Stormwater and On-site Sewage Facility Education and Outreach to Small Coastal Cities

Texas Water Resources Institute TR-559
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Tres Palacios River at FM 1468 near Clemville, TX. Photo by Ed Rhodes, TWRI.

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Texas Commission on Environmental Quality

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Acknowledgements

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Essential Element Statement using the FY2022-2026 EPA Strategic Plan:

- Essential Element 1 - Goal 5: Ensure Clean and Safe Water for All Communities
- Essential Element 2 - Objective 5.2: Protect and Restore Waterbodies and Watersheds
- Essential Element 3 - Non-point Source Pollution Control (Clean Water Act Section 319). Project period: 10/28/2020 – 02/28/2025

Acronyms

BAEN	Texas A&M AgriLife Biological and Agricultural Engineering
H-GAC	Houston-Galveston Area Council
I-Plans	Implementation Plans
MS4	Municipal Separate Storm Sewer System
OSSF	On-Site Sewage Facility
SW	Stormwater
TCEQ	Texas Commission on Environmental Quality
TWRI	Texas Water Resources Institute
WPP	Watershed Protection Plans

Section 1: Background, Significance, and Area

Background

This project targeted several watersheds with existing total maximum daily load implementation plans (I-Plans) or watershed protection plans (WPPs) within the Texas Coastal Zone, including: Tres Palacios Creek, Lavaca River, Arroyo Colorado, Lower Nueces River, Bastrop Bayou, Cedar Bayou, Double Bayou, and San Bernard River watersheds. These watersheds are typified by rural communities with small population centers.

Each WPP identified a need to implement management measures to tackle the bacterial and nutrient loadings from stormwater runoff in their area. In addition to common stormwater concerns (household waste, pet waste, etc.), reduction of bacteria via on-site sewage facilities (OSSFs or "septic systems") improvements was a common goal. In the Texas Coastal Zone, it is extremely important to properly maintain and not allow untreated waste to travel through the permeable soil to sensitive waterbodies and coastlines nearby. To this end, poorly maintained and failing OSSFs became an additional target for the proposed project.

The Texas Water Resources Institute (TWRI), Houston-Galveston Area Council (H-GAC), and other partnerships had facilitated the development and implementation of their respective I-Plans and WPPs in the project area. As each organization worked with stakeholders in these watersheds, a common emerging theme was the lack of locally available resources to implement stormwater management measures and conduct education/outreach to combat water quality issues in their area. Stakeholders within the watersheds felt that residents did not receive the same educational opportunities as residents in larger municipalities. Additionally, low levels of awareness of the impact of everyday actions on water quality were seen as a major challenge for stormwater management.

Project Significance

The goal of this project was to support coastal cities without municipal separate storm sewer system permits (MS4) by providing education and outreach materials, training, and programs to address urban water quality concerns. TWRI worked with local municipalities to identify educational topics and outreach needs, develop the related educational and outreach materials, and train local municipalities about how to use materials available on H-GAC's Costal Communities website. This technical and program support was necessary

to fill gaps in water education in small communities, who did not have the resources to create or procure these materials on their own. It also allowed the communities to take ownership of their own water quality awareness campaigns and improvement initiatives.

This project leveraged H-GAC's Texas Coastal Communities program to help small non-MS4 communities prevent water pollution by providing resources that evaluate nonpoint source reduction needs, locate funding opportunities, and promote education and outreach. However, H-GAC is limited to their regional jurisdiction when delivering programming. To overcome this, TWRI partnered with H-GAC to deliver educational content to stakeholders in additional communities beyond their jurisdiction.

To get educational information to more OSSF owners, additional alternative outreach was conducted via a direct mailing campaign. This method has been used in other watershed outreach settings with success in raising awareness in audiences (Berthold et al. 2022). These educational postcards are an effective way of delivering informational content and recommendations as a low-cost alternative to educational programs. Additionally, they reach audiences that might otherwise not be interested in, able to, or otherwise be exposed to traditional in-person education programs.

Study Area

The project area is shown in Figure 1.

