ does not apply the single sample criterion for their assessment. In most cases, these standards are generally applied as an effluent permit limit for WWTFs. In the region, the majority of TPDES permits have effluent limitations set for *E. coli*. However, some permits have enterococci as the indicator organism where the effluent is discharged into tidal waters. Select WWTFs may have more stringent bacteria permit limits depending on site-specific conditions or participation in TMDL projects such as the BIG.

Effluent discharges from WWTFs are regulated by TCEQ, with water quality limits specified in each discharger's permit. Both TCEQ and Harris County Pollution Control Services (HCPCS) perform effluent monitoring for compliance with water quality permits through their inspection and enforcement programs. These effluent discharge limits are also monitored by WWTF personnel on a frequency dependent on facility size, location, wastewater type (domestic or industrial), and other factors. Results from field measurements (pH, dissolved oxygen, instantaneous flow, etc.) and laboratory analyses (biochemical oxygen demand, total suspended solids, ammonia, etc.) from these required monitoring events are submitted to the TCEQ monthly as a Discharge Monitoring Report.

Evaluating trends in permit exceedances for indicator bacteria is important in understanding the impact WWTFs may have on overall surface water quality. DMRs are the most comprehensive data available for the broad regional evaluations conducted under the WQMP Update, even though there are some inherent uncertainties. As with any self-reported data, there is an expectation that some degree of uncertainty or variation from normal conditions may occur. Additionally, samples are collected at the weir and not at the end of the outfall pipe, so results generated do not take into account potential bacterial regrowth in the outfall pipe.

The data acquired under this task continues to be widely used by local projects and entities. Water quality protection efforts, including the various watershed protection plans, TMDLs, and the Clean Rivers Program, use the data to guide and inform planning decisions.

For this project, H-GAC staff evaluated the occurrence of self-reported bacteria violations through domestic WWTF DMRs in the region for the period of 2017–2021. Evaluations were based on the regulatory permit limits specific to each facility and consider the number of exceedances and bacteria loadings by year and by WWTF size. The data analyzed for this project are self-reported by WWTFs.

DMR data for this analysis were acquired from EPA's Enforcement and Compliance History Online[3] (ECHO) ICIS-NPDES Permit Limit and Discharge Monitoring Datasets webpage on 2/28/22.

Additional wastewater permit limit data was acquired from TCEQ's Permit Application and Registration Information Systems (PARIS) database through their Water Quality Permit Query[4] on 5/16/22.

The acquisition and analysis of wastewater DMR data and effluent permit limit data adhered to updated QAPPs and QA/QC methods.

---

3 https://echo.epa.gov/tools/data-downloads/icis-npdes-dmr-and-limit-data-set

4 https://www6.tceq.texas.gov/wqpaq/index.cfm?fuseaction=home.AdvanceSearch

Permitted Outfalls in the Region

Based on the GIS data acquired from TCEQ, there are 1,262 permittees in the TCEQ Outfall Layer for 2021, with the EPA Registry showing 1,259 permittees (Table 2). For 2020, there were 1,243 permittees in the TCEQ Outfall Layer and 1,231 in the EPA Registry.

Of the permittees in the EPA Registry, self-reported DMR data (of any type) were submitted in 2021 for 1,004 outfalls, with bacteria data being submitted for 890 of the outfalls.

Of the permittees submitting bacteria DMR data in 2021, 801 are domestic WWTFs, and 89 are industrial facilities. A summary of the WWTFs submitting DMR data in 2020 and 2021 is provided in Table 3.

NOTE: The number of permittees can change from year-to-year, and multi-year comparisons are based on the current wastewater outfall GIS layer. Therefore, slight variations may be present from the data presented in this report and previous or subsequent reports.

Differences between the TCEQ and EPA data sets are likely due to new permits approved by TCEQ but not yet entered into the EPA Registry.

The data presented in this report are accurate as of the date the data were acquired, but previous or subsequent data could be slightly different based upon the number of outfalls present at the time of that data acquisition.

TABLE 2: Wastewater Permittees in the Houston-Galveston Region, 2020 and 2021

WWTF Type	Number of Permittees 2020	Number of Permittees 2021	Difference
Permittees in the TCEQ Outfall Layer	1,243	1,262	19
Permittees in the EPA Registry	1,231	1,259	28
Permittees submitting DMR data (any type)	1,001	1,004	3
Permittees submitting DMR bacteria data	886	890	4

Compared to the 2020 data set, there was an increase of 19 permittees in the TCEQ Outfall Layer and 28 permittees in the EPA Registry for 2021.

The number of permittees (all WWTF types) submitting DMR data increased from 1,001 in 2020 to 1,004 in 2021 (Table 3). The number of permittees submitting bacteria data increased from 886 to 890. For the domestic WWTFs, 803 submit DMR data, with 801 of those facilities submitting bacteria data.

TABLE 3: Permittees Submitting DMR Data, 2020 and 2021

WWTF Type	2020		2021	
	Permittees Submitting DMR Data (any type)	Permittees Submitting DMR Bacteria Data	Permittees Submitting DMR Data (any type)	Permittees Submitting DMR Bacteria Data
Domestic	801	795	803	801
Industrial	200	91	201	89
TOTAL	**1,001**	**886**	**1,004**	**890**

The subsequent analyses presented in this report pertain to the domestic WWTFs, as these provide wastewater treatment for a defined service area, unlike an industrial facility that provides treatment for a single location. In order to determine permit exceedance rates, analyses only consider those results from WWTFs with a permit limit. If a facility reports results but has no established effluent permit limit, those results are not included in the analyses.

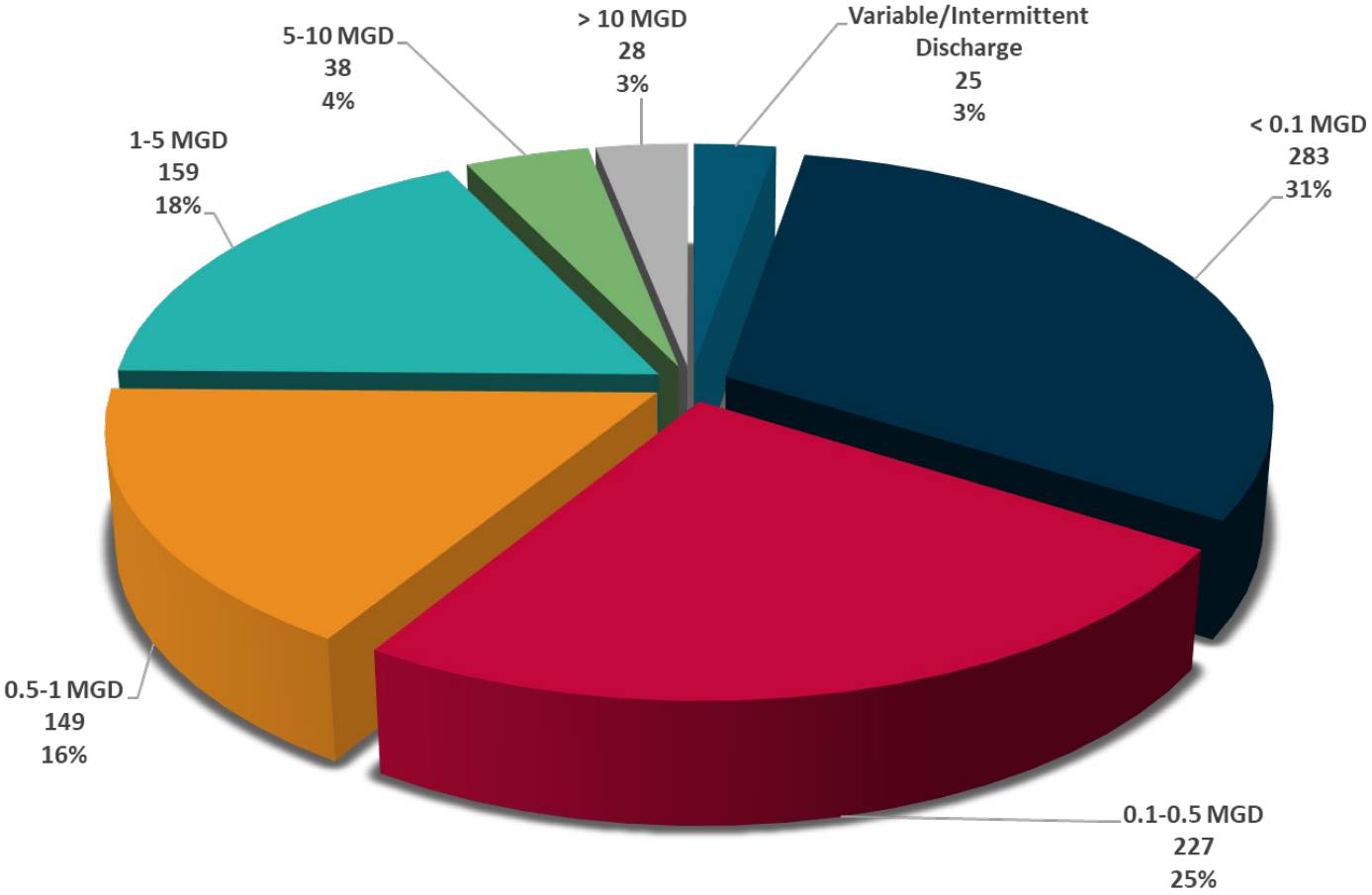
For many of the analyses in this report, WWTFs are evaluated on relative facility size, as categorized by daily flow in MGD. Those facility size categories and the number of facilities per category are shown in Table 4 and Figure 1.

The total number of dischargers submitting bacteria DMR data shown in Table 3 (890 WWTFs) differs from that in Table 4 (909 WWTFs) due to a difference in the time frame the data represent. The values shown in Table 3 are based on 2021 data only. The number of WWTFs by size shown in Table 4 are calculated using data from 2017–2021 so permit exceedance rates by year and facility size can be determined.

TABLE 4: Number of WWTFs Reporting Bacteria DMR Data by WWTF Relative Facility Size, 2017–2021

WWTF Facility Size by MGD	Number of Facilities 2017–2021	Percentage of Facilities
Variable/Intermittent	25	2.8%
<0.1 MGD	283	31.1%
0.1 – 0.5 MGD	227	25.0%
0.5 – 1 MGD	149	16.4%
1 – 5 MGD	159	17.5%
5 – 10 MGD	38	4.2%
>10 MGD	28	3.1%
TOTAL	**909**	**100.0%**

FIGURE 1: Percentage of WWTFs by Relative Facility Size, 2017–2021



Within the region, the largest number of WWTFs are in the <0.1 MGD category (31.1% of facilities) followed by those in the 0.1 – 0.5 MGD category (25.0% of facilities). Combined, these two categories represent over half of the permitted domestic facilities submitting bacteria data in the region. Considering regional growth patterns and the proliferation of MUDs and other special districts, it is expected that the number of these smaller facilities would be very high in the region. WWTFs in the Variable/Intermittent category represent the smallest group, at 2.8% of all facilities. The largest WWTFs, those in the >10 MGD category, represent 3.1% of the total WWTFs in the region.

Bacteria DMR Data Analysis and Permit Exceedances

In 2021, WWTFs within the Region self-reported a combined 8,579 bacteria geometric mean results and 8,737 bacteria daily maximum/single grab sample results. These records include only those outfalls with permit limits. Facilities that test and report data but do not have a permit limit are not included in these numbers. The number of reported results by year (2017–2021) is shown in Table 5.

TABLE 5: Bacteria DMR Data Permit Samples by Year, 2017–2021

Bacteria Parameter	Geometric Mean Samples					Daily Maximum/Grab Samples				
	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
E. coli	6,690	6,762	7,162	7,237	7,314	6,927	7,029	7,286	7,380	7,458
Enterococci	1,059	1,081	1,156	1,228	1,265	1,085	1,107	1,174	1,240	1,279
TOTAL	**7,749**	**7,843**	**8,318**	**8,465**	**8,579**	**8,012**	**8,136**	**8,460**	**8,620**	**8,737**

Of these reported results for 2021, 78 of the geometric mean results (0.9%) and 260 of the daily maximum/single grab sample results (3.0%) exceeded permit limits (Table 6). Overall, there is a 99.1% compliance with geometric mean permit limit results, and a 97.0% compliance for daily maximum/single grab sample results for effluent monitoring samples reported in 2021.

TABLE 6: Bacteria DMR Data Reported and Permit Exceedance Rates, 2021

Bacteria Data Reported	Geometric Mean Results	Daily Maximum / Single Grab Sample Results
Total Results Reported	8,579	8,737
Total Exceeding Limit	78	260
Percent Exceedance	0.9%	3.0%
Percent Compliance	99.1%	97.0%

Geometric mean and single grab bacteria effluent reporting and compliance data for 2021 were also evaluated by relative facility size. Table 7 shows the number of geometric mean and daily maximum/single grab sample results reported, the number exceeding permit limits, and the percent exceedance for each of the WWTF relative facility size categories. For geometric mean results in 2021, percent exceedances ranged from 0.0% (Variable/Intermittent and 5 – 10 MGD) to 1.5% (< 0.1 MGD). For daily maximum/single grab sample results, percent exceedances ranged from 0.6% (Variable/Intermittent) to 9.0% (> 10 MGD).

TABLE 7: Bacteria DMR Data Permit Exceedance Rates by Relative Facility Size, 2021

Relative Facility Size	Geometric Mean Results Reported	Geometric Mean Results Exceeding Permit Limit	Geometric Mean Percent Exceedance	Daily Maximum/ Single Grab Results Reported	Daily Maximum/ Single Grab Results Exceeding Permit Limit	Daily Maximum/ Single Grab Results Percent Exceedance
Variable/Intermittent	159	-	-	169	1	0.6%
< 0.1 MGD	1,496	23	1.5%	1,541	31	2.0%
0.1 – 0.5 MGD	2,495	30	1.2%	2,594	50	1.9%
0.5 – 1 MGD	1,734	9	0.5%	1.734	34	2.0%
1 – 5 MGD	1,915	13	0.7%	1,915	89	4.6%
5 – 10 MGD	456	-	-	460	26	5.7%
> 10 MGD	324	3	0.9%	324	29	9.0%
TOTAL	**8,579**	**78**	**0.9%**	**8,737**	**260**	**3.0%**

As presented in Table 7, WWTFs in the 0.1 – 0.5 MGD category have the largest number of samples reported (both geometric mean and single grab samples), with the smallest number being for facilities in the Variable/Intermittent category, followed by the > 10 MGD category. WWTFs in the < 0.1 MGD category have the highest percent exceedance for geometric mean samples at 1.5%, while the > 10 MGD category has the highest percent exceedance rate for the daily maximum/single grab samples at 9.0% Although the daily maximum/single grab percent exceedance is highest for WWTFs in the > 10 MGD category, these facilities have a low geometric mean exceedance rate (0.9%). These facilities also collect samples at a greater frequency than other facilities due to their flow volume.

Geometric mean and single grab bacteria sampling and compliance data were also evaluated by year. Table 8 shows the number of geometric mean and daily maximum/single grab sample results reported, the number exceeding permit limits, and the percent of samples exceeding permit limits for each year (2017–2021). In general, results indicate a small number of bacteria permit exceedances are reported annually. For 2021, 78 of 8,579 geometric mean results, or 0.9%, were reported as exceedances. Of the 8,737 daily maximum/single grab samples reported, 260 results, or 3.0%, were reported as permit exceedances in the self-reported DMR data.

TABLE 8: Bacteria DMR Data Permit Exceedance Rates by Year, 2017–2021

Year	Total Geometric Mean Results Reported	Samples Exceeding Geometric Mean Permit Limit	Percent Samples Exceeding Geometric Mean Permit Limit	Percent Compliance for Geometric Mean Results	Total Daily Maximum/ Single Grab Results Reported	Samples Exceeding Daily Maximum/ Single Grab Permit Limit	Percent Samples Exceeding Daily Maximum/ Single Grab Permit Limit	Percent Compliance for Daily Maximum/ Single Grab Results
2017	7,749	75	1.0%	99.0%	8,012	296	3.7%	96.3%
2018	7,843	66	0.8%	99.2%	8,136	268	3.3%	96.7%
2019	8,318	83	1.0%	99.0%	8,460	298	3.5%	96.5%
2020	8,465	72	0.9%	99.1%	8,620	227	2.6%	97.4%
2021	8,579	78	0.9%	99.1%	8,737	260	3.0%	97.0%

Overall, rates of compliance were high across all relative facility size categories, with 99.1% of geometric mean results and 97.0% of daily maximum/single grab samples meeting effluent permit limits.

Year-to-year bacteria DMR permit exceedance data were also analyzed by relative facility size. The bacteria permit limit exceedance rates for each facility size category for geometric mean and daily maximum/single grab samples for the period of 2017–2021 are presented in Table 9.

TABLE 9: Bacteria DMR Data Geometric Mean and Daily Maximum/Single Grab Sample Permit Exceedance Rates by Relative Facility Size and Year, 2017–2021

Relative Facility Size	Geometric Mean Samples Percent Exceedances					Daily Maximum/Grab Samples Percent Exceedances				
	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Variable/Intermittent	24.0%	24.1%	8.3%	3.4%	0.0%	29.2%	25.0%	8.3%	3.4%	0.6%
<0.1 MGD	1.5%	0.7%	1.4%	1.5%	1.5%	2.7%	1.7%	2.7%	2.3%	2.0%
0.1 – 0.5 MGD	1.2%	1.1%	1.1%	1.2%	1.2%	2.3%	1.9%	2.3%	1.9%	1.9%
0.5 – 1 MGD	0.3%	0.3%	0.5%	0.2%	0.5%	2.1%	1.7%	2.6%	2.3%	2.0%
1 – 5 MGD	0.8%	0.6%	0.9%	0.4%	0.7%	5.1%	5.6%	5.1%	3.7%	4.6%
5 – 10 MGD	0.5%	1.5%	0.9%	0.7%	0.0%	8.5%	7.7%	6.1%	3.7%	5.7%
>10 MGD	0.4%	0.8%	1.0%	0.3%	0.9%	12.6%	9.9%	8.9%	4.3%	9.0%

Permit exceedances for geometric mean permit limits are generally low. For the period of 2017–2019, WWTFs in the Intermittent/Variable category had the highest rate of bacteria permit exceedances for geometric mean data. However, in 2021 there were no geometric mean sample violations for this facility size category. As these Intermittent/Variable facilities only discharge while in operation, it is likely that shutdowns due to COVID-19 could have reduced the number of permit exceedances in 2020 and 2021.

Higher permit exceedance rates are observed with the daily maximum/single grab samples as compared to the geometric mean results. However, this is to be expected. For smaller facilities, dischargers may only have to sample once per quarter or once per month. For larger facilities with higher flow volumes, sampling frequency may increase to weekly or daily, with multiple single grab results for each facility each month, but only one geometric mean result reported.

Overall, bacteria permit limit exceedance rates are low and WWTFs in the region are typically within permit compliance. However, it is important to remember that these DMR data are self-reported and therefore have some inherent uncertainty. In many cases, these samples are collected at the same time each day, which may bias the results if sample collection is postponed until conditions are ideal.

In addition to the analysis of the exceedance rates for the geometric means previously discussed, the geometric mean of the reported geometric mean and single grab *E. coli* sample results were calculated. This analysis calculated the geometric mean for all results reported each year for each relative facility size category. Results of these analyses are presented in Table 10.

TABLE 10: Geometric Mean (MPN/100 mL) of E. coli DMR Geometric Mean and Daily Maximum/Single Grab Sample Results by Relative Facility Size and Year, 2017–2021

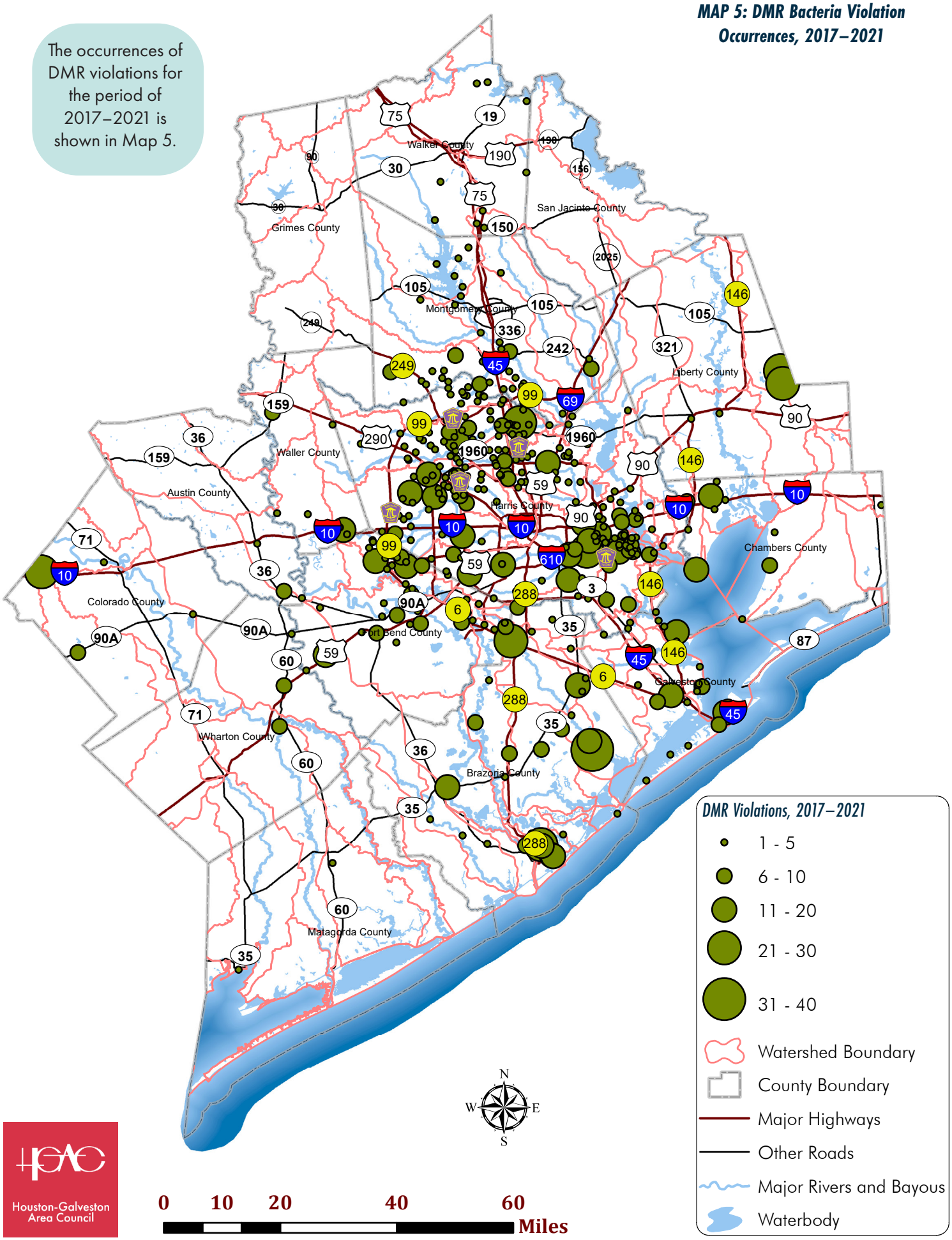
Relative Facility Size	Geometric Mean (MPN/100 mL) of *E. coli* DMR Geometric Mean Results					Geometric Mean (MPN/100 mL) of *E. coli* Daily Maximum/Grab Samples				
	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Variable/Intermittent	185	98	56	9.1	5.4	240	131	70	12	6.1
<0.1 MGD	2.1	2.1	2.3	2.0	1.8	2.8	2.6	3.0	2.6	2.3
0.1 – 0.5 MGD	2.0	2.0	2.0	1.8	1.7	2.5	2.4	2.4	2.2	2.0
0.5 – 1 MGD	1.8	1.8	1.8	1.8	1.8	3.1	3.1	2.9	2.6	2.7
1 – 5 MGD	2.3	2.5	2.4	2.4	2.4	7.7	9.0	7.9	7.1	6.9
5 – 10 MGD	2.0	2.0	1.7	1.8	1.7	14	11	8.5	8.1	7.6
>10 MGD	2.3	2.3	2.2	2.3	2.3	17	17	18	17	20

Maps 5 — 8 illustrate the frequency of DMR bacteria violations and the density of those violations by watershed. Maps 5 and 6 show this data for the period of 2017—2021. Maps 7 and 8 show this data for 2021. These maps illustrate areas in the region that have the highest rate of permit exceedances based on the reported DMR data acquired from TCEQ and EPA. It is evident that the more populated urban and suburban areas present in the region experience the greatest number of bacteria violations compared to more rural watersheds along the region's perimeter. It should be noted that spatial analysis of DMR exceedances are based on the location of WWTF outfalls. On Maps 6 and 8, watersheds that have no outfalls located within their boundary are shown in white to indicate that there are no data. On Maps 5 and 7, no symbols appear on those watersheds. That does not imply that there are no bacteria issues within these watersheds, just that there are no permitted point source discharges.

The DMR bacteria violation frequency map illustrates that the more populated urban and suburban areas in the region are experiencing the highest rate of bacteria violations. However, it should be noted that the density of WWTF outfalls in urban and suburban centers is much greater than the less populated watersheds in the region, therefore it would be expected that the number of DMR bacteria violations would also be higher.

MAP 5: DMR Bacteria Violation Occurrences, 2017–2021

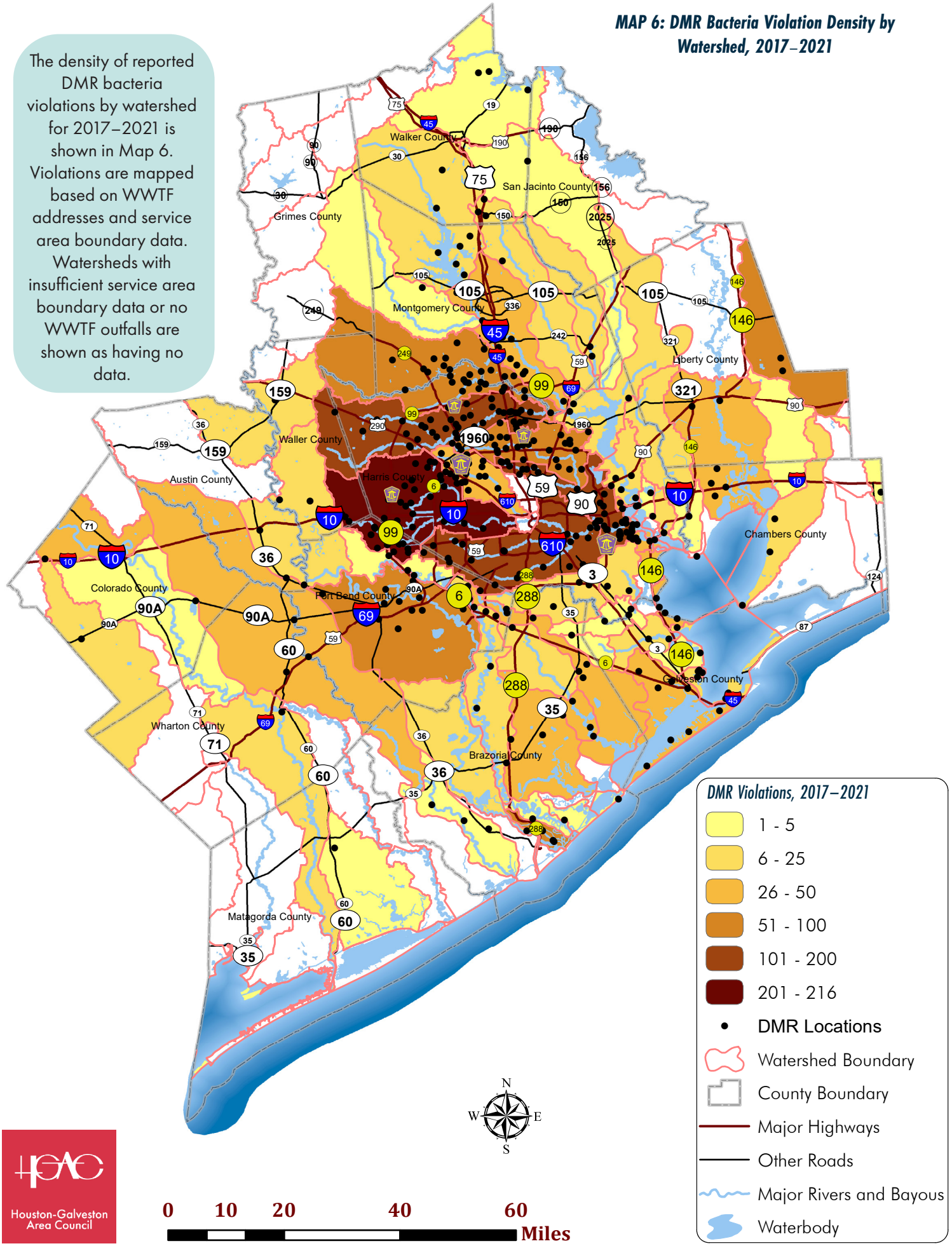
The occurrences of DMR violations for the period of 2017–2021 is shown in Map 5.



Houston-Galveston Area Council

MAP 6: DMR Bacteria Violation Density by Watershed, 2017–2021

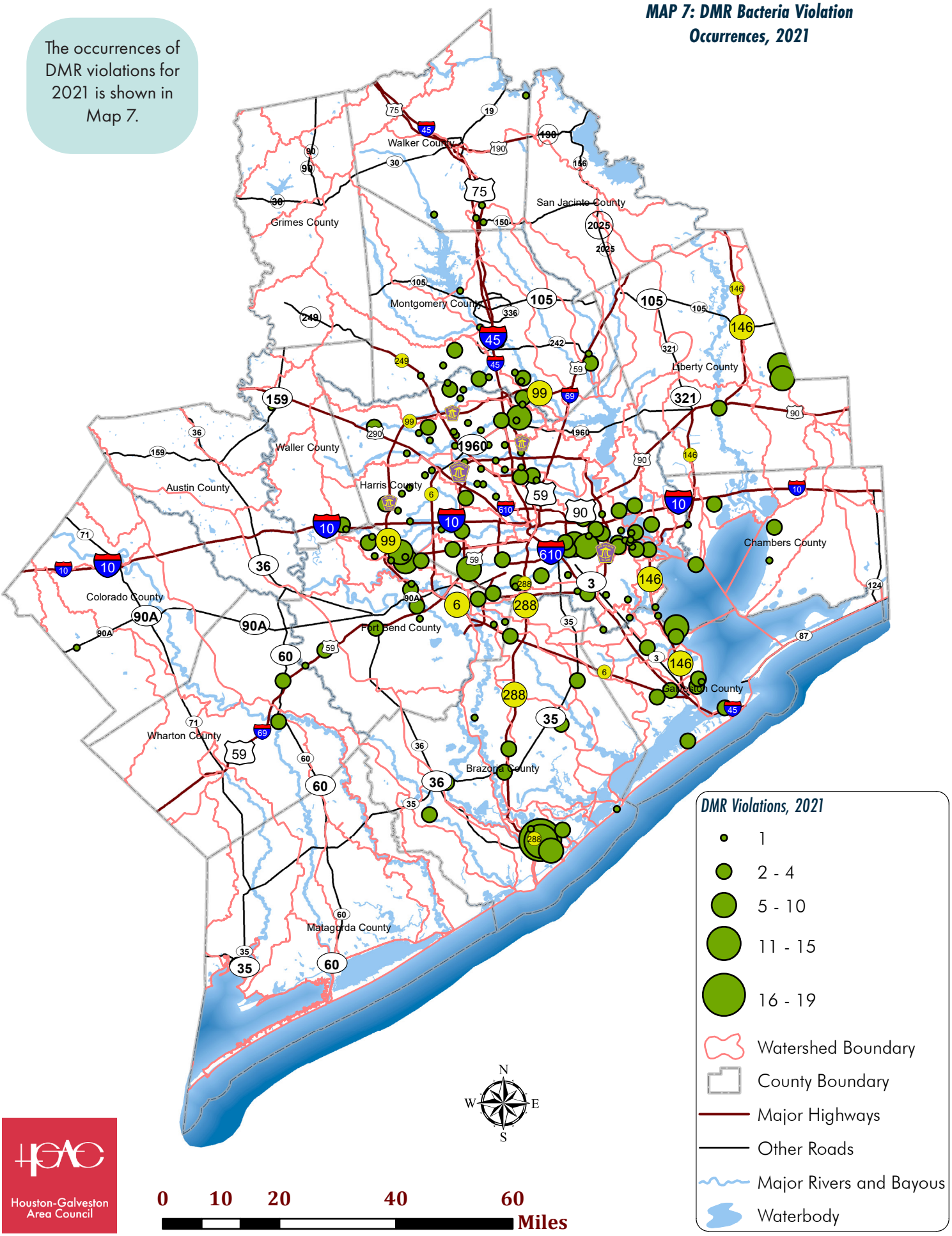
The density of reported DMR bacteria violations by watershed for 2017–2021 is shown in Map 6. Violations are mapped based on WWTF addresses and service area boundary data. Watersheds with insufficient service area boundary data or no WWTF outfalls are shown as having no data.



Houston-Galveston Area Council

The occurrences of DMR violations for 2021 is shown in Map 7.

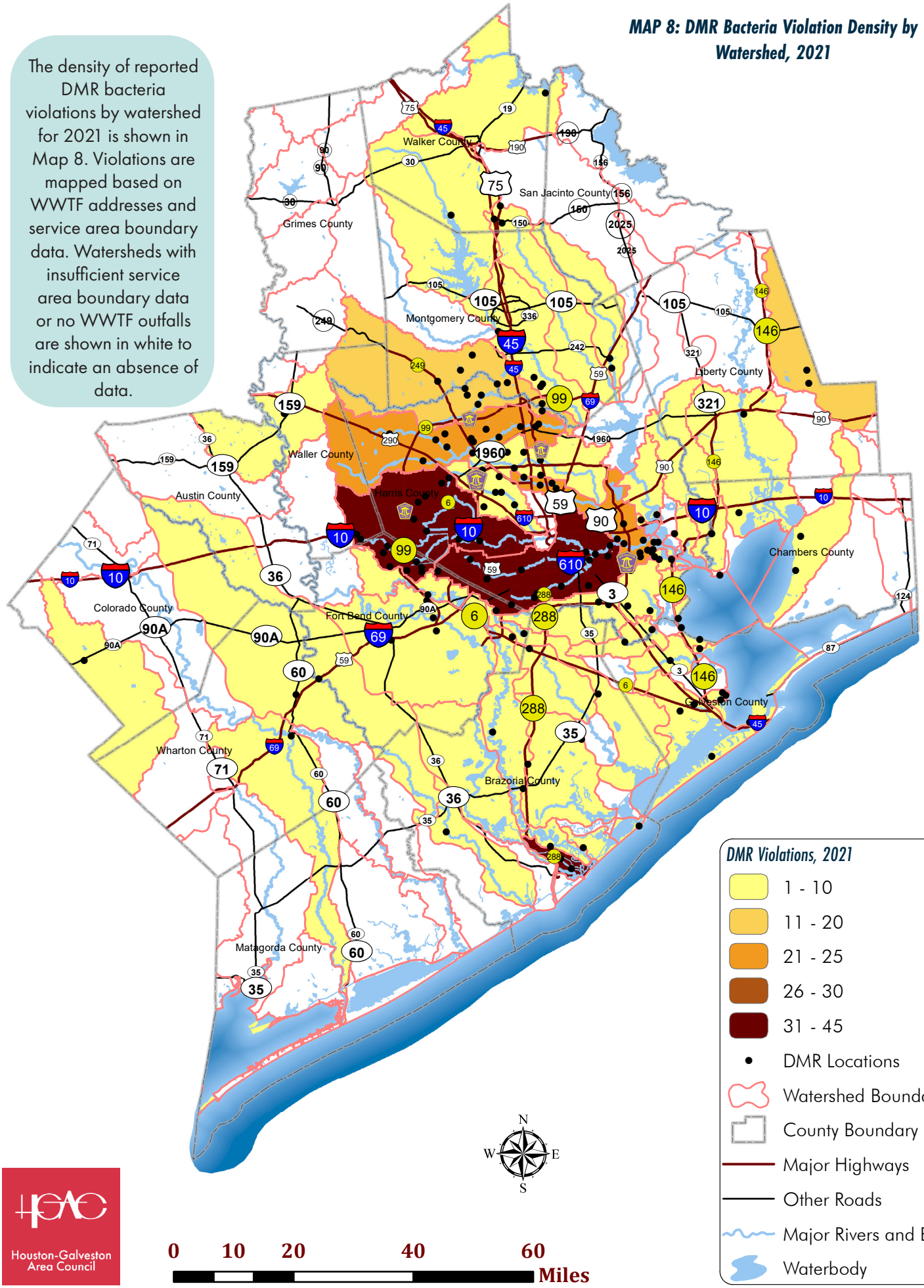
MAP 7: DMR Bacteria Violation Occurrences, 2021



Houston-Galveston Area Council

MAP 8: DMR Bacteria Violation Density by Watershed, 2021

The density of reported DMR bacteria violations by watershed for 2021 is shown in Map 8. Violations are mapped based on WWTF addresses and service area boundary data. Watersheds with insufficient service area boundary data or no WWTF outfalls are shown in white to indicate an absence of data.



Houston-Galveston Area Council

Total WWTF Annual Discharge

The total discharge from domestic WWTFs for each year was calculated based upon the reported average daily discharges as reported in the DMRs. These results, reported in MGD, are shown in Table 11 and Figure 2.

For 2021, there was a total reported discharge of 589 MGD.

TABLE 11: Total Reported Discharge (in MGD) from Domestic WWTFs by Year, 2017–2021

Discharge	2017	2018	2019	2020	2021
Total Reported Discharge, MGD	581	571	576	555	589

FIGURE 2: Total Reported Discharge (in MGD) from Domestic WWTFs by Year, 2017–2021

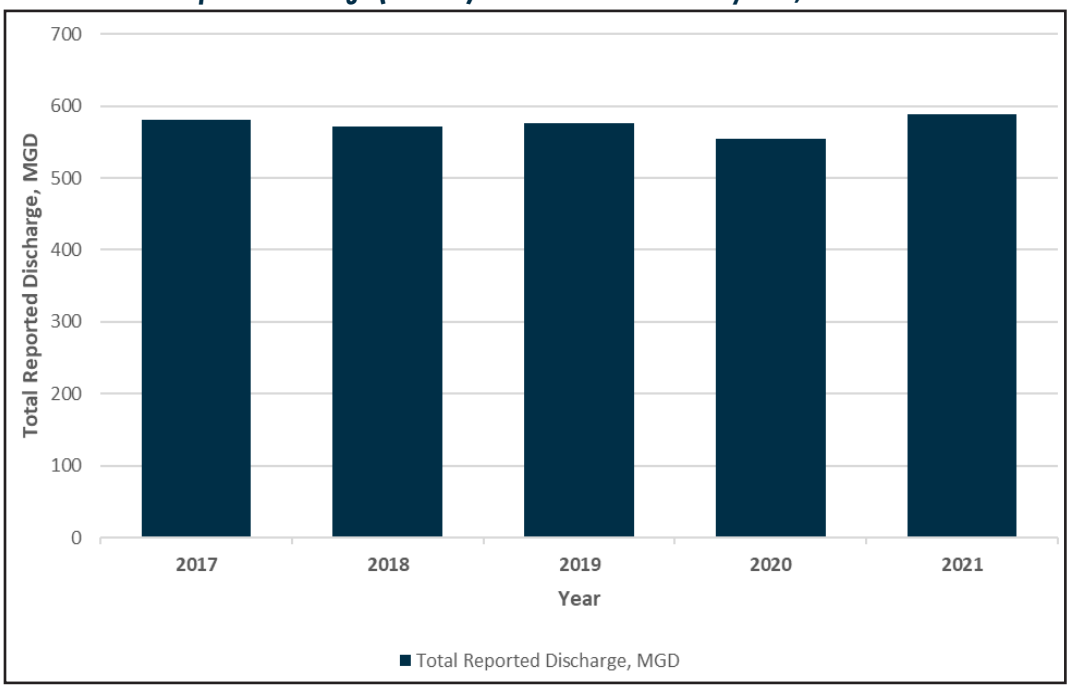


PHOTO: Incubators for E. coli and Enterococci Analysis

Estimated WWTF Daily *E. coli* Load

The estimated *E. coli* daily loads (in Millions MPN per day) from domestic WWTFs are shown in Table 12. Results are shown by year and relative facility size, and are based on WWTF effluent discharge rates and average *E. coli* geometric mean concentrations reported by facility size.

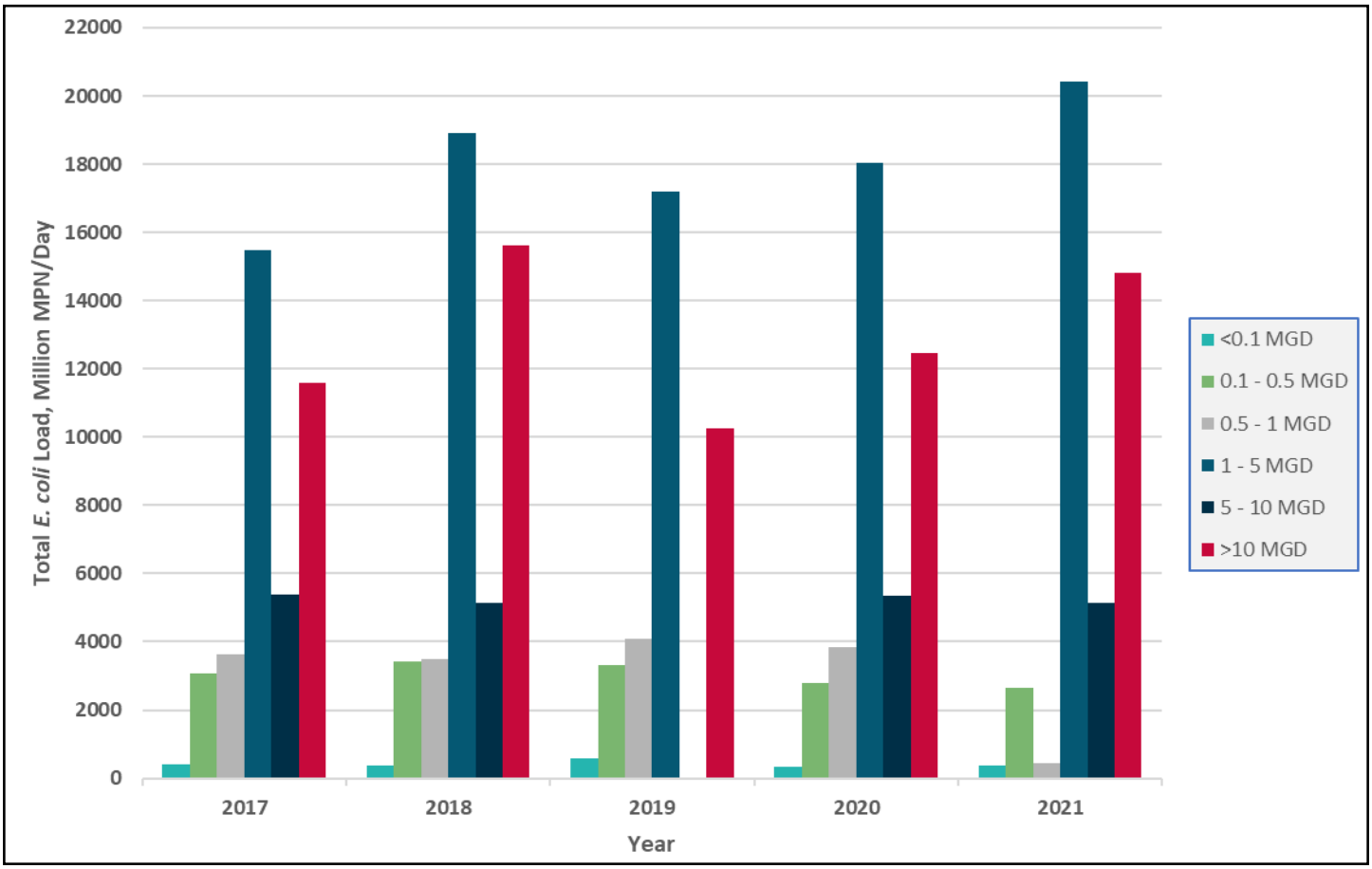
TABLE 12: Estimated Daily E. coli Load (in Million MPN/Day) from Domestic WWTFs by Relative Facility Size and Year, 2017–2021

Relative Facility Size	2017	2018	2019	2020	2021
<0.1 MGD	400.8	380.2	578.7	342.0	389.0
0.1 – 0.5 MGD	3,063.0	3,436.2	3,328.1	2,777.8	2,643.1
0.5 – 1 MGD	3,645.4	3,496.4	4,101.8	3,833.4	437.2
1 – 5 MGD	15,493.3	18,916.4	17,193.0	18,024.8	20,410.3
5 – 10 MGD	5,400.3	5,142.9	46,25.8	5,340.1	5,123.2
>10 MGD	11,597.0	15,620.3	10,259.1	12,474.9	14,810.8

For the period of 2017—2021, WWTFs in the 1—5 MGD size category contributed the most bacteria loading. In 2021, the estimated bacteria loading for this facility size category was 20,413.3 Million MPN/Day (or 2.04 x 10^{10} MPN/Day). WWTFs in the <0.1 MGD size category contributed the least amount of bacteria loading. Although this category represents the largest number of facilities [283 WWTFs, or 31.1% of the total number of facilities(as shown in Table 4)], the relatively low flow rates for this category helps minimize the amount of bacteria loading entering local waterways. Load calculations were not performed for the Intermittent/Variable facility due to the infrequent nature of their discharges and variability of their flow rates.

Figure 3 shows the year-to-year comparison of the estimated *E. coli* load (in Million MPN/Day) for each WWTF relative size category.

FIGURE 3: Estimated E. coli Load (in Million MPN/Day) from Domestic WWTFs by Relative Facility Size and Year, 2017–2021



SANITARY SEWER OVERFLOW DATA ANALYSIS

What is a Sanitary Sewer Overflow?

A Sanitary Sewer Overflow, or SSO, is defined as any type of unauthorized discharge of untreated or partially treated wastewater from a collection system or its components (e.g., manholes, lift stations, clean-outs, etc.) before reaching a treatment facility. Issues such as blockages, significant inflow and infiltration (I&I) of excess water flowing into sewer pipes from stormwater (inflow) or groundwater (infiltration), poor operation and maintenance, or inadequate capacity to collect, store, or treat the wastewater can result in SSOs.

Unlike treated WWTF effluent, SSOs represent a high, if episodic, risk because they can have bacterial concentrations several orders of magnitude higher than treated sewage. Untreated sewage can contain large volumes of raw fecal matter, making areas with sizable and/or chronic SSO issues a significant human health risk under certain conditions.

SSOs are self-reported to the TCEQ, with each event linked to the water quality permit number for the facility or subscriber reporting the violation. A permitted facility may be a municipality, municipal water district, private individual, or company. A subscriber system is a sewer system that conveys flow to a wastewater treatment facility that is owned by a separate entity. The term is not intended to indicate individual private laterals, such as a homeowner's connection to a sewer system.

As specified in 30 TAC § 327.32(c), permitted facilities are required to report SSOs to TCEQ within 24-hours of becoming aware of the event, and provide a written notification within 5 days. A monthly summary is also required. Exceptions are made for accidental discharges of less than 1,000 gallons, which only have to be reported monthly provided they are controlled or removed before entering a water way or adversely affecting a source of public or private drinking water. Information reported must include (at a minimum) the location, volume, and content of the discharge, a description of the discharge and its cause, dates and times of the discharge, and steps taken to reduce, eliminate, and prevent recurrence of the discharge.

PHOTO: Sanitary Sewer Overflow Due to Excessive Rainfall Event

Sanitary Sewer Overflow Data Analysis Methods

H-GAC analyzed SSO violation data for the period of 1/1/21 – 12/31/21. Statewide SSO data were acquired from TCEQ on 3/16/22, and filtered to examine data from TCEQ Region 12 (Houston). Analysis included an overview of the total number of permittees reporting SSOs, the causes of SSOs, and the estimated overflow volume by cause.

SSO volumes are self-reported estimates based on visual observations or estimated calculations. Therefore, the values reported can be subjective based on the best professional judgment of the individual reporting the event. Additionally, it is possible that SSOs may go undetected in certain conditions and are therefore not documented or reported to the TCEQ. However, self-reported SSO violation reports are the most comprehensive source of data that can be used to evaluate SSO events and their potential impact to regional water quality.

The frequency of SSO violations by watershed was also evaluated and mapped for this project. Violations were mapped based on the service area boundary linked to each WWTF reporting the event. Service area boundary data was acquired through municipality, private utility, and public municipal utility district (MUD) records. Service area boundaries are updated on an annual basis to reflect things like collection system expansions and other changes or updates. However, spatial analysis of SSOs is limited due to unavailable or unusable service area boundary information. Private utilities in smaller communities, for example, may not maintain usable records of their service area boundaries while service area boundaries do not exist for most package facilities, industrial WWTFs, and other subscribers.

Additionally, due to inconsistent reporting of SSO event addresses and location data, frequency maps were generated using the address of the WWTF's permitted outfall itself rather than the actual location of the SSO event. Therefore, watersheds with insufficient service area boundary data or no WWTF located within its boundaries may be mapped as having no data (as is done in Map 10) even if SSO events were common in those areas.

PHOTO: Sanitary Sewer Overflow

PHOTO: Infrastructure Failure

Domestic Wastewater Permittees Reporting Sanitary Sewer Overflows

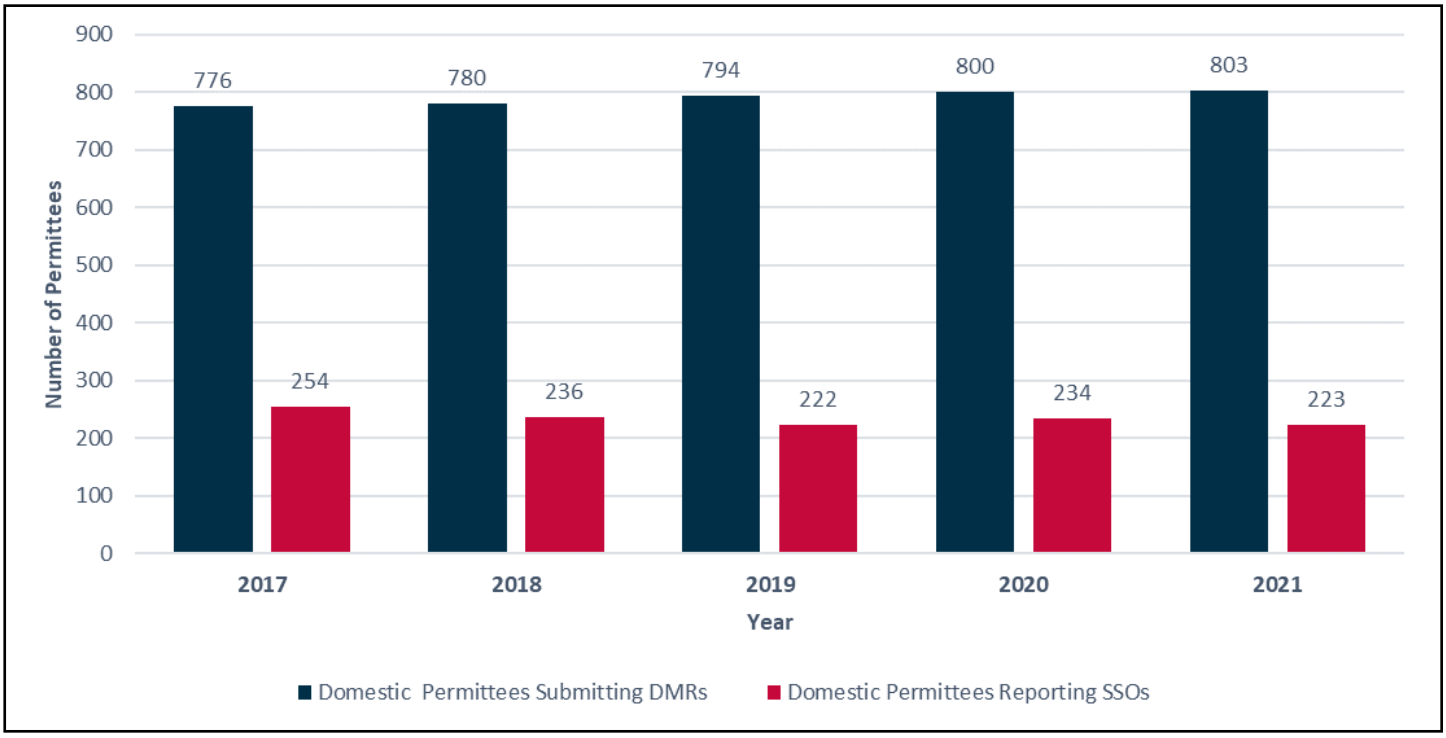
H-GAC evaluated the number of domestic wastewater permittees submitting SSO violation reports by year compared to the number of permittees in the region submitting Discharge Monitoring Report data. The number of domestic WWTFs submitting DMRs and reporting SSOs for the period of 2017—2021 are presented in Table 13 and Figure 4.

In 2021, SSO violations are being reported for 27.8% percent of the domestic WWTFs that submit DMR data within the region.

TABLE 13: Domestic WWTFs Submitting DMRs and Reporting SSOs Each Year, 2017–2021

Year	Domestic Permittees Submitting DMRs	Domestic Permittees Reporting SSOs	Percentage Permittees Reporting SSOs
2017	776	254	32.7%
2018	780	236	30.3%
2019	794	222	28.0%
2020	800	234	29.3%
2021	803	223	27.8%

FIGURE 4: Domestic WWTFs Submitting DMRs and Reporting SSOs Each Year, 2017–2021



Number and Volume of Sanitary Sewer Overflows

The total number of SSO violations and the estimated flow volume for the region was calculated based upon the self-reported data. This information is presented in Table 14. In 2021 there were 1,472 events reported in the data provided by TCEQ. The total volume for these events was 7,014,800 gallons.

TABLE 14: Reported SSOs and Estimated Discharge Volume, 2021

Year	Number of SSOs Reported	Estimated Volume (Thousand Gallons)
2021	1,472	7,014.8

Causes of Sanitary Sewer Overflows

In order to determine the primary causes of SSO events, the number of SSO events by reported SSO cause (as reported to TCEQ by the permittees) was calculated. It should be noted, however, that categorization depends on the accuracy of the data reported by the permittees and that while a single cause is listed on the SSO report, many SSOs are caused by a combination of factors. For example, fats/oils/grease (FOG) collecting in lift station pumps can cause overflows in high rain events when excess water is in the system. The event may be listed as lift station failure, but FOG and inflow and infiltration (I&I) of stormwater were both causative elements in this example.

In reviewing the data, H-GAC evaluated not only the listed cause, but also the comments associated with the event to determine if a different cause was more appropriate. For example, if the cause was listed as Equipment Failure but the equipment failed due to a power failure, then the cause was changed to Power Outage for this analysis. If the cause was listed as inflow and infiltration but a blockage by grease was mentioned in the comments field, the cause of the SSO was changed to blockage (grease), as the blockage would have caused the excess water to backup and overflow.

The number of SSOs for 2021 by cause and the volume of discharge (in thousands of gallons) for each reported cause is shown in Table 15. The most common cause listed for reported SSOs in 2021 is Line Blockages – Fats/Oils/Grease with 441 events reported for this source. Combined with the 77 line blockages due to rags/wipes and the 149 due to other causes, line blockages of all types represent 637 SSO events. The reported source with the largest volume of discharge was WWTF Operation or Equipment Malfunction, at approximately 1,483,800 gallons.

As stated earlier, it must be pointed out that many of these SSO events are due to multiple causes and are reported as a single cause based upon the best professional judgment of the person reporting the SSO. Additionally, because of the uncertainty and variability of estimating discharge from these events, volumes reported should only be considered to be estimates.

TABLE 15: Number and Volume of Reported SSOs, 2021

Reported Cause	Number of SSO Events	Percentage of SSO Events	Volume (X 1,000 gallons)	Percentage of SSO Discharge Volume
Collection System Structural Failure	177	12.0%	876.4	12.5%
WWTF Operation or Equipment Malfunction	251	17.1%	1,483.8	21.2%
Lift Station Failure	114	7.7%	356.1	5.1%
Power Failure	5	0.3%	154.6	2.2%
Rain/Inflow/Infiltration	251	17.1%	1,312.6	18.7%
Severe Weather/Natural Disaster	33	2.2%	1,425.3	20.3%
Line Blockage – Fats/Oils/Grease	411	27.9%	221.6	3.2%
Line Blockage – Rags/Wipes	77	5.2%	1,093.4	15.6%
Line Blockage – Other Causes	149	10.1%	90.8	1.3%
Human Error	1	0.1%	0.1	0.001%
Unknown Cause	3	0.2%	0.1	0.001%
TOTAL	**1,472**	**100.0%**	**7,014.8**	**100.0%**

Figure 5 shows the number and volume of SSO events by cause category.

FIGURE 5: Number and Volume of SSO Events by Reported Cause, 2021

	Collection System Structural Failure	WWTF Operation or Equipment Malfunction	Lift Station Failure	Power Failure	Rain/Inflow/Infiltration	Severe Weather/ Natural Disaster	Line Blockage - Fats/Oils/ Grease	Line Blockage - Rags/Wipes	Line Blockage - Other Causes	Human Error	Unknown Cause
Number of SSO Events	177	251	114	5	251	33	411	77	149	1	3
Volume (X1000 gallons)	876.4	1,483.80	356.1	154.6	1,312.60	1,425.30	221.6	1,093.40	90.8	0.1	0.1

As noted earlier, Line Blockage – Fats/Oils/Grease is the most commonly reported source of SSOs, with WWTF Operation or Equipment Malfunction having the largest volume of discharge.

Line Blockages – Fats/Oils/Grease account for 27.9% of the reported SSO events. Most of these events were contained quickly, as they account for only 3.2% of the SSO discharge volume. Once again, it is important to consider that SSO events are typically due to a multitude of causes, such as I&I backing up due to a line blockage or equipment failing due to a power failure. These events are listed as reported by the permittee based upon their best professional judgment but may not present a true and accurate accounting of these events due to limitations in the reporting system. More specifically, the reporting system allows for only one cause to be listed.

Figure 6 shows the reported cause categories as a percentage of the total number of SSO events. Figure 7 shows the percentage of total volume discharged for each cause category.

The most common causes of SSOs in 2021 were Line Blockage – Fats/Oils/Grease (27.9%), WWTF Operation or Equipment Failure (17.1%), and Rainfall/Inflow/Infiltration (17.1%). The largest volume of discharge during SSO events are due to WWTF Operation or Equipment Malfunction (21.2%), Severe Weather/Natural Disaster (20.3%), and Rain/Inflow/Infiltration (18.7%).

FIGURE 6: Categories of Reported SSO Events by Percentage, 2021

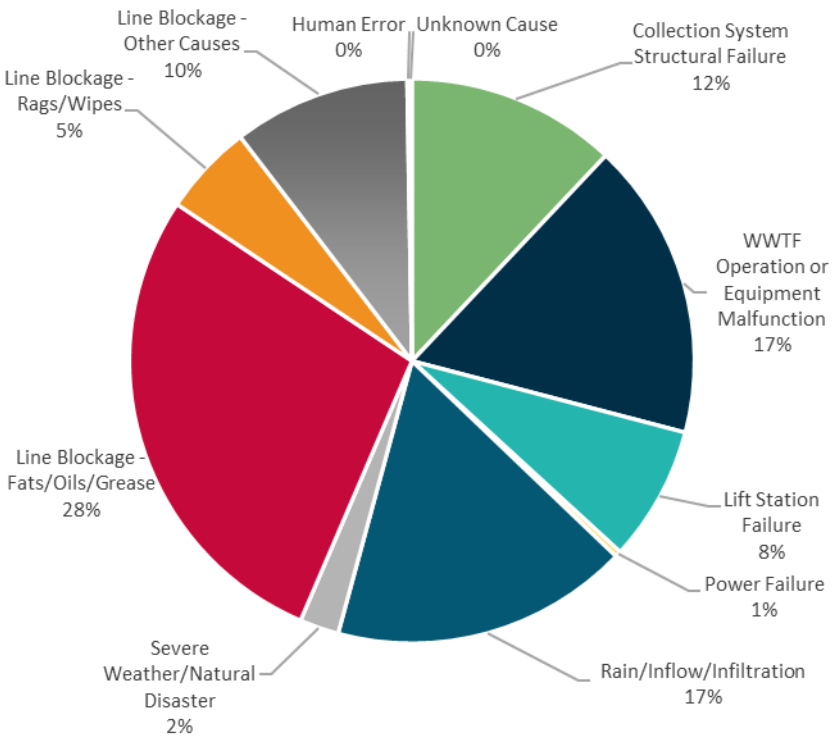
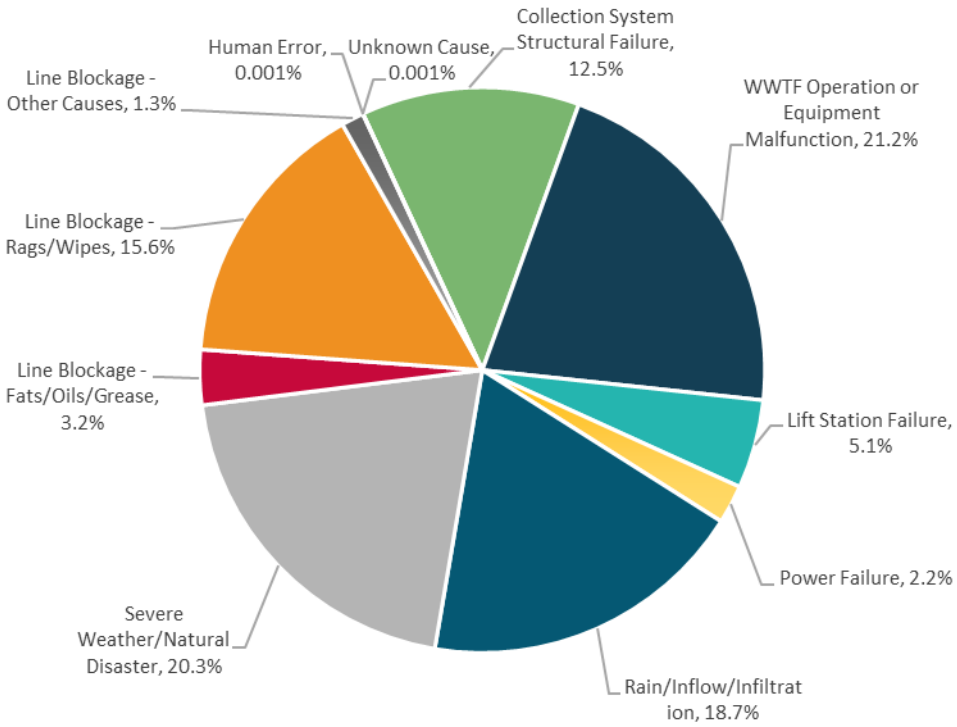


FIGURE 7: Volumes of Reported SSO Events by Percentage, 2021



Year-To-Year Comparison of Sanitary Sewer Overflow Causes

The number of SSO events by cause category were determined for each year from 2017–2021. These data are shown in Table 16 and in Figure 8.

TABLE 16: Number of Reported SSOs by Cause, 2017–2021

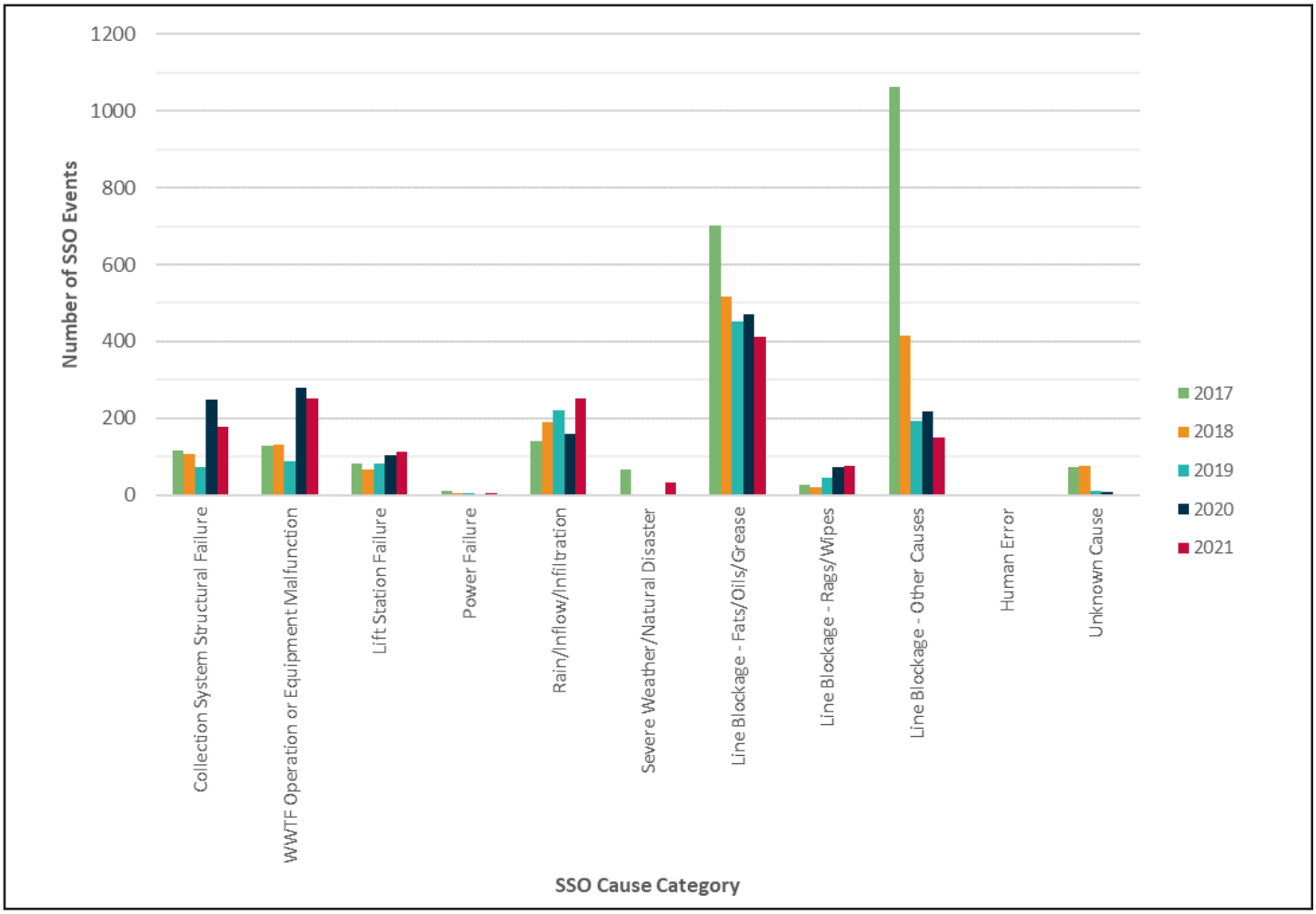
Reported Cause	Number of SSO Events				
	2017	2018	2019	2020	2021
Collection System Structural Failure	116	108	72	250	177
WWTF Operation or Equipment Malfunction	130	132	90	279	251
Lift Station Failure	81	68	81	103	114
Power Failure	11	4	4	1	5
Rain/Inflow/Infiltration	141	190	222	158	251
Severe Weather/Natural Disaster	68	2	0	1	33
Line Blockage – Fats/Oils/Grease	701	517	452	470	411
Line Blockage – Rags/Wipes	26	21	45	74	77
Line Blockage – Other Causes	1,061	414	193	218	149
Human Error	2	3	3	1	1
Unknown Cause	72	76	12	8	3
TOTAL	**2,409**	**1,535**	**1,174**	**1,563**	**1,472**

The percentages of SSO events by cause category for each year from 2017–2021 are shown in Table 17. Line Blockages – Fats/Oils/Grease is consistently the largest percentage of SSO events (27.9% in 2021). Clogged pipes due to FOG can also be an underlying cause to SSO events by other cause categories, such as Rain/Inflow/Infiltration.

TABLE 17: Percentage of Reported SSOs by Cause, 2027–2021

Reported Cause	Percentage of SSO Events				
	2017	2018	2019	2020	2021
Collection System Structural Failure	4.8%	7.0%	6.1%	16.0%	12.0%
WWTF Operation or Equipment Malfunction	5.4%	8.6%	7.7%	17.9%	17.1%
Lift Station Failure	3.4%	4.4%	6.9%	6.6%	7.7%
Power Failure	0.5%	0.3%	0.3%	0.1%	0.3%
Rain/Inflow/Infiltration	5.9%	12.4%	18.9%	10.1%	17.1%
Severe Weather/Natural Disaster	2.8%	0.1%	0.0%	0.1%	2.2%
Line Blockage – Fats/Oils/Grease	29.1%	33.7%	38.5%	30.1%	27.9%
Line Blockage – Rags/Wipes	1.1%	1.4%	3.8%	4.7%	5.2%
Line Blockage – Other Causes	44.0%	27.0%	16.4%	13.9%	10.1%
Human Error	0.1%	0.2%	0.3%	0.1%	0.1%
Unknown Cause	3.0%	5.0%	1.0%	0.5%	0.2%
TOTAL	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

FIGURE 8: Number of Reported SSO Events by Cause, 2017–2021



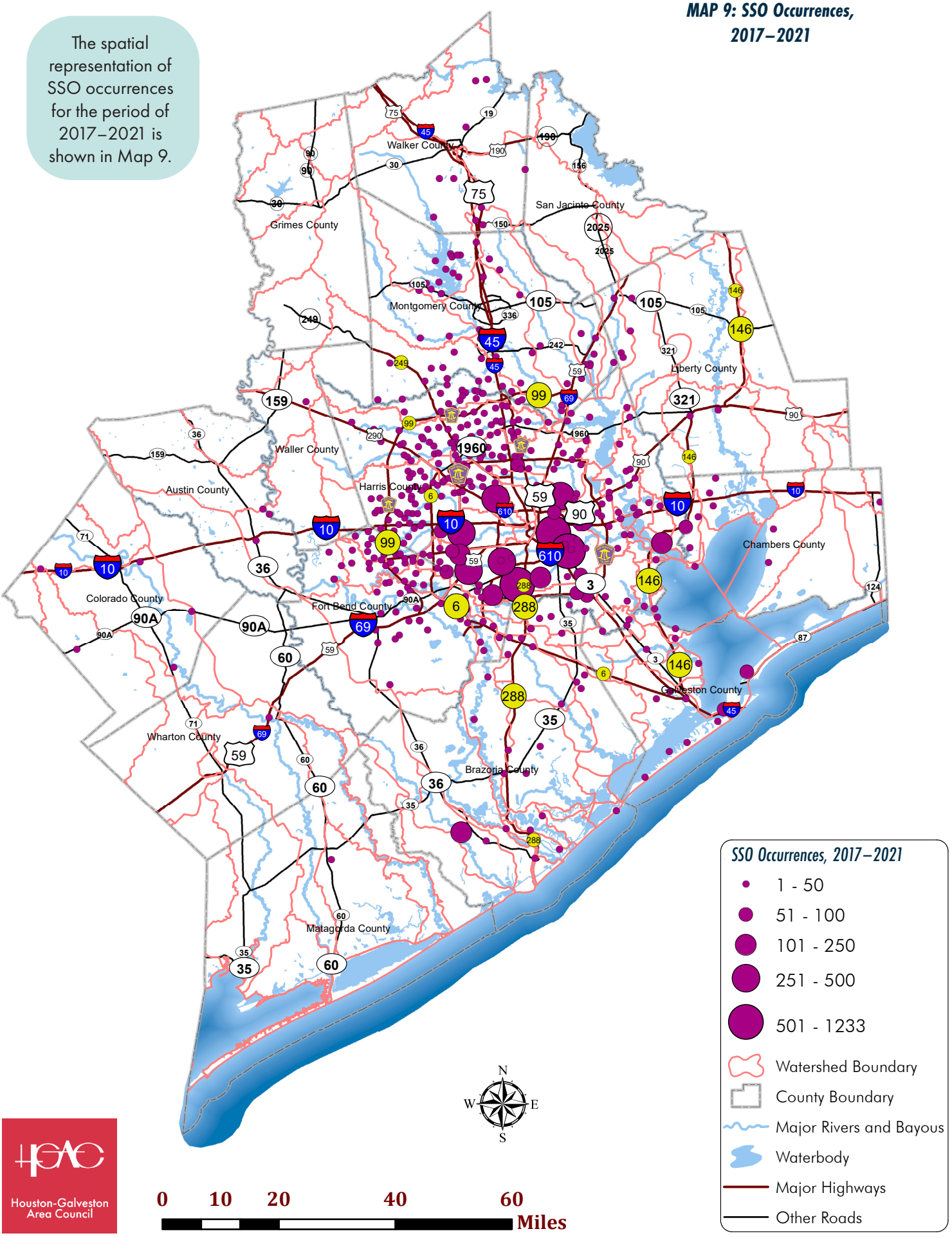
Frequency and Density of SSO Occurrences

Maps 9 – 12 show the frequency and density of SSOs within the region. Maps 9 and 10 show the frequency and density of SSOs for the period of 2017–2021, while Maps 11 and 12 show the frequency and density for 2021.

Based on the locations of reported SSOs, the more populated urban and suburban watersheds throughout the region are experiencing higher rates of SSO events compared to the more rural, smaller communities along the outer perimeter of the region. However, it should be noted that some rural communities with small WWTFs and package facilities may be underrepresented due to staff and resource limitations resulting in a greater likelihood of SSOs going undetected. Regardless, it is expected that developed areas experience more frequent SSO events due to larger populations putting added strain on the collection systems overall, including contributing FOG to the collection system, resulting in a greater frequency of blockages. Also, the amount of impervious cover in urban areas may make SSOs more visibly identifiable, as rural systems may have long runs of pipe between connections or running though undeveloped areas where they may go unseen. The age of the collection system (pipes, manholes, lift stations, etc.) can also be a contributing factor to SSO events. As these systems age, they become more likely to experience structural failures such as line breaks.

The spatial representation of SSO occurrences for the period of 2017–2021 is shown in Map 9.

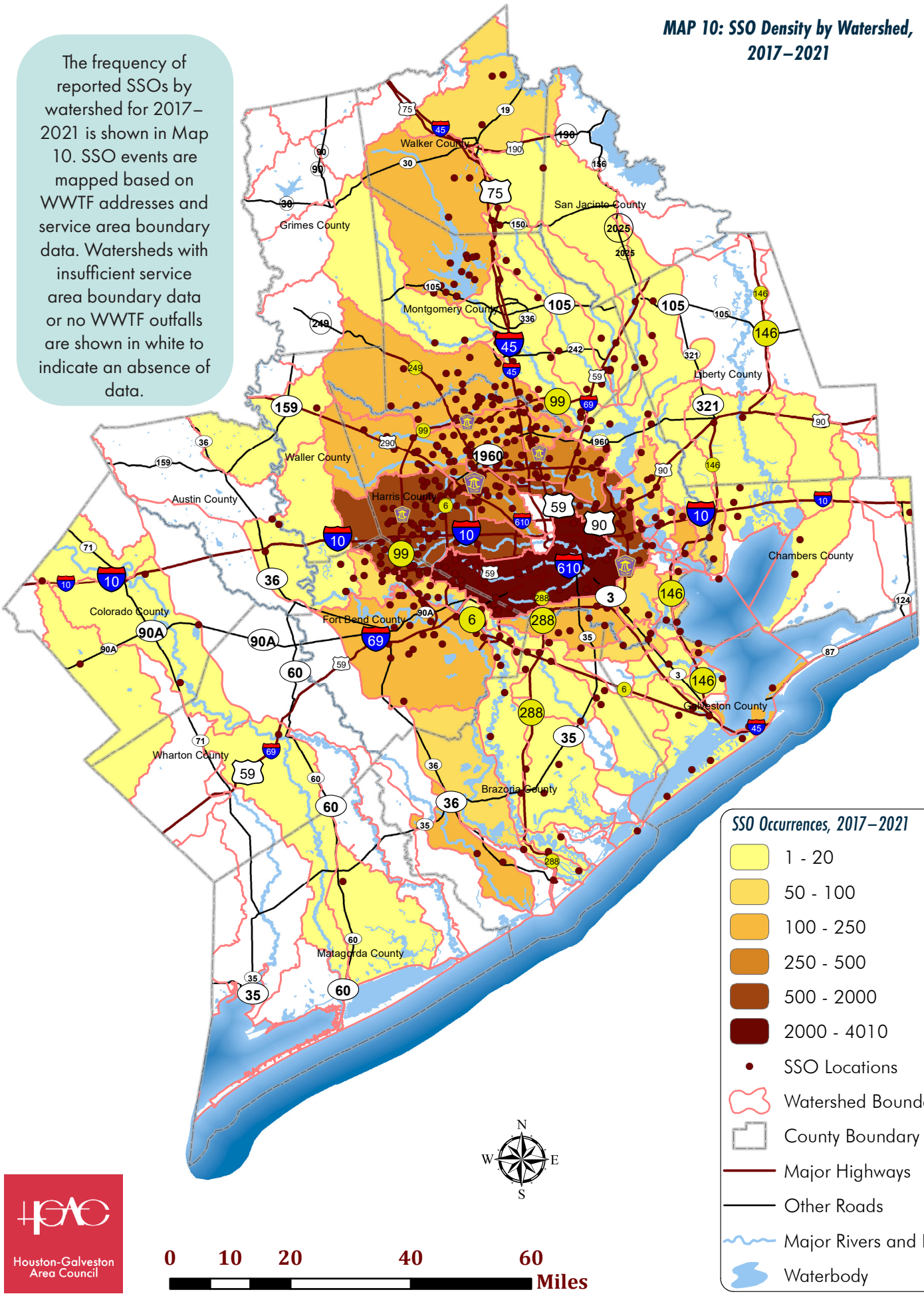
MAP 9: SSO Occurrences, 2017–2021



Houston-Galveston Area Council

MAP 10: SSO Density by Watershed, 2017–2021

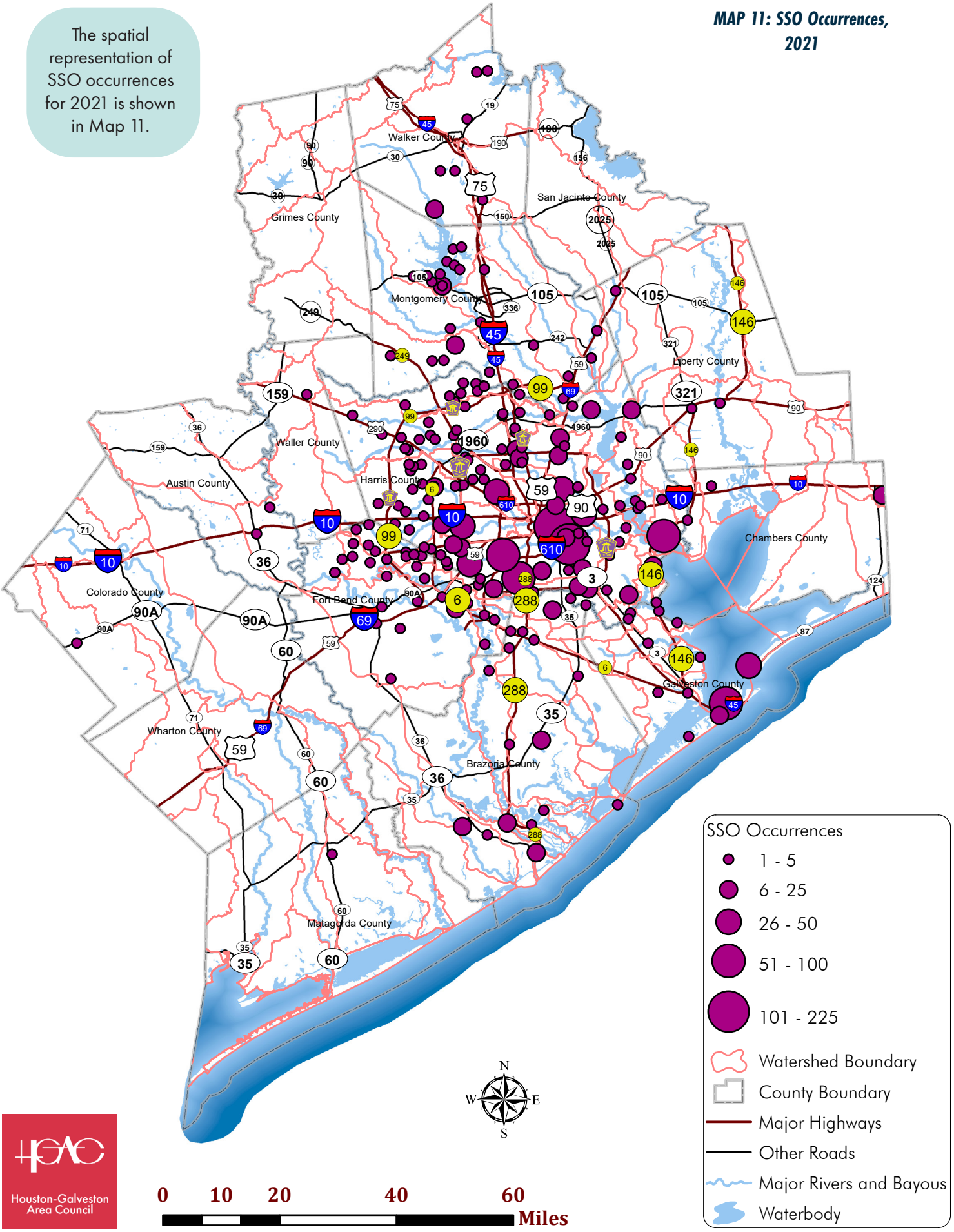
The frequency of reported SSOs by watershed for 2017–2021 is shown in Map 10. SSO events are mapped based on WWTF addresses and service area boundary data. Watersheds with insufficient service area boundary data or no WWTF outfalls are shown in white to indicate an absence of data.



Houston-Galveston Area Council

The spatial representation of SSO occurrences for 2021 is shown in Map 11.

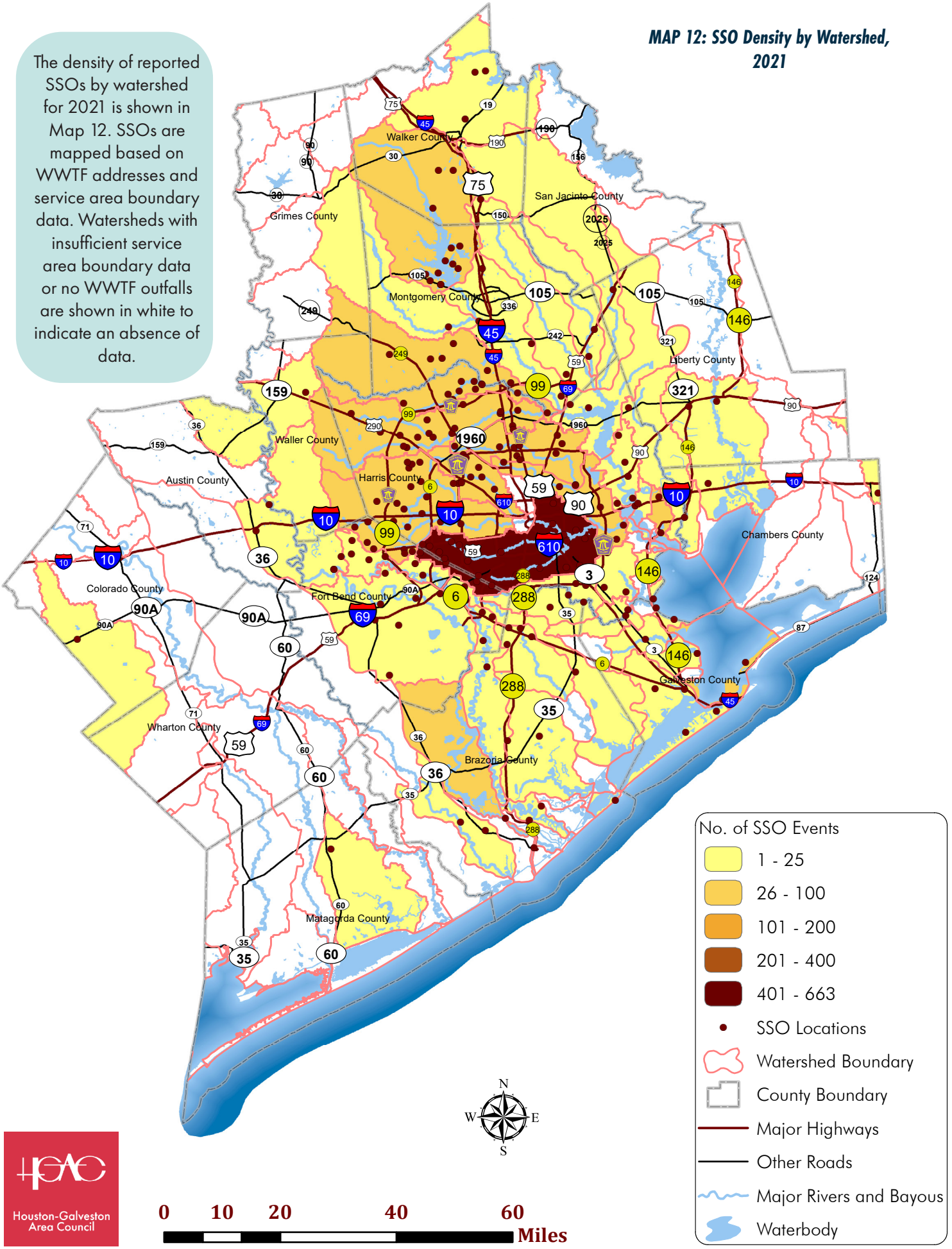
MAP 11: SSO Occurrences, 2021



Houston-Galveston Area Council

MAP 12: SSO Density by Watershed, 2021

The density of reported SSOs by watershed for 2021 is shown in Map 12. SSOs are mapped based on WWTF addresses and service area boundary data. Watersheds with insufficient service area boundary data or no WWTF outfalls are shown in white to indicate an absence of data.



Houston-Galveston Area Council

CONFORMANCE REVIEW FOR CWSRF PROJECTS

The goal of this Task is to review and provide input on Clean Water State Revolving Fund loan applications in the Houston-Galveston region and assure compliance with the latest Water Quality Management Plan.

H-GAC responds to requests from TCEQ to review CWSRF applications and assists applicants and TCEQ in the resolution of conflicts between proposed project information and H-GAC's most recently approved WQMP.

In conjunction with H-GAC's role as a regional planning group and the local council of governments for the Houston-Galveston area of the Upper Gulf Coast, staff regularly provides comments on grant proposals of varying types. For the WQMP Update, H-GAC reviews proposals for projects under the Texas Water Development Board's (TWDB) Clean Water State Revolving Fund (CWSRF) program. These reviews help ensure regional goals are represented in project funding decisions at a variety of governmental levels.

Entities with wastewater treatment facility and transport infrastructure make loan applications to TWDB to assist in the cost of improvements. These applications are reviewed by TCEQ. If requested by TCEQ, H-GAC also completes a review to determine if the applicant has conformed to the regional water quality management plan. H-GAC reviews the grant application and associated engineering documentation (such as the Preliminary Engineering Report, Environmental Review, population projections, etc.) for concurrence with broad regional planning priorities and goals (such as improving water quality, protecting waterways, reducing bacteria or nutrient loading, etc.).

During this review process, H-GAC staff looks for:

- Population projections that match TWDB, H-GAC, or other relevant forecasts;
- Alternatives that may impact water quality considerations; and
- Concurrence with regional priorities and goals (water quality impacts, etc.)

As part of this Project, H-GAC staff used data gathered under this and previous projects to review and provide comments on one CWSRF project application during the FY 22 WQMP Update period. The outcome of that review is shown in Table 18. The CWSRF project reviewed during this year was consistent with regional goals of the WQMP.

TABLE 18: Clean Water State Revolving Fund Application Review, FY 2022

Project ID	Requesting Entity	Project Summary	Findings
73913	City of Shenandoah	This project is for updates and improvements to the City of Shenandoah's wastewater treatment plant, including the construction, conversion, and replacement of treatment units to expand the intended design capacity of the plant. The project also includes electrical upgrades and general site improvements to address drainage issues.	The goals of the project are consistent with regional goals as defined in the WQMP.

The goal of this Task is to support watershed planning in the Houston-Galveston Region and to support regional information sharing on water quality and related topics. Work performed under this task includes:

- Coordination of water quality planning efforts with flood mitigation, resilience, and habitat conservation processes in areas with existing watershed protection plans
- Support for watershed-based plans that are not covered under other contracts.
- Facilitation of the Natural Resources Advisory Committee (NRAC)
- Urban Forestry support and coordination

SUPPORT WATERSHED PLANNING

Coordination of Water Quality Planning Efforts

WQMP project staff work closely with other H-GAC staff in the development of watershed-based plans, including Total Maximum Daily Loads and watershed protection plans. Data acquired and analyzed under this project are used to inform decisions for these other watershed projects.

During the majority of the project year, we were unable to meet in person due to social distancing requirements related to COVID-19.

Support for Watershed-Based Plans

Facilitation of regional communication, coordination, and cooperation on water quality efforts through staff presence and participation is an essential component of the Water Quality Management Plan. H-GAC staff routinely attend meetings of, or otherwise support, numerous other organizations involved in water quality efforts throughout the region. Due to the density of work in the Houston-Galveston Region, coordination and communication are essential.