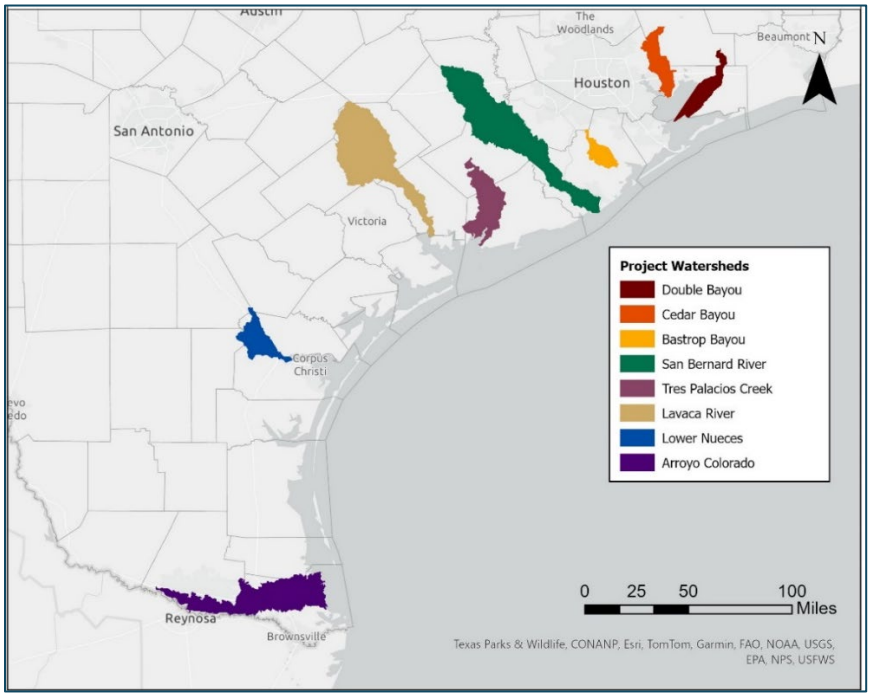

Figure 1. Map of Coastal Communities project area with targeted watersheds.

Section 2: Summary of PRs

Task reports for Tasks 2, 3, and 4 were prepared with additional details and descriptions of task activities and results (see Appendix A).

In summary, TWRI met with coastal cities to discuss educational material needs. In response, fliers, bill inserts, and other images were created for city staff to use. The materials were designed to raise awareness and educate residents on common nonpoint source pollutants, such as: lawn mowing and fertilization practices, pet waste, OSSF maintenance and signs of possible failure, and more. All materials were posted on the H-GAC's Coastal Communities website (www.coastalcommunitiestx.com) as free, downloadable content in the Coastal Communities Outreach Roadmap.

TWRI conducted multiple distance-based trainings with small communities located along the Texas coast to inform them about the free educational resources available online. Follow-up with these communities was conducted after the initial training to collect general feedback, provide additional training, and gather suggestions for future educational material development. Many of the communities successfully used the materials in their own community outreach events and social media feeds.

To get educational information to more OSSF owners, TWRI worked with project partners to develop alternative outreach materials about OSSF maintenance relevant to the Texas Coastal Zone. TWRI sent educational postcards to homeowners with OSSFs within the project area to encourage proper maintenance habits. A follow-up study conducted by mail showed that the postcards raised knowledge of important maintenance concepts. The results of this study were shared with a regional audience of researchers and science communicators at the 2024 Gulf of Mexico Alliance Conference in Tampa, Florida. TWRI plans to use the information gathered in this study to improve future education and outreach initiatives on OSSFs and wastewater issues.

Section 3: Project Funding

Funding Sources, Budget, and Spending

Table 1. Summary of funding sources and amounts.

Source	Approved Amount	Spent
TCEQ (60%)	$353,917	
Cost Share (40%)	$235,945	
Total	**$589,862**	**$589,860 (est.)**

Section 4: Discussion

Accomplishments

All project tasks and deliverables were completed and submitted within the project period.