During the current project term, staff helped coordinate activities and provide data for several projects, including both internal programs and outside organizations. Examples of the groups and projects staff worked with this year include:

- Galveston Bay Estuary Program (GBEP) subcommittee memberships;
- Coordination with the Clean Rivers Program on the development of the Basin Highlights Report;
- Participation in the BIG OSSF and Illicit Discharge Regional Workgroup;
- Promotion of OSSF projects, including the Supplemental Environmental Project for the Homeowner Wastewater Assistance Program;
- Preparation of OSSF education and outreach programs and materials for the Coastal Communities project;
- Participation in the Watershed Coordinator's Roundtable;
- Coordination with ongoing TMDL, WPP, and other efforts, such as:
  - Bacteria Implementation Group (BIG) TMDL
  - San Jacinto-Brazos Coastal Basin TMDL
  - Brazos-Colorado Coastal Basin TMDL
  - Upper Oyster Creek TMDL
  - Chocolate Bayou TMDL
  - East Fork San Jacinto River TMDL
  - West Fork San Jacinto River WPP
  - Big Creek TMDL
  - Cedar Bayou WPP
  - Bastrop Bayou WPP
  - San Bernard River WPP
  - Cypress Creek WPP
  - Spring Creek WPP

Total Maximum Daily Loads (TMDLs) and Implementation Plans (I-Plans) in the Houston-Galveston Region

TMDL is a regulatory process triggered when a waterway is listed as impaired for one or more water body standard criterion as defined in the *Texas Surface Water Quality Standards*. The TMDL calculates the maximum amount of a pollutant that a water body can receive and still meet water quality criteria. An Implementation Plan (I-Plan) is then completed with the assistance of watershed stakeholders to reduce pollutant loads to meet the pollutant criterion. The I-Plan contains a series of recommended regulatory and/or non-regulatory best practices, identifies funding sources and implementing partners, and determines a project timeline.

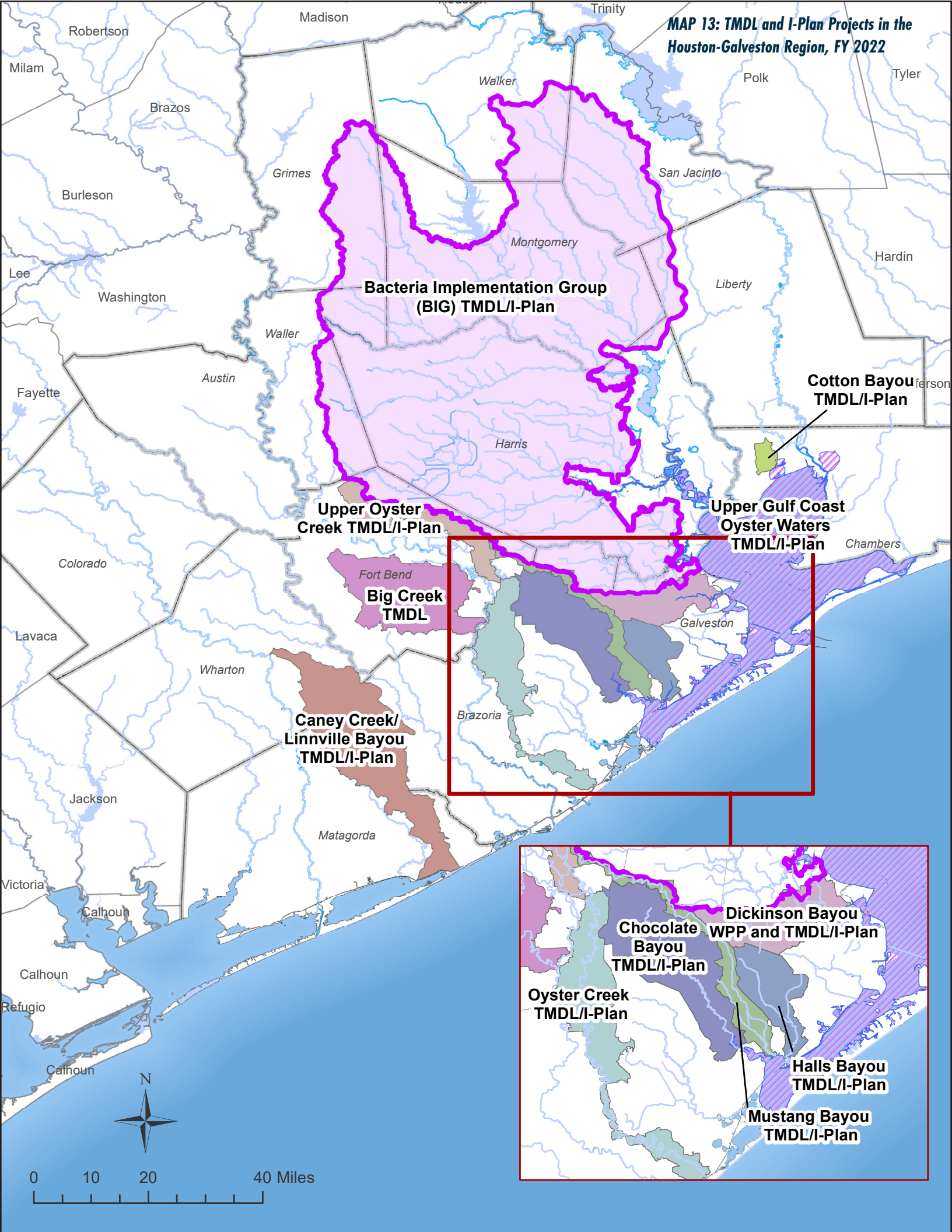
As part of the Water Quality Management Plan project, H-GAC provided support for public outreach activities for completed TMDL projects and other TMDL projects being developed in the region, including activities necessary to plan and conduct meetings. H-GAC with support from the TCEQ facilitates seven TMDL projects within the H-GAC planning area and partners on two others. These projects are shown in Table 19 and Map 13. Please note that the BIG TMDL project area overlaps with several of the WPP and other TMDL projects.

Links to the websites for the TMDL projects are included in the **Additional Resources** section of this report.

TABLE 19: Regional Total Maximum Daily Load (TMDL) and Implementation Plan (I-Plan) Project Summary for the Houston-Galveston Region, FY 2022

WATERSHED / PROJECT NAME	TMDL PROJECT AREAS	IMPAIRMENT TYPE	I-PLAN STATUS
Bacteria Implementation Group (BIG)	Buffalo and Whiteoak Bayou, Clear Creek, Houston Metropolitan, East and West Fork of San Jacinto River and Upper Lake Houston, Jarbo Bayou, and Armand Bayou	Bacteria	I-Plan complete and in implementation
Upper Oyster Creek	Upper Oyster Creek	Bacteria Dissolved Oxygen	I-Plan complete and in implementation
Basin 11	Chocolate Bayou, Oyster Creek, Halls Bayou, Willow Bayou, Mustang Bayou, Persimmon Bayou, New Bayou	Bacteria	I-Plan in development
Basin 13	Caney Creek and Linnville Bayou	Bacteria	I-Plan in development and under review by TCEQ
Cotton Bayou*	Cotton Bayou	Bacteria	I-Plan in development
Big Creek*	Big Creek	Bacteria	TMDL in development
Dickinson Bayou	Dickinson Bayou	Bacteria Dissolved Oxygen	Bacteria I-Plan is complete; Dissolved Oxygen I-Plan in development
Upper Texas Gulf Coast Oyster Waters	Chocolate Bay, Bastrop Bay, Christmas Bay, Drum Bay and Galveston Bay: Upper, Trinity, East, West, and Lower Bays	Bacteria	I-Plan is complete and in implementation
Houston Ship Channel	San Jacinto River Tidal, Houston Ship Channel, Buffalo Bayou Tidal, Upper Galveston Bay, and tidal tributaries	Dioxin and PCBs in Fish Tissue	Legacy pollutant sites under Superfund; no TMDL I-Plan is planned

* These projects are located in river basins covered by other Clean Rivers Program partners

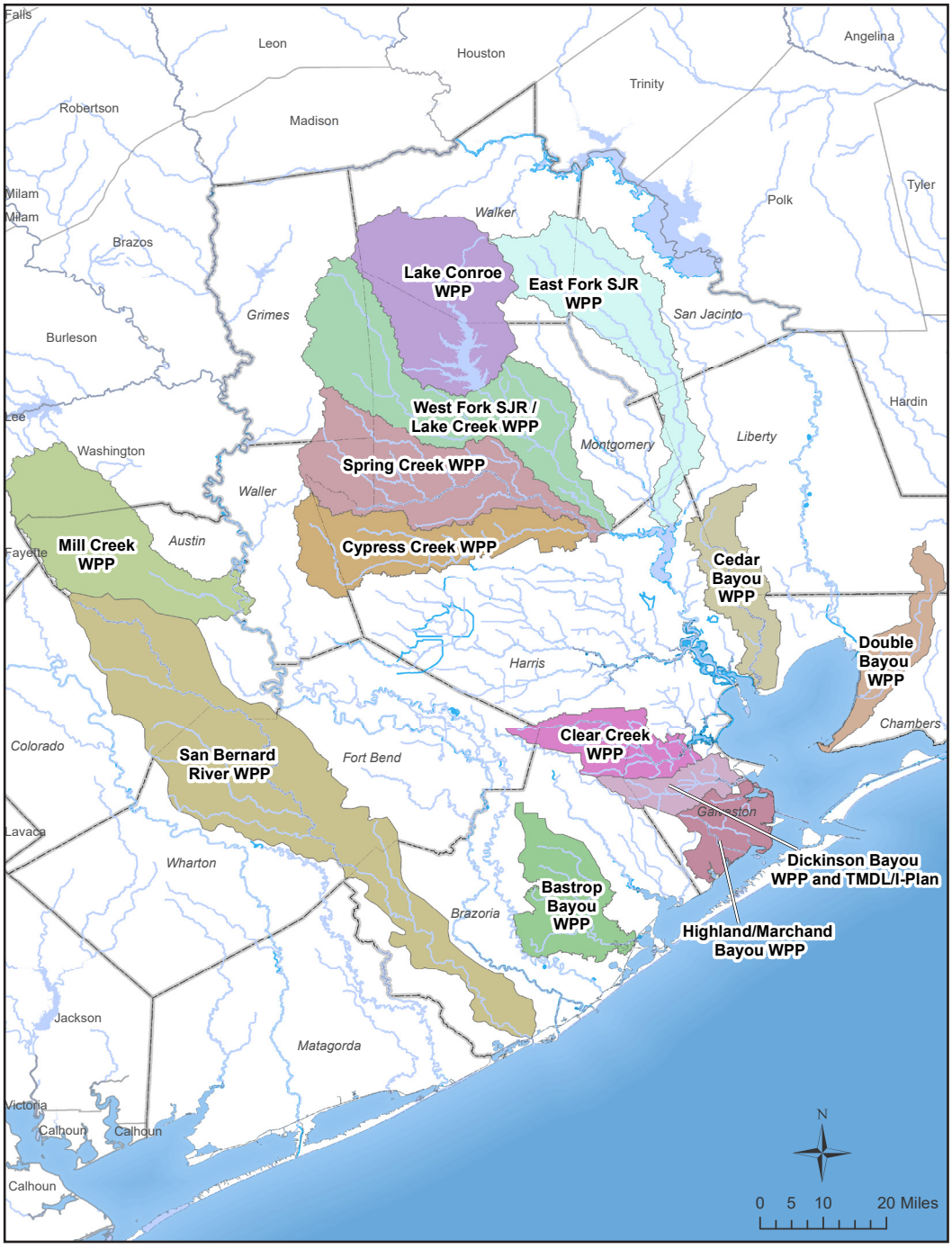

MAP 13: TMDL and I-Plan Projects in the Houston-Galveston Region, FY 2022
Madison
Trinity
Robertson
Milam
Walker
Polk
Tyler
Brazos
Grimes
San Jacinto
Burleson
Montgomery
Hardin
Lee
Liberty
Washington
Bacteria Implementation Group (BIG) TMDL/I-Plan
Waller
Austin
Fayette
Cotton Bayou TMDL/I-Plan
Harris
Upper Oyster Creek TMDL/I-Plan
Upper Gulf Coast Oyster Waters TMDL/I-Plan
Chambers
Colorado
Fort Bend
Big Creek TMDL
Galveston
Lavaca
Wharton
Brazoria
Caney Creek/ Linnville Bayou TMDL/I-Plan
Jackson
Matagorda
Victoria
Calhoun
Dickinson Bayou WPP and TMDL/I-Plan
Chocolate Bayou TMDL/I-Plan
Oyster Creek TMDL/I-Plan
Calhoun
Refugio
Halls Bayou TMDL/I-Plan
Calhoun
Mustang Bayou TMDL/I-Plan
N
0
10
20
40 Miles

Watershed Protection Plans (WPPs) in the Houston-Galveston Region

Watershed protection plans empower local stakeholders to improve water quality issues using a voluntary, community-driven approach. Plans are based on a template developed by the U.S. Environmental Protection Agency (EPA) that seeks to identify causes and sources of pollution, establish improvement goals, identify feasible and effective voluntary measures to address them, and establish metrics of success. WPPs are usually developed in response to an exceedance of one or more state water quality standards in a specific waterway, but they can also be implemented as a preventative measure. Unlike TMDL projects which focus on specific impairments, WPPs can consider a wide range of stakeholder concerns related to water quality and coordinate with related efforts. Implementation activities outlined by WPPs are entirely voluntary, contain no regulatory requirements, and generally focus on nonpoint source pollution.

WPPs are developed by voluntary partnerships of local stakeholders, including governments, residents, businesses, community organizations, and agricultural producers. WPPs currently being implemented or developed throughout the region are described in Map 14 and Table 20.

MAP 14: WPP Projects in the Houston-Galveston Region, FY 2022



Links to the websites for the WPP projects are included in the **Additional Resources** section of this report.

TABLE 20: Regional WPP Project Summary for the Houston-Galveston Region, FY 2022

WATERSHED/ PROJECT NAME	WATER BODIES INCLUDED	IMPAIRMENT(S)	CONCERN(S)	WPP STATUS
Bastrop Bayou WPP	Bastrop Bayou, Flores Bayou, Austin Bayou, Brushy Bayou	Bacteria, Dissolved Oxygen	Dissolved Oxygen	WPP approved by the EPA in 2016; Implementation ongoing
Cedar Bayou WPP	Cedar Bayou, Cary Bayou, Adlong Ditch	Bacteria, Dissolved Oxygen, PCBs, Dioxins	Dissolved Oxygen, Macrobenthic Community, Ammonia	WPP approved by the EPA in 2016; Implementation ongoing
Clear Creek WPP	Clear Creek, Magnolia Creek, Chigger Creek, Cow Bayou, Robinson Bayou, Mary's Creek, Hickory Slough, Turkey Creek, Mud Gully	Bacteria, Dissolved Oxygen, PCBs, Dioxins	Dissolved Oxygen, Ammonia, Nitrate, Total Phosphorus, Chlorophyll-*a*	In development
Cypress Creek WPP	Cypress Creek, Faulkey Gully, Spring Gully, Little Cypress Creek	Bacteria	Dissolved Oxygen, Habitat, Nitrate, Total Phosphorus	WPP approved by the EPA in 2021; Implementation ongoing
Dickinson Bayou WPP	Dickinson Bayou, Bensons Bayou, Bordens Gully, Geisler Bayou, Gum Bayou, Cedar Creek	Bacteria, Dissolved Oxygen, PCBs, Dioxins	Dissolved Oxygen	WPP approved by the EPA in 2009; Implementation ongoing
Double Bayou WPP	East Fork Double Bayou, West Fork Double Bayou	Bacteria, Dissolved Oxygen, PCBs, Dioxins	Chlorophyll-*a*	WPP approved by the EPA in 2016; Implementation ongoing
East Fork San Jacinto River WPP	East Fork San Jacinto River, Winters Bayou, Nebletts Creek, Boswell Creek	Bacteria	Bacteria	In development
Highland and Marchand Bayous WPP	Highland Bayou, Marchand Bayou	Bacteria, Dissolved Oxygen, PCBs, Dioxins	Dissolved Oxygen, Chlorophyll-*a*	WPP approved by the EPA in 2021; Implementation ongoing
Lake Conroe WPP	Lake Conroe	None	None	WPP completed in 2015
Mill Creek WPP*	Mill Creek	Bacteria	Habitat	WPP approved by the EPA in 2016; Implementation ongoing
San Bernard River WPP	San Bernard River, Gum Tree Branch, West Bernard Creek, Peach Creek, Mound Creek	Bacteria, Dissolved Oxygen	Dissolved Oxygen, Habitat, Ammonia	WPP approved by the EPA in 2017; Implementation ongoing
Spring Creek WPP	Spring Creek, Mill Creek, Panther Branch, Bear Branch, Lake Woodlands, Willow Creek, Walnut Creek, Brushy Creek	Bacteria	Bacteria, Dissolved Oxygen, Fish Community, Nitrate, Total Phosphorus, Cadmium	Draft WPP submitted for TCEQ review in 2021
West Fork San Jacinto River and Lake Creek WPP	West Fork San Jacinto River, Whiteoak Creek, Stewarts Creek, Crystal Creek, Lake Creek, Mound Creek	Bacteria	Dissolved Oxygen, Macrobenthic Community, Nitrate	WPP approved by the EPA in 2019; Implementation ongoing

* These projects are located in river basins covered by other Clean Rivers Program partners

Facilitation of the Natural Resources Advisory Committee

As an extension of H-GAC's role as a coordinator of regional planning efforts, H-GAC staff members develop and maintain relationships with other local and state governments, community groups, and other organizations involved in efforts related to the aims of this Project. Through this task, H-GAC provides staff for the quarterly NRAC meeting to address regional watershed management and related natural resource issues. The NRAC provides policy recommendations for H-GAC's Board of Directors and serves as a regional roundtable for coordinating environmental efforts. This committee provides an efficient communication network and point of contact for H-GAC staff with other local and regional water quality decision makers.

Four NRAC meetings were held during the Project term. Topics discussed at these meetings are presented in Table 21.

TABLE 21: Natural Resources Advisory Committee Meetings, FY 2022

Date	Topics Discussed
11-04-21	• Membership Updates • Environmental Committee Highlights • Environmental Program Highlights • Subcommittee Reports • Conservation Subcommittee Report on Priorities Project List
02-03-22	• Environmental Committee Highlights • Environmental Program Highlights • Subcommittee Reports • Galveston Bay Foundation Presentation
05-05-22	• Membership Updates • Environmental Committee Highlights • Environmental Program Highlights • Subcommittee Reports • Appointment of new members • Harris-Galveston Subsidence District Presentation on water conservation initiatives
08-04-22	• Environmental Committee Highlights • Environmental Program Highlights • Subcommittee Reports • Water Quality Management Plan Presentation

Urban Forestry Support and Coordination

Through the Urban Forestry Support and Coordination subtask, H-GAC supports regional efforts to coordinate water quality and forestry efforts, with a focus on riparian and urban areas. These efforts have been closely coordinated with H-GAC's Regional Conservation Initiative (RCI), an ongoing effort to promote conservation projects by local governments and partners. Time and effort on some forestry projects was augmented by staff capacity from the RCI. Staff from H-GAC continue to serve on and/or coordinate with the following forestry projects:

- Cities in Forests national association of municipal forestry programs
- Texas Forests and Drinking Water Partnership
- Houston Area Urban Forestry Council
- H-GAC Regional Conservation Initiative
- Bayou Preservation Association Stream Corridor Restoration Committee

H-GAC staff also actively participated in continuing to develop the Corporate Sustainability program with Texas A&M Forest Service to promote and fund riparian reforestation plantings in the Houston region, with one planting held. For this planting, over 7,000 trees were planted in the riparian area of impaired Cypress Creek.

H-GAC has supported our local governments and organizations with direct support through:

- Assisting the City of Houston with funding development and identification for grants
- Assisting City of Houston with spatial data development
- Assisting Buffalo Bayou Partnership in developing GIS applications to track invasive species in forested riparian area assessments
- Application for a forestry related grant for the Houston Area Urban Forestry Council

H-GAC staff has also presented at various events, including as a featured speaker on forestry and conservation at the following events:

- Texas Recreation and Parks Society East Region Workshop
- The Association of Water Board Directors annual national meeting

H-GAC has also continued to represent forestry practices and goals as part of broader projects, including TCEQ TMDL and WPP/319h planning grant projects in the region.

PHOTO: Tree-Lined Street, Houston

OSSF PLANNING, COORDINATION, AND OUTREACH

The goal of this Task is to administer and coordinate H-GAC's On-Site Sewage Facility program activities. These activities include maintaining and continuing to develop the existing spatial database of permitted and projected unpermitted OSSF locations. These activities also provide coordination in support of an existing Supplemental Environmental Project (SEP) to repair or replace failing OSSFs within the region, coordinate regional water quality and wastewater infrastructure projects, and provide outreach and educational activities.

Work performed under this task includes:

- Permitted OSSF Update
- Unpermitted OSSF Update
- Authorized Agent Coordination
- SEP Coordination and Outreach
- OSSF Outreach and Education

On-Site Sewage Facilities in the Houston-Galveston Region

Decentralized on-site sewage facilities are a widespread wastewater treatment technology in the region. OSSFs are relied on for the treatment and disposal of wastewater in areas not conducive to centralized sanitary sewer service. Although they produce treated effluent of a high grade when functioning properly, OSSFs can be appreciable sources of bacterial contamination if they are not properly maintained and functioning. Annually, thousands of OSSFs are designed, sited, permitted, and installed within the region, especially in the rapidly developing unincorporated areas of northern Harris and Montgomery counties, as well as the rural counties along the region's outer boundary. While new systems are subject to permit requirements as specified in Title 30 Texas Administrative Code Chapter 285 (30 TAC §285), many systems installed prior to 1989 did not require a permit. Specific locations of these unpermitted systems may be unknown. Information regarding these unpermitted systems is particularly significant because they represent a majority of all OSSFs in the H-GAC service area.

TCEQ has authority over the regulation and permitting of OSSFs in Texas. In many cases, that authority is delegated by TCEQ to Authorized Agents (counties, municipalities, river authorities, and other responsible entities). As there is no centralized repository for OSSF permitting data, the Authorized Agents have traditionally maintained these data in a variety of formats. To ensure a regional, uniform set of data for use by Authorized Agents and water quality planning efforts, H-GAC developed a comprehensive inventory of permitted system locations and likely unpermitted system locations under previous grant contracts.

During this Project year, new data provided by the Authorized Agents were added to H-GAC's regional OSSF permit database. Additionally, H-GAC developed and initiated a new method to estimate the projected locations of unpermitted OSSFs in the region. In previous project years, H-GAC utilized parcel and census block data for its estimations. Beginning in FY 2022, this process switched to using 9-1-1 address data to perform the location analysis. This allows H-GAC to estimate the location of these systems with a much higher level of specificity.

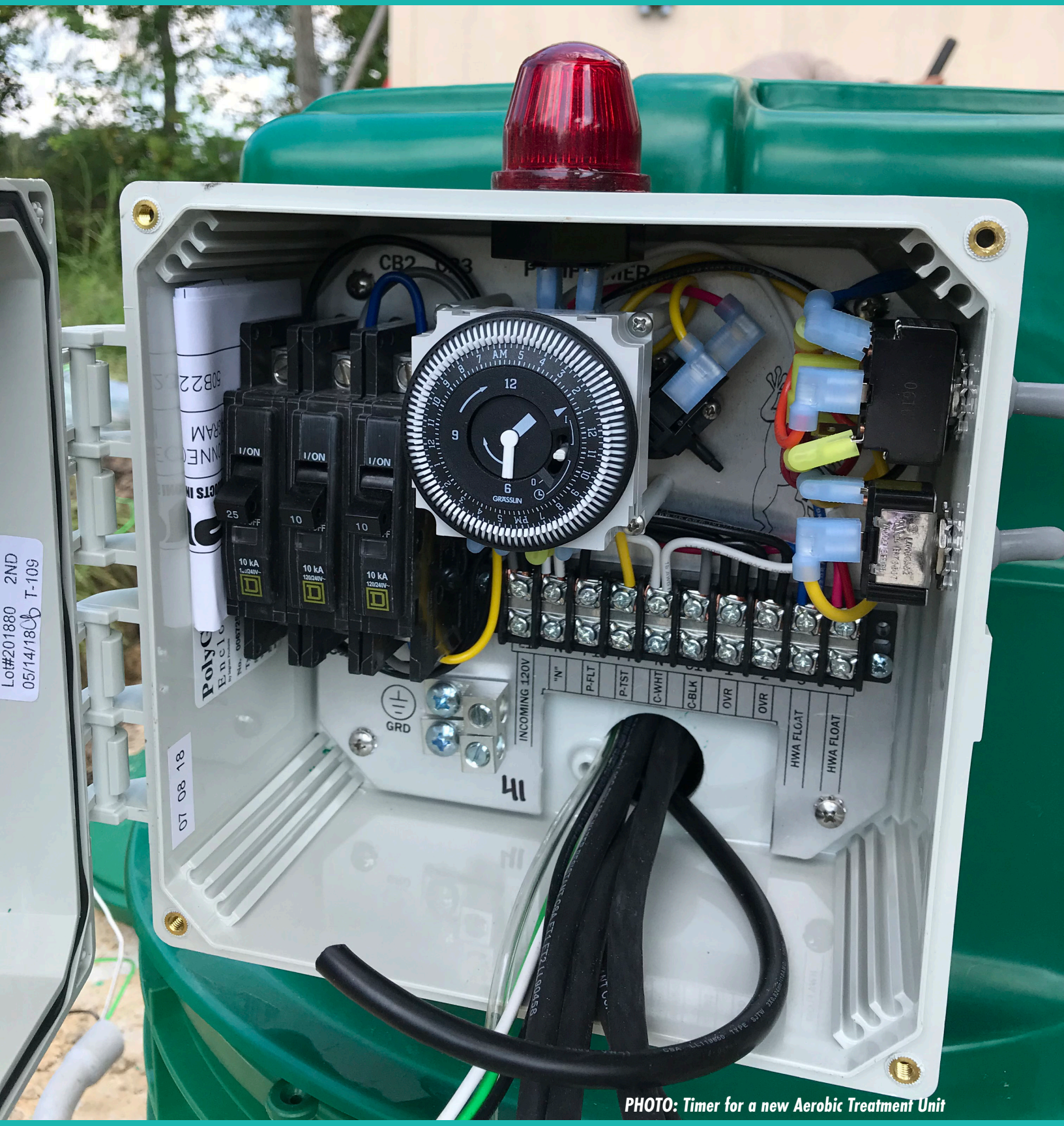


PHOTO: Timer for a new Aerobic Treatment Unit

PERMITTED OSSF UPDATE

For the Permitted OSSF Update, H-GAC staff continued to update the OSSF location database with data from Authorized Agents, including permitted OSSF locations and related permit data as appropriate.

The intent of the OSSF database is to provide a comprehensive, spatially-explicit inventory for all permitted OSSF locations throughout the region. No such inventory existed prior to the initiation of H-GAC's initial database development. The initial work had collected location data for permitted OSSFs and developed a program under which participating Authorized Agents would submit new system data on a regular basis, including spatial locations using Global Positioning System (GPS) units provided by H-GAC.

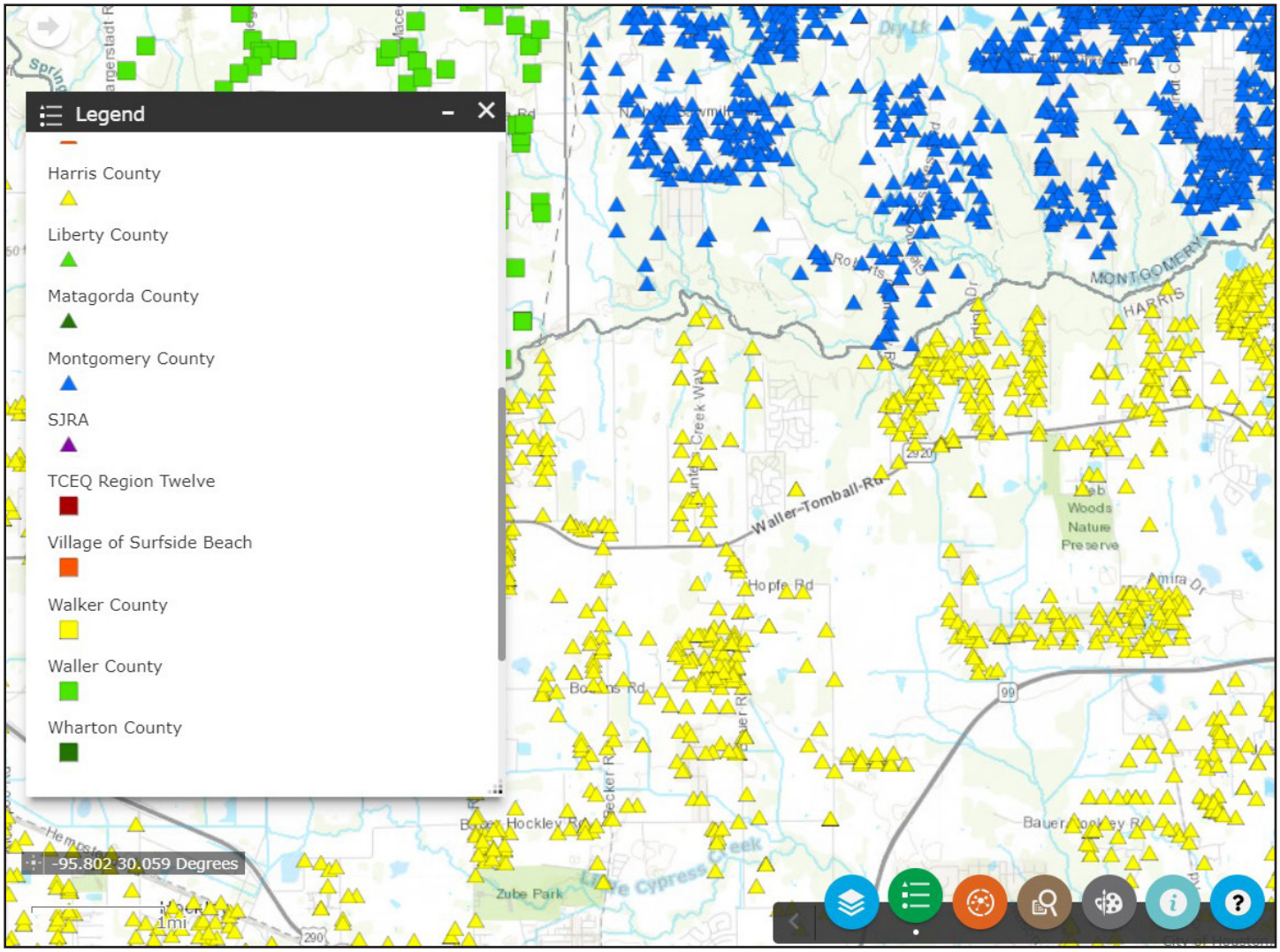


FIGURE 9a: H-GAC's Interactive OSSF Information Systems Mapping Tool (Permitted OSSFs by Authorized Agent)

This information is updated annually and is available to the public through H-GAC's online interactive [OSSF Information System][5]. This ArcGIS mapping tool allows the user to view the locations of permitted OSSFs by age, Authorized Agent or permitting authority (Figure 9a), and the number of permits per square mile (Figure 9b).

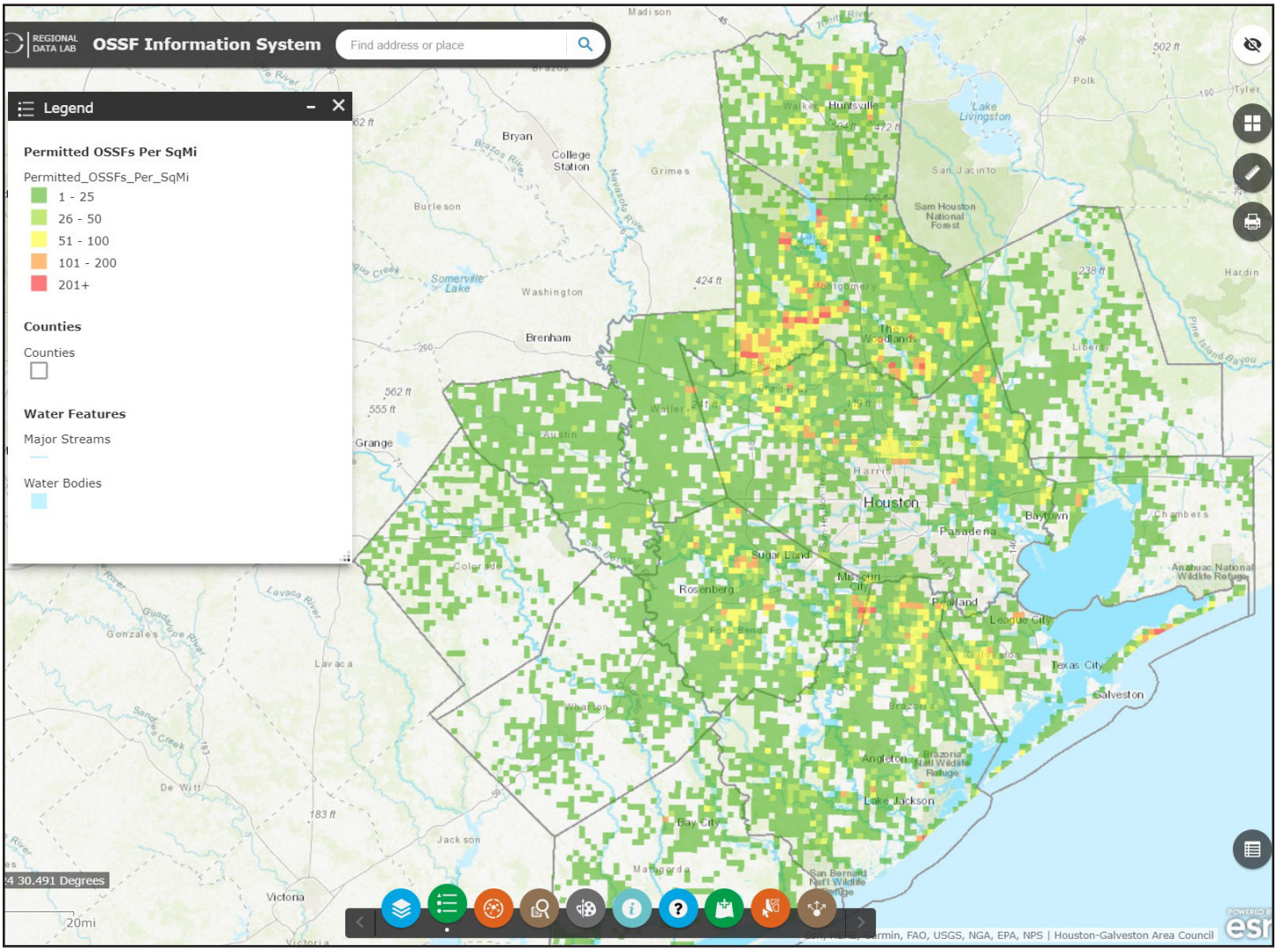


FIGURE 9b: H-GAC's Interactive OSSF Information Systems Mapping Tool (Permitted OSSFs per Square Mile)

5 https://datalab.h-gac.com/OSSF/

Acquisition of OSSF Permit Data

Authorized Agents typically submit data to H-GAC in electronic format. Data received from Authorized Agents are reviewed by H-GAC staff and reformatted as necessary for inclusion into the geospatial database. The methods employed in the update of the OSSF database are described in further detail in the *H-GAC Water Quality Management Plan Data Acquisition and Geospatial Data Quality Assurance Project Plan*. Any data errors (incorrect GPS coordinates, typographical errors, etc.) were corrected, while duplicate records were removed.

The FY 2022 update brings the database current through the end of calendar year 2021. There were a total of 8,949 permitted systems added to the database for 2021. This included the addition of 4,362 permitted OSSFs in Grimes County. Grimes County is not a part of H-GAC's 13-county region, but it, along with San Jacinto County, are a part of H-GAC's Clean Rivers Program area. Watersheds that H-GAC monitors extend into a part of these counties, so H-GAC has been seeking this OSSF permit data for a long time to use in watershed-based planning efforts in these areas. Although we have so far been unsuccessful in acquiring data from San Jacinto County, we were able to acquire data from Grimes County for the first time this year.

As of 12/31/21, there are a total of 119,972 permitted OSSFs in the database. Austin, Colorado, and Walker counties did not report any data to H-GAC for 2021, or for several years prior. Attempts have been made to resume acquisition of this data. Liberty County did not report data in 2020, but reported 511 new permits in 2021.

Table 22 shows a breakdown of the number of permitted systems by county. **Appendix C** contains maps of the locations of permitted and projected unpermitted OSSFs by county.

TABLE 22: Permitted OSSFs by County, 2020 and 2021

County	Permitted Systems 2020	New Permitted Systems 2021	Total Permitted Systems 2021
Austin	3,178	Not Reported	3,175
Brazoria	15,363	715	16,074
Chambers	1,308	148	1,450
Colorado	595	Not Reported	595
Fort Bend	13,527	535	14,062
Galveston	6,333	360	6,694
Grimes*	No Data Available	4,346	4,363
Harris	23,349	887	24,227
Liberty	990	511	1,502
Matagorda	1,493	169	1,663
Montgomery	33,209	797	34,012
San Jacinto*	No Data Available	No Data Available	No Data Available
Walker	6,043	Not Reported	6,041
Waller	4,363	293	4,655
Wharton	1,270	188	1,459
TOTAL	**111,021**	**8,949**	**119,972**

* These counties are outside H-GAC's 13-County Region, but are within H-GAC's Clean Rivers Program area.

Processing Notes for OSSF Permit Data

It is often necessary to further process the data that is received from Authorized Agents. This includes such tasks as making sure that data is in a consistent format, removing duplicates, verifying or removing permits that are located outside an Authorized Agent's county boundaries, geocoding street addresses to determine latitude and longitude, correcting GPS coordinates that may have been entered incorrectly, and verifying locations using Star*Map or Google Earth.

Table 23 documents data processing notes related to the most recent update, including data corrections.

TABLE 23: OSSF Data Processing and Database Update Notes for 2021

County or Authorized Agent	Update Notes
Austin	First email sent 2/25/22 requesting permit data. Did not submit data.
Brazoria	Records updated and processed.
Chambers	Records updated and processed.
Colorado	First email sent 2/25/22 requesting permit data. Did not submit data.
Fort Bend	No notes.
Galveston	Records labeled as "complaints" were not included in counts. Two records found outside Galveston County border (were not removed).
Grimes*	Submitted all data for the first time in 2022. Could not source street centerline data for geocoding accuracy. Date of installation was not reported so unable to determine system ages.
Harris	In previous years, Harris County had resubmitted their entire data set. This year they submitted data from 2021 only so it was not necessary to search for and remove duplicates as in years prior.
Liberty	Two systems located on county border were included in total count. Total of 119 records were unable to be geocoded with reasonable accuracy. Therefore, these systems were not included in this year's update.
Matagorda	One system was unable to be geocoded with reasonable accuracy. Therefore, this system was not included in this year's update.
Montgomery	Only submitted data from January 2021 – August 2021. Email requests for remaining data were unanswered. Removed one odd record and moved three records that laid just outside the county boundary to inside the boundary.
San Jacinto*	No data received following multiple requests.
San Jacinto River Authority	Emailed SJRA contact but received no response. SJRA did not submit data for 2021.
Walker	One system located on county border was included in total count.
Waller	Three records unable to be geocoded with reasonable accuracy and were not included in update. Six records added with STAR*Map assistance.
Wharton	No notes.

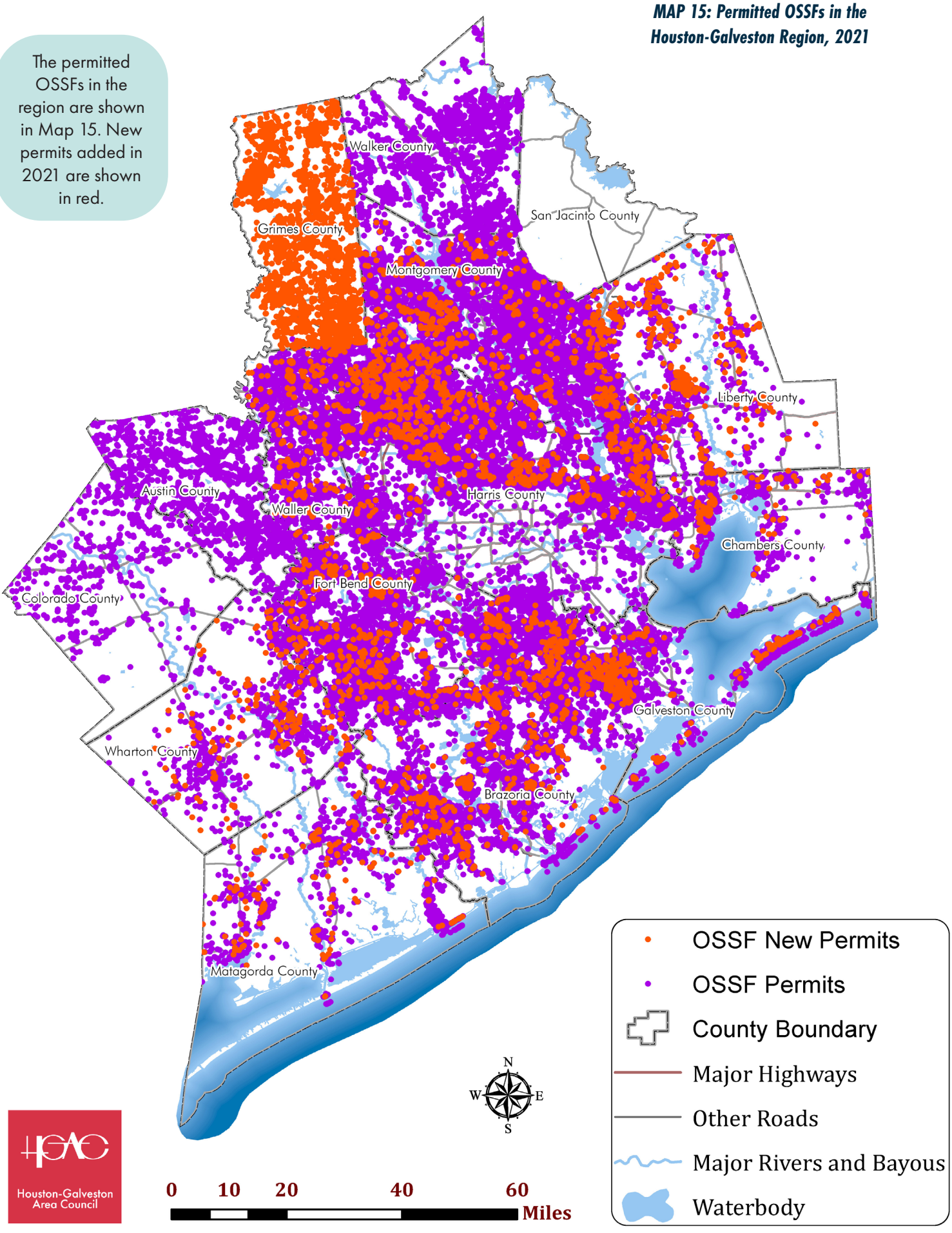
* These counties are outside H-GAC's 13-County Region, but are within H-GAC's Clean Rivers Program area.

Locations and Concentrations of Permitted OSSFs in the Houston-Galveston Region

The locations and concentrations of permitted OSSFs in the Houston-Galveston region are shown in Maps 15 and 16. For the OSSF permits, existing permits are shown in purple and new permits (those added in calendar year 2021) are shown in red. All permits for Grimes County are shown in red as this is the first year those permits were added to the regional permit database.

The permitted OSSFs in the region are shown in Map 15. New permits added in 2021 are shown in red.

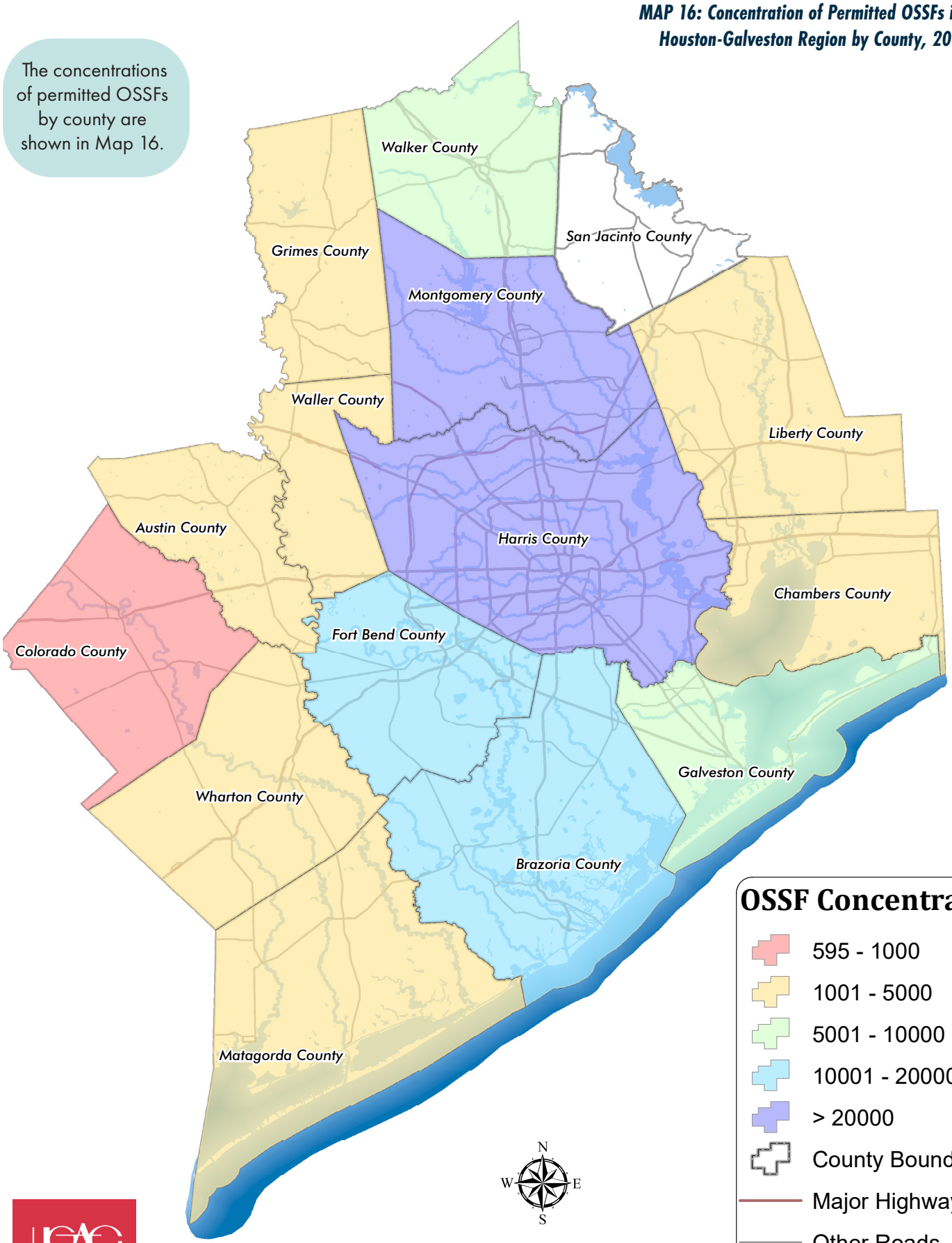
MAP 15: Permitted OSSFs in the Houston-Galveston Region, 2021



Houston-Galveston Area Council

MAP 16: Concentration of Permitted OSSFs in the Houston-Galveston Region by County, 2021

The concentrations of permitted OSSFs by county are shown in Map 16.



Houston-Galveston Area Council

UNPERMITTED OSSF UPDATE

The OSSF inventory data developed by H-GAC deals specifically with permitted OSSFs. For most Authorized Agents, systems began to be permitted after1989. OSSFs installed prior to this date were not necessarily required to have a permit (depending on county). These systems are considered to be "grandfathered" and, in most cases, are not actively tracked unless violation data exist for that site. While many of these systems are well-maintained, aging systems in general pose a greater threat of failure and contamination of groundwater and surface water sources. Many of these older systems may be of a type that is not appropriately suited for the soil type. These unpermitted systems represent an appreciable portion of the systems in service.

The OSSF data have already been used for a variety of watershed protection efforts and other local planning projects. With the projected population expansion and aging infrastructure, additional information about unpermitted system locations will be vital to utility planning and developing watershed-based plans to address water quality impairments and concerns throughout the region.

For the Unpermitted OSSF Update, H-GAC staff estimated the number and probable locations of unpermitted systems, which were typically installed prior to the requirement that OSSFs be permitted. In previous project years, this analysis was performed using polygons representing parcel and census block data. For the current project year, H-GAC used 9-1-1 addressing to estimate the projected locations of potentially unpermitted OSSFs on a county level. This method used an automated script to interpolate the addresses of these unpermitted systems.

The Unpermitted OSSF Update was performed in compliance with the *H-GAC Water Quality Management Plan Data Acquisition and Geospatial Data Quality Assurance Project Plan*.

Previous Methodology Using Parcel and Census Block Data

For the current project, H-GAC's methods for the unpermitted analysis differed from previous years, in which unpermitted locations were deduced through a comparison of polygons (known parcels/census blocks), known locations of OSSFs, and known sanitary sewer systems service boundary data. In previous iterations of this analysis, parcels with occupied structures that are located outside of established service areas and do not have a permitted OSSF were assumed to have an unpermitted OSSF.

As originally performed, the Unpermitted OSSF Update identified the locations of unpermitted OSSFs by tax parcel polygon or census block data using H-GAC's comprehensive parcel database. Tax appraisal parcels allowed for numeric estimations of unpermitted OSSFs. However, there are some limitations to this method. For example, the centroid of the parcel is usually identified as the location of the OSSF. As properties vary in size and shape, the centroid in many cases is not adjacent to the actual system. It is also assumed that there is a 1:1 ratio of OSSFs to parcels. This potentially underestimates the number of OSSFs, as there is typically only one OSSF per parcel for a single-family residency use, but there likely could be more than one system per parcel under certain uses (such as a mobile home community).

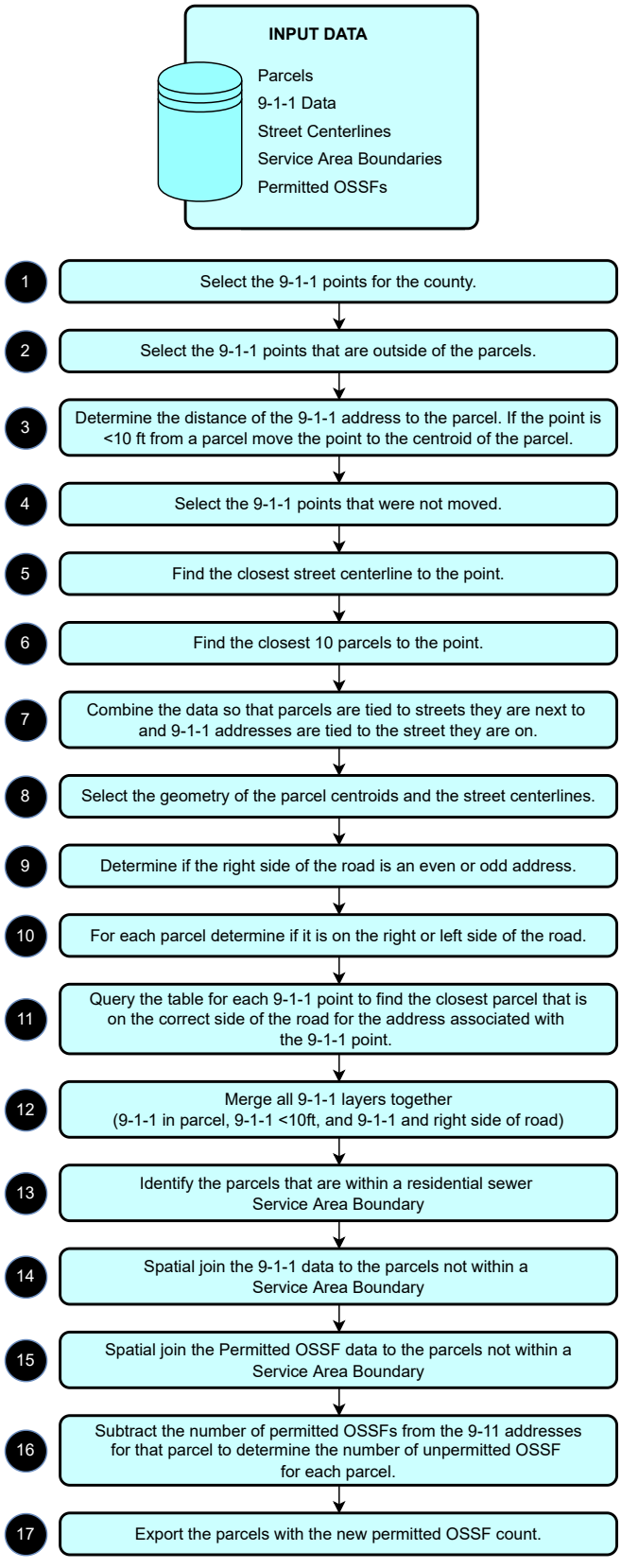
For the counties for which H-GAC does not have digitized tax parcels available (Austin, Chambers, Matagorda, Walker, and Wharton), census blocks were used to complete the analysis. However, use of the census blocks is not ideal either. Using this methodology, areas containing unpermitted OSSFs could be established, but it is difficult to ascertain a numeric estimation or the exact physical location of systems. A 1:1 ratio is also used for the census blocks to provide a conservative estimate, but it is almost a certainty that there will be multiple households per census block, so the number of OSSFs will be underestimated using census block data.

Updated Methodology Using 9-1-1 Addresses

While parcel and census block data have been extremely useful in prior project years for identifying potential locations of unpermitted OSSFs, H-GAC found it necessary to refine the process by utilizing the 9-1-1 address data set. The QAPP has been revised to allow use of the 9-1-1 address points, and H-GAC staff have developed a methodology to begin using these data to generate a more accurate and detailed estimation of the numbers and potential locations of unpermitted OSSF systems.

To begin using 9-1-1 addressing to better delineate the location and number of potential unpermitted OSSFs, H-GAC's Data Analytics and Research Department developed an automated methodology using code written in Python. The general workflow performed by the code is detailed in Figure 10.

FIGURE 10: General Workflow for OSSF Unpermitted Analysis Code



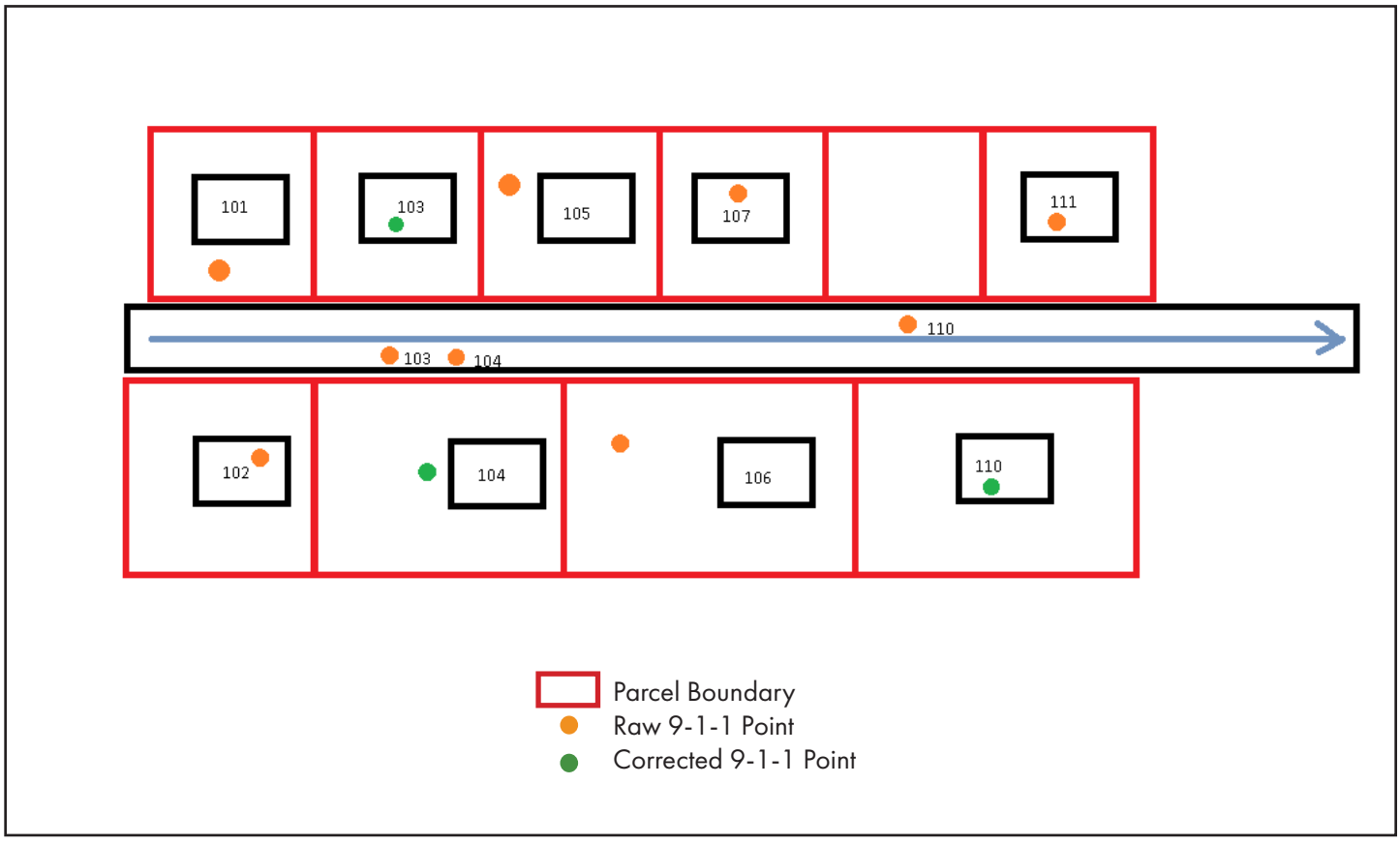
For the analysis of unpermitted OSSFs in the region, the following data inputs are used:

- Parcel Data
- 9-1-1 Addresses
- Street Centerlines
- Service Area Boundaries
- Permitted OSSF Data

The use of 9-1-1 address data presents some challenges, as these points are sometimes assigned through address interpolation. Although many of the address points will be correctly assigned to a parcel, this process can also assign the 9-1-1 address point to the centerline of the street. In order to more accurately determine the location of these potential unpermitted systems, it is necessary to correct the 9-1-1 address data to assign the address points to the parcel. This data correction step is used to determine if the 9-1-1 address point is already in a parcel, if the address is odd or even, and identifies the location of the closest parcels for comparison.

The code examines the 9-1-1 address and if it is <10 feet from a parcel, assigns it to that parcel. If the 9-1-1 address is not matched to a parcel, the code then looks to the next 10 closest parcels in order and determines if the parcels are on the left or right side of the road to determine the closest odd or even numbered parcel relative to the address point. The code then fixes the 9-1-1 address points so that they are assigned to the centroid of the parcels (Figure 11).

FIGURE 11: Fixing of 9-1-1 Address Points to Assign to Parcels

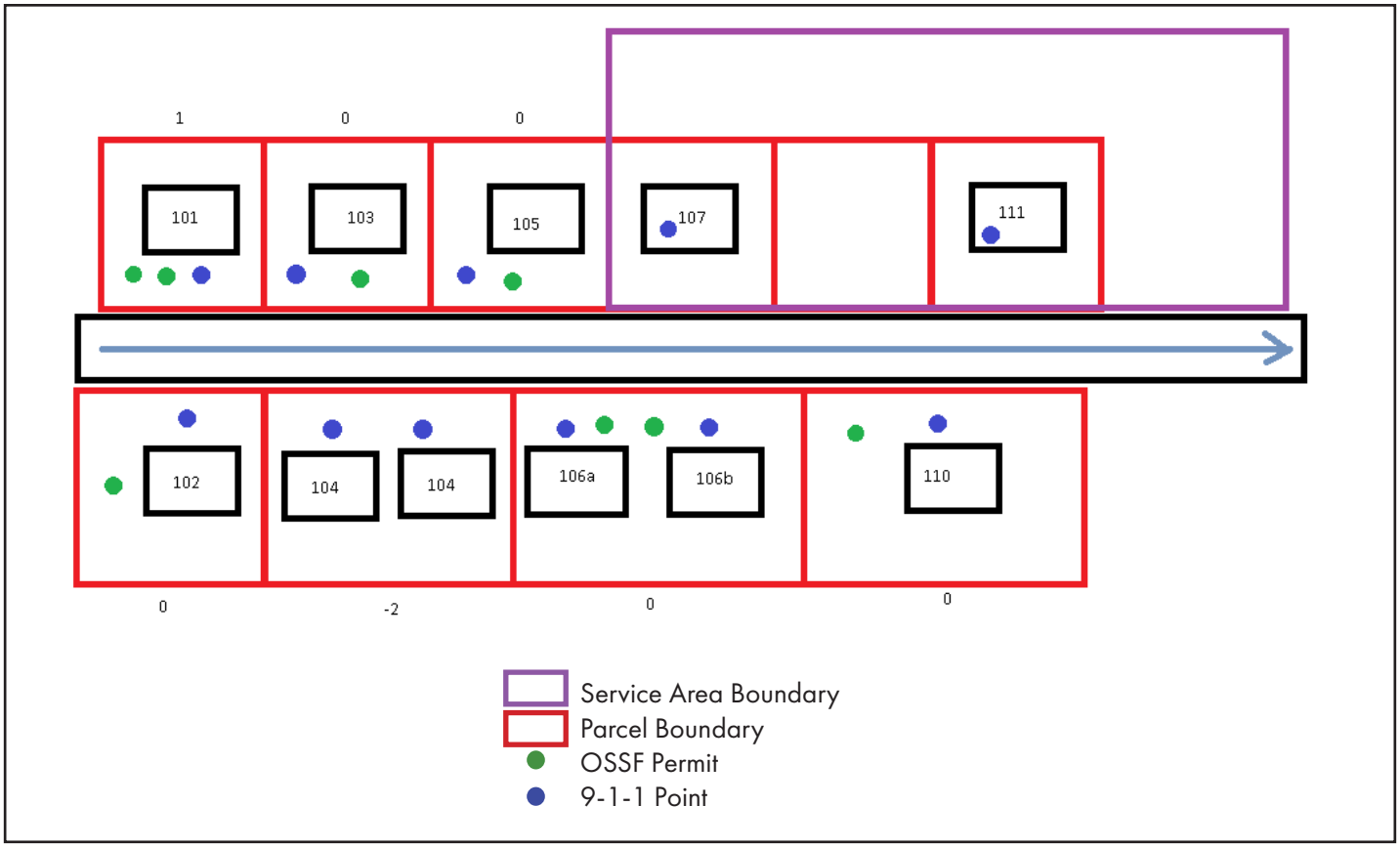


Next, the code spatially joins the 9-1-1 layer and the Permitted OSSF layer to the parcels. Points that are within a known service area boundary are excluded, as it is assumed that these homes are connected to residential sewer. The code then calculates the number of 9-1-1 address points and the number of permitted OSSFs for each parcel (Figure 12).

The difference between the number of permitted OSSFs and the number of 9-1-1 address points is used to estimate the number of unpermitted OSSFs within a parcel. For example:

- If there is one address and one OSSF, the difference is 0, meaning that there are as many addresses as there are OSSFs. There are no unpermitted OSSFs counted for this parcel.
- If you had one permitted OSSF but three addresses on a parcel, the difference would be -2. This would indicate that there should be two additional unpermitted OSSFs on this parcel.
- If there is a greater number of permitted OSSFs than addresses, that typically reflects cases where the parcel data is not updated, so for example, the parcel data may not reflect a new subdivision that is being built. It may also indicate that multiple permitted OSSFs are associated with a single 9-1-1 address, such as the address for a mobile home community. These parcels need to be verified.

FIGURE 12: Fixing of 9-1-1 Address Points to Assign to Parcels



In cases where the number of permitted OSSFs exceed the number of addresses, it is necessary to verify the data. This is done through a combination of review of aerial imagery (Figure 13) and by contacting the owner of the parcel to determine the source of the discrepancy.

Appendix D lists parcels that were removed from the unpermitted analysis following verification that these parcels were unlikely to contain unpermitted OSSFs.

FIGURE 13: Aerial Imagery Verification of Unpermitted OSSFs

Results of Unpermitted OSSF Analysis Using 9-1-1 Addresses

Based upon H-GAC's Unpermitted OSSF analysis using 9-1-1 address data, it is projected that there are 222,240 parcels with a total of 239,938 potentially unpermitted OSSFs within the region for calendar year 2021. This number include an estimated 4,005 unpermitted OSSFs in Grimes County.

Comparison of Unpermitted OSSF Analysis Methodologies

In prior years, the number of potential unpermitted OSSFs was projected using a combination of parcels and census blocks (when parcel data was not available) to generate a polygon count. This methodology assumes a 1:1 ratio of OSSFs to polygons, and because of that inherent issue, this methodology likely underestimates the number of unpermitted OSSFs.

For the most recent data analyzed using this methodology (calendar year 2020, performed in FY 2021), it was estimated that there were 199,006 unpermitted OSSFs in the region based upon the combined number of parcels and census blocks. These results were presented in the *FY 2021 Water Quality Management Plan Update Report* from last year.

For the FY 2022 project, H-GAC utilized a combination of the parcel data and the 9-1-1 address data set to estimate the number and locations of potential unpermitted OSSFs for the first time. Based upon this updated analysis methodology, H-GAC determined a parcel count of 222,240 parcels containing 239,938 potential unpermitted OSSFs for calendar year 2021. These totals include 3,055 parcels and 4,005 potential unpermitted OSSFs in Grimes County that were not included in last year's data set.

A comparison of the data sources, polygon counts, parcel counts, and the estimated numbers of unpermitted OSSFs for calendar years 2020 and 2021 is provided in Table 24.

TABLE 24: Potential Unpermitted OSSFs by County Using Parcel/Census Block Data (2020) and 9-1-1 Addresses (2021)

County	2020 Analysis		2021 Analysis		
	Data Source	Polygon/OSSF Count	Data Source	Parcel Count	Unpermitted OSSF Count
Austin	Census Block	209	Parcel + 9-1-1	2,538	3,122
Brazoria	Parcel	33,521	Parcel + 9-1-1	22,309	26,745
Chambers	Parcel	5,451	Parcel + 9-1-1	5,631	6,202
Colorado	Census Block	475	Parcel + 9-1-1	274	299
Fort Bend	Parcel	9,421	Parcel + 9-1-1	9,407	10,331
Galveston	Parcel	5,724	Parcel + 9-1-1	7,197	7,233
Grimes	No Data	No Data	Parcel + 9-1-1	3,055	4,005
Harris	Parcel	77,584	Parcel + 9-1-1	93,703	86,328
Liberty	Parcel	11,093	Parcel + 9-1-1	12,400	16,148
Matagorda	Census Block	392	Parcel + 9-1-1	3,976	4,663
Montgomery	Parcel	43,377	Parcel + 9-1-1	45,206	55,127
San Jacinto	No Data	No Data	No Data	No Data	No Data
Walker	Census Block	179	Parcel + 9-1-1	4,287	5,541
Waller	Parcel	11,029	Parcel + 9-1-1	7,579	8,645
Wharton	Census Block	551	Parcel + 9-1-1	4,678	5,549
	TOTAL	**199,006**	**TOTAL**	**222,240**	**239,938**

TABLE 25: Percent Change in Potential Unpermitted OSSFs Using Different Methodologies

County	2020 Unpermitted OSSFs (Parcel Data)	2021 Unpermitted OSSFs (9-1-1 Data)	Change	Percent Change
Austin	209	3,122	2,913	1394%
Brazoria	33,521	26,745	(6,776)	-20%
Chambers	5,451	6,202	751	14%
Colorado	475	299	(176)	-37%
Fort Bend	9,421	10,331	910	10%
Galveston	5,724	7,233	1,509	26%
Grimes	No Data	4,005	4,005	N/A
Harris	77,584	86,328	8,744	11%
Liberty	11,093	16,148	5,055	46%
Matagorda	392	4,663	4,271	1090%
Montgomery	43,377	55,127	11,750	27%
San Jacinto	No Data	No Data	N/A	N/A
Walker	179	5,541	5,362	2996%
Waller	11,029	8,645	(2,384)	-22%
Wharton	551	5,549	4,998	907%
TOTAL	**199,006**	**239,938**	**40,932**	**21%**

Table 25 shows the percent change in results from 2020 to 2021 due to the change in methodologies used to estimate the number of potential unpermitted OSSFs. Using the updated 9-1-1 address methodology, H-GAC estimates an additional 40,932 unpermitted OSSFs within the region (including an additional 4,005 OSSFs in Grimes County that were not included in the 2020 totals). This represents an increase of 21% compared to the 2020 estimation.

As the previous method assumed a 1:1 ratio of OSSFs to parcels, it underestimated the number of potential unpermitted OSSFs. The revised 9-1-1 address methodology takes into account the possibility of multiple OSSFs on one parcel, such as what would be observed with a subdivision or mobile home community. H-GAC feels that it is a much more accurate representation of the true number of unpermitted OSSFs.

The number of permitted and estimated unpermitted OSSFs by county and the estimated total number of OSSFs in the region for 2021, with permitted data updated through 12/31/21, is shown in Table 26.

TABLE 26: Summary of Permitted and Unpermitted OSSFs by County, 2021

County	Permitted Systems 2021	Unpermitted Systems 2021	TOTAL OSSFs 2021
Austin	3,175	3,122	6,297
Brazoria	16,074	26,745	42,819
Chambers	1,450	6,202	7,652
Colorado	595	299	894
Fort Bend	14,062	10,331	24,393
Galveston	6,694	7,233	13,927
Grimes	4,363	4,005	8,368
Harris	24,227	86,328	110,555
Liberty	1,502	16,148	17,650
Matagorda	1,663	4,663	6,326
Montgomery	34,012	55,127	89,139
San Jacinto	No Data	No Data	No Data
Walker	6,041	5,541	11,582
Waller	4,655	8,645	13,300
Wharton	1,459	5,549	7,008
TOTAL	**119,972**	**239,938**	**359,910**

For the most recent analysis of 2021 data, there were 119,972 permitted OSSFs and 239,938 potential unpermitted OSSFs, for an estimated total of 359,910 OSSFs within the Houston-Galveston region.

Limitations of the Unpermitted OSSF 9-1-1-Analysis Methodology

Although H-GAC staff feels that the updated methodology utilizing 9-1-1 address data provides for a more accurate estimation of the number and locations of the potential unpermitted OSSFs within the region, this method is not without limitations. The main limitation for this method is that the process is only as good as the input data. For example, if the street centerline data is sparse, the resulting counts and locations will not be as accurate. Another limitation is that the large geographical area and population makes ground-truthing of the data through direct observation impractical. Because of this, verification is performed using aerial imagery. While the aerial imagery for populous counties such as Harris and Montgomery is high resolution, this fine level of detail is not always available for rural counties. The imagery that H-GAC has was also taken at the end of 2019, and there has been a significant amount of development since that time.

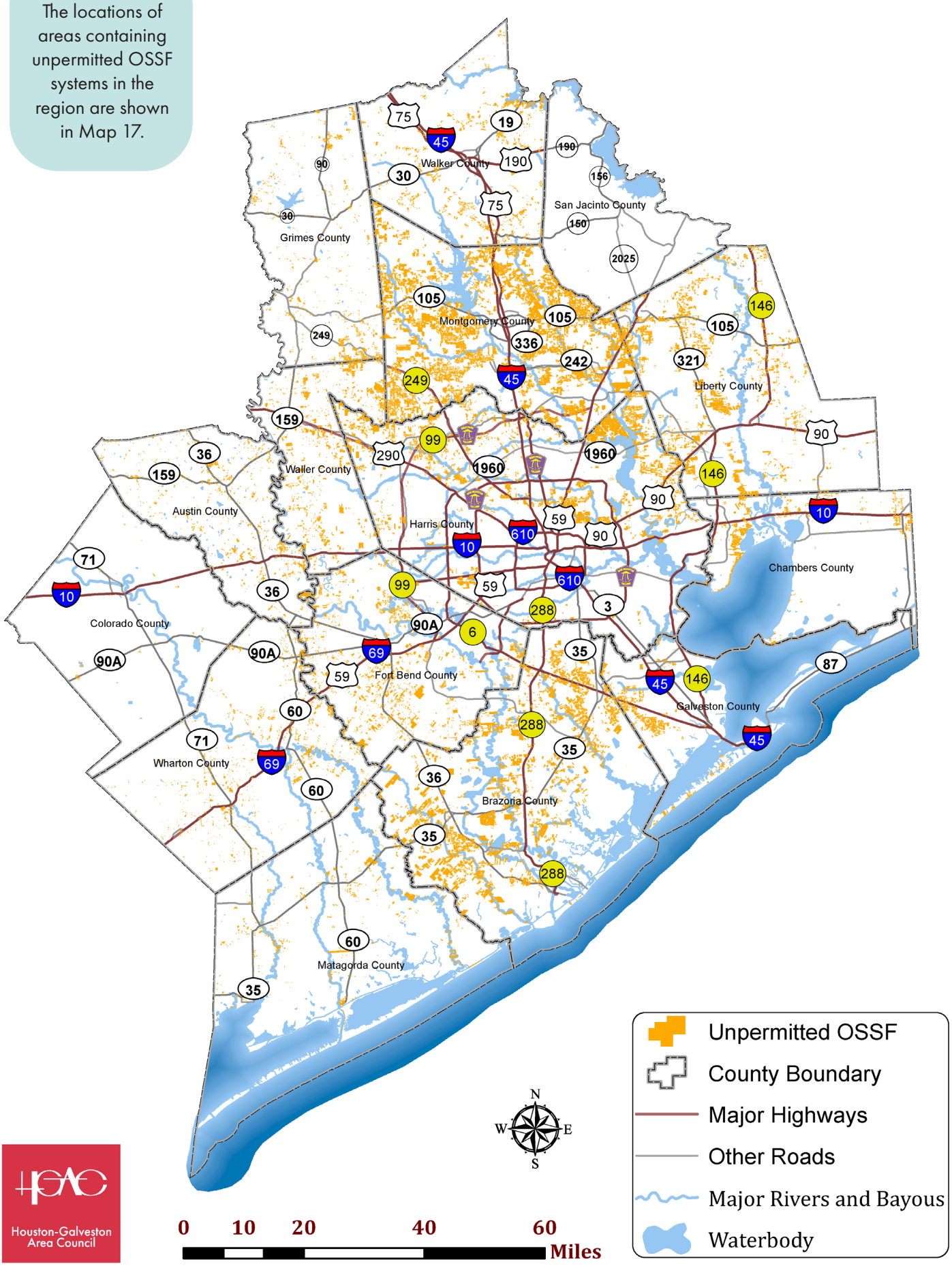
Discrepancies with the unpermitted OSSF estimations were identified by Harris County Engineering. Harris County Engineering is the Authorized Agent for permitting OSSFs in the unincorporated portion of Harris County. In the incorporated portions of the county, OSSFs are permitted by the TCEQ Region 12 office. H-GAC does not currently have OSSF permit data from TCEQ Region 12. As such, our analysis shows addresses in these incorporated areas (such as Humble and Kingwood) as locations of potentially unpermitted OSSFs. However, there likely are permits issued by TCEQ Region 12 for these addresses. This misclassification artificially increases the estimated number of potentially unpermitted OSSFs, although the total number of OSSFs (permitted and unpermitted) should not be affected. H-GAC has made a request to the TCEQ Region 12 office asking for the OSSF permit data for the region. H-GAC's GIS data layers will be updated when these data are received.

Harris County Engineering is also in possession of historical OSSF permit data from the period of 1978 – 1994. These records do not exist in an electronic format and are not incorporated into H-GAC's permitted OSSF GIS layer. There are approximately 14,000 OSSF permits in these historical records. Harris County Engineering will provide H-GAC with a copy of these data for conversion into an electronic format and incorporation into the permitted GIS layer. As these data are added and the addressed are reflected in the permitted OSSF count, the number of potential unpermitted OSSFs will be reduced. Because acquisition and conversion of this data will require a QAPP amendment, H-GAC is unable to add this data in the current project year. However, this acquisition and conversion has been added as a subtask in the FY 2023 project Scope of Work.

Because of these limitations, H-GAC will work in future project years to refine this methodology. However, staff feels that even with its limitations, the new process brings us one step closer to having a more accurate estimation of potential unpermitted OSSFs than the method that relies on strictly parcel and census block data.

MAP 17: Unpermitted OSSFs in the Houston-Galveston Region, 2021

The locations of areas containing unpermitted OSSF systems in the region are shown in Map 17.



AUTHORIZED AGENT COORDINATION

H-GAC staff works in coordination with Authorized Agents and their Designated Representatives to receive OSSF permit data submissions for inclusion into the regional OSSF database. For counties in the Coastal Zone (Brazoria, Chambers, Galveston, Harris, and Matagorda), H-GAC facilitates data gathering and sharing with Texas A&M AgriLife Extension, who are currently developing a Coastal Zone OSSF database for TCEQ.

Several counties did not submit data for inclusion in this year's OSSF database update, with some not having submitted data in several years. Staff changes at both H-GAC and some of the Authorized Agents have led to the need to meet with those entities' Designated Representatives and reestablish some of the working relationships that have existed in the past. While staff have had discussions with several of the Designated Representatives, further meetings are necessary to resume receiving data from the other permitting authorities.

H-GAC staff reached out to the Designated Representatives for both San Jacinto County and Grimes County. Although both of these counties are outside H-GAC's 13-County area, H-GAC does conduct water quality monitoring in those counties. Additionally, H-GAC is the lead agency on watershed-based plans being developed for water bodies in those counties. Information on OSSF location and density is very important for TMDL implementation or making recommendations in watershed protection plans. For the first time, Grimes County submitted data to H-GAC in 2022.

During the FY 2022 project year, H-GAC presented on OSSF topics at three meetings. These meetings are detailed in Table 27. Staff presented on H-GAC's OSSF Mapping Tool at all three meetings, with an in-depth presentation at a meeting dedicated to the agency's interactive web tools. The purpose of this meeting was to demonstrate the tools that are available and how other agencies and individuals can make use of these tools in the preparation of grant applications, watershed-based plans, reports, etc.

Staff also presented at the BIG TMDL OSSF/Illicit Discharge Regional Work Group meeting. This meeting was attended by staff from the following Authorized Agents:

- Brazoria County
- Chambers County
- Harris County
- Montgomery County
- San Jacinto River Authority
- Texas Commission on Environmental Quality, Region 12
- Waller County

Participation in the BIG's OSSF/Illicit Discharge Regional Work Group allowed H-GAC staff the opportunity to present the Unpermitted OSSF Analysis using 9-1-1 address data to the Authorized Agents and Designated Representatives for the first time. H-GAC was able to present on the general methodology, the rationale behind the switch in methodologies, and the preliminary results of the analysis.

TABLE 27: OSSF Program Coordination and Outreach Meetings, FY 2022

Date	Meeting	Presentations
2/14/22	Clean Waters Initiative - Navigating Texas Water Development Board Grants and Loans for Water and Wastewater	H-GAC Web Tools for Completing Financial Assistance Applications - OSSF Mapping Tool
4/28/22	Clean Waters Initiative - H-GAC Web Tools	OSSF Mapping Tool
5/12/22	BIG OSSF/Illicit Discharge Regional Work Group	OSSF Regional Data - OSSF Database and 9-1-1 Addressing for Unpermitted Analysis OSSF Online Mapping Tool SEP Update

PHOTO: Installation of a new Aerobic Treatment Unit, Alvin, TX (10/15/21)

SEP COORDINATION AND OUTREACH

H-GAC is the Third-Party Administrator for a Supplemental Environmental Project (SEP) through the TCEQ (Agreement No. 2012-15). H-GAC's Homeowner Wastewater Assistance Program funds the repair or replacement of malfunctioning or failing OSSFs for homeowners who meet certain income requirements. Funding from this project may also be used to provide extension of first-time sewer service, pump-out service, and water conservation equipment. Homeowners are not charged for any portion of the cost of the work performed.

Funding for the SEP program is provided through voluntary contributions by respondents in a TCEQ enforcement action. These respondents negotiate an agreement to perform a TCEQ-approved SEP to offset a portion of the assessed administrative penalty. In addition to the funding through TCEQ, the Harris County District Attorney's Office also provides funding through their enforcement actions. Homeowners under enforcement for violation of TCEQ rules set forth in 30 TAC § 285 are not eligible for assistance under the TCEQ SEP. However, the additional funding from the Harris County District Attorney's Office does not have that same requirement. Additionally, since Harris County is concerned about water quality on a regional level, their funding is not limited to just Harris County and can be used to address OSSF issues throughout the region. Funding has also been supplied by industrial partners for projects in Brazoria County.

Coordination of H-GAC's Homeowner Wastewater Assistance Program occurs through the WQMP project. The WQMP contract does not fund any OSSF repair and replacement projects, as that funding strictly comes from one or more of the SEP funding sources. However, the WQMP supports the SEP program as a component of the water quality planning process, particularly the outreach and education component of the SEP. Through the SEP, H-GAC can identify failing OSSFs, either through homeowner self-disclosure or reported through referrals from Authorized Agents or OSSF professionals. This is an important planning tool used by H-GAC in addressing failing or malfunctioning OSSFs as a major contributor to bacterial impairments in the region. By identifying these systems and then targeting them for repair, replacement, or decommissioning through the SEP, H-GAC can actively contribute to the remediation of these systems.

H-GAC's efforts largely target priority watersheds (such as those monitored by the Clean Rivers Program or subject to a WPP or TMDL) to identify areas with failing OSSFs and evaluate best management practices to address the issue. Efforts are coordinated with the appropriate H-GAC staff for each watershed project, as well as the local permitting and enforcement agencies.

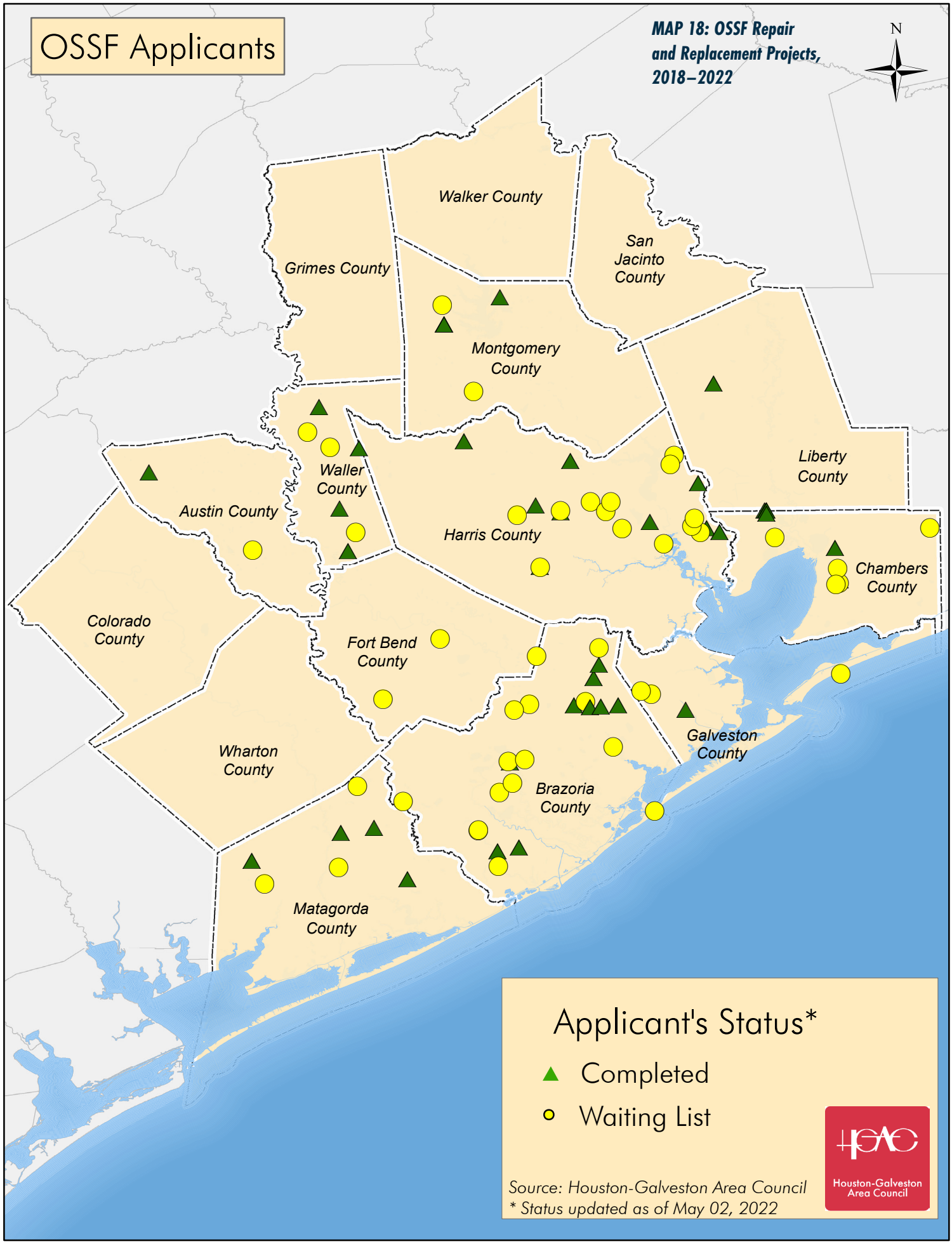
SEP activities supported by the WQMP include coordinating with elected government officials and enforcement agencies to promote the program and presenting at numerous meetings to inform homeowners and OSSF professionals about the program and the qualifications that applicants must meet to qualify.

As of 7/1/22, the SEP program has funded the replacement of 27 failed OSSFs and the repair of 15 malfunctioning OSSFs (Table 28). Due to diminished funding levels as well as COVID-19 travel and social distancing restrictions, H-GAC was only able to complete three OSSF replacements in FY 2022. In addition to those systems that have been repaired or replaced, H-GAC has 48 homeowners on a waiting list.

Map 18 shows the spatial distribution of OSSF repair and replacement projects throughout the region.

TABLE 28: SEP OSSF Replacements and Repairs by County, 2018–2022

County	Replacement	Repair	Waiting
Austin	1	-	1
Brazoria	6	3	14
Chambers	4	-	6
Colorado	-	-	-
Fort Bend	-	-	2
Galveston	1	1	3
Grimes	-	-	-
Harris	5	3	13
Liberty	-	4	1
Matagorda	3	1	3
Montgomery	2	2	2
San Jacinto	-	-	-
Walker	-	1	-
Waller	5	-	3
Wharton	-	-	-
TOTAL	**27**	**15**	**48**


OSSF Applicants
MAP 18: OSSF Repair and Replacement Projects, 2018–2022
N
Walker County
Grimes County
San Jacinto County
Montgomery County
Liberty County
Waller County
Austin County
Harris County
Chambers County
Colorado County
Fort Bend County
Wharton County
Galveston County
Brazoria County
Matagorda County
Applicant's Status*
Completed
Waiting List
Source: Houston-Galveston Area Council
* Status updated as of May 02, 2022
Houston-Galveston Area Council

OSSF OUTREACH AND EDUCATION

Homeowner Education Courses

Through H-GAC's OSSF Outreach and Education programs, staff traditionally conduct or facilitate educational training courses on basic OSSF maintenance and fundamentals of operation. These training courses are offered to homeowners, real estate inspectors and other interested parties as requested.

Homeowner outreach conducted through the SEP is an important component of numerous watershed-based projects. H-GAC uses this program as a vehicle by which homeowners can be educated about the proper operation and maintenance of their systems. Unfortunately, the ongoing COVID-19 situation greatly limited us from holding in-person classes during this project year. Staff intends on holding a homeowner education course in July or August 2022 to specific project communities if there is interest, or hold a workshop in a central location where residents in different communities can attend. H-GAC will also explore opportunities to make OSSF Homeowner Education Courses available online, either through interactive presentations via Teams or Zoom, or through hosted web videos, such as YouTube.

Coastal Communities Outreach Tools

In collaboration with the H-GAC's Coastal Communities Outreach and Education program, staff prepared newsletter and social media content for distribution to residents of the Coastal Communities project area. This included not only information related to on-site sewage facilities, but also topics such as FOG, pet waste, household hazardous waste, litter, and illegal dumping.

For OSSF outreach and education, several outreach tools were created, including flyers, bill inserts, and web banners that can be utilized by communities through the Coastal Communities Tool Kit. Examples of these outreach materials are shown in Figure 14.

These outreach resources were created through the project "Outreach Implementation for Galveston Bay Water Quality Projects" funded by a Fiscal Year 2021 grant from the Galveston Bay Estuary Program[6]. This project is a continuation H-GAC's Coastal Communities Outreach and Education program which developed an outreach roadmap and resources to assist small, non-MS4, communities in the region's coastal counties with the creation and implementation of water quality outreach and education for their residents. The initial Coastal Communities project was funded in part by the TCEQ through a grant from the United States Environmental Protection Agency.

6 https://gbep.texas.gov/

FIGURE 14: Coastal Communities Outreach and Education Materials

SUMMARY

The FY 2022 Water Quality Management Plan Update Report summarizes the activities conducted under TCEQ Contract 582-22-30193.

For this year's Project, H-GAC acquired and analyzed wastewater treatment facility infrastructure data for the Houston-Galveston area region. Both the wastewater permitted discharger GIS layer and the Service Area Boundary GIS layer were updated as part of this work, expanding the data repository that H-GAC maintains. These data are used throughout multiple H-GAC programs, such as the Clean Rivers Program, as well as in the development of watershed-based plans such as WPPs and TMDLs.

A primary component of the WQMP Update involves the acquisition and analysis of self-reported Discharge Monitoring Report data. These data are important for evaluating potential sources of bacteria in area waterways. Analysis of WWTF effluent monitoring data provides a means by which decision makers and water resource managers can evaluate the role wastewater infrastructure plays in regional water quality issues. The analysis provided in this report shows wastewater treatment facilities are typically operating within compliance of their effluent discharge permit limits for bacteria. However, considering the volume of discharge and the potential for high bacteria loading in the case of a system malfunction, it is prudent to continue to monitor the DMR data closely. The DMR data acquired through this project are important for other watershed-based projects within the region, most notably the Bacteria Implementation Group TMDL project. Through addressing issues such as wastewater treatment facility discharge permit limits, the BIG has been very successful in reducing bacteria loading in the region's water bodies.

As part of the WQMP Update, H-GAC also analyzed self-reported Sanitary Sewer Overflow data for the region. SSO data are of great interest due to the potential for acute loading of extremely elevated levels of human fecal bacteria. H-GAC analyzed the frequency, volume, and root causes of SSOs.