The project team found that the remote trainings were well-received by city staff. They were often eager to learn about the pre-made materials available to them and quickly took to using the Coastal Communities website. Traffic for the toolbox webpage greatly increased during and immediately after the trainings were completed. Several cities used the materials by posting items on social media, printing flyers for hallway/door displays at public buildings, and even handing out bookmarks and flyers at libraries.

Additionally, the direct mailers distributed in Jackson County provided evidence of effective increases in awareness and knowledge for OSSF owners, especially for audiences that were not inclined to attend in-person events. TWRI was also able to use the evaluation to gather more data that has informed more recent educational campaigns. This mailing campaign and evaluation also garnered interest from Extension professionals in other states when it was presented at the 2024 Gulf of Mexico Alliance Conference in Tampa, Florida. Attendance at this conference proved fruitful for sharing the approach used for mailing outreach as part of this project and prompting conversations about alternative education/outreach strategies that could be used in future CWA Section 319(h) projects.

Challenges, Lessons Learned, and Recommendations

At the beginning of this project, we were approximately six months into the COVID-19 pandemic. The original proposed project (submitted in 2019) was not designed for such circumstances, so the project team was challenged to adapt the project to this new reality.

This slowed the design of training materials and project implementation as the world adapted to the new COVID-19 workflow. Trainings with cities were originally planned as primarily in-person events, with online meetings as needed. TWRI adapted by performing these events remotely via phone and email coordination. In turn, this limited in-person interaction with the cities and in turn may have impacted the reach and depth of the trainings.

The project team found that the small cities that were targeted for the trainings experienced high employee turnover and unreliable email/telephone contact information. Often, upon reaching out to city employees (city clerks, secretaries, environmental/utilities directors), the project team would either not receive a response or find out that the person had left, did not have a valid email address, or could not receive phone calls/voicemails. Additionally, a few trainees left their city position between the initial training and the follow-up calls. This made it difficult to evaluate the effect of the initial training, but did open up the opportunity to follow up with a different city employee and conduct another training. Future projects may consider a shortened evaluation timeline (e.g., within three to six months rather than one year). It might also help to take a more deliberate "train-the-trainer" approach by targeting individuals who are responsible for oversight, management, and training or professional development of city staff.

The project team found that the most enthusiastic group for these trainings were librarians. They expressed great interest in the materials because they were free to use, educational, and could be distributed to the many audiences that visit the library or attend their events. Future projects of this nature and even watershed planning/implementation projects should take this avenue of outreach into consideration. The librarians are ready and willing participants in a variety of educational initiatives but feel underutilized in the context of watershed education. Other iterations of the project might also expand the training initiative to include larger professional development groups, such as the Texas Library Association, Texas City Management Association, or Texas Water Utilities Association.

In training follow-up calls, several cities recommended that future iterations of the project work toward Spanish translations of the same materials. Spanish is the second-most common language in Texas. As watershed outreach and education efforts expand beyond traditional audiences and into new mediums such as social media, which can be shared instantaneously, it is becoming more important for these materials to have translated editions.

Regarding the outreach via mailers, TWRI recommends that this practice be further developed and evaluated in the context of water resource education. This practice reaches audiences that may not be aware of, interested in, or able to attend traditional Extension

events that are held in person and/or online. These mailers are also cost-effective - roughly $2 in printing and postage provides a mailer each quarter for identified addresses and a year's worth of outreach. Additional work needs to be done to improve the visibility of these mailers and for identification of target audiences using GIS technology to improve mail lists, such as linking OSSF records to mailing addresses and geospatial data for delineation within target watersheds.