H-GAC continues to develop and foster relationships with

interested parties in the region's watersheds and coordinate regional water quality activities. H-GAC has been a leader in TMDL and WPP efforts, and the coordination activities of the WQMP Update Project mesh well with the overall approach of outreach, targeted studies, and implementation activities. By having multiple water quality projects concurrently within the same organization, H-GAC is able to achieve vertical integration between base data sources, internal analysis, watershed planning efforts, and external coordination.

The OSSF Database development which started in previous projects continued during this year and will be an ongoing effort that will be continuously updated. This project deliverable remains useful in H-GAC's various watershed planning efforts. H-GAC acquires OSSF permit data from Authorized Agents throughout the region and consolidates that data into a regional database. An estimation of unpermitted OSSFs is also performed through this project. The number, location, and density of these OSSFs are important considerations in the development of watershed-based plans. This information is also useful in targeting OSSF homeowner education and outreach programs or OSSF repair and replacement initiatives.

H-GAC is the Third Party Administrator for a Supplemental Environmental Project to repair or replace malfunctioning or failed OSSFs for qualifying homeowners within the region. Through this SEP, H-GAC addressed numerous failing systems. Although the WQMP Contract does not fund any OSSF repair or replacement, many of the coordination, outreach, and education activities are conducted through this Project.

The accumulated data sets, the GIS analyses, and other deliverables generated through this Project have been submitted electronically to TCEQ. Where allowable and appropriate, data from this Project will be used to support other related efforts.

This *WQMP Update Report,* once accepted by the H-GAC Board of Directors and certified by TCEQ, will be incorporated into the State's Water Quality Management Plan.

ADDITIONAL RESOURCES

The following resources are provided for additional information on topics discussed in this report:

Houston-Galveston Area Council

Houston-Galveston Area Council Main Page
https://www.h-gac.com/Home

Water Quality Management Planning
https://www.h-gac.com/water-quality-management-planning

On-Site Sewage Facilities (OSSF)
https://www.h-gac.com/on-site-sewage-facilities

OSSF Information System
https://datalab.h-gac.com/ossf

Clean Rivers Program
https://www.h-gac.com/clean-rivers-program

Clean Rivers Program 2021 Basin Summary Report
https://datalab.h-gac.com/BSR2021/

Clean Rivers Program 2022 Basin Highlights Report
https://datalab.h-gac.com/BHR2022/

Water Resources Information Map (WRIM)
https://h-gac.com/go/wrim

Natural Resources Advisory Committee (NRAC)
https://www.h-gac.com/board-of-directors/advisory-committees/natural-resources-advisory-committee

Clean Waters Initiative Workshops
https://www.h-gac.com/clean-water-initiative-workshops

Bacteria Implementation Group (BIG)
https://www.h-gac.com/bacteria-implementation-group

Watershed-Based Plans
https://www.h-gac.com/watershed-based-plans

Coastal Communities
https://www.h-gac.com/coastal-communities

Coastal Communities Tools & Resources
https://www.coastalcommunitiestx.com/get-tools.html

Texas Water Development Board

Clean Water State Revolving Fund (CWSRF) Loan Program
http://www.twdb.texas.gov/financial/programs/CWSRF/index.asp

Texas Commission on Environmental Quality

Permit Application and Registration Information Systems (PARIS) Water Quality Permit Query
https://www6.tceq.texas.gov/wqpaq/index.cfm?fuseaction=home.AdvanceSearch

TCEQ GIS Data
https://www.tceq.texas.gov/gis/download-tceq-gis-data

Texas Surface Water Quality Standards
https://www.tceq.texas.gov/waterquality/standards

Texas Integrated Report of Surface Water Quality
https://www.tceq.texas.gov/waterquality/assessment

Texas Clean Rivers Program
https://www.tceq.texas.gov/waterquality/clean-rivers/index.html

Surface Water Quality Segments Viewer
https://www.tceq.texas.gov/gis/segments-viewer

Surface Water Quality Web Reporting Tool
https://www80.tceq.texas.gov/SwqmisPublic/index.htm

State Water Quality Management Plan
https://www.tceq.texas.gov/permitting/wqmp

Total Maximum Daily Load Program
https://www.tceq.texas.gov/waterquality/tmdl/index.html

Nonpoint Source Program
https://www.tceq.texas.gov/waterquality/nonpoint-source/index

Wastewater and Stormwater Permitting
https://www.tceq.texas.gov/permitting/wastewater

Supplemental Environmental Projects
https://www.tceq.texas.gov/compliance/enforcement/sep

On-Site Sewage Facilities Rules and Regulations
https://www.tceq.texas.gov/permitting/ossf/ossfregulators.html

Galveston Bay Estuary Program
https://gbep.texas.gov/

United States Environmental Protection Agency

Enforcement and Compliance History Online (ECHO)
https://echo.epa.gov/

ECHO Facility Search - Enforcement and Compliance Data
https://echo.epa.gov/facilities/facility-search?mediaSelected=cwa

ECHO ICIS-NPDES Permit Limit and Discharge Monitoring Datasets
https://echo.epa.gov/tools/data-downloads/icis-npdes-dmr-and-limit-data-set

ECHO Water Pollution Search
https://echo.epa.gov/trends/loading-tool/water-pollution-search/

Municipal Wastewater
https://www.epa.gov/npdes/municipal-wastewater

Septic Systems (Onsite/Decentralized Systems)
https://www.epa.gov/septic

Septic Systems Outreach Toolkit
https://www.epa.gov/septic/septic-systems-outreach-toolkit

Houston Region Total Maximum Daily Load Projects

BIG Project TMDL
https://www.h-gac.com/bacteria-implementation-group

Upper Oyster Creek TMDL
https://www.h-gac.com/watershed-based-plans/upper-oyster-creek-tmdl-and-implementation-plan

Basin 11 TMDL
https://www.h-gac.com/watershed-based-plans/san-jacinto-brazos-coastal-basin-tmdl-and-implementation-plan

Basin 13 TMDL
https://www.h-gac.com/watershed-based-plans/brazos-colorado-coastal-basin-tmdl-and-implementation-plan

Cotton Bayou TMDL
https://www.h-gac.com/watershed-based-plans/cotton-bayou-tmdl

Big Creek TMDL
https://www.h-gac.com/watershed-based-plans/big-creek-tmdl

Dickinson Bayou TMDL
https://agrilife.org/dickinsonbayou/watershed-information/

Upper Texas Gulf Coast Oyster Waters TMDL
https://www.tceq.texas.gov/waterquality/tmdl/74-uppercoastoyster.html

Houston Ship Channel TMDL
https://www.h-gac.com/watershed-based-plans/houston-ship-channel-and-galveston-bay-tmdl-and-implementation-plan

Houston Region Watershed Protection Plan Projects

Bastrop Bayou WPP
http://www.houstontx.gov/planhouston/sites/default/files/plans/bb_watershed_protection_plan.pdf

Cedar Bayou WPP
https://www.h-gac.com/getmedia/b3ea3b36-a3c5-4ddf-bab9-e0ccdba6657b/WPP-Cedar-Bayou

Clear Creek WPP
www.clearcreekpartnership.com

Cypress Creek WPP
www.cypresspartnership.com

Dickinson Bayou WPP
https://agrilife.org/dickinsonbayou/watershed-information/

Double Bayou WPP
https://www.doublebayou.org/

East Fork San Jacinto River WPP
www.eastforkpartnership.com

Highland and Marchand Bayous WPP
https://agrilifecdn.tamu.edu/highlandbayou/files/2016/10/Highland-Bayou-WPP-Draft-14-20161215.pdf

Lake Conroe WPP
http://www.sjra.net/wp-content/uploads/2014/12/Lake-Conroe-Watershed-Protection-Plan.pdf

Mill Creek WPP
https://millcreek.tamu.edu/watershed-protection-plan/

San Bernard River WPP
https://www.h-gac.com/watershed-based-plans/san-bernard-river-watershed-protection-plan

Spring Creek WPP
www.springcreekpartnership.com

West Fork San Jacinto River and Lake Creek WPP
www.westfork.weebly.com

This Page Intentionally Blank

APPENDICES

LIST OF APPENDICES

Appendix A: Wastewater Data Update and Coordination Data Deliverables
Appendix B: OSSF Database Update Data Deliverables
Appendix C: Maps of Permitted and Unpermitted OSSFs
Appendix D: Parcels Excluded from Unpermitted OSSF Analysis
Appendix E: Water Quality Management Plan Update Timeline
Appendix F: Water Quality Management Plan Update Final Report Documentation and Comments

This Page Intentionally Blank

Appendix A: Wastewater Data Update and Coordination Data Deliverables

The following Contract Deliverables were submitted electronically with this report:

GIS LAYERS

- Wastewater Outfalls GIS Layer
- Service Area Boundaries GIS Layer

MAPS

- SAB_2022_Outfalls_Map
- DMR_Freq_2017_2021
- DMR_Freq_2021
- DMR_Occurrences_2017_2021
- DMR_Occurrences_2021
- SSO_Freq_2017_2021
- SSO_Freq_2021
- SSO_Occurrences_2017_2021
- SSO_Occurrences_2021

DATA ANALYSIS

- Region 12 DMR Analysis SAS Output File

This Page Intentionally Blank

Appendix B: OSSF Database Update Data Deliverables

The following Contract Deliverables were submitted electronically with this report:

GIS LAYERS

- Permitted OSSF Database
- Unpermitted OSSF Analysis

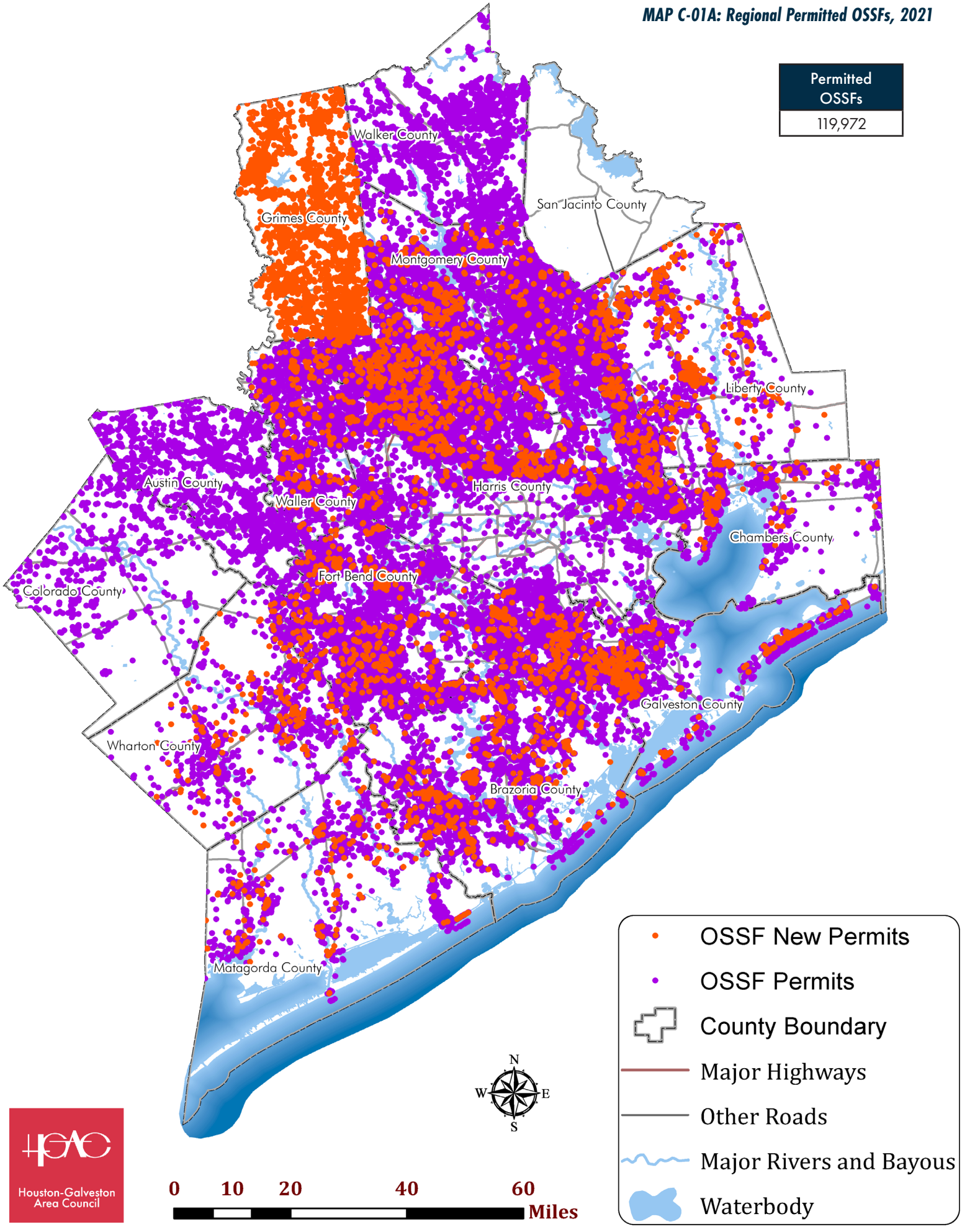
MAPS

- 2022_Regional_OSSFs_Map
- 2022_Regional_OSSFConcentration_Map
- 2022_Regional_Unpermit_OSSFs_Map
- OSSF Applicants Map

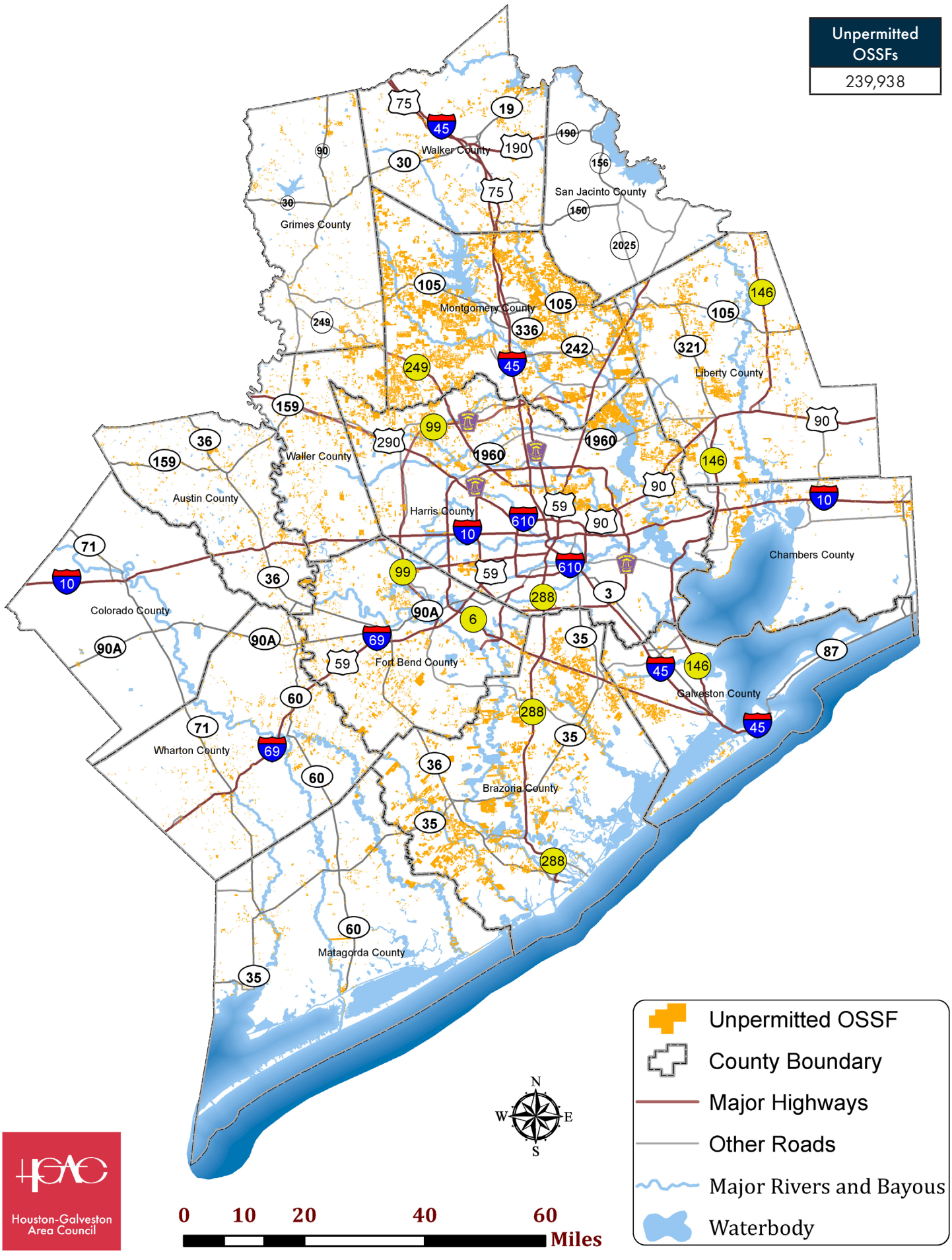
This Page Intentionally Blank

Appendix C: Maps of Permitted and Unpermitted OSSFs by County

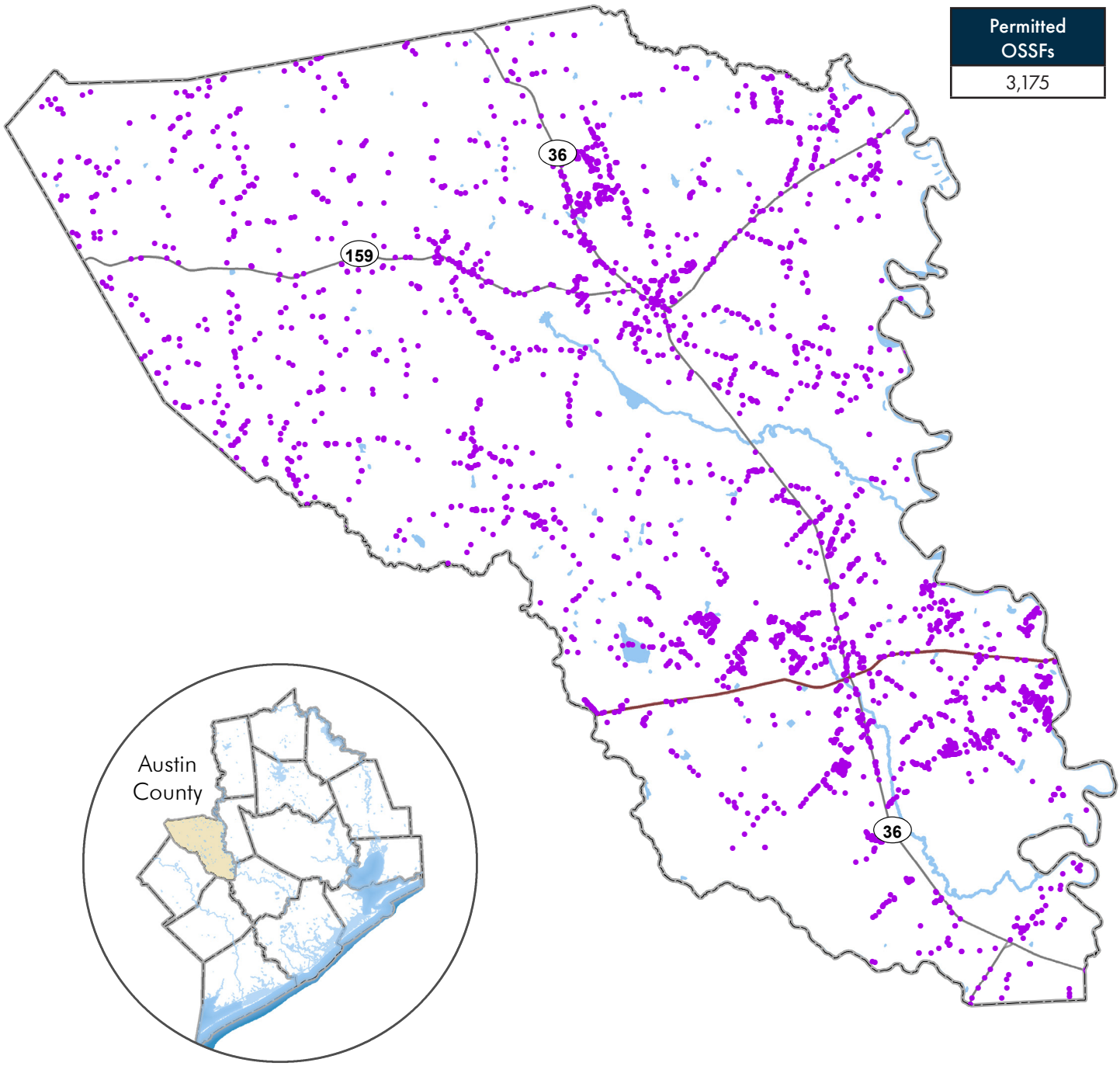
MAP C-01A: Regional Permitted OSSFs, 2021



MAP C-01B: Regional Potential Unpermitted OSSFs, 2021

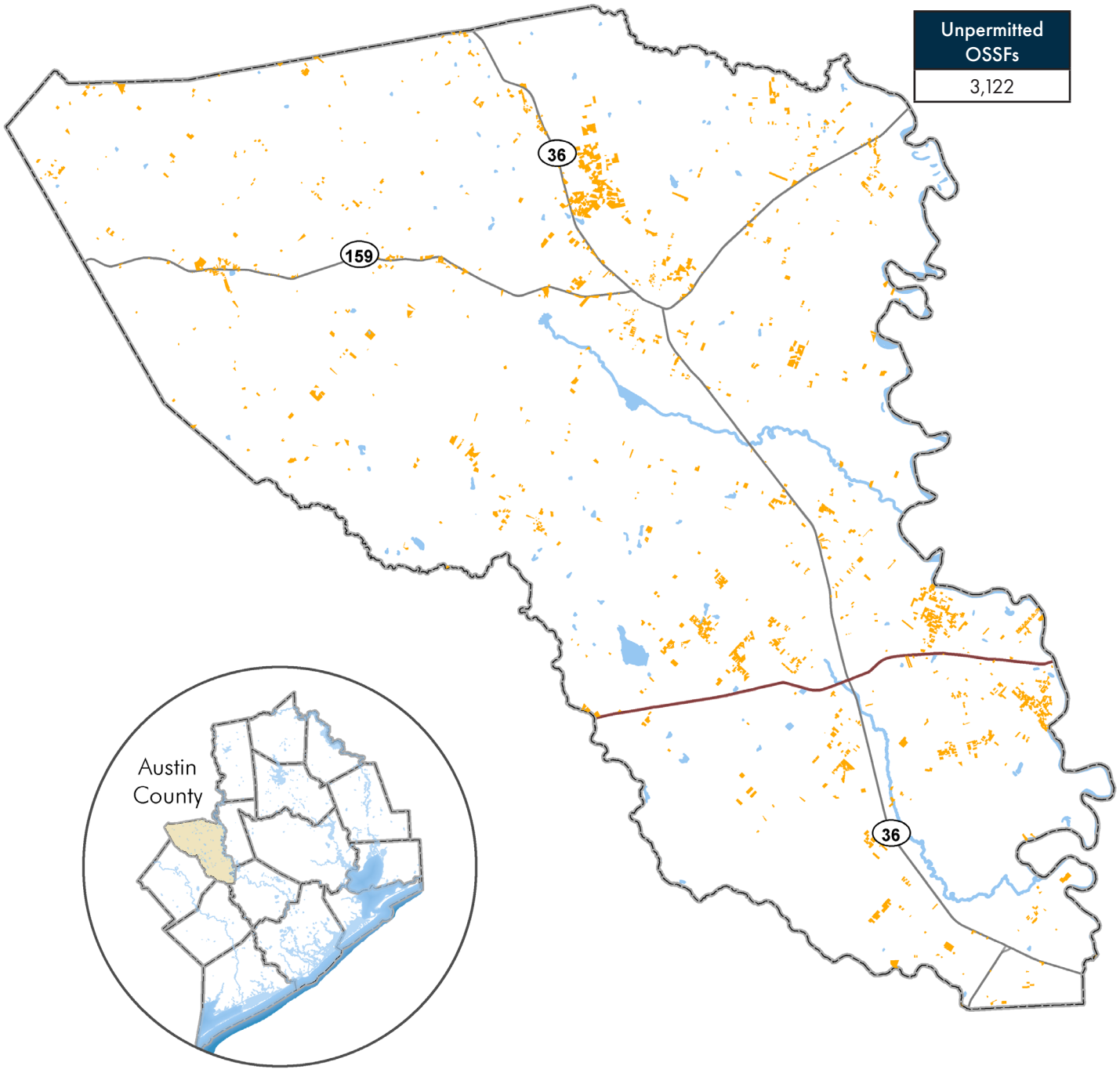


MAP C-02A: Austin County Permitted OSSFs, 2021



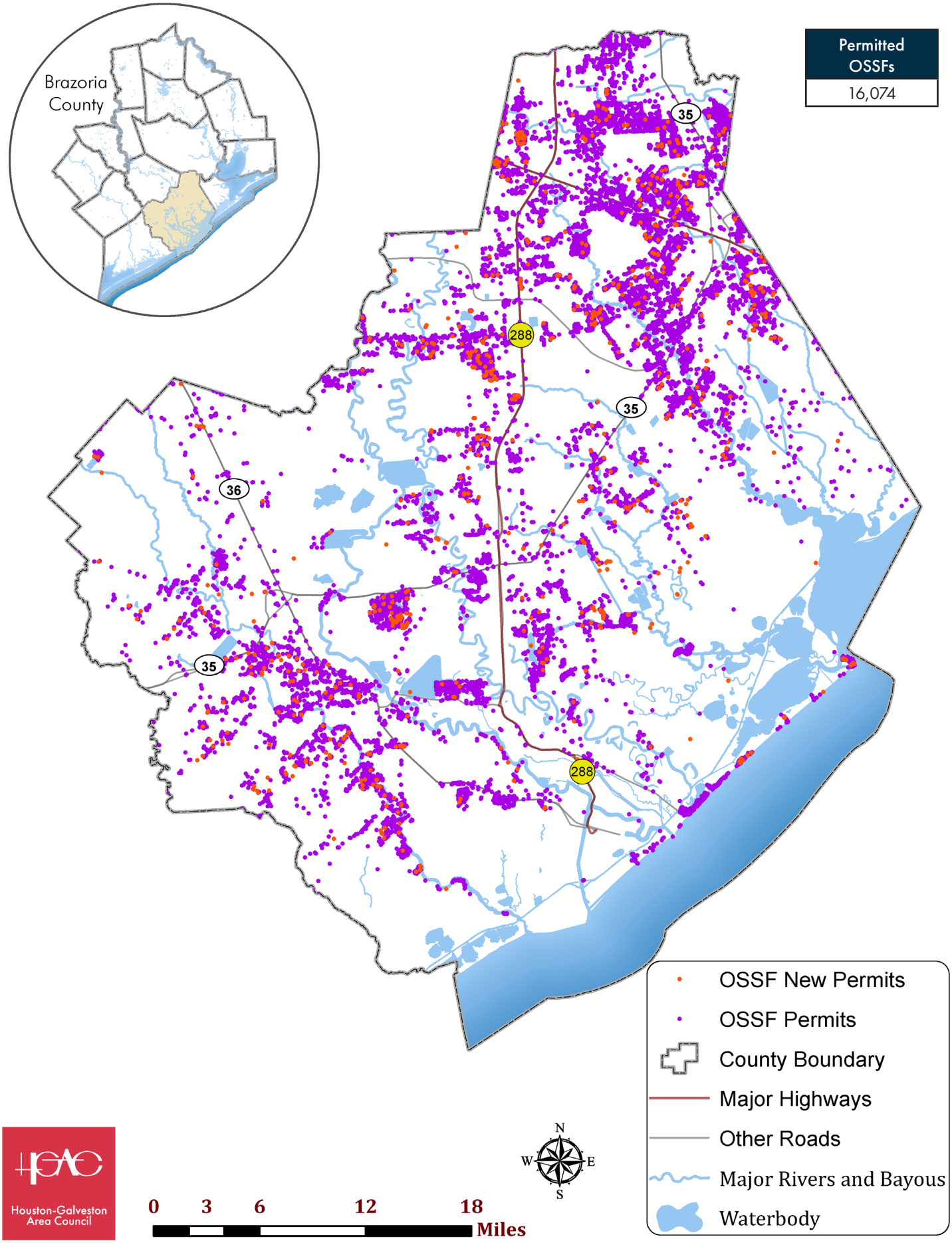
Houston-Galveston Area Council

MAP C-02B: Austin County Potential Unpermitted OSSFs, 2021

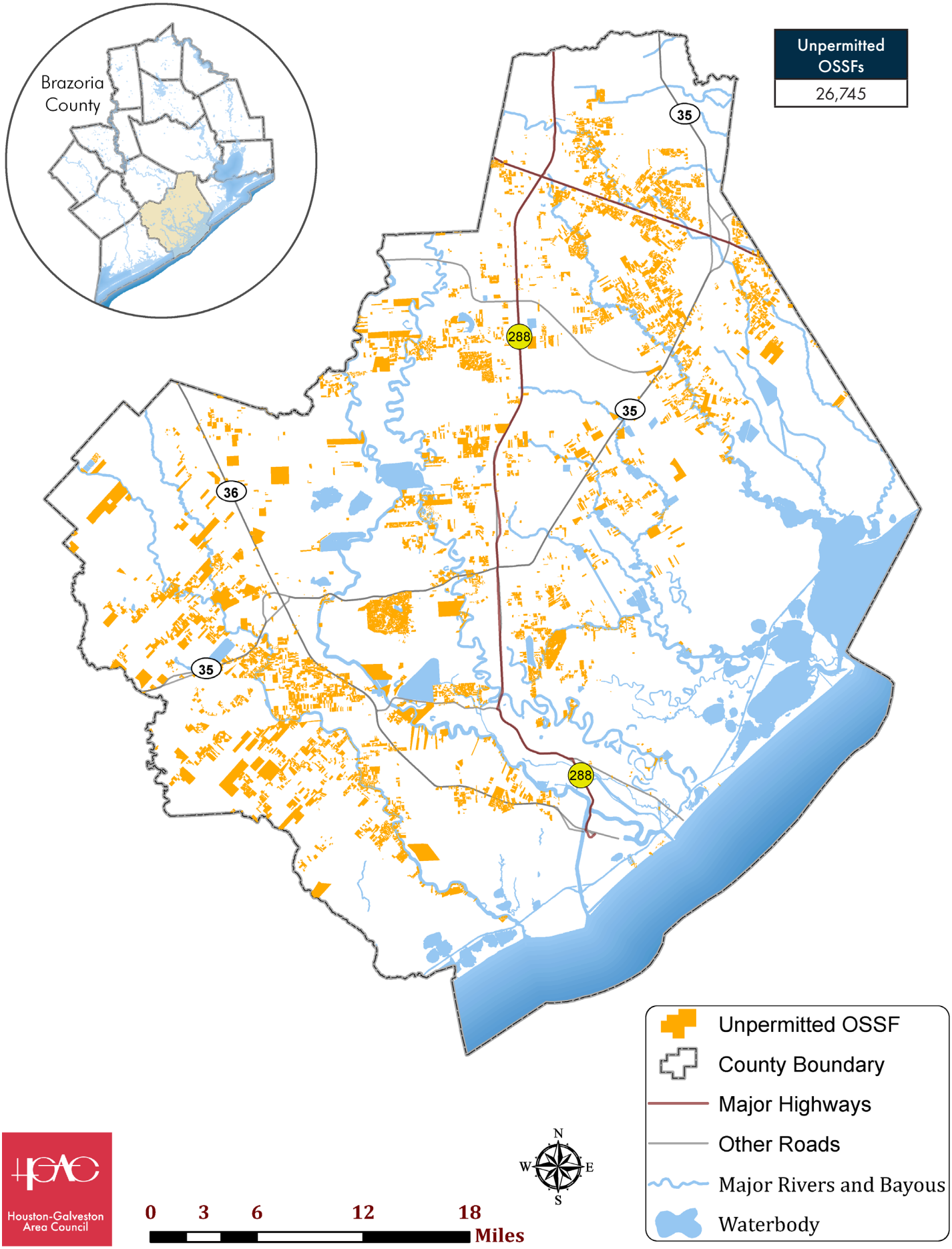


Houston-Galveston Area Council

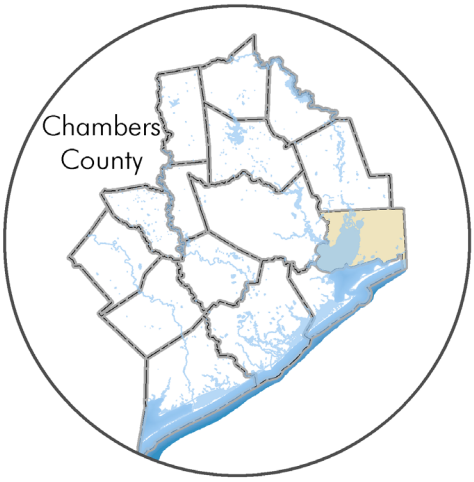
MAP C-03A: Brazoria County Permitted OSSFs, 2021



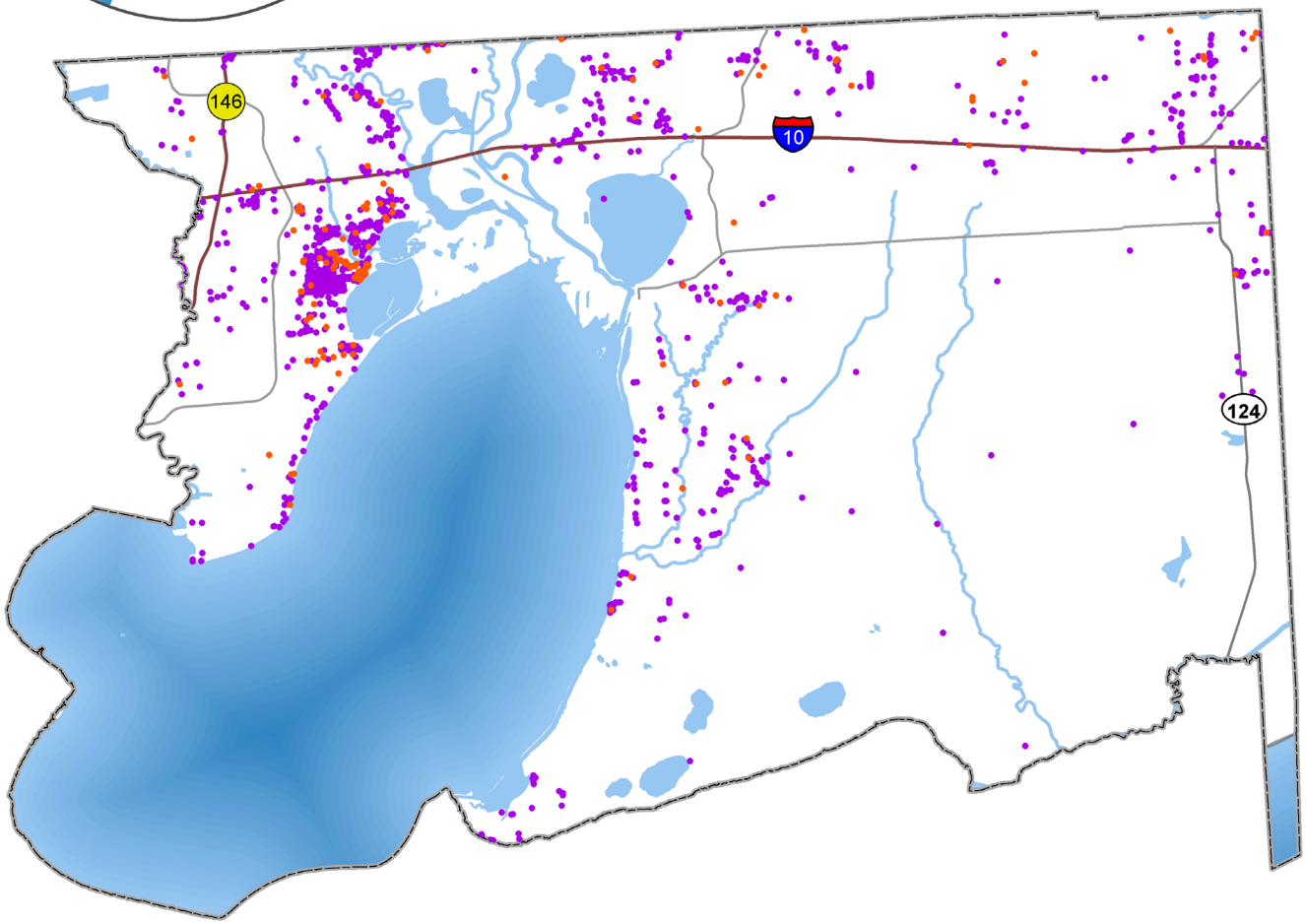
MAP C-03B: Brazoria County Potential Unpermitted OSSFs, 2021



MAP C-04A: Chambers County Permitted OSSFs, 2021



Permitted OSSFs
1,450



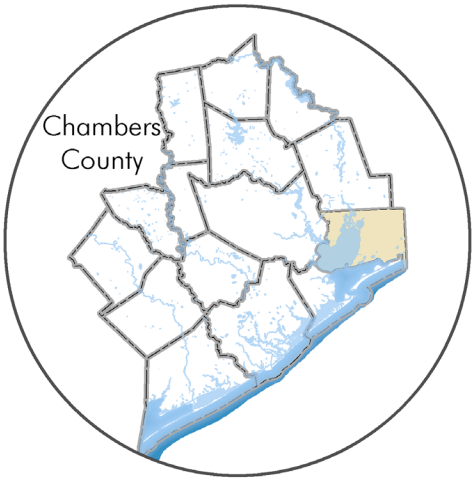
- OSSF New Permits
- OSSF Permits
- County Boundary
- Major Highways
- Other Roads
- Major Rivers and Bayous
- Waterbody

N
W E
S

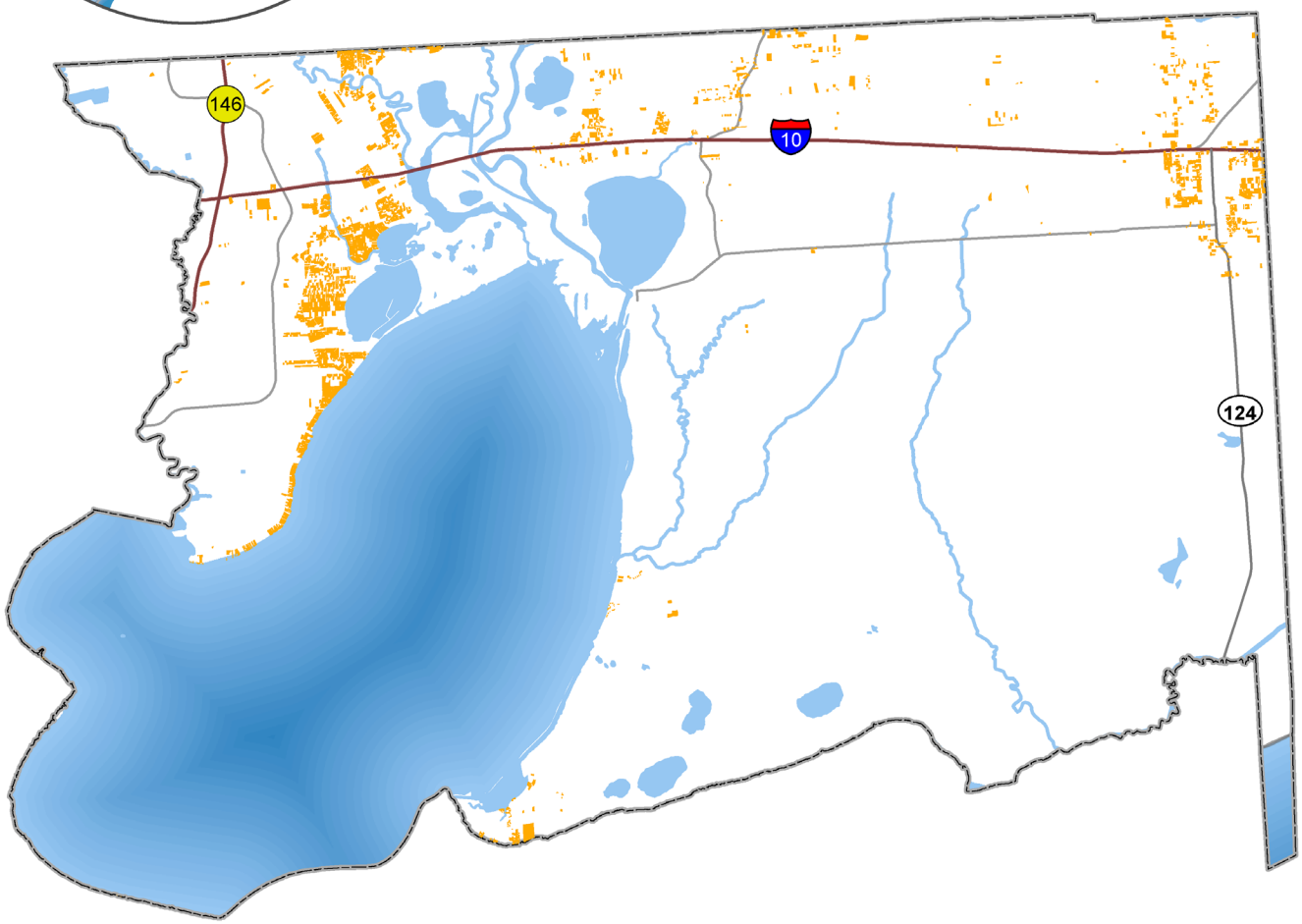
0 2.5 5 10 15 Miles

Houston-Galveston Area Council

MAP C-04B: Chambers County Potential Unpermitted OSSFs, 2021



Unpermitted OSSFs
6,202



Unpermitted OSSF
County Boundary
Major Highways
Other Roads
Major Rivers and Bayous
Waterbody