Appendix A – Task Reports

Task 2: Stormwater Educational Material Development

The objective of Task 2 was to develop urban water quality education and outreach materials based on locally identified needs in order to expand stormwater education and outreach in coastal communities without a TCEQ stormwater permit. Targeted communities included the Tres Palacios, Lavaca River, Arroyo Colorado, Lower Nueces River, Bastrop Bayou, Cedar Bayou, Double Bayou and San Bernard River watersheds. This task contained the following Subtasks:

- Subtask 2.1: Education Material Planning
- Subtask 2.2: Educational Material Development
- Subtask 2.3: Texas Coastal Communities Website Updates
- Subtask 2.4: Task Report

Subtask 2.1: Education Material Planning

In FY21, TWRI reached out to project cities to begin conversations about training materials. In total, TWRI targeted 30 cities within the project watersheds to gather needs and interests for development of additional education materials. In total, 20 of the targeted 30 cities responded with substantial interest in the materials and provided suggestions. Based on the feedback from these 20 cities, TWRI developed materials focused on pet waste, OSSFs, and general stormwater pollution. Additionally, H-GAC provided a PowerPoint for use in the city trainings that demonstrated the materials already on the Coastal Communities website.

Subtask 2.2: Educational Material Development

Using feedback from the cities in Subtask 2.1, TWRI produced two inserts/postcards on OSSFs, stormwater, fertilizers, and pet waste (Figure 2) and a flyer/fact sheet on urban stormwater pollution sources (Figure 3). The materials were produced and approved in FY22.

Figure 2. Examples of the infographics/bill inserts produced.

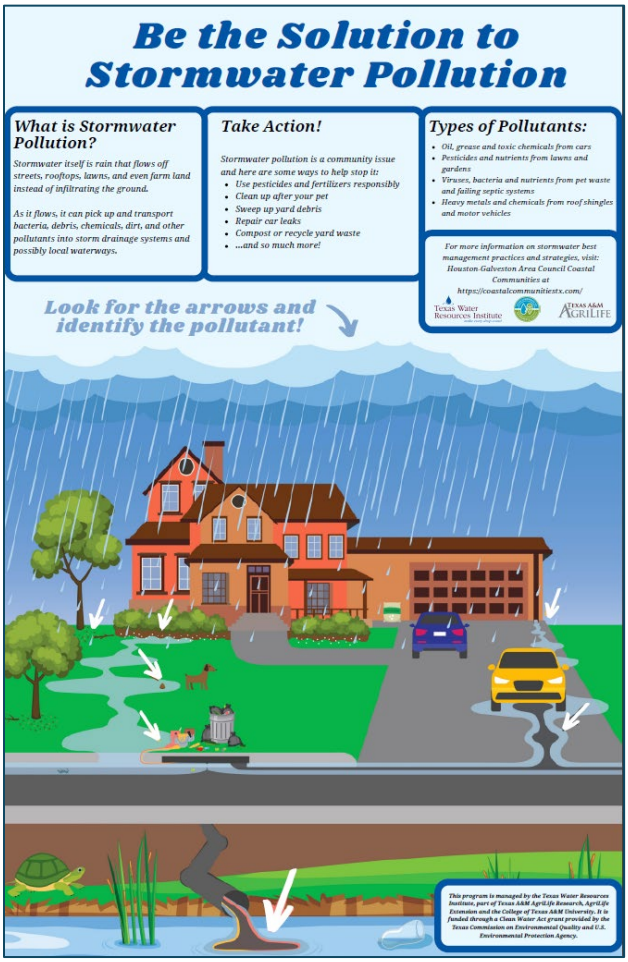

Figure 3. Stormwater pollution fact sheet/flyer produced.

The materials were posted on the Coastal Communities website by H-GAC in FY23. Screenshots of the postings were submitted to show their location and dissemination via the website (Figure 4).