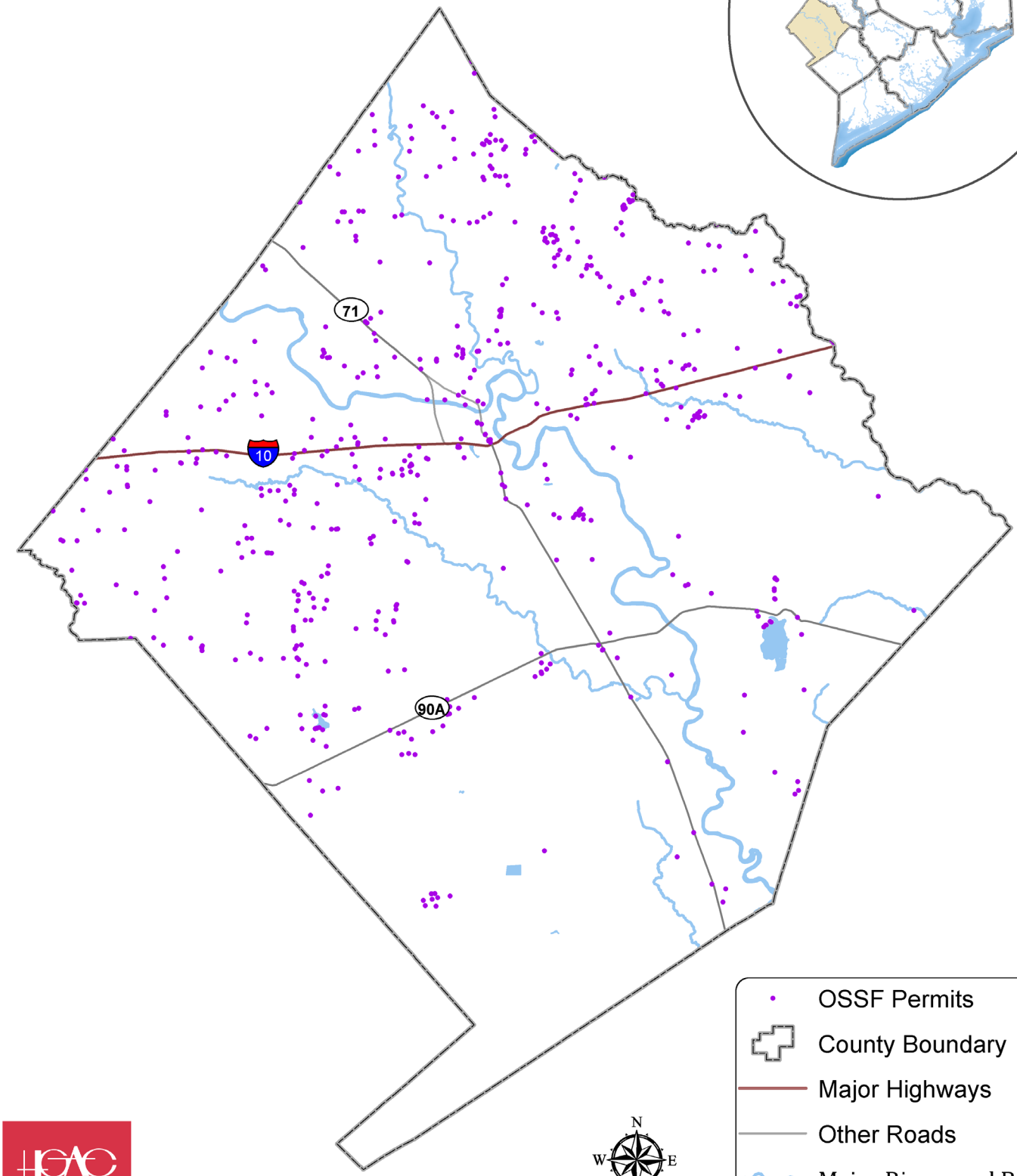
N
W
E
S

0 2.5 5 10 15 Miles

Houston-Galveston Area Council

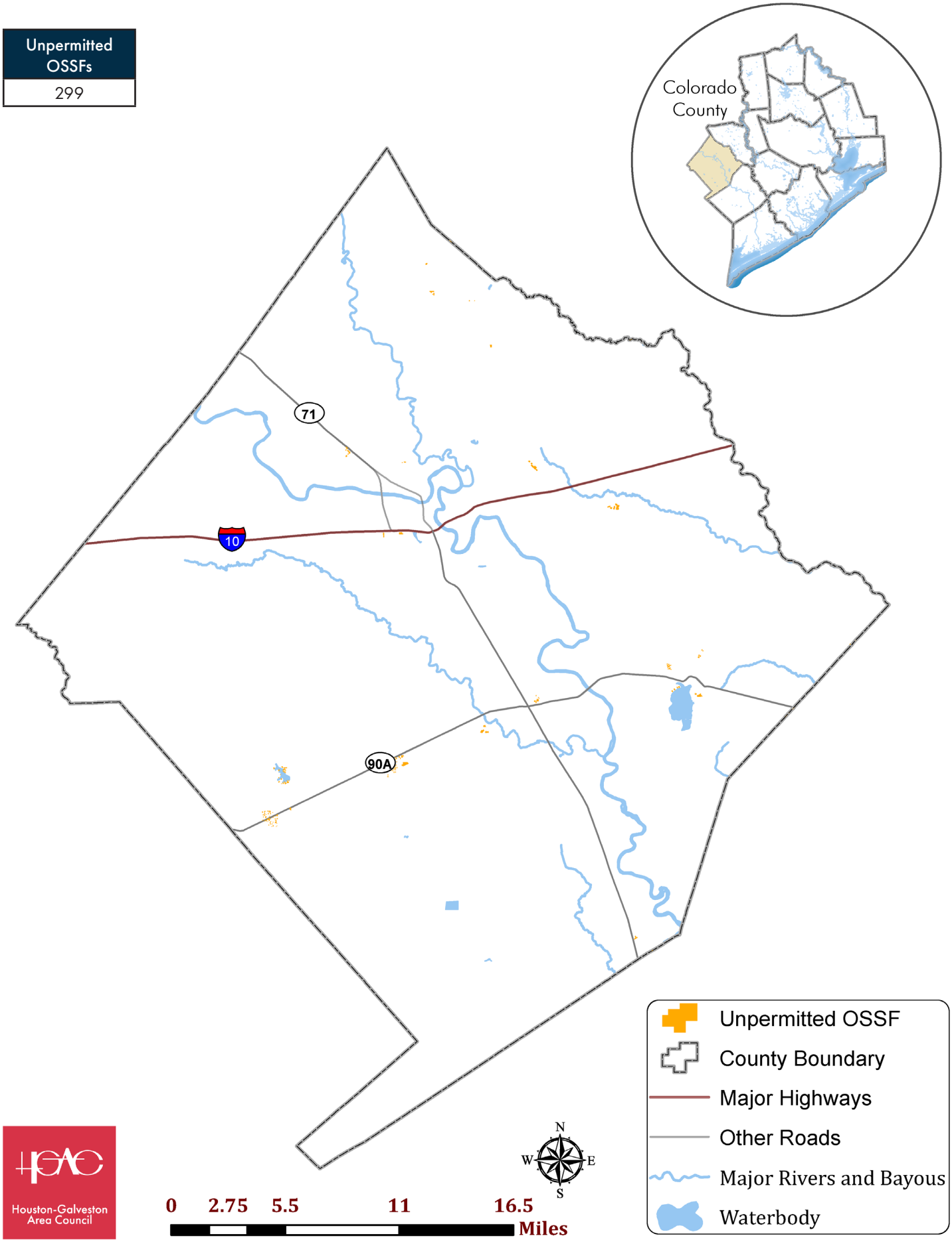
MAP C-05A: Colorado County Permitted OSSFs, 2021

Permitted OSSFs
595



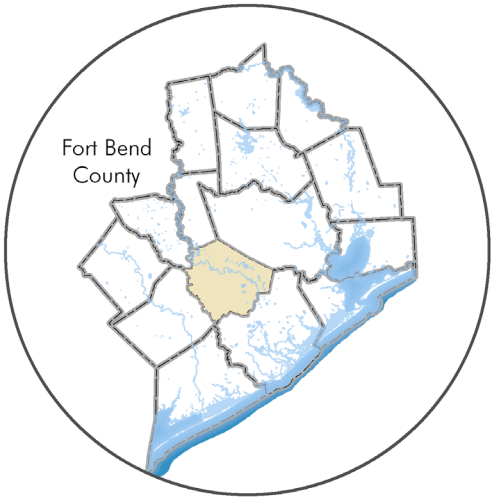
Houston-Galveston Area Council

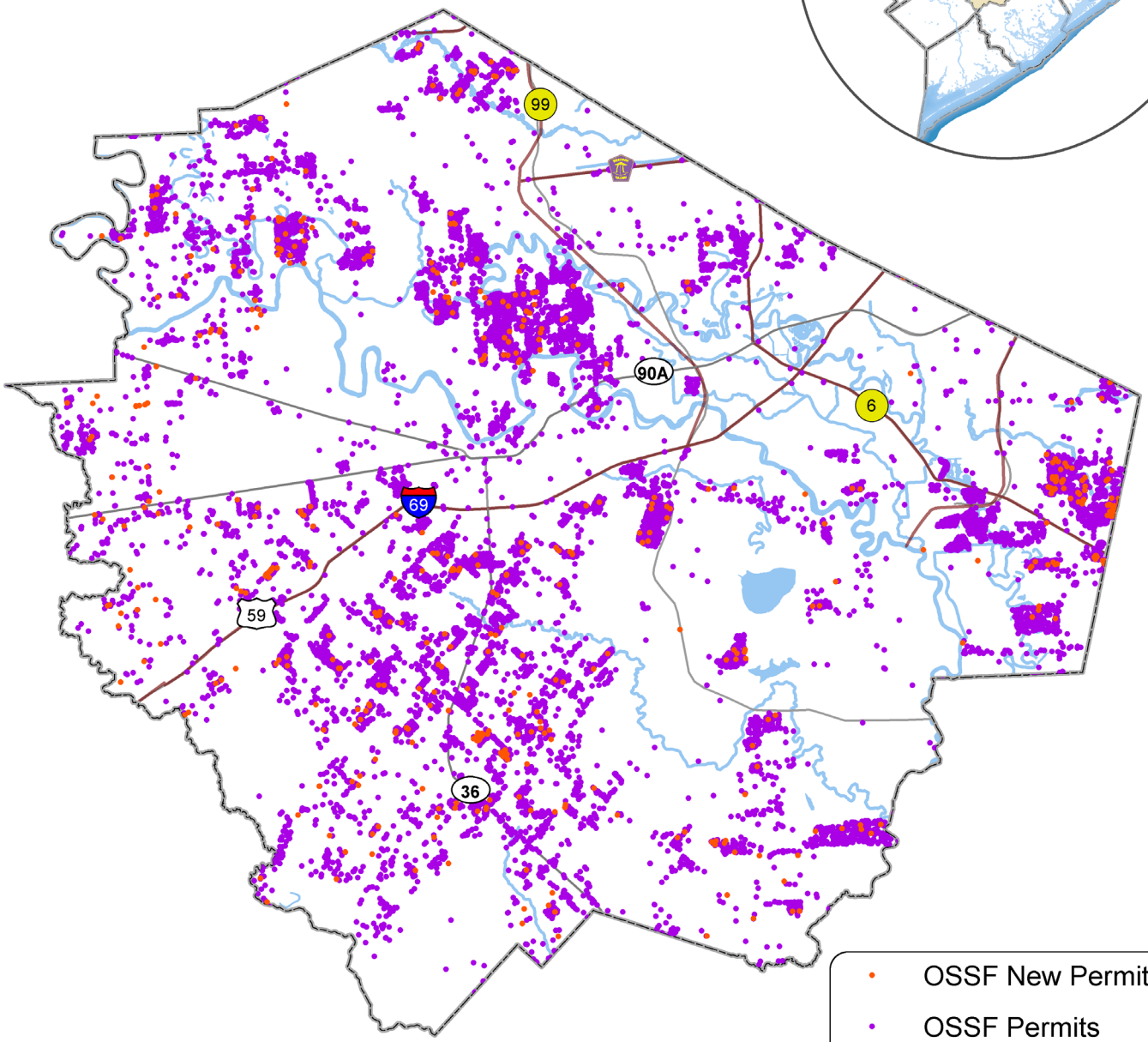
MAP C-05B: Colorado County Potential Unpermitted OSSFs, 2021



MAP C-06A: Fort Bend County Permitted OSSFs, 2021

Permitted OSSFs
14,062





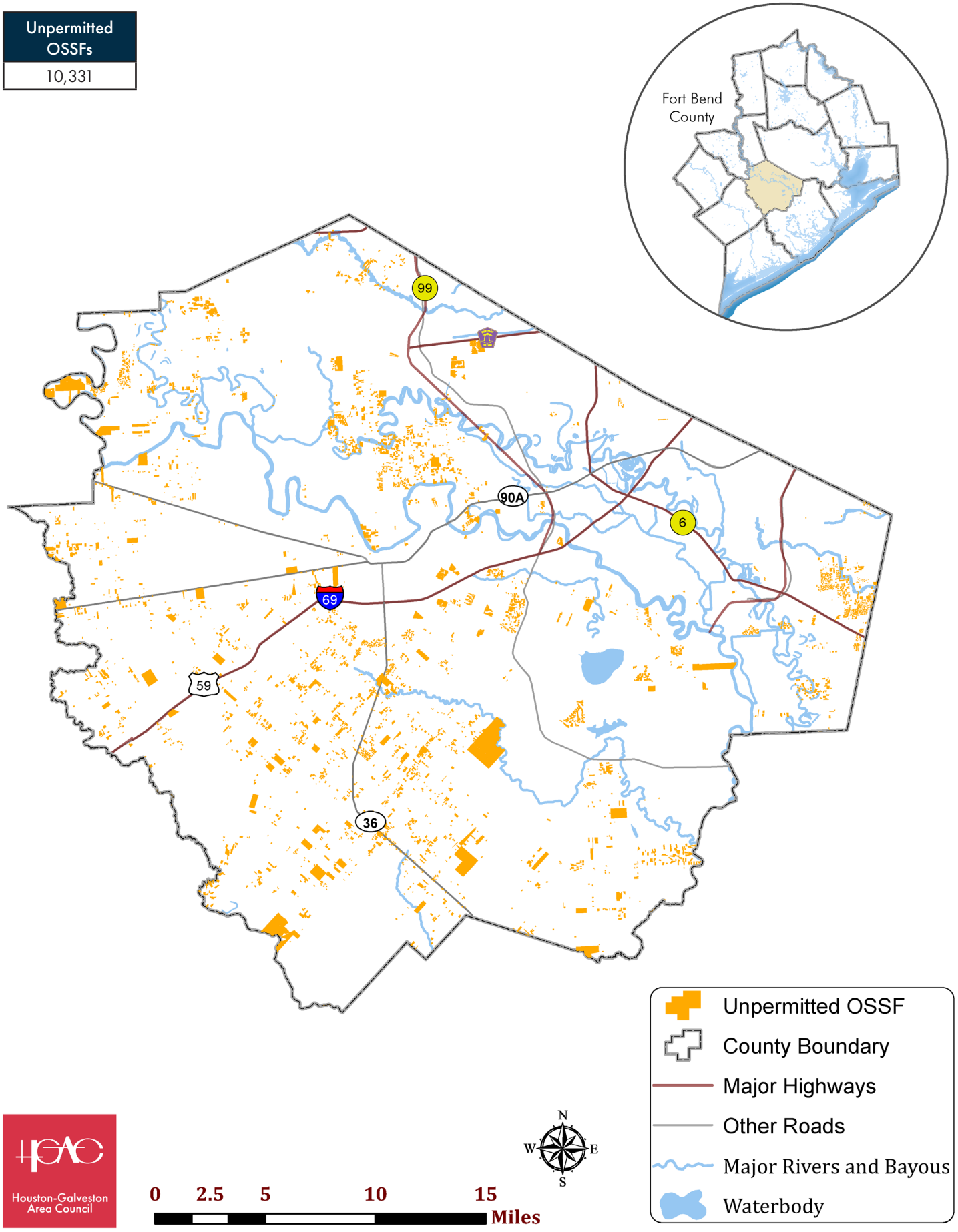
- OSSF New Permits
- OSSF Permits
- County Boundary
- Major Highways
- Other Roads
- Major Rivers and Bayous
- Waterbody

Houston-Galveston Area Council

N
W E
S

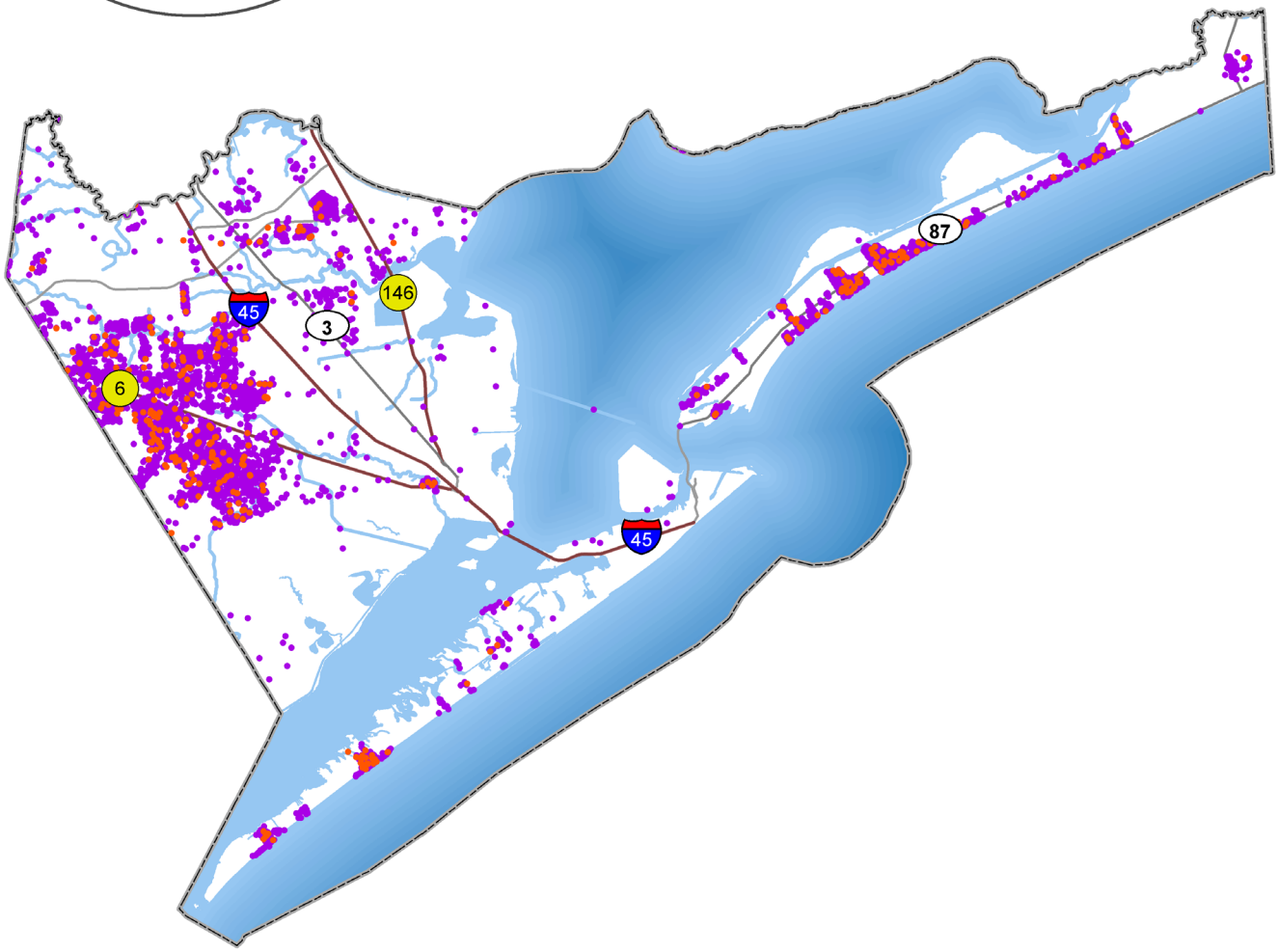
0 2.5 5 10 15 Miles

MAP C-06B: Fort Bend County Potential Unpermitted OSSFs, 2021



MAP C-07A: Galveston County Permitted OSSFs, 2021

Permitted OSSFs
6,694



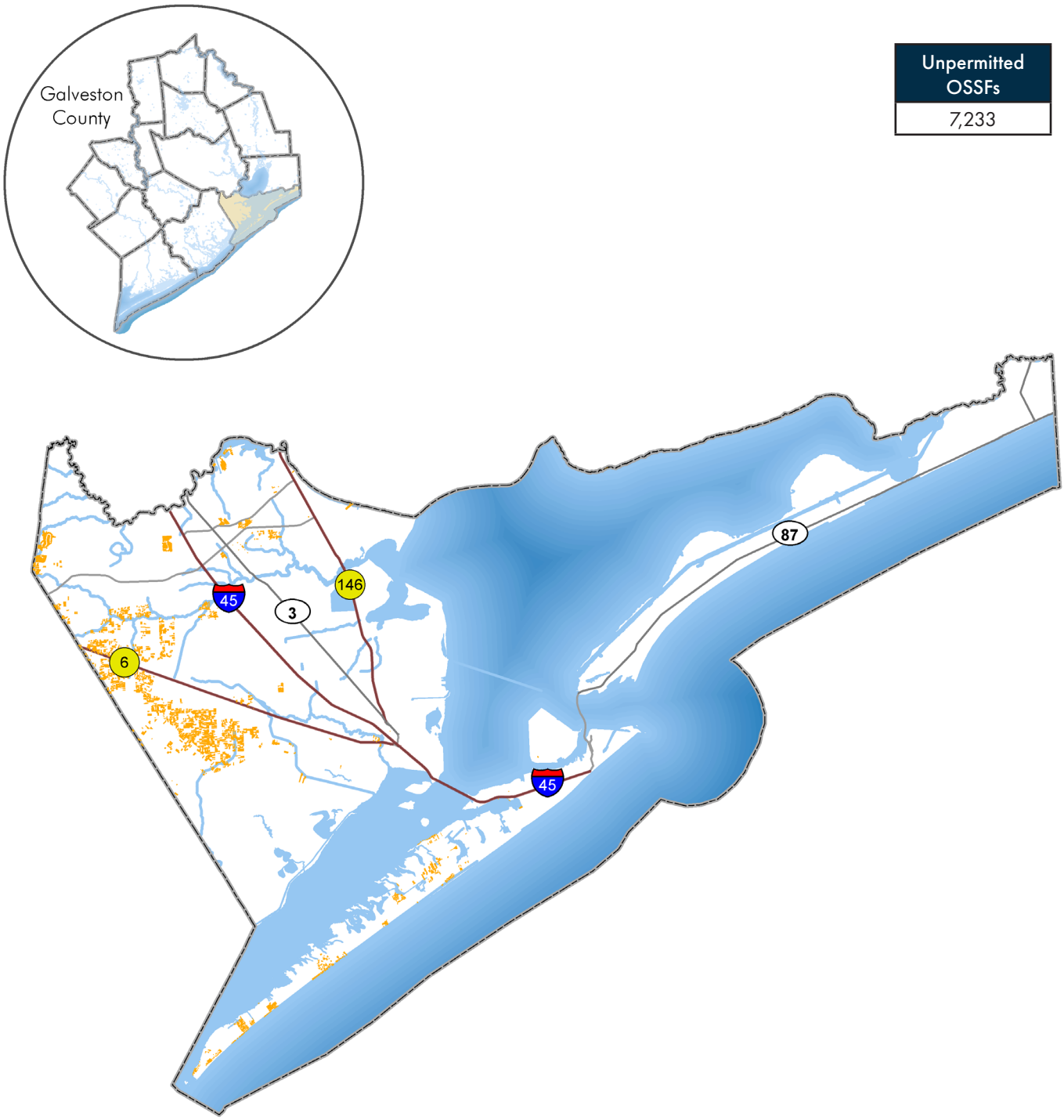
- OSSF New Permits
- OSSF Permits
- County Boundary
- Major Highways
- Other Roads
- Major Rivers and Bayous
- Waterbody

Houston-Galveston Area Council

N
W E
S

0 3.5 7 14 21 Miles

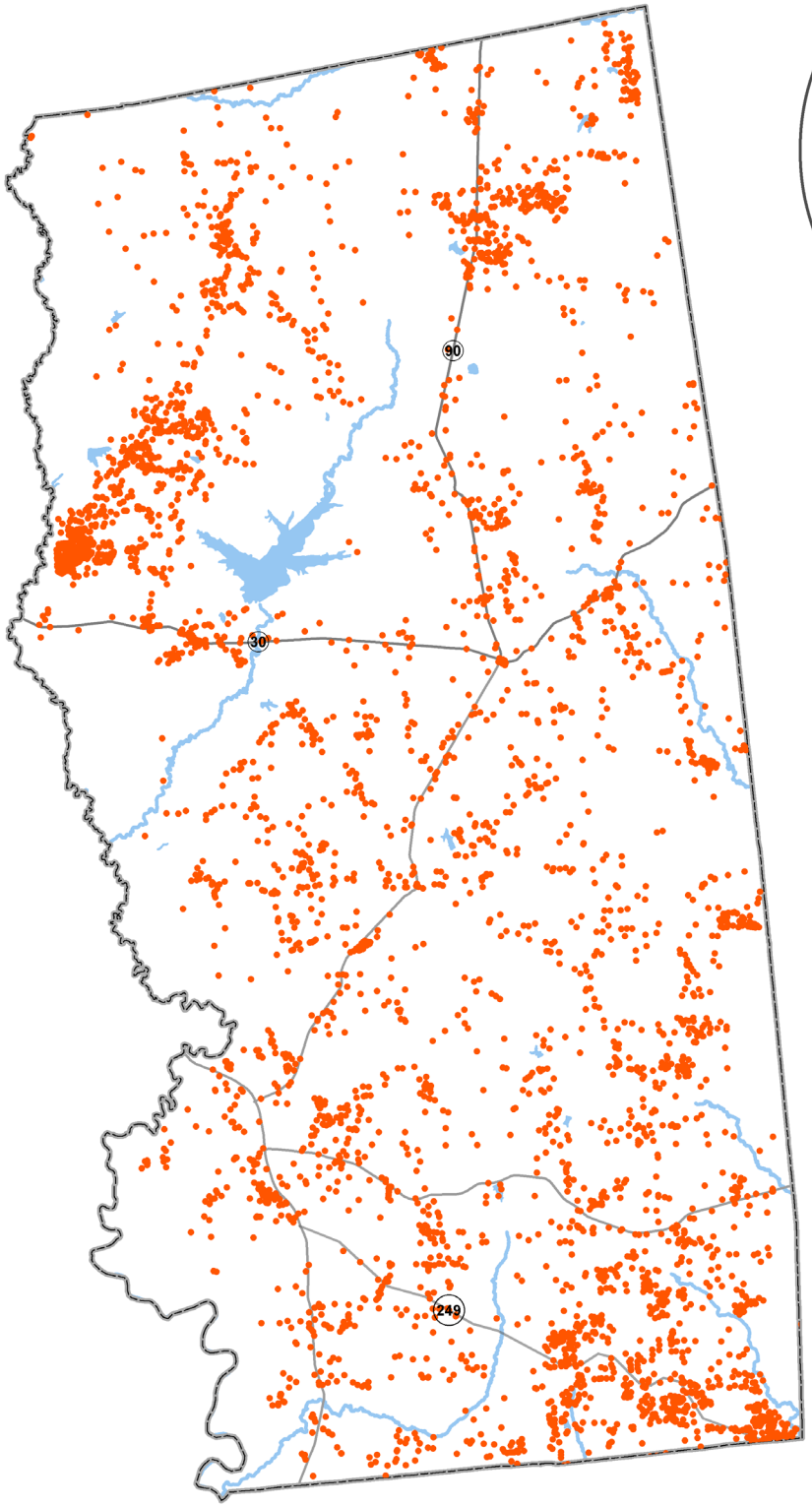
MAP C-07B: Galveston County Potential Unpermitted OSSFs, 2021



Houston-Galveston Area Council

MAP C-08A: Grimes County Permitted OSSFs, 2021

Permitted OSSFs
4,363



OSSF New Permits
County Boundary
Major Highways
Other Roads
Major Rivers and Bayous
Waterbody

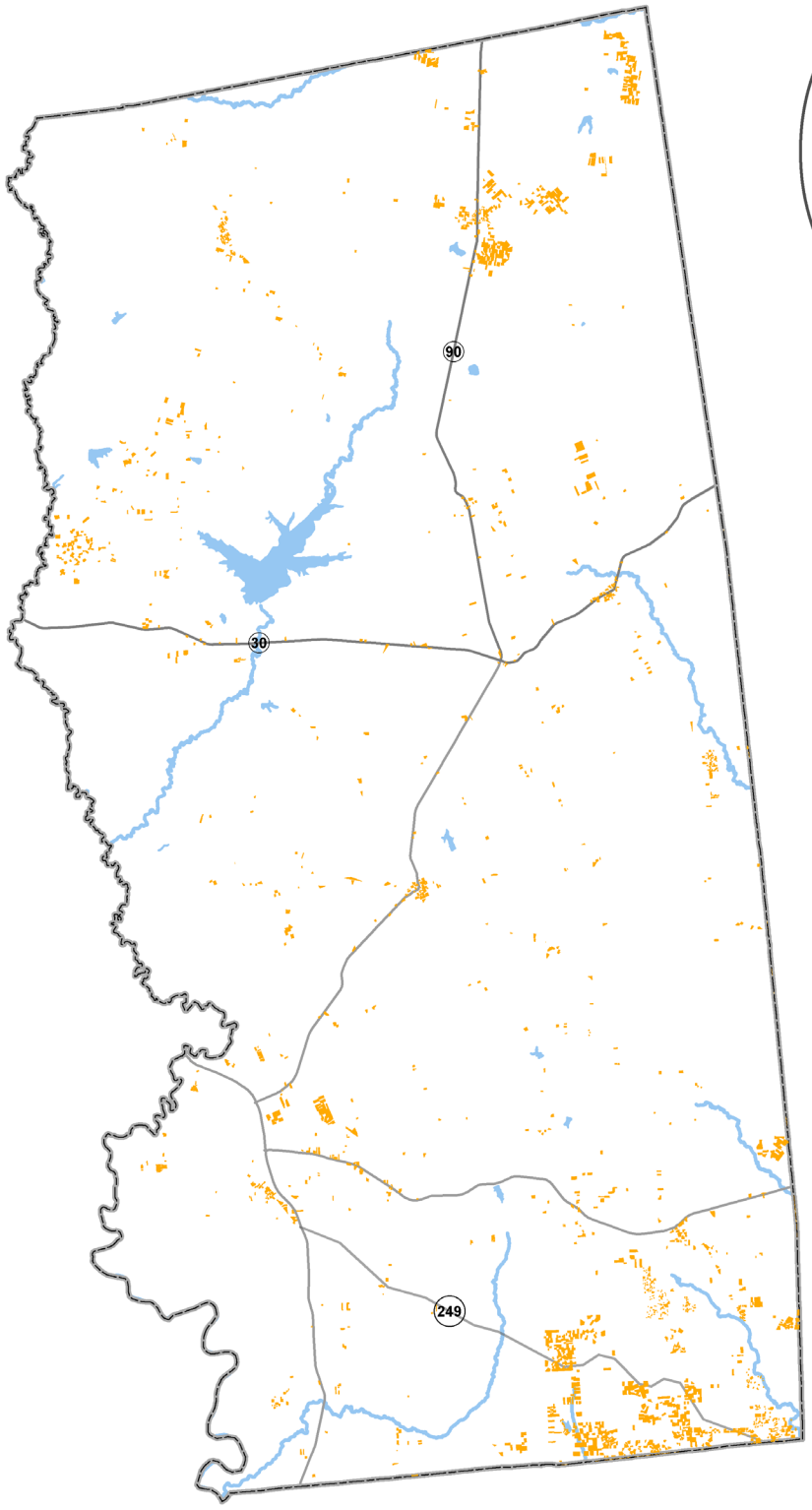
N
W
E
S

0 2.5 5 10 15
Miles

Houston-Galveston Area Council

MAP C-08B: Grimes County Potential Unpermitted OSSFs, 2021

Unpermitted OSSFs
4,005



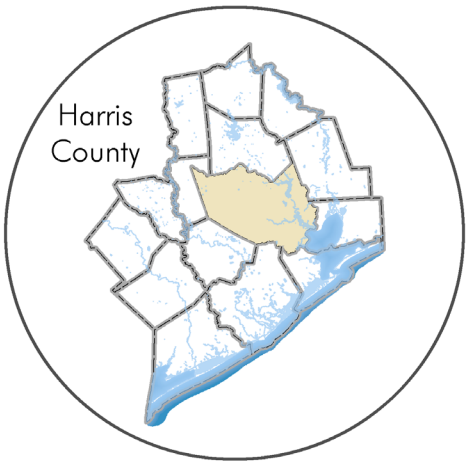
- Unpermitted OSSF
- County Boundary
- Major Highways
- Other Roads
- Major Rivers and Bayous
- Waterbody

N
W E
S

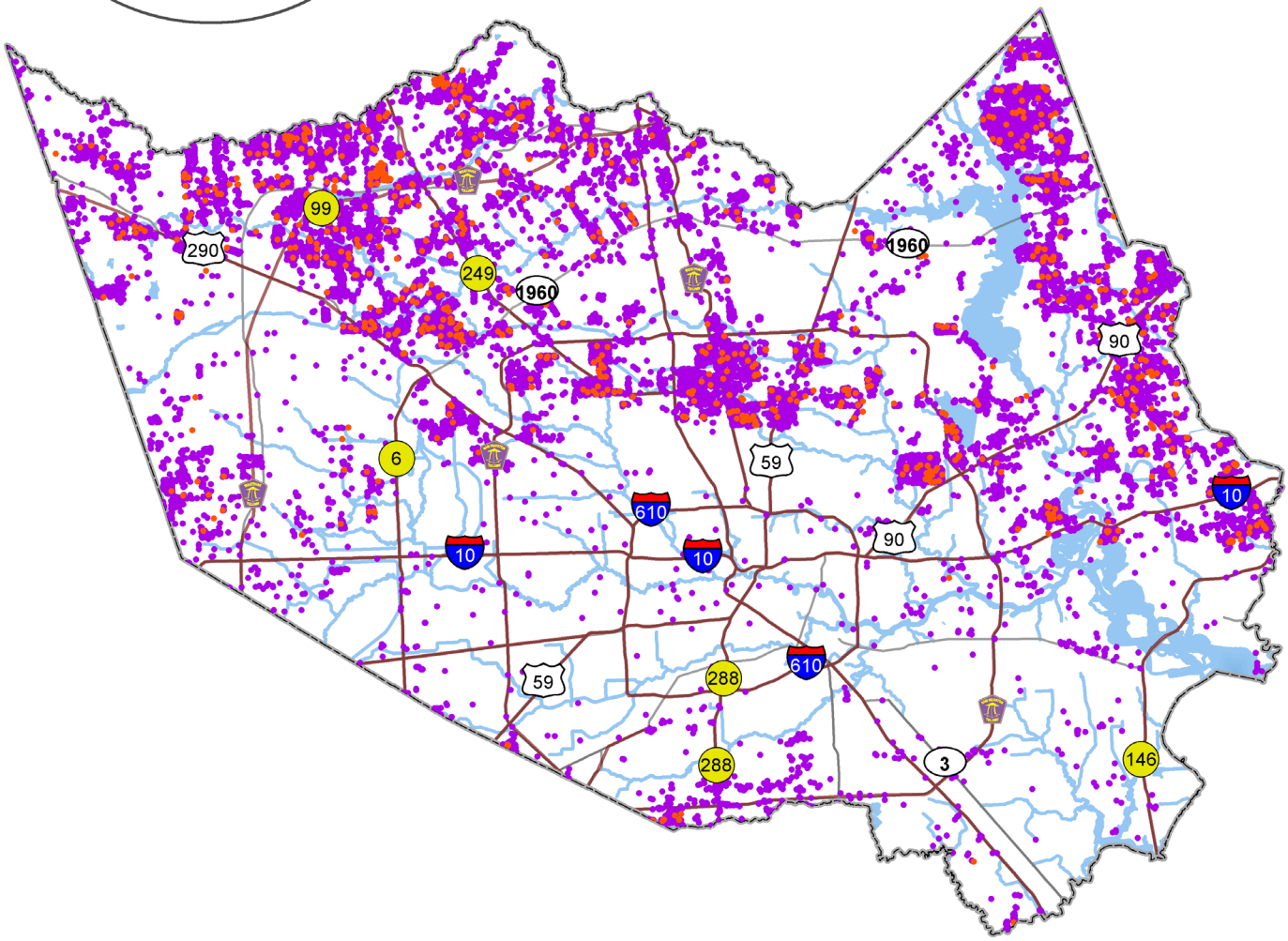
0 2.5 5 10 15 Miles

Houston-Galveston Area Council

MAP C-09A: Harris County Permitted OSSFs, 2021



Permitted OSSFs
24,227



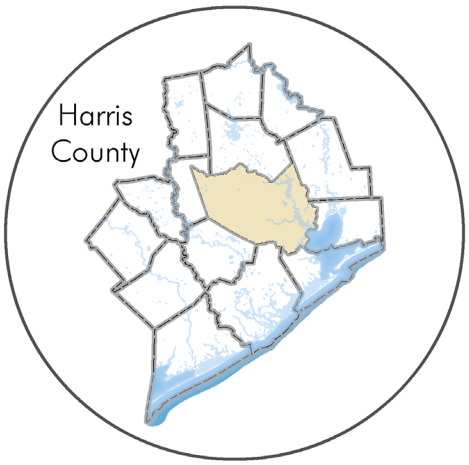
- OSSF New Permits
- OSSF Permits
- County Boundary
- Major Highways
- Other Roads
- Major Rivers and Bayous
- Waterbody

Houston-Galveston Area Council

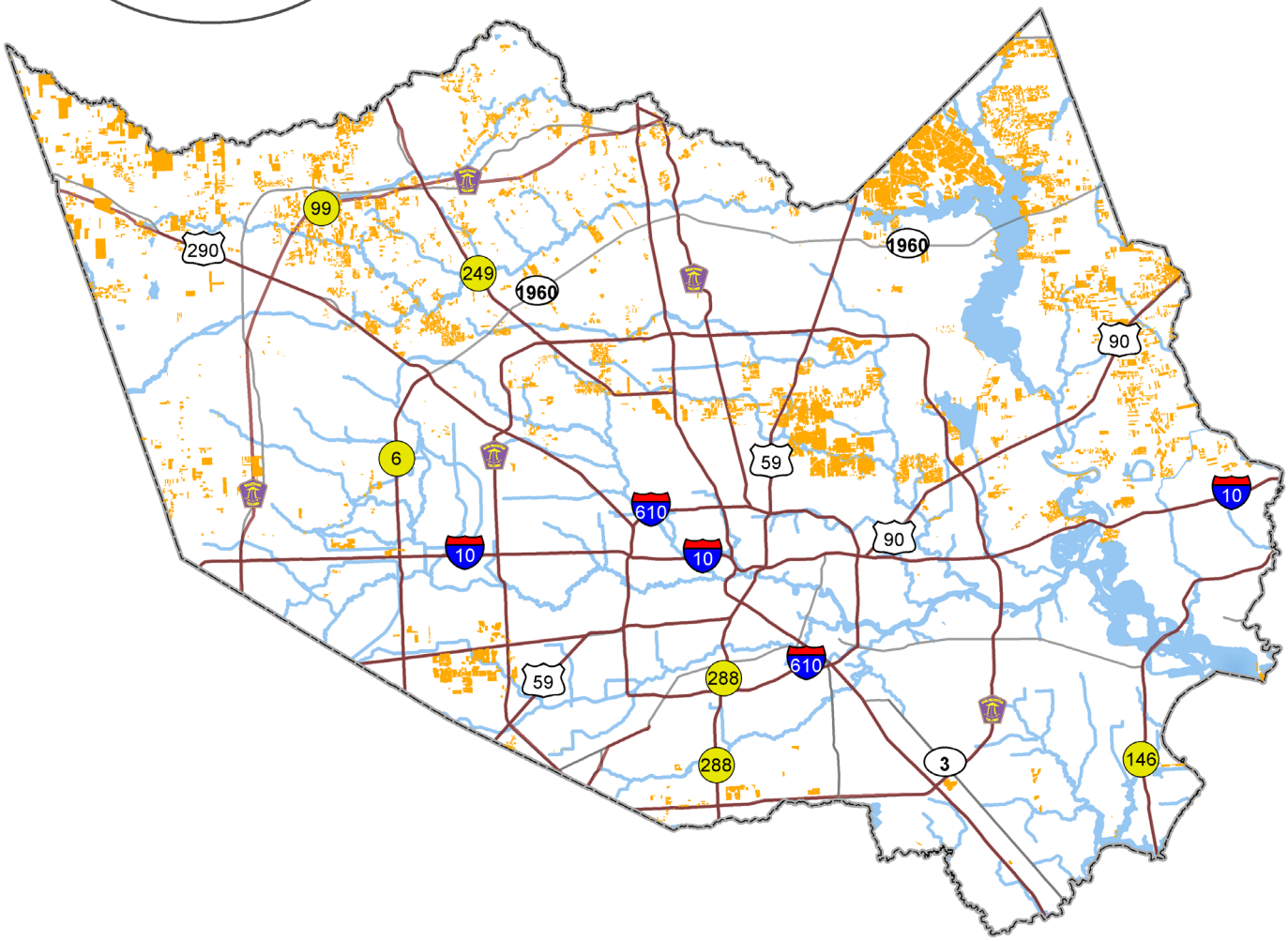
N W E S

0 4.25 8.5 17 25.5 Miles

MAP C-09B: Harris County Potential Unpermitted OSSFs, 2021



Unpermitted OSSFs
86,328



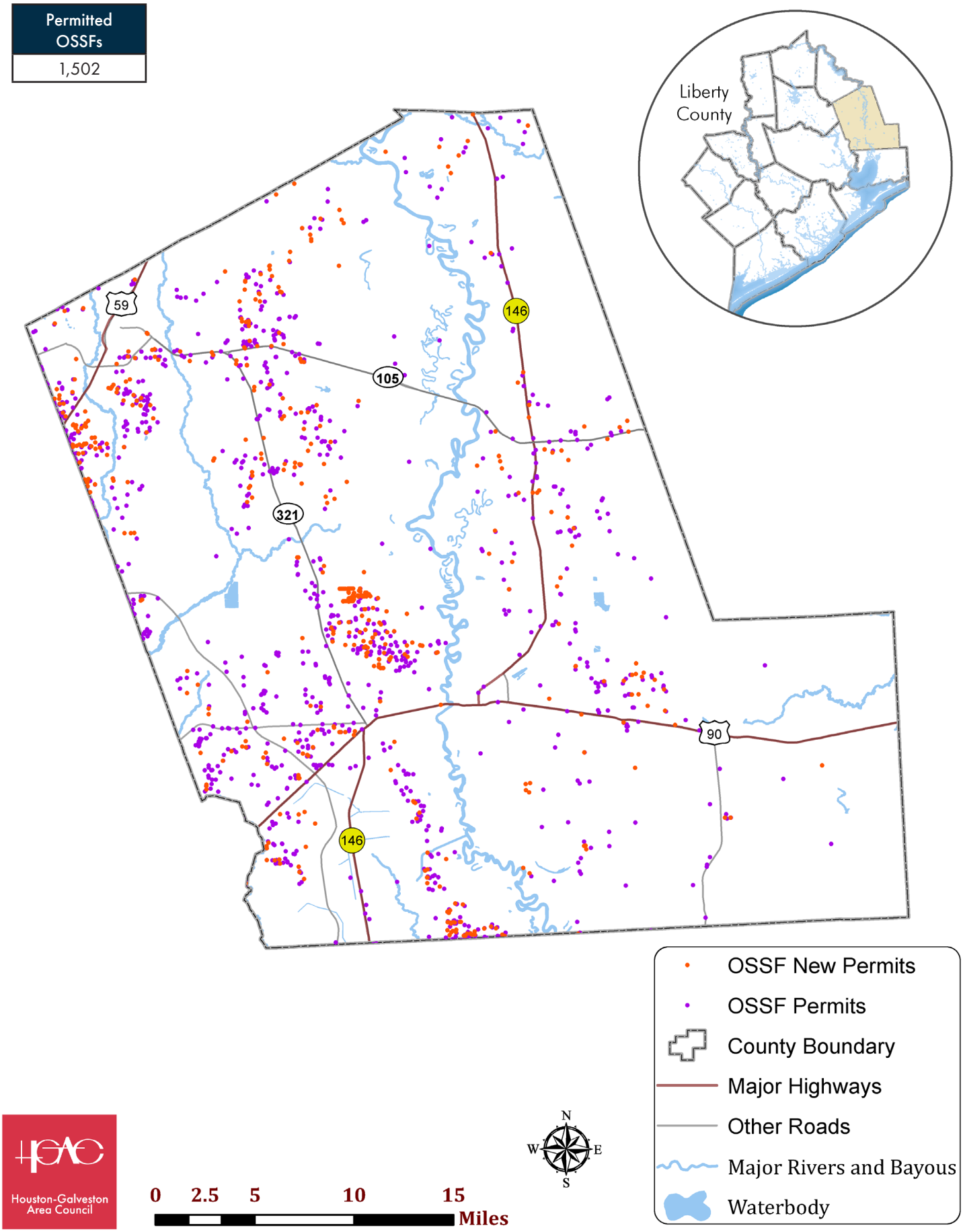
- Unpermitted OSSF
- County Boundary
- Major Highways
- Other Roads
- Major Rivers and Bayous
- Waterbody

N
W E
S

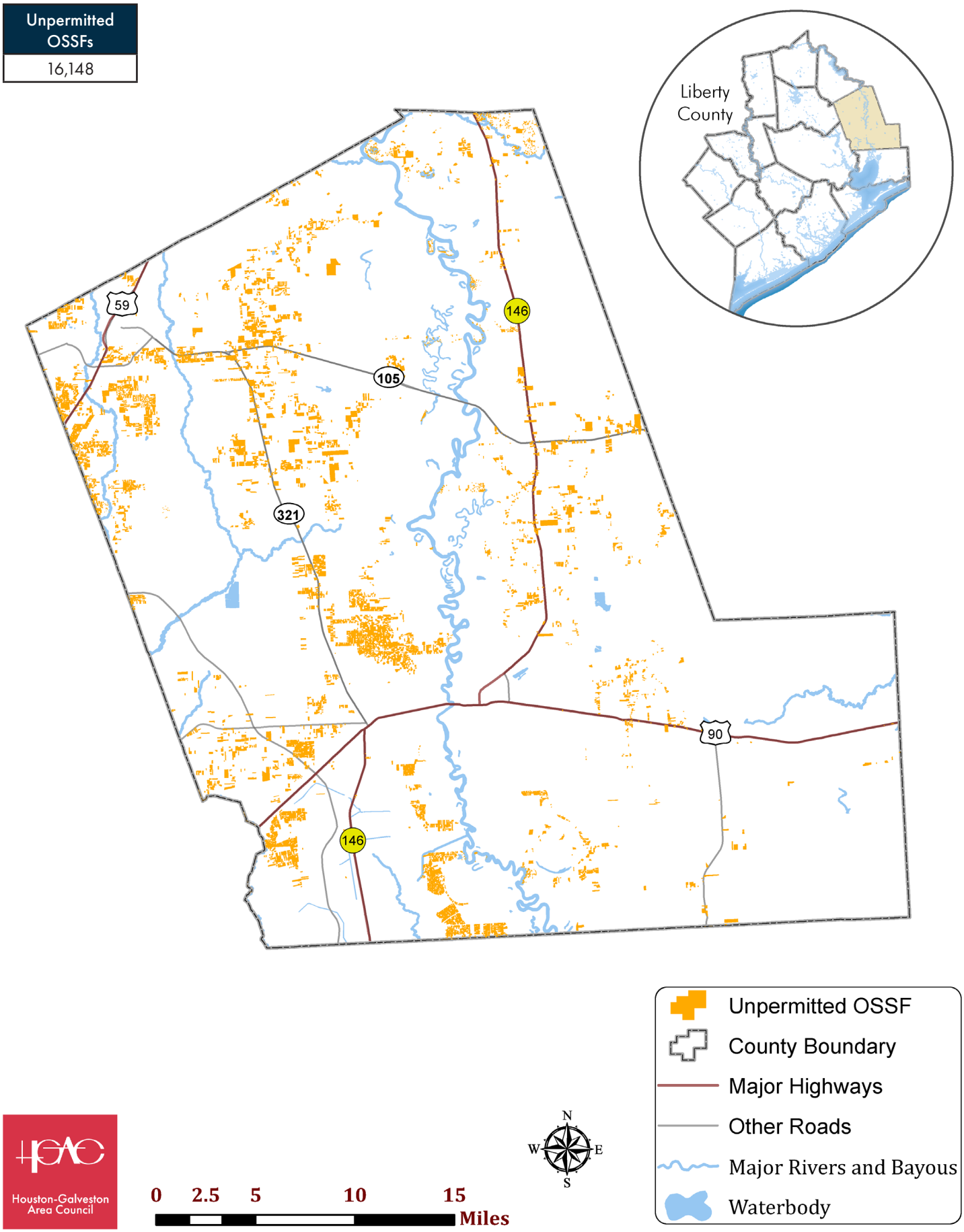
0 4.25 8.5 17 25.5 Miles

Houston-Galveston Area Council

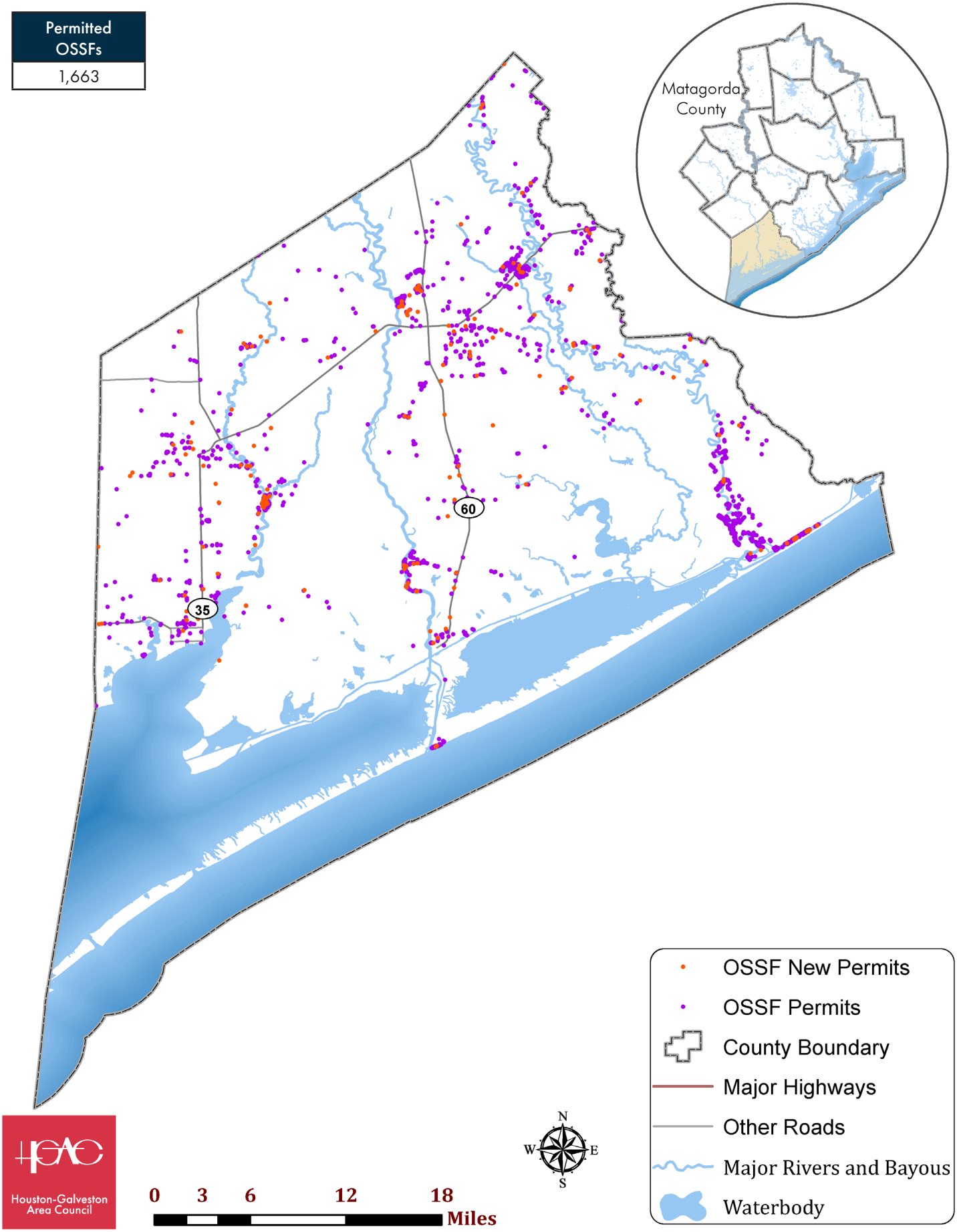
MAP C-10A: Liberty County Permitted OSSFs, 2021



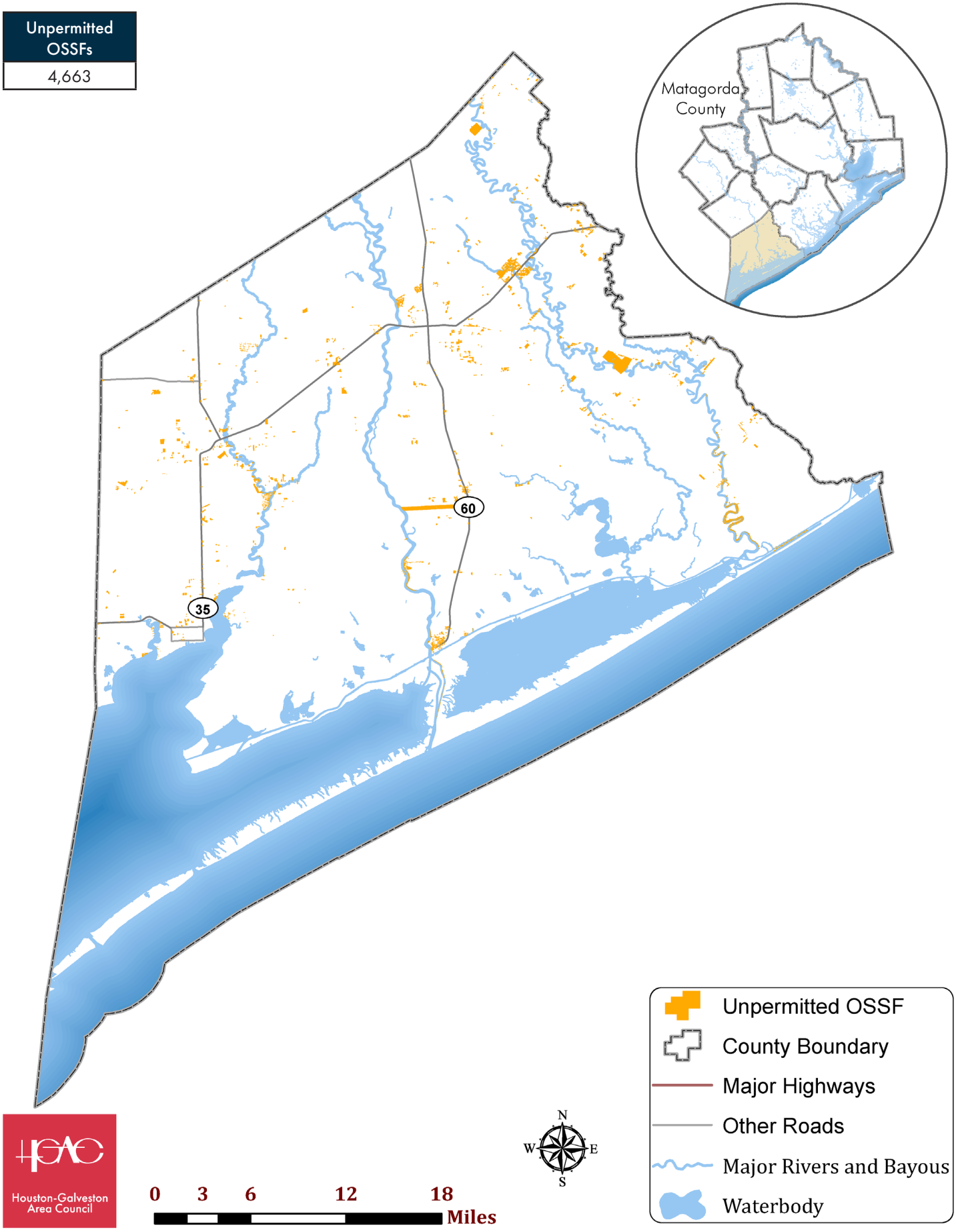
MAP C-10B: Liberty County Potential Unpermitted OSSFs, 2021



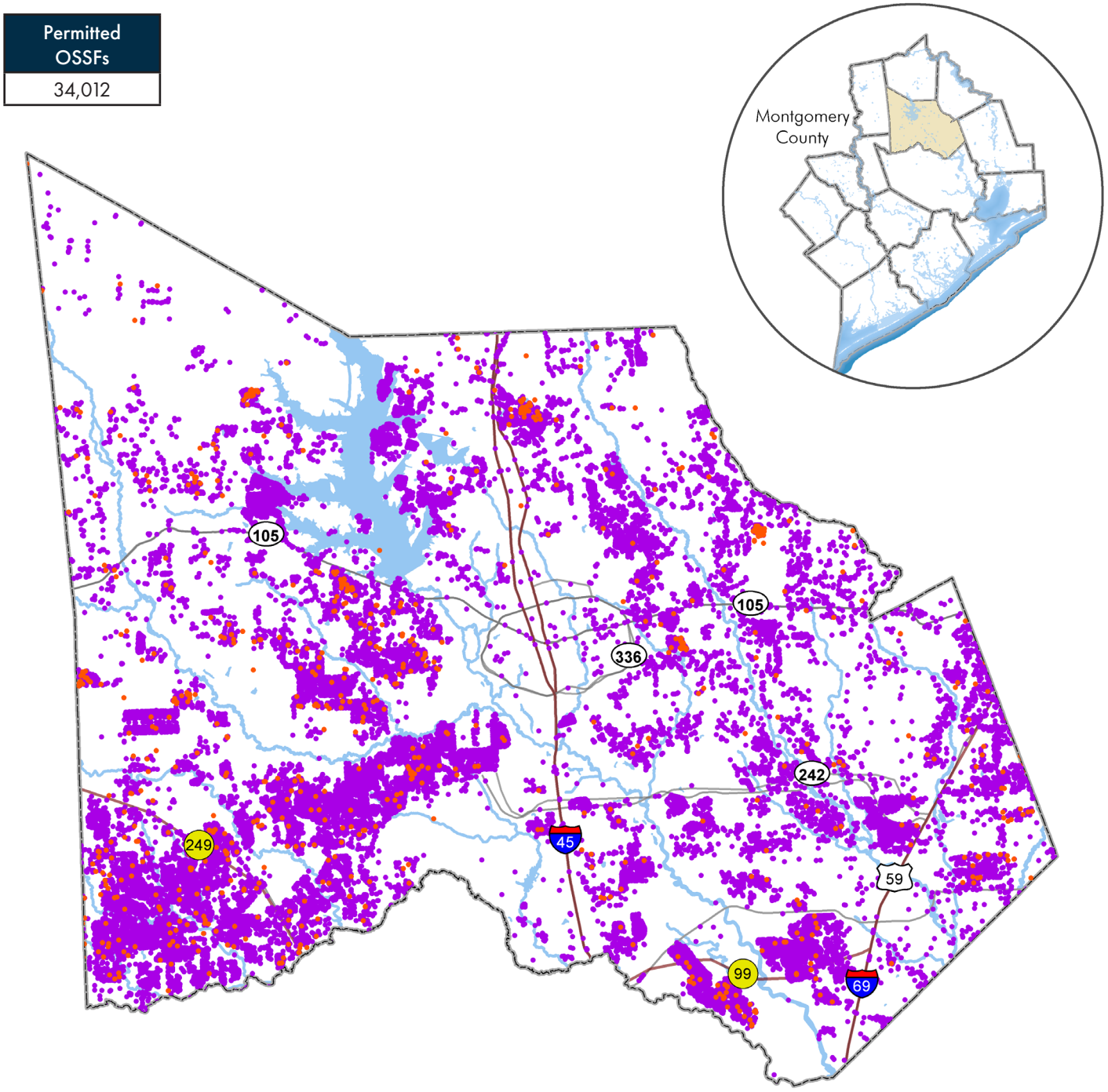
MAP C-11A: Matagorda County Permitted OSSFs, 2021



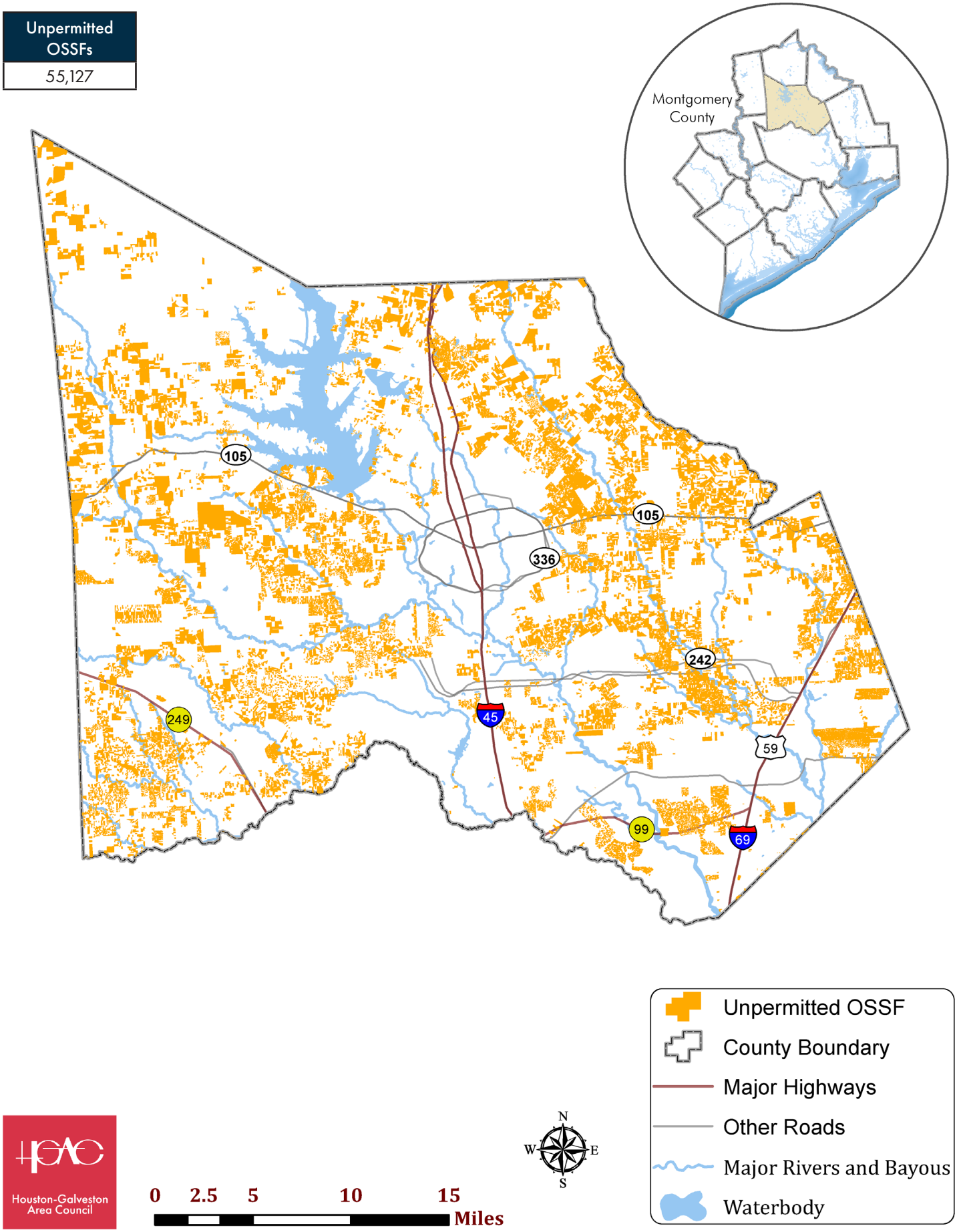
MAP C-11B: Matagorda County Potential Unpermitted OSSFs, 2021



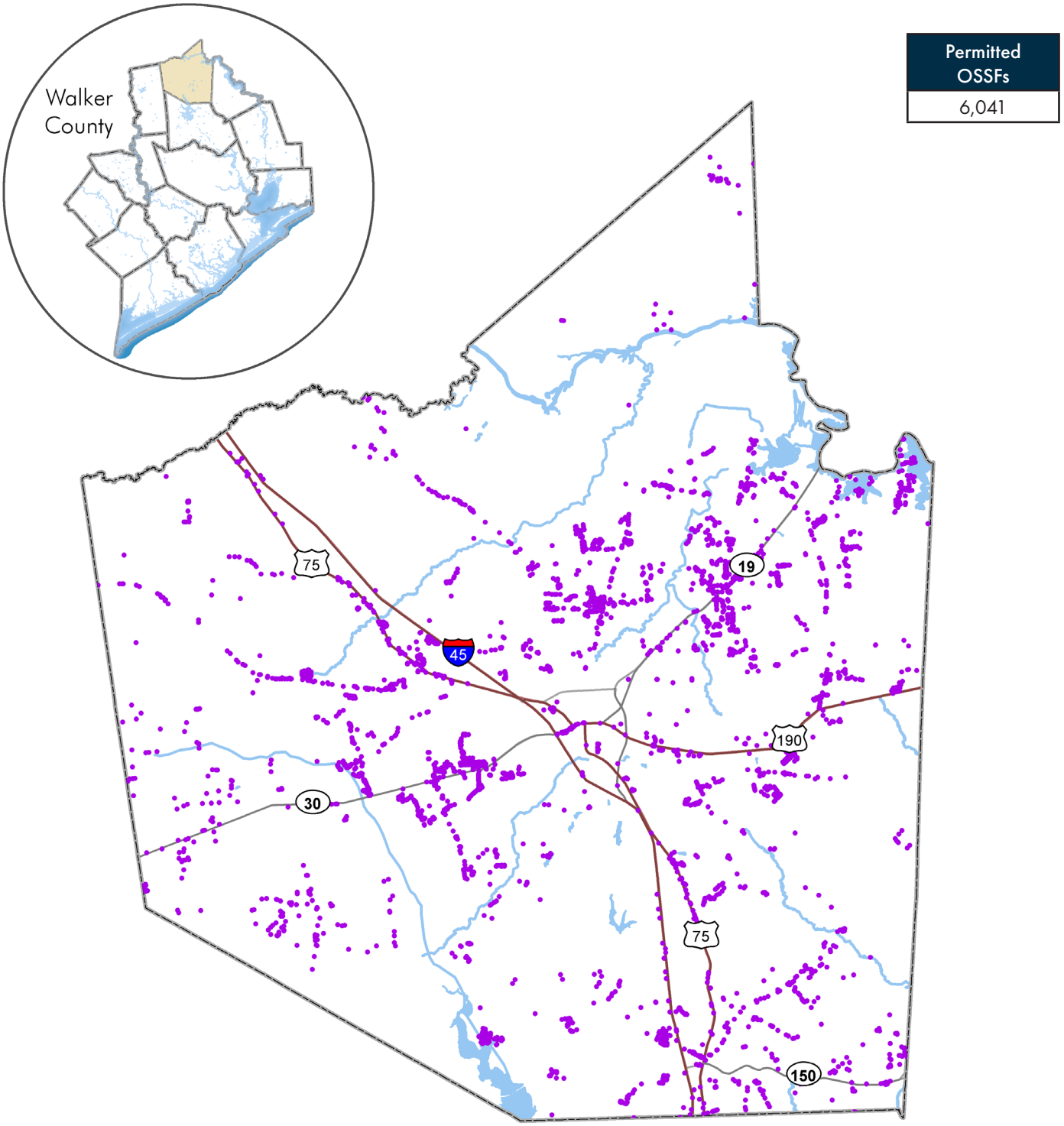
MAP C-12A: Montgomery County Permitted OSSFs, 2021



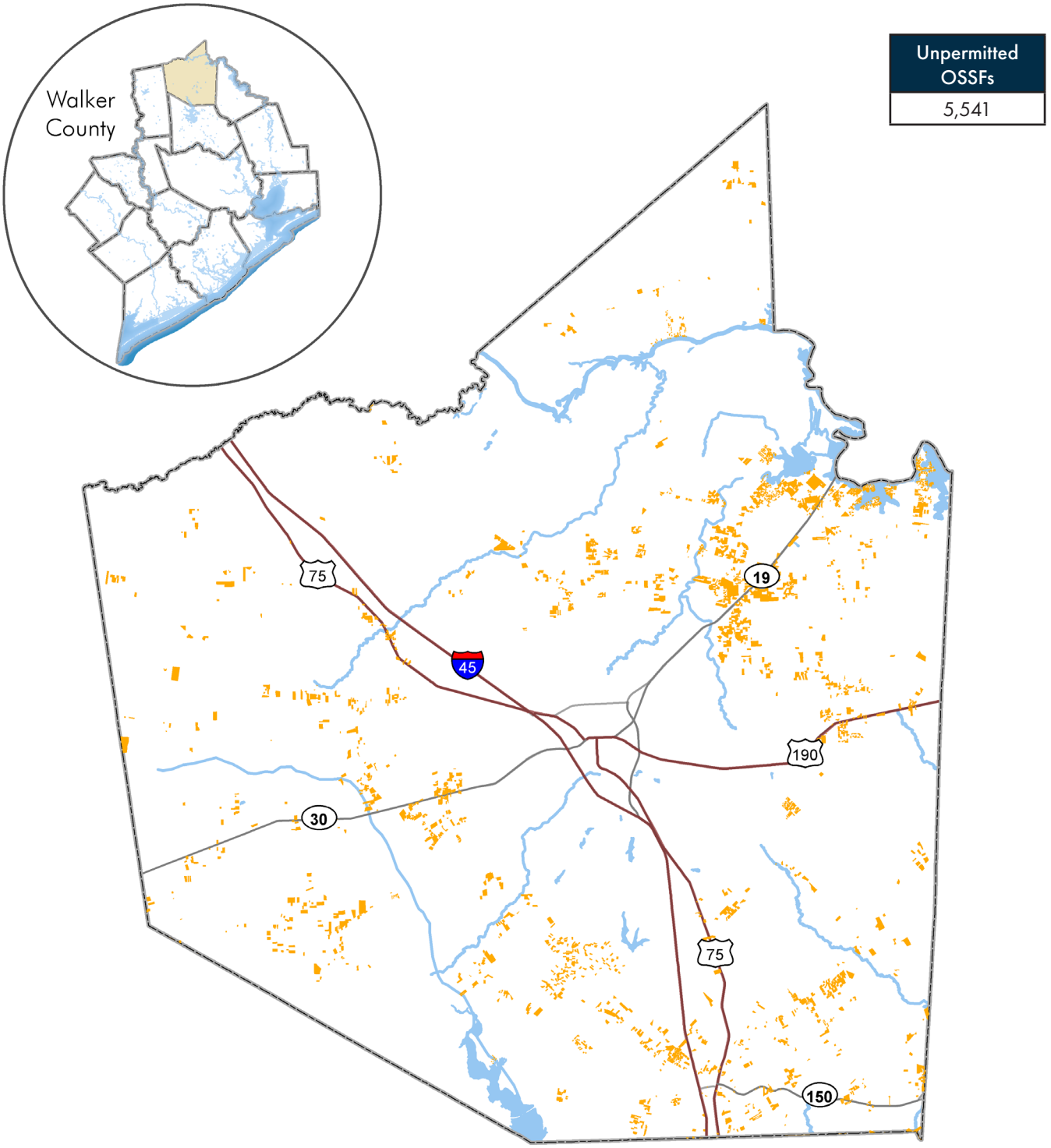
MAP C-12B: Montgomery County Potential Unpermitted OSSFs, 2021



MAP C-13A: Walker County Permitted OSSFs, 2021

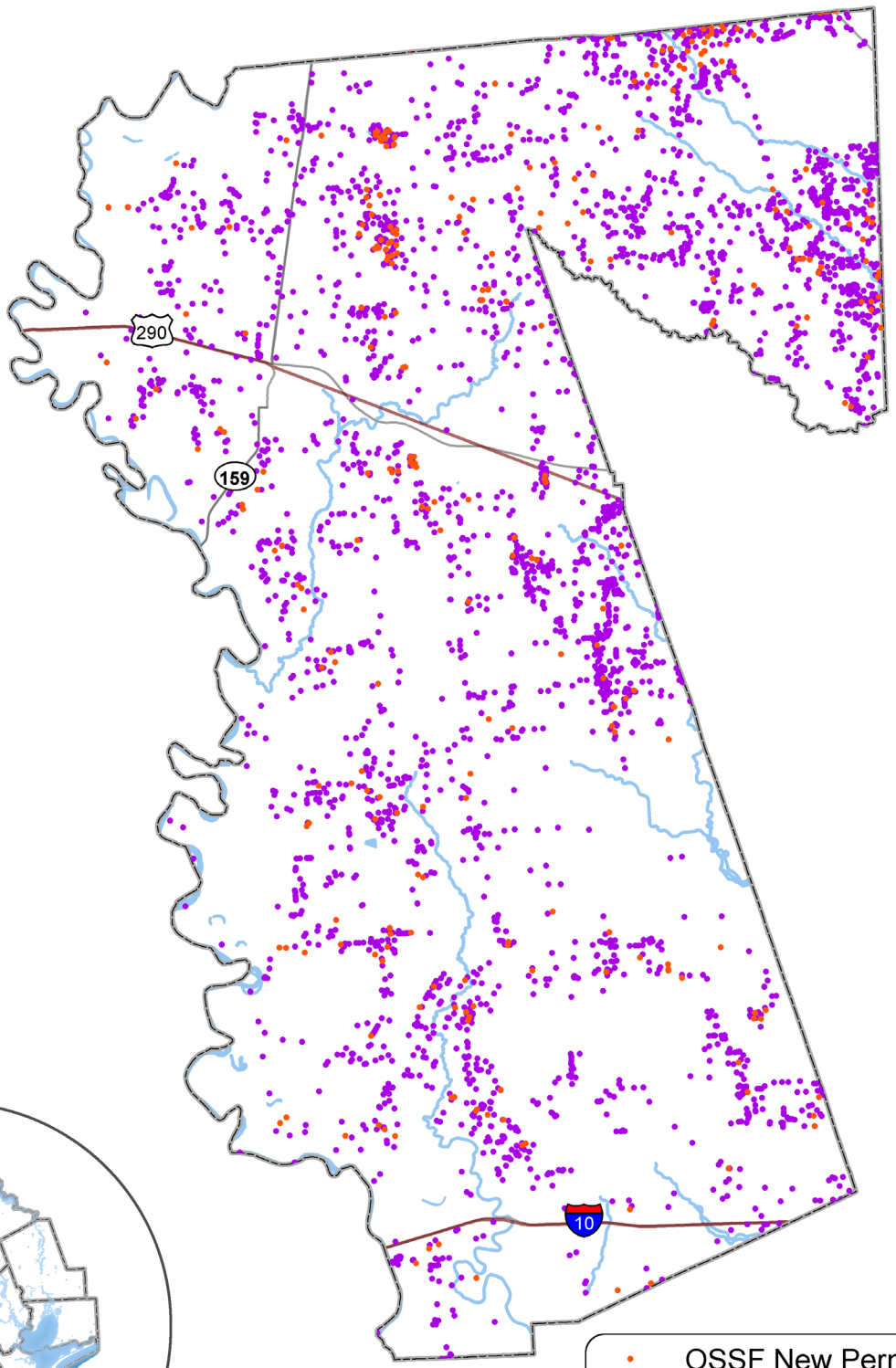


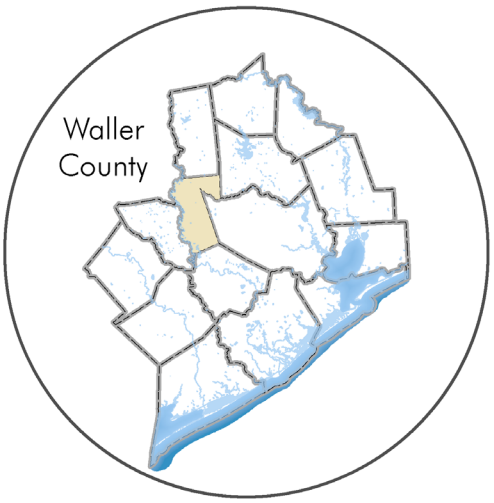
MAP C-13B: Walker County Potential Unpermitted OSSFs, 2021



MAP C-14A: Waller County Permitted OSSFs, 2021

Permitted OSSFs
4,655





- OSSF New Permits
- OSSF Permits
- County Boundary
- Major Highways
- Other Roads
- Major Rivers and Bayous
- Waterbody

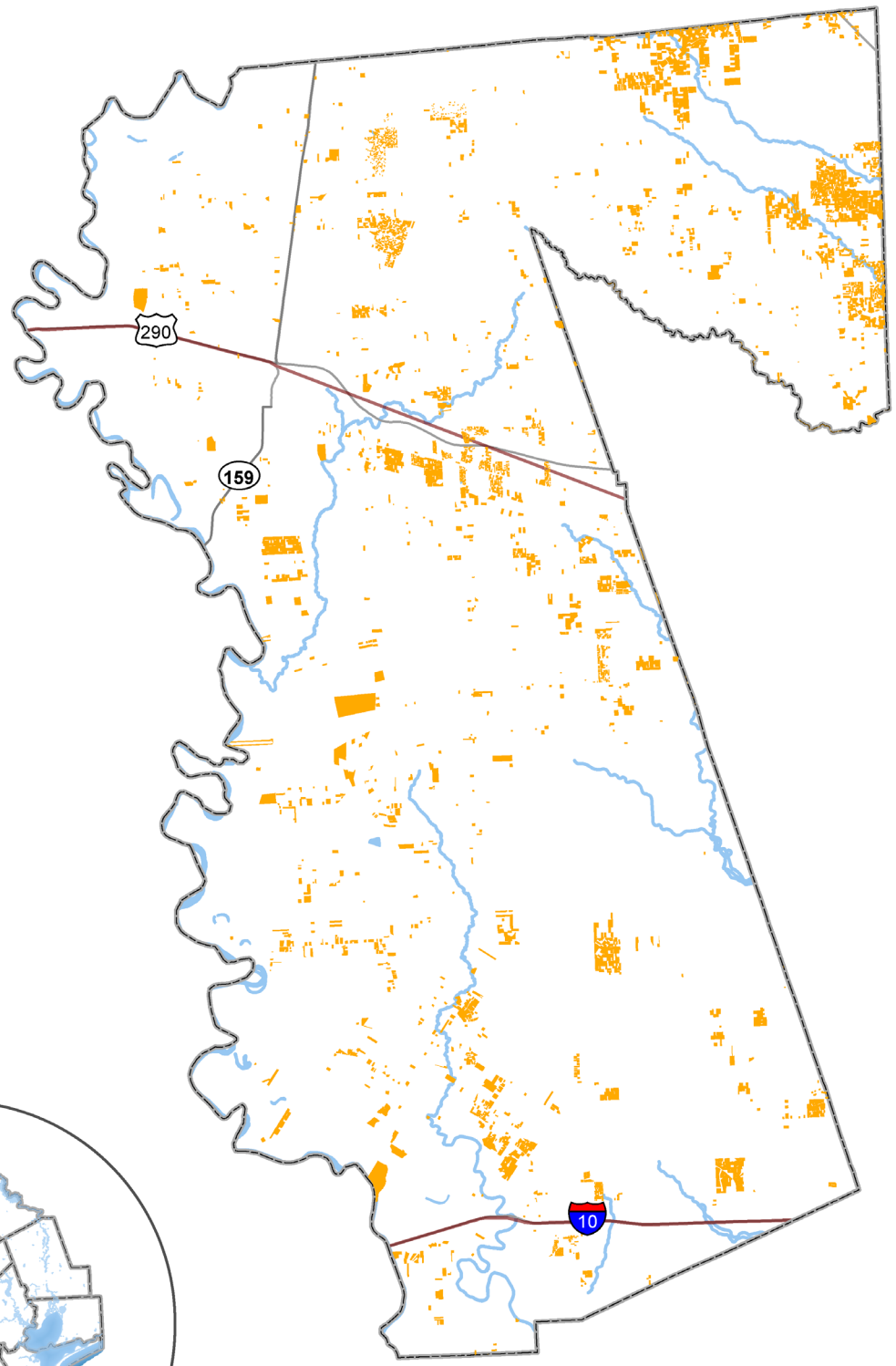
N
W E
S

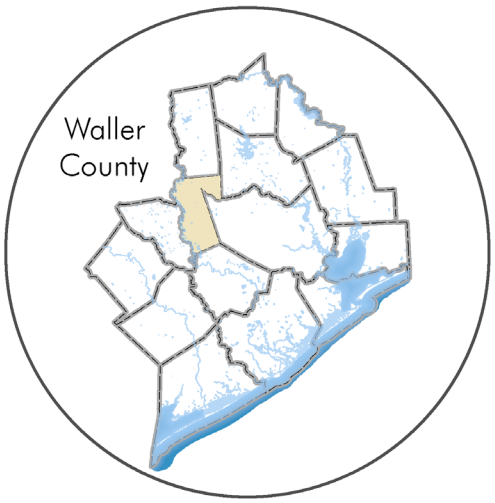
0 2 4 8 12
Miles

Houston-Galveston Area Council

MAP C-14B: Waller County Potential Unpermitted OSSFs, 2021

Unpermitted OSSFs
8,645





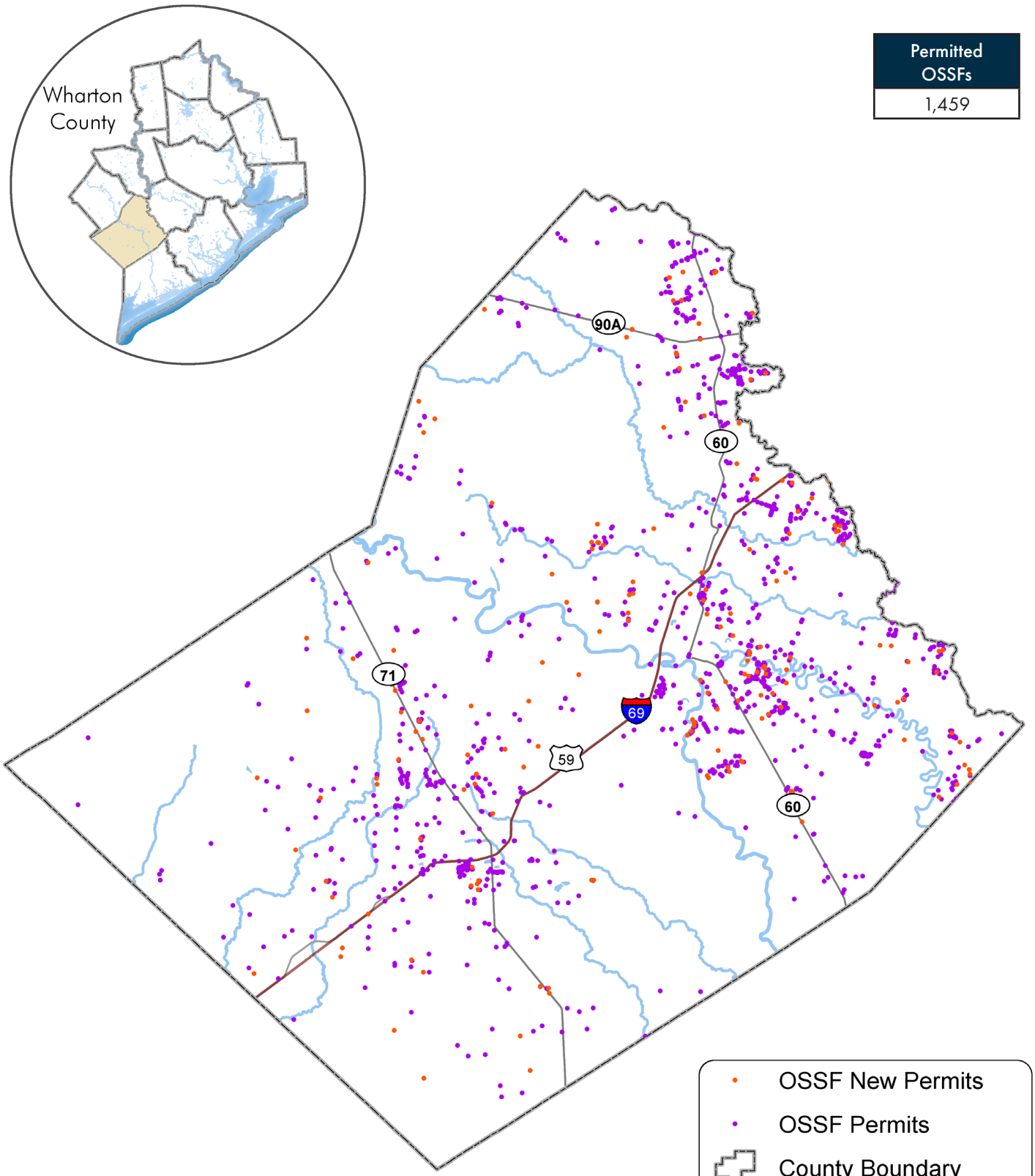
Houston-Galveston Area Council

N
W
E
S

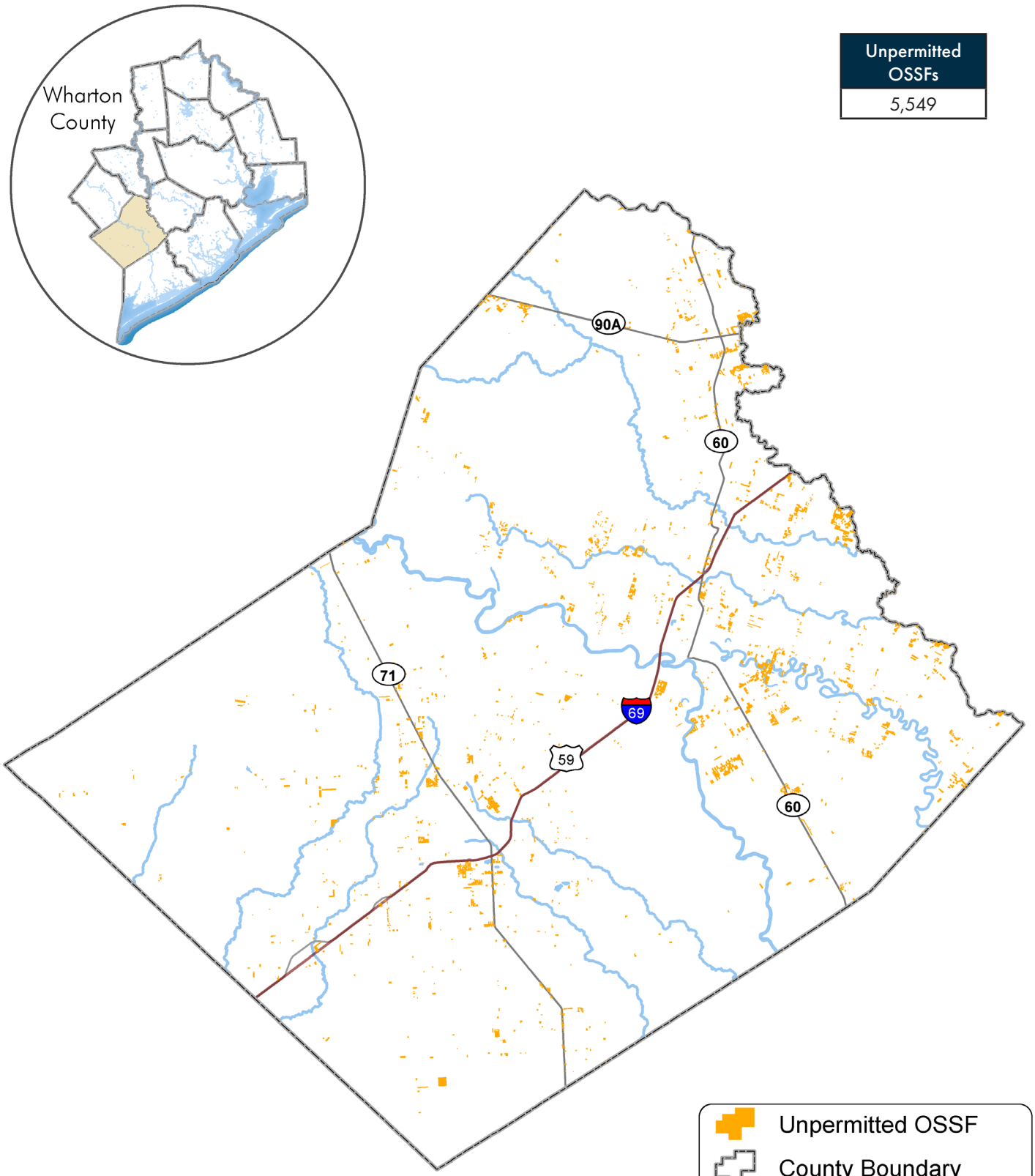
0 2 4 8 12 Miles

- Unpermitted OSSF
- County Boundary
- Major Highways
- Other Roads
- Major Rivers and Bayous
- Waterbody

MAP C-15A: Wharton County Permitted OSSFs, 2021



MAP C-15B: Wharton County Potential Unpermitted OSSFs, 2021



Houston-Galveston Area Council

This Page Intentionally Blank

County	Parcel ID	OSSF Count	Reason for Removal
Brazoria	BZ65833	96	Imagery indicates only one house on parcel.
Brazoria	BZ112192	60	Mobile Home Community website (Creekside Community) indicates "water, sewer, and trash" are included with each lot.
Brazoria	BZ24384	31	New subdivision built 2022 that indicates water sewer to water district.
Brazoria	BZ24365	15	Imagery indicates no units on property. Most likely new community to be built.
Brazoria	BZ34083	10	Imagery indicates only one house on parcel.
Chambers	CH19131	26	Nearby home indicates public sewer in home description.
Fort Bend	FB386263	296	New subdivision is/being built. Most likely not having OSSFs. Related to FB18639.
Fort Bend	FB18639	108	New subdivision is/being built. Most likely not having OSSFs. Related to FB386263.
Fort Bend	FB2640	30	Addresses within parcel indicate newly built lease homes. Most likely not having OSSFs.
Fort Bend	FB236527	12	Recently built townhomes. Most likely not having OSSFs.
Fort Bend	FB17459	10	New community being built. Most likely not having OSSFs.
Harris	HR992100	359	New subdivision is/being built. Most likely not having OSSFs.
Harris	HR87504	141	Townhomes within Harris most likely not having individual OSSF permits.
Harris	HR1333994	126	New subdivision is/being built. Most likely not having OSSFs.
Harris	HR87506	89	Townhomes within Harris most likely not having individual OSSF permits.
Harris	HR925190	57	New subdivision is/being built. Most likely not having OSSFs.
Harris	HR87508	46	Townhomes within Harris most likely not having individual OSSF permits.
Harris	HR1315130	44	Mobile home community (Lakewood Village) website indicates public sewer.
Harris	HR1315131	44	Mobile home community (Lakewood Village) website indicates public sewer.
Harris	HR1315132	44	Mobile home community (Lakewood Village) website indicates public sewer.
Harris	HR1315135	36	Mobile home community (Lakewood Village) website indicates public sewer.
Harris	HR168358	40	Walnut Terrace Apartment homes most likely not on OSSF.
Harris	HR927271	32	New subdivision is/being built. Most likely not having OSSFs.
Harris	HR1315136	31	Mobile home community (Lakewood Village) website indicates public sewer.
Harris	HR1064318	25	New subdivision is/being built. Most likely not having OSSFs.
Harris	HR169331	24	Terra Courtyard Condos with public sewer.
Harris	HR1318293	24	Current imagery does not indicate residential units on parcel.
Harris	HR1318295	20	Current imagery does not indicate residential units on parcel.
Harris	HR1342058	20	New subdivision is/being built. Most likely not having OSSFs.
Harris	HR742943	19	New subdivision is/being built. Most likely not having OSSFs.
Harris	HR927297	18	Enclave at Northpointe subdivision. Website indicates public sewer.
Harris	HR1063890	18	New subdivision built in 2020. Most likely not having OSSFs.
Harris	HR1315134	18	Mobile home community (Lakewood Village) website indicates public sewer.
Harris	HR1305711	18	Shopping center within Kingwood.
Harris	HR1318294	15	Current imagery does not indicate residential units on parcel.
Harris	HR110509	13	Park West Apartments, most likely not on OSSFs.
Matagorda	MA12215	17	Appears as an apartment complex. Would not have individual OSSFs.
Montgomery	MG223086	175	Mobile Home Community no longer present.
Montgomery	MG64446	135	New Perry Home subdivision.
Montgomery	MG58083	103	Mobile Home Community no longer present. Possibly KB Homes Creekside Court.
Montgomery	MG52191	68	New subdivision built in 2021.
Montgomery	MG35127	33	New subdivision built in 2021.
Montgomery	MG227753	28	Riverway Properties selling land in Dec 2021. No current residential homes.
Montgomery	MG216878	20	Imagery indicates only one house on parcel.
Montgomery	MG58080	19	New subdivision built in 2021. Webpage indicates Enclave at Dobbin is served by public sewer.
Montgomery	MG73519	14	New subdivision built with indications of public sewer.
Waller	WA21750	75	Apartment Complex (newer build)
Wharton	WH27781	81	Called El Campo Village to confirm that sewer is connected to city.