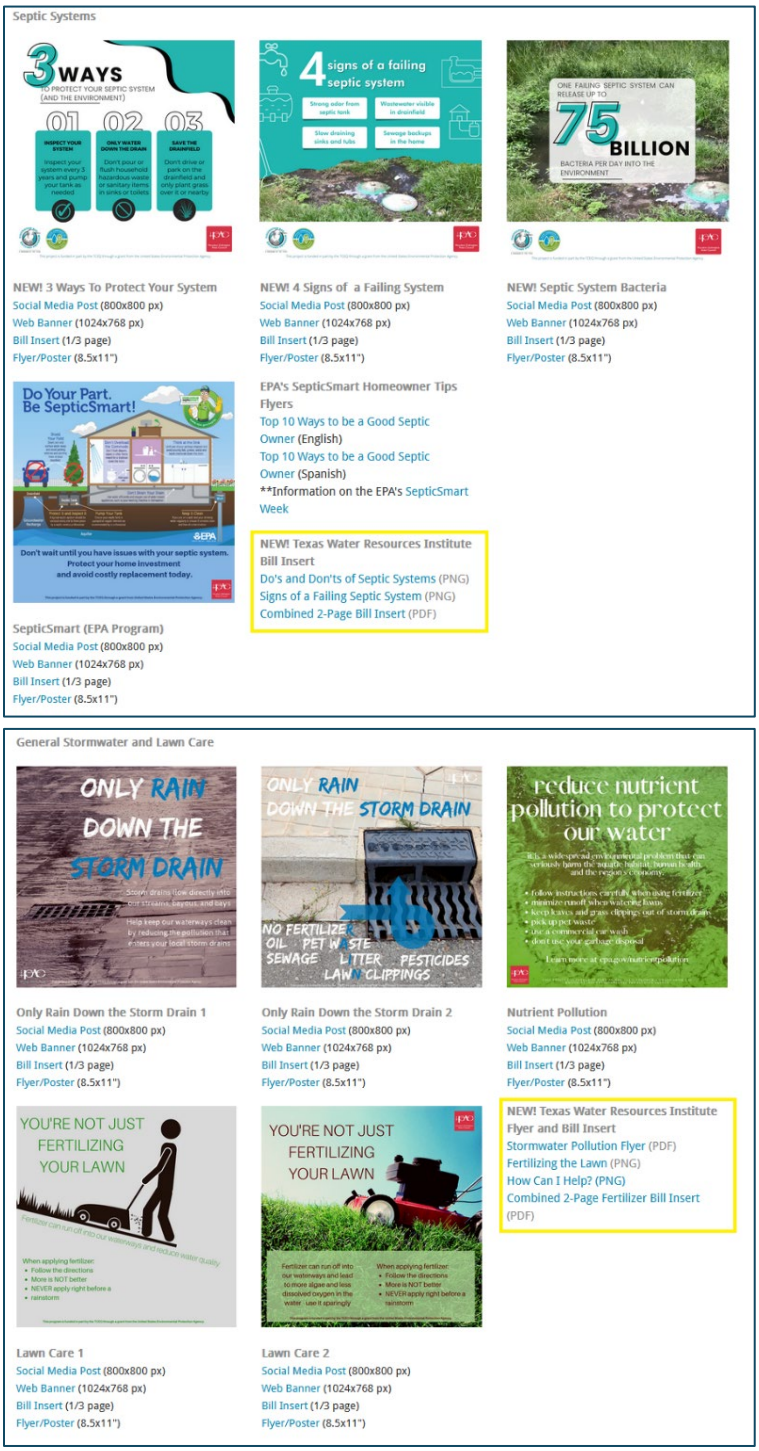

Figure 4. Screenshots of educational materials (highlighted in yellow) uploaded to the Coastal Communities toolbox.

Subtask 2.3: Texas Coastal Communities Website Updates

H-GAC intermittently provided website statistics, including unique website visits and individual page views for the project. Unique visits are defined as one individual interacting with the website and represent one person, even if they visit the website multiple times. Page views are defined as visits to pages, which can include one person accessing pages multiple times. Between July 20, 2022, and November 15, 2022, there were 229 unique visits to the website and 382 page views. The materials produced in Subtask 2.2 were posted to the Coastal Communities website by H-GAC in the beginning of FY23 (October-November 2022). Trainings were conducted between October 2022 and August 2023. Follow-up evaluations, which led to retraining, were conducted between November 2023 and March 2024. From November 15, 2022, to June 1, 2024, there were 1,351 unique visits and 1,760 page views. This represents a 489% increase in unique visits and a 360% increase in page views.