This Page Intentionally Blank

Appendix E: Water Quality Management Plan Update Timeline

The *Water Quality Management Plan Update Report* summarizes all contract activities and findings relevant to the water quality goals of the Houston-Galveston region. A draft of this Update Report has been made available for public comment in accordance with Texas Water Code (TWC) Section 26.037 to allow interested parties the opportunity to comment and provide input into the WQMP Update. The report has also been submitted to H-GAC's Natural Resources Advisory Committee for review and comment.

Comments received will be addressed in the Final Report. A table documenting comments received and H-GAC's written response to those comments will be incorporated into the Final WQMP Report as an Appendix (see **Appendix F**).The Final *WQMP Update Report* will be submitted to H-GAC's Board of Directors for acceptance. Once accepted by the Board, the Update will be certified by TCEQ for inclusion in the State's Water Quality Management Plan.

The timeline presented in Table E-1 was established to meet the requirements of TWC Section 26.037 related to the public comment period for the report.

TABLE E-1: WQMP Report Review, Acceptance, and Submittal Timeline

Task	Due Date
WQMP Update Draft Report and Project Data Deliverables due to TCEQ	7/1/22
Thirty-Day Public Comment Period Opens	7/1/22
Send Draft WQMP Update Report electronically to NRAC members for review	7/1/22
Upload Draft WQMP Update Report to H-GAC's website	7/1/22
Public Comment Period closes	7/31/22
Revise Draft WQMP Update Report to address public comments	7/31/22 - 8/4/22
Present Final WQMP Update Report to NRAC for recommendation to Board of Directors	8/4/22
H-GAC Board of Directors Meeting	8/16/22
Upload Final WQMP Report to H-GAC's website	8/31/22
Submit Final WQMP Update Report and documentation of public comment period to TCEQ	8/31/22

This Page Intentionally Blank

Appendix F: Water Quality Management Plan Update Final Report Documentation and Comments

The following Contract Deliverables were submitted electronically with the Final version of this report:

- Documentation of Public Participation
- Comments received on the FY 2022 Water Quality Management Plan Update Report
- Response to comments on the FY 2022 Water Quality Management Plan Update Report

Documentation of Participation in the WQMP Update

- To ensure the public has an opportunity to participate in the WQMP Update and provide comments on the report, a 30-day public comment period was available. This comment period opened on 7/1/22.

- The Draft WQMP Update Report was sent electronically to members of the Natural Resources Advisory Committee (NRAC) for review and comment on 7/1/22.

- The Draft WQMP Update Report document was posted on H-GAC's website for public review and comment on 7/1/22.

- The Public Comment period closed on 7/31/22.

- The Draft WQMP Update Report was presented to the NRAC on 8/4/22 as part of a public meeting. The NRAC voted unanimously to recommend that the H-GAC Board of Directors accept the Final WQMP Update Report (as amended to address public comments).

- The Final WQMP Update Report was submitted to the H-GAC Board of Directors for acceptance on 8/16/22.

- The Final WQMP Update Report was submitted to TCEQ for certification on 8/31/22.

Public Comments on WQMP Update

From	Page #	Comment	Response
Kristin DeBone Project Manager NonPoint Source Program Texas Commission on Environmental Quality	19, 22, 56, 72	Hyperlinks written out are not accessible (screen readers will read out the website link). It is preferred to have the hyperlink on relevant words in the sentence with a footnote that includes the hyperlink and text description. Page 72 just needs a footnote for the hyperlink.	Added links to keywords and footnotes for links. Also linked the keywords for the webpages listed in the Reference section.
	12	Regarding the "2020 Texas Integrated Report of Surface Water Quality" The 2022 version is now EPA accepted, and although you only mention this once I'm not sure if you will want to update to the new version for this report. Either way it should be written out as the "EPA-approved 202x..."	Changed language to say "EPA-approved 2020..." At the time the report was written, the 2022 version of the IR was still in draft form awaiting EPA approval. The 2020 IR is the version used to prepare the impairment maps. The 2022 IR was approved by EPA on July 7, 2022. The WQMP Update Report went out for public comment on July 1, 2022. H-GAC used the 2020 IR as it was the most recently approved version. The EPA-approved 2022 IR will be used for next year's report.
	20	"shownin" instead of "shown in Map 4" and Map 4 is labeled as Map 5 (there is no map 4).	Corrected typo. Map 4 was mis-numbered.
		No in text mentions of maps 4-9, all other maps, figures, and tables have some mention in the text.	These maps are mentioned in the blue call-out box associated with each map.
	35	"Sanitary Sewer Overflow" figure caption might be easier to read if moved to the left side of the image	Moved caption so that it is easier to read.
	41	"Also to be considered is the age of the infrastructure, as older systems will be more likely to experience structural failures such as line breaks" sentence could be reworded in more plain language.	Changed text to the following: "The age of the collection system (pipes, manholes, lift stations, etc.) can also be a contributing factor to SSO events. As these systems age, they become more likely to experience structural failures such as line breaks."
	43	Map 10 caption has "Map 9"	Corrected.
	56-57	Figure 9 is very pixelated; can you save the image at a higher dpi?	I tried unsuccessfully to get a higher dpi screen capture. Instead, I replaced the large image with two smaller images. Having the images smaller minimizes the amount of pixelation present.
	63	You have two sentences in a row starting with "in order to.." consider rewording one.	Reworded the second sentence to read: "This data correction step is used to determine if the 9-1-1 address point is already in a parcel, if the address is odd or even, and identifies the location of the closest parcels for comparison."
	63	Figure 11 is very small and difficult to read	Increased size of image
	64	Figure 12 is very small and difficult to read	Increased size of image
	76	The H-GAC homepage link goes to the OSSF page	Modified link
	77	Is the website still called PARIS? It goes to the Water Quality Permit Query page	Changed name of link
	79	Some of the Weebly hosted links do not have "Weebly.com" in the url, but luckily they do redirect to the correct website. WPPs include Clear Creek, Cypress Creek, East Fork, Spring Creek, and West Fork	This is a known and recurring issue, but the links should point to the correct page.

From	Page #	Comment	Response
Danielle Cioce Manager Watershed Protection Group/Disaster Debris Operations Office of the County Engineer Harris County	n/a	Danielle Cioce (Harris County Engineering) met with H-GAC Water Resources and Data Analytics staff on 7/18/22 to discuss identified discrepancies in the unpermitted OSSF analysis for Harris County. H-GAC's unpermitted analysis does not include recent data from TCEQ Region 12. TCEQ Region 12 is the Authorized Agent for the incorporated portion of Harris County, while Harris County Engineering is the Authorized Agent for the unincorporated portion of the county. Because this TCEQ Region 12 data is missing, addresses are showing up as potential unpermitted systems when they likely have a TCEQ-issued permit. This is notable in incorporated areas such as Kingwood.	Staff contacted Miranda Jordan, Water Section Team Leader for TCEQ Region 12 on 7/18/22 to request the permit records for the unincorporated portion of Harris County and other areas in the region that may not be delegated to another Authorized Agent. This request was forwarded to Donna Cosper with TCEQ's Central Office.
	n/a	Harris County Engineering has historical permit records for approximately 14,000 permitted OSSFs from the period of 1978 – 1994. These records exist in scanned PDF format and are not available in a database or spreadsheet format. These permitted systems are not included in H-GAC's permitted OSSF data layer and are being reflected in the estimation of potentially unpermitted systems. This is artificially increasing the estimated number of unpermitted OSSFs in Harris County.	Danielle Cioce will provide H-GAC with a PDF copy of the historical permit records. H-GAC's Data Analytics staff will convert the file to a usable electronic format using optical character recognition (OCR). H-GAC will amend the project QAPP to specify the QA/QC protocols for the use of OCR technology to convert these records to a useful digital format. Once converted to a digital record, these permits will be incorporated into H-GAC's permitted OSSF database and the unpermitted estimation will be revised accordingly. Once converted to digital format, H-GAC will provide a copy of the electronic records to Harris County Engineering. Since it necessary to revise the project QAPP before this data can be acquired, H-GAC is unable to complete this task in the current project fiscal year. Updates to the Harris County OSSF Historical Permit Data has been added as a Subtask in the FY 23 - 24 project Scope of Work.
	n/a	Harris County Engineering questioned H-GAC's methods for excluding parcels from the unpermitted OSSF analysis (see Appendix D). Danielle Cioce offered to review specific parcels (using Harris County Engineering staff's first-hand knowledge) to determine if there are OSSFs on these parcels.	Harris County Engineering was provided with spatial data for parcels containing high OSSF counts that need to be verified. This file was provided on 7/19/22.

From	Page #	Comment	Response
Jim Kain Private Citizen Cypress Creek Watershed	n/a	**Draft H-GAC Water Quality Management Plan 2022 Comments** Comments on the FY 2022 Draft WQMP were received From Mr. Jim Kain. The comments received were in narrative format and addressed each major task of the project. A copy of Mr. Kain's comments and discussion of the Draft WQMP are included on the following pages.	The comments provided are greatly appreciated. The extended analyses of the data presented in the report provide a great new perspective and will help guide staff in further assessment of the data. Generally, many of the comments and recommendations pertain to analyses that are beyond the scope for projects under the 604(b) program. Many of these analyses are performed under contracts for specific TMDL or WPP projects. Data collected under the WQMP are used as the basis of the analyses in these TMDL/WPP projects, but the WQMP project is primarily a data acquisition project, with detailed analyses conducted under the watershed-specific projects. Additionally, the report is an update, not an exhaustive and complete report. The WQMP Update Report provides updates to previously submitted reports, which remain in effect. For the Update, it is not necessary to report on data that has already been submitted under those previous projects. H-GAC will be unable to implement the suggested DMR and SSO analyses for the FY 2022 report due to time and budget. As this project contract ends in August 2022, the number of available labor hours remaining under this grant is insufficient to conduct these additional analyses. However, the suggested analyses would provide some additional insight into issues affecting water quality in the region and would be useful for future WQMP Updates. WQMP staff will work with the Data Analytics team to revise the SAS code for the data analyses to include some of these additional in-depth looks at the data. The comments provided were extremely insightful and present several ways that H-GAC can further evaluate the causes of SSOs or DMR violations. Implementing these additional analyses will help improve the report. Comments on the Support Watershed Planning section pertain to the Cypress Creek WPP. Although data used in the development of the Cypress Creek WPP are acquired under the WQMP project, the specific analyses for that project (such as Load Duration Curves) are performed under that project's contract. Those analyses and calculations are beyond the scope of the WQMP project and are instead funded through TCEQ's 319(h) program. These comments received were forwarded to Justin Bower, Principal Planner. Mr. Bower is the H-GAC Project Manager for the Cypress Creek WPP. The comments provided were very helpful and we would greatly appreciate your input in the stakeholder process for this WPP. Thank you for your comments on H-GAC's OSSF planning, coordination, and outreach activities. The Homeowner Wastewater Assistance Program is one of the highlights of H-GAC's water quality programs. H-GAC's OSSF education/training efforts were hampered in FY 2022 due to COVID and social distancing requirements. Additional education/training opportunities have been included in the Scope of Work for the FY 2023/2024 project contract. For example, H-GAC plans on developing a video presentation for Homeowner OSSF Maintenance. Again, thank you for your comments. The time spent on reviewing the report and preparing these comments is greatly appreciated. The insightful nature of the analyses will be extremely useful for WQMP project staff as we prepare the next WQMP Update.

From: Jim Kain
To: Sims, Brian
Subject: Draft H-GAC Water Quality Management Plan 2022 Comments
Date: Wednesday, July 20, 2022 3:53:59 PM
Attachments: Draft plan 2022 COMMENTS.docx

Brian: Attached are comments to consider for your draft plan. Overall, the draft Management Report is first-rate. With a few minor edits, this report could be excellent and a great roadmap for planning. The Houston-Galveston Area Council and the Texas Commission on Environmental Quality deserve recognition for their insightful compilation and assessment of water quality, WWTF data, and OSSF concerns.

Draft H-GAC Water Quality Management Plan 2022 Comments

The following are several section comments to consider for the 2022 Houston-Galveston Area Council Water Quality Management Plan update for analysis regarding wastewater infrastructure, watershed planning, decentralized on-site sewage facilities, and nonpoint sources of pollution that affect regional water quality.

Wastewater Discharge Monitoring Report Data Analysis

Evaluations were based on the regulatory permit limits specific to each facility and consider the number of exceedances and bacteria loadings by year and by WWTF size. Table 4 show the number of facilities reporting Bacteria DMR data by facility size range in MGD. The number of facilities in each flow range that had no exceedances is not shown but would be informative. The geometric mean for effluent bacteria is particularly useful in the laboratory for bacterial data from serial dilution assays and in environmental sampling data which might range over several orders of magnitude, but the geometric mean as a measure of the central tendency mean tends to dampen extreme values and is always smaller than the corresponding arithmetic mean. Indeed, overall rates of DMR compliance for geometric mean permit limits are 99.1%, which might downplay potential impacts in the management plan. The percent compliance for daily maximum single grab results indicates 97.0% of daily maximum/single grab samples meet effluent permit limits and this DMR requirement is what reviewers should carefully analyze for environmental impacts (potential disease outbreak, recreation safety, and drinking water source/reuse safety); root causes, and corrective actions to maximize water quality improvement efforts. As noted in the draft report, higher permit exceedance rates are observed with the daily maximum/single grab samples as compared to the geometric mean results. For smaller facilities, dischargers may only have to sample once per quarter or once per month. For larger facilities with higher flow volumes, sampling frequency may increase to weekly or daily, with multiple single grab results for each facility each month, but only one geometric mean result reported. More populated urban and suburban areas in the region experience the highest rate of bacteria violations. The report needs to explain what these monitoring results mean to the public. Also, the report should note what actions a discharger should immediately take in the event of an exceedance to prevent human exposure to E. coli. Additional data may be needed to understand the cause of the exceedance.

E-coli exposure can cause infection, diarrhea, and other illness in humans. The report should note that most coliforms are harmless and e-coli are preferred indicator organisms to identify potential fecal contamination in freshwater and the possible presence of disease-causing bacteria and viruses. The draft report should explain the geometric mean units of MPN/100 ml and what values are used to assess recreational water quality. If colony forming units/100 ml data is referenced, differences in interpretation should be noted. The draft report should note any EPA or TCEQ recommended MPN/100 ml value or statistical threshold value (STV) of cfu per 100 ml (STV 90th Percentile) considered protective of human health or as a potential indicator of illness criteria, as well as an estimated illness rate per 1000 people if one is in contact with highly contaminated water.

The report briefly discusses data gaps where insufficient service boundary reports or lack of WWTF outfall information exists. The Management Report should outline long term action steps and possible deadlines in a timeline that will prevent or minimize future e-coli exceedances, especially for geometric mean daily maximum grab samples. Depending on the source and WWTF plant activity during any upset, different steps will likely be necessary to remediate the issues and reduce the likelihood of future

events. The report makes no mention of other water quality parameters or profiles that might be considered (nutrients, DO, antibiotic resistant bacteria) in the management plan besides e-coli data.

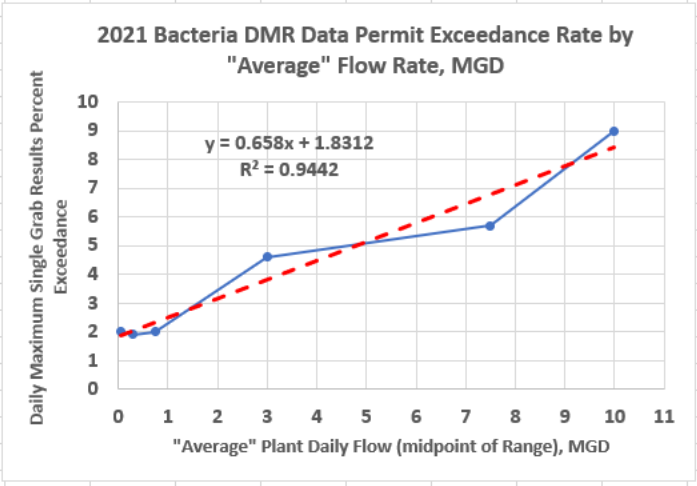
Total WWTF Annual discharges between 2017 and 2021 are noted in table 11, approaching 600 MGD. Table 12 gives the estimated daily E. coli load (million MPN/Day) from domestic WWTFs by size (flow range) and year. The table data, when considering trends, indicates where further analysis is warranted and areas of first focus. The 2021 facility data for 1-5 MGD (20.410.3 million MPN/Day) (159 facilities, with a 32% increase in bacterial load from 2017 to 2021) and for > 10 MGD (14,810.8 million MPN/Day) (28 facilities, with a 28% increase in bacterial load from 2017 to 2021) have the greatest DRM geometric mean E. coli rates (table 10) and daily bacterial loadings (table 12), and one should analyze operations and analytical data at these facilities as a priority to plan and expeditiously execute corrective actions.

Table 9 shows the daily maximum grab samples percent exceedances between 2017 and 2021. For 2021, relative size (MGD) and percent exceedances for 1-5 MGD, 5 – 10 MGD, and > 10 MGD are respectively 4.6%, 5.7%, and 9.0%. However, per Table 4, there are 159 facilities for 1 – 5 MGD, and 28 for > 10 MGD; however, only 38 for 5 – 10 MGD. One could theorize the facilities to initially review more in-depth would be the ones in the 1 – 5 MGD and > 10 MGD ranges if resources are limited. There is uncertainty as to the flow rates when the highest daily maximum single grab sample was taken.

If one assumes an "average" flow at or near the design flow range midpoint, it is possible to anticipate or predict an approximate annual percent exceedance based on MGD flow (see graph). Such a tool would enable an inspector to quickly benchmark a facility for expected exceedances and determine if the plant operation is suspect, superior, or poorly operated.

Q - MGD Range	Q - MGD Mid.	plants No.	Exceedance No.	No. grabs	Reported No. of grabs per plant
0.1	0.05	283	31	1,541	5.4
0.1 -0.5	0.3	227	50	2,594	11.4
0.5 - 1	0.75	149	34	1,734	11.6
1 - 5	3	159	89	1,915	12.0
5 - 10	7.5	38	26	460	12.1
> 10	10	28	29	324	11.6
	sum:	884		8,568	9.7

Q - MGD Size Range	Mid	Exceedance %	Predicted %
< 0.1	0.05	2	1.9
0.1 -0.5	0.3	1.9	2.0
0.5 - 1	0.75	2	2.3
1 - 5	3	4.6	3.8
5 - 10	7.5	5.7	6.8
> 10	10	9	8.4

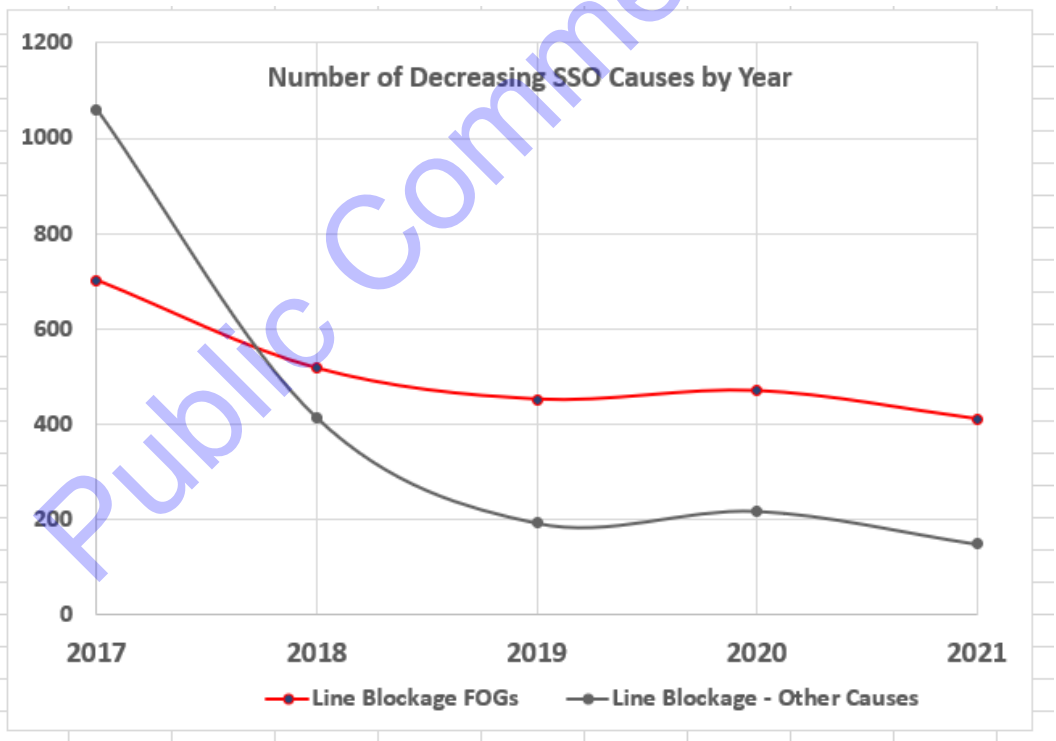


Sanitary Sewer Overflow Data Analysis

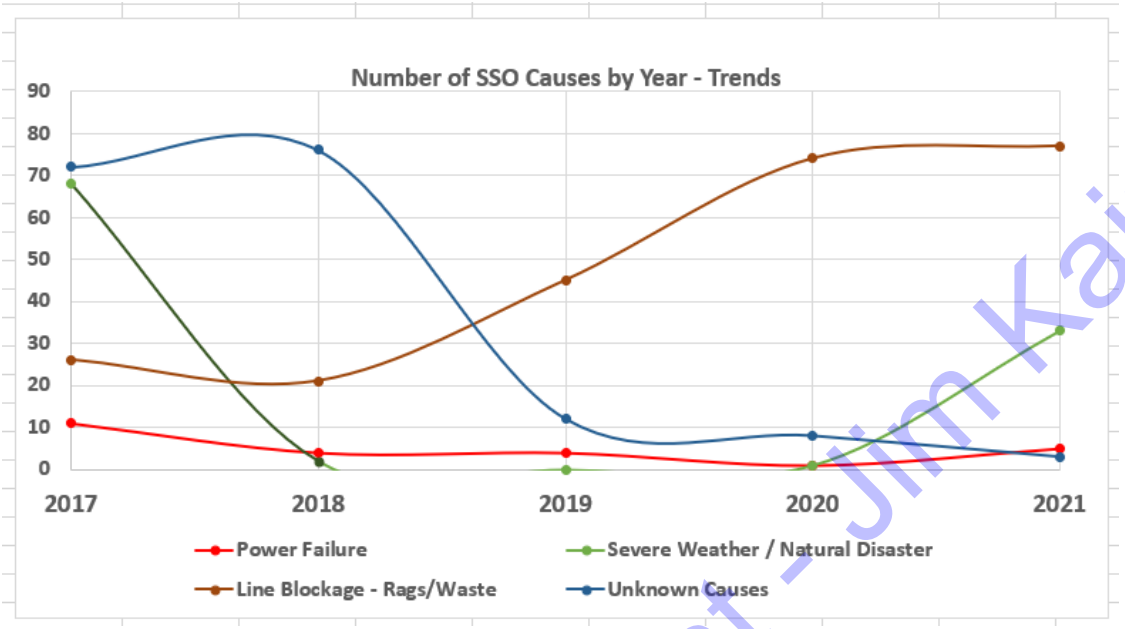
The Management Plan section on sanitary sewer overflows (SSOs), violations, causes, number of events, and frequency was very information and well written. However, to better understand the data visually, it is necessary to plot the SSO occurrences as time trends to see what potential causes are increasing and decreasing. This analysis can indicate areas of concern facilities have been successful in mitigating. Also, using 6-Sigma concepts, Pareto Charts (a bar chart and a cumulative line graph) can identify the most important problems to improve first. The right graph is worth 1000 words.

Trend Charts	1	2	3	4	5	6	7	8	9	10	11	
	Collection System Structural Failure	WWTF Operation or Equip. Malfunction	Lift Station Failure	Power Failure	Rain/Inflow/Infiltration	Severe Weather/Natural Disaster	Line Blockage - Fats/Oils/Grease	Line Blockage - Rags/Wipes	Line Blockage - Other Causes	Human Error	Unknown Cause	Total
2017	116	130	81	11	141	68	701	26	1,061	2	72	2,409
2018	108	132	68	4	190	2	517	21	414	3	76	1,535
2019	72	90	81	4	222	0	452	45	193	3	12	1,174
2020	250	279	103	1	158	1	470	74	218	1	8	1,563
2021	177	251	114	5	251	33	411	77	149	1	3	1,472

SSO events from FOG blockages and other causes have decreased since 2017 which indicates control efforts and education have been beneficial. Still, FOG line blockages account for almost 28% of SSOs so additional mitigation is warranted.

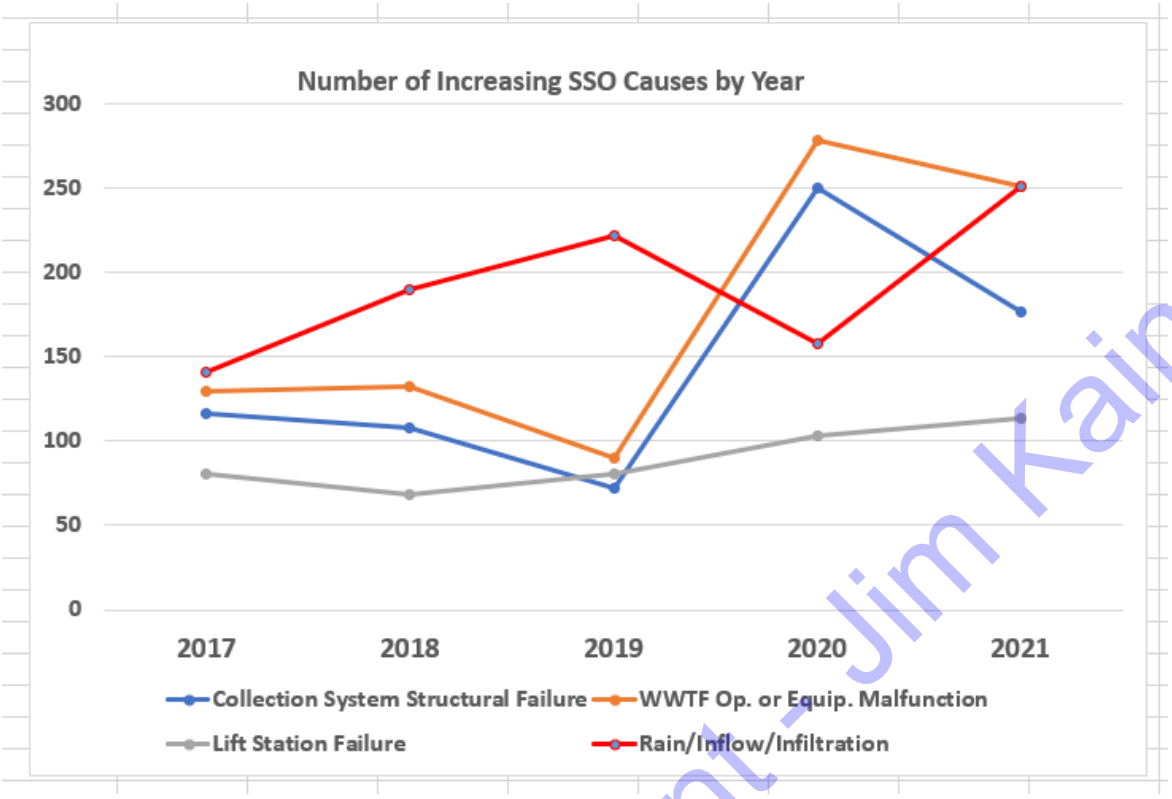


The following graph indicates that SSOs from Rags/Waste have been increasing so corrective actions/training efforts should be encouraged even though this concern is only about 5% of the total 2021 SSOs.



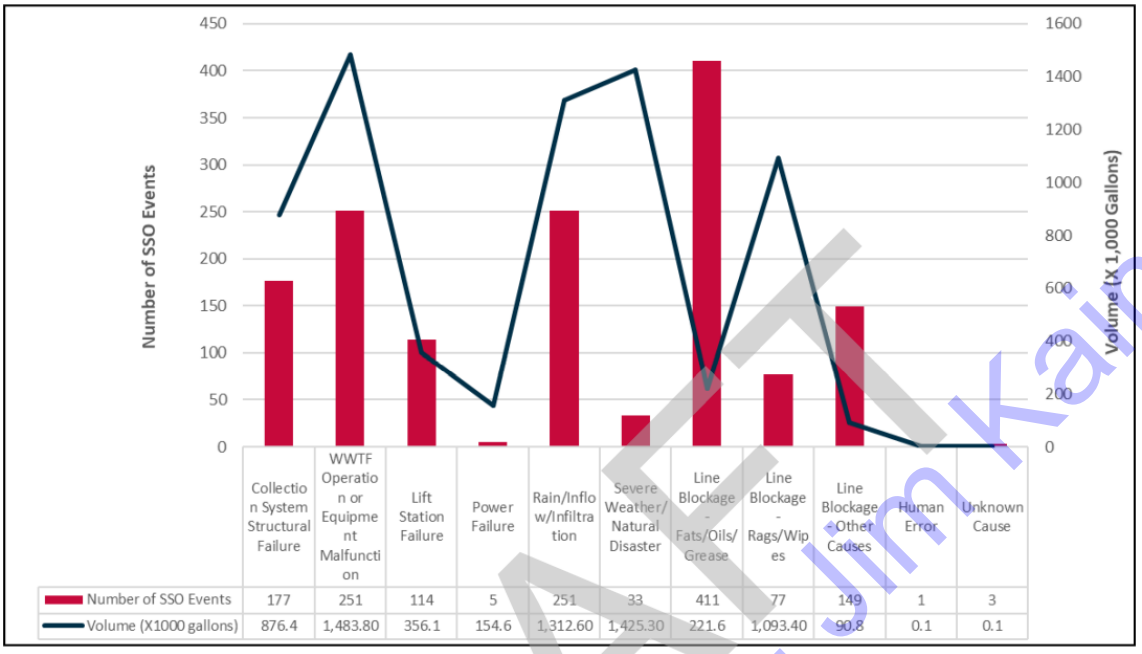
The following graph shows that rainfall infiltration is a continuing problem, trending upward. Even more enlightening is the tremendous increase in SSOs due to WWTP operation or Equipment Malfunction. This is entirely unacceptable and definitely an area for root cause analysis, reliability/failure reviews, and control charts to monitor and maintain new levels of improvement. The are many 6-Sigma tools that could focus on people, processes, machines, materials, measurement, and environmental parameters (critical to quality measures – CTQs) and the Management Plan should consider these to identify clearly observable patterns and focus on major priority key issues. A handful of tools could help slash SSO frequency and cut related costs. If resources are limited, the secret of success (cutting SSOs) will be to avoid trying to do everything at once and instead focus on the most important highest-leverage things to improve. After controlling WWTF failures/Equipment Malfunctions, the next area would be Rain Infiltration followed by Collection System Structural Failures.

5



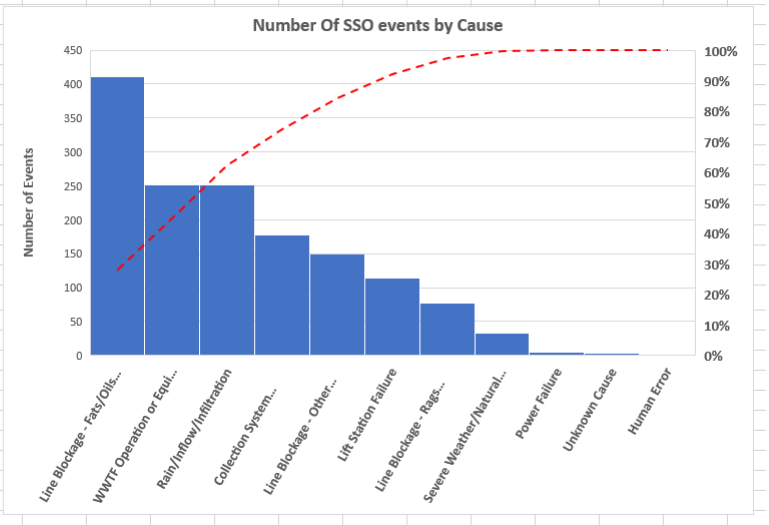
The following Figure 5 from the Draft Management Plan is concise and shows 2021 accurately. However, it needs to be coupled to trend charts for a reader to quickly visualize mission-critical problems to solve first and key measures and targets for significant improvement.

FIGURE 5: Number and Volume of SSO Events by Reported Cause, 2021



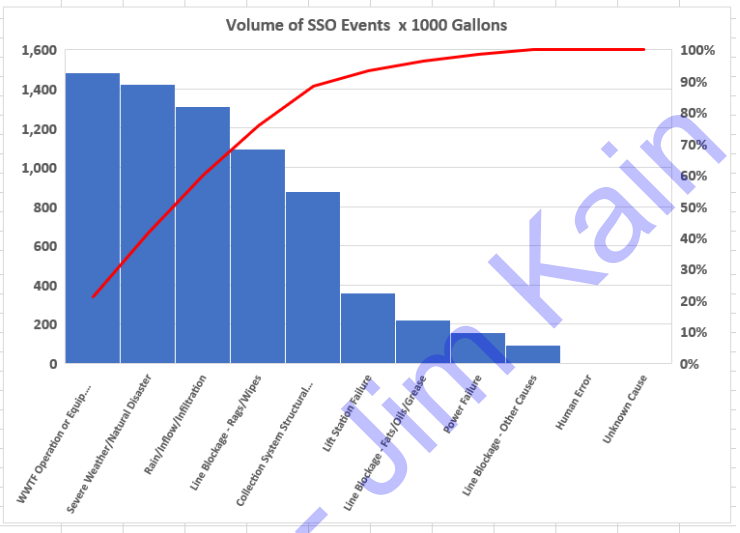
The following Pareto Chart's Cumulative Summary line show that Line Blockages form FOGs and WWTF Operation & Equipment Failures account for 45% of SSO event in 2021. With Rain Infiltration also considered, 62% of SSO events are caused by 3 issues (out of 11). With decreasing blockages for FOGs, the next key and easy area to gain quick results will be a detailed assessment of WWTF Operation & Equipment Malfunctions. A problem well stated is a problem half solved. Tracking failures and the use of 6-Sigma tools (Root Cause, DMAIC, 5-whys, Fishbone Diagrams, Pareto Graphs, Control Charts, Countermeasure Plans, etc.) will verify root causes and validate selection of countermeasures. Use of these tools as well as preventative maintenance tools/software and GIS reviews should aid and sustain the effort to reduce SSOs.

2021	No.	%
Collection System Structural Failure	177	12.0
WWTF Operation or Equip. Malfunction	251	17.1
Lift Station Failure	114	7.7
Power Failure	5	0.3
Rain/Inflow/Infiltration	251	17.1
Severe Weather/Natural Disaster	33	2.2
Line Blockage - Fats/Oils/Grease	411	27.9
Line Blockage - Rags/Wipes	77	5.2
Line Blockage - Other Causes	149	10.1
Human Error	1	0.1
Unknown Cause	3	0.2
Total	1,472	



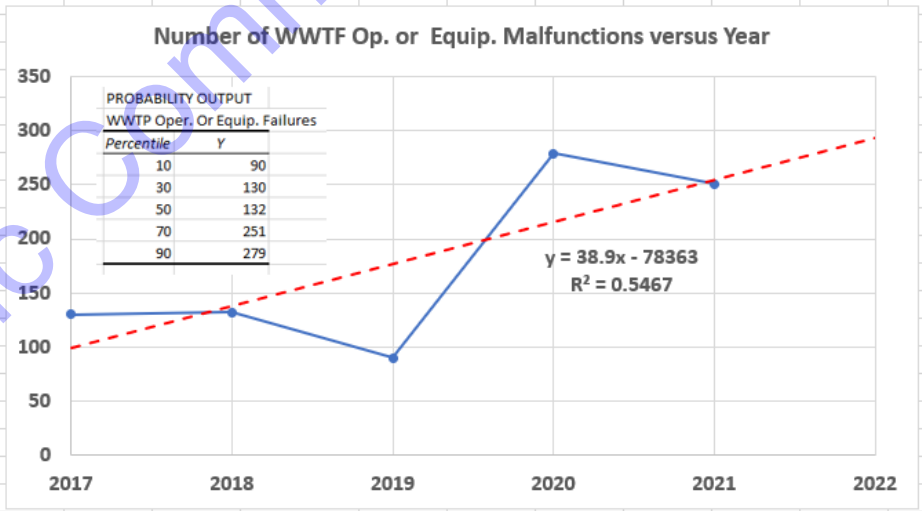
The following Pareto Chart show that WWTF Operation or Equipment Malfunction has the largest volume impact on SSO events (21.2%). This cause, coupled with severe weather/natural disaster, covers 41.5% of events. Needless to say, an in-depth look at WWTF Operation or Equipment Malfunction warrants an immediate review.

2021	Vol. X 1000 gal	%
Collection System Structural Failure	876.4	12.5
WWTF Operation or Equip. Malfunction	1,483.8	21.2
Lift Station Failure	356.1	5.1
Power Failure	154.6	2.2
Rain/Inflow/Infiltration	1,312.6	18.7
Severe Weather/Natural Disaster	1,425.3	20.3
Line Blockage - Fats/Oils/Grease	221.6	3.2
Line Blockage - Rags/Wipes	1,093.4	15.6
Line Blockage - Other Causes	90.8	1.3
Human Error	0.1	0.0
Unknown Cause	0.1	0.0
Total	7,014.8	100.0

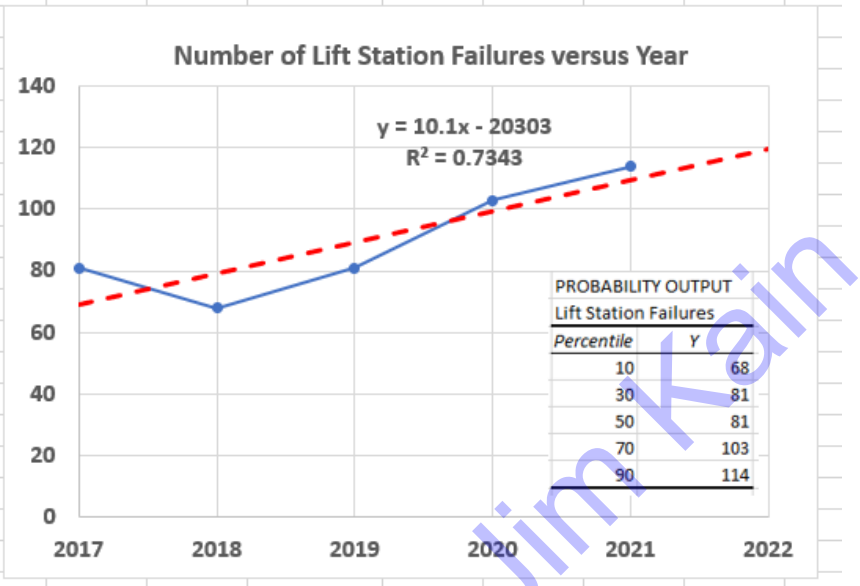


The following two figures indicate that both WWTF Operation/Equipment Malfunctions and lift station failures are trending upward. Assuming continuing control/maintenance measures currently in place (without new countermeasure improvements), one could predict 293 WWTF Operational/Equipment failures and 119 lift station failures in 2022.

	WWTF Op. or Equip. Mal.
2017	130
2018	132
2019	90
2020	279
2021	251



	Lift Station Failure
2017	81
2018	68
2019	81
2020	103
2021	114



Support Watershed Planning

Data acquired and analyzed under this project and Management Plan section are used to inform decisions for Houston-Galveston watershed projects. This section was well written and presented and will give people insight into the vast amount of work that has been done and being planned. The links to the websites for TMDL projects in the Additional Resources section of this report were very helpful. The March 2021 Cypress Creek Watershed Protection Plan (WPP) was informative as I live nearby. The Cypress Creek report notes that WWTF Malfunctions, as a broad category, remain the primary volumetric source of SSOs, accounting for 57.5% of all SSOs. Weather-related events are next at 29.0%, followed by blockages at 9.4%, with an unknown portion making up 4.1% of volume. The breakdown of sources over the entire watershed should not be taken as an accurate cause profile for individual areas in the watershed but reflects the general challenges to the area's wastewater infrastructure. However, one could say that the Cypress Creek report mirrors the draft 2022 H-G AC Water Quality Management Plan Update, with a review of plant malfunctions being a warranted key issue. Concerning E.-coli permit exceedances for the 95 facilities in the Cypress Creek database, most plants have less than one percent of their samples in violation. However, roughly a third of all plants (27) had between one to ten percent of their samples in violation, although most of this range is under 5%. The plants were generally more able to meet the geomean standard than the single grab standard, indicating that conditions may have a high degree of variability.

The report includes Load Duration Curves (LDCs) at various sub-watershed areas. E.-coli sources other than WWTFs are noted. LDCs use observed water quality data to indicate the difference between the levels of pollutant or condition in a waterway, and the levels at which the applicable water quality standards would be met. The difference then becomes the basis for improvement goals. The Cypress Creek results indicate E. coli loads are greatly in excess of the standard in almost all locations and flow conditions, regardless of flow volume and developmental character (Table 30). The most pronounced

need is in the lowest portion of the watershed, likely as a combination of upstream inputs and the decrease in natural filtration of land cover in the more densely developed downstream areas.

Targeted assessment and application of best management practices (BMPs) could be expected to reduce or remove impairments and concerns in this watershed. While there were exceedances for the evaluated water quality parameters, the majority of WWTFs met their treated effluent permit limits most of the time without significant issue. The conclusion was that it is unlikely that WWTFs along Cypress Creek are an appreciable source of contamination in the watershed on a chronic, wide-ranging scale. However, I would encourage a review of the 5 worst performing facilities in terms of permit compliance (for all parameters) and equipment failure records to ease any local stakeholder concerns.

OSSF Planning, Coordination, and Outreach

This section of the draft report was very informative. The work under this section (updates on permitted and unpermitted OSSFs, Supplemental Environmental Project coordination and outreach, and education for homeowners on OSSF) is critical for environmental quality and watershed protection, and without question, the happiness of home owners with onsite treatment systems. I encourage licensing and evaluations by OSSF Designated Representatives, Site Evaluators, Licensed Installers, and Maintenance Providers. I believe a lot of older pre-permit installations are approaching their useful equipment life and may have limited drain field capability, perhaps reaching a nuisance stage or polluting groundwater, or allowing illicit discharges. I applaud H-GAC's Homeowner Wastewater Assistance Program which funds the repair or replacement of malfunctioning or failing OSSFs for homeowners who meet certain income requirements. By identifying these systems and then targeting them for repair, replacement, or decommissioning through the SEP, H-GAC can actively contribute to the remediation of these systems. Perhaps partial funding by the Texas Lottery for this work could be considered/promoted! Homeowner outreach conducted through the SEP is another important component of numerous watershed-based projects and further education/training efforts should be increased. It would be great if funding for training applicants for licensure positions were made available.

Overall, the draft Management Report is first-rate. With a few minor edits, this report could be excellent and a great roadmap for planning. The Houston-Galveston Area Council and the Texas Commission on Environmental Quality deserve recognition for their insightful compilation and assessment of water quality, WWTF data, and OSSF concerns.

From: Sims, Brian
To: Jim Kain
Cc: Running, Todd; Windham, Rachel; Bower, Justin
Subject: RE: Draft H-GAC Water Quality Management Plan 2022 Comments
Date: Wednesday, July 20, 2022 7:49:00 PM

Mr. Kain,

Thank you very much for your kind words regarding the Water Quality Management Plan Update. Your thorough review of the document and suggestions for further and more in-depth analyses are greatly appreciated. You provided some wonderful insight into the data contained within the report. This type of review is extremely beneficial, as it not only allows us to improve the report for this year, but also provides us with a good foundation for how to refine our data analyses in future project years and provide the type of data that is most useful to water quality planners, utility operators, local government officials, and regulatory agencies.

For much of the additional data analyses that you suggested, it may be necessary to wait until the next project year to incorporate those types of changes. We update the draft report in response to comments, but that typically doesn't involve incorporating further statistical analyses, charts, and graphs as the inclusion of these additional items may not meet the requirements of the Texas Water Code since these additional analyses would not be available for review under the required 30-day public comment period. I will discuss this with the Texas Commission on Environmental Quality to determine what (if any) additional analyses we are able to include and still be compliant with the public comment requirements. However, I will certainly be expanding some of the narrative discussion contained in the document, as you brought forward several items that would improve the quality and usefulness of the report.

Thank you very much for the time and effort you put into your review. Again, it is greatly appreciated and will be used to improve H-GAC's methods and reports.

Sincerely,

Brian Sims

BRIAN SIMS
Senior Planner
Houston-Galveston Area Council
3555 Timmons Lane, Suite 120
Houston, TX 77027
Mailing Address: P.O. Box 22777
Houston, TX 77227
Direct | 713-993-2438
h-gac.com

"H-GAC honors, respects, and promotes the great diversity of our region while serving today and planning for tomorrow."

Houston-Galveston Area Council
3555 Timmons Lane, Suite 120
Houston, Texas 77027
713.627.3200
h-gac.com

CE0822