Subtask 2.4: Task Report

This task report describes the activities and deliverables completed as part of Task 2, including the following deliverables:

2.1 Education material planning meeting summaries, minimum of 10
2.2 Draft educational materials will be submitted to TCEQ Project Manager for review and approval (at least two weeks prior to dissemination); four draft educational materials to be developed
2.2 Documentation of educational materials dissemination
2.3 Texas Coastal Communities website updates
2.4 Draft Task Report
2.4 Final Task Report

Task 3: Provide Stormwater Education Technical Assistance

The objective of Task 3 was to provide training to project cities on accessing and using the Texas Coastal Communities website resources. Technical assistance will be provided for municipalities that need assistance customizing materials. This task contained the following Subtasks:

- Subtask 3.1: Stormwater Education Training for Cities
- Subtask 3.2: Customize Stormwater Education Materials
- Subtask 3.3: Follow Up with Cities
- Subtask 3.4: Task Report

Subtask 3.1: Stormwater Education Training for Cities

Ten cities participated in one-on-one training sessions on how to access the toolbox, use the suggested campaign schedule, and request custom materials from H-GAC/TWRI. The ten participating cities were El Campo, Moulton, Hallettsville, Sinton, Taft, Beeville, Pharr, San Juan, Robstown, and Beach City. Training materials were created by TWRI to guide the trainings and explain step-by-step processes for the cities (Figure 5).

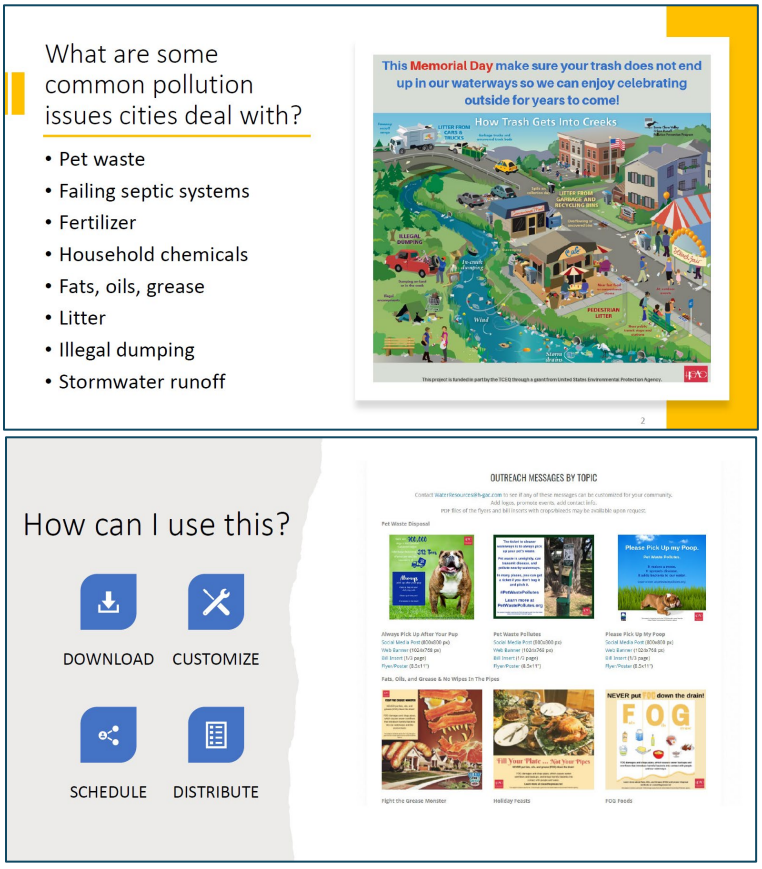

Figure 5. Examples of slides from the training materials.

Subtask 3.2: Customize Stormwater Education Materials

At their request, TWRI created customized materials for the City of Taft. This request included customization (addition of City of Taft logo) for 23 materials from the website covering all topics, including OSSFs, curbside debris, pet waste, illegal dumping, lawn care, and more (Figure 6). All other cities felt the standard materials were adequate and did not request customized materials.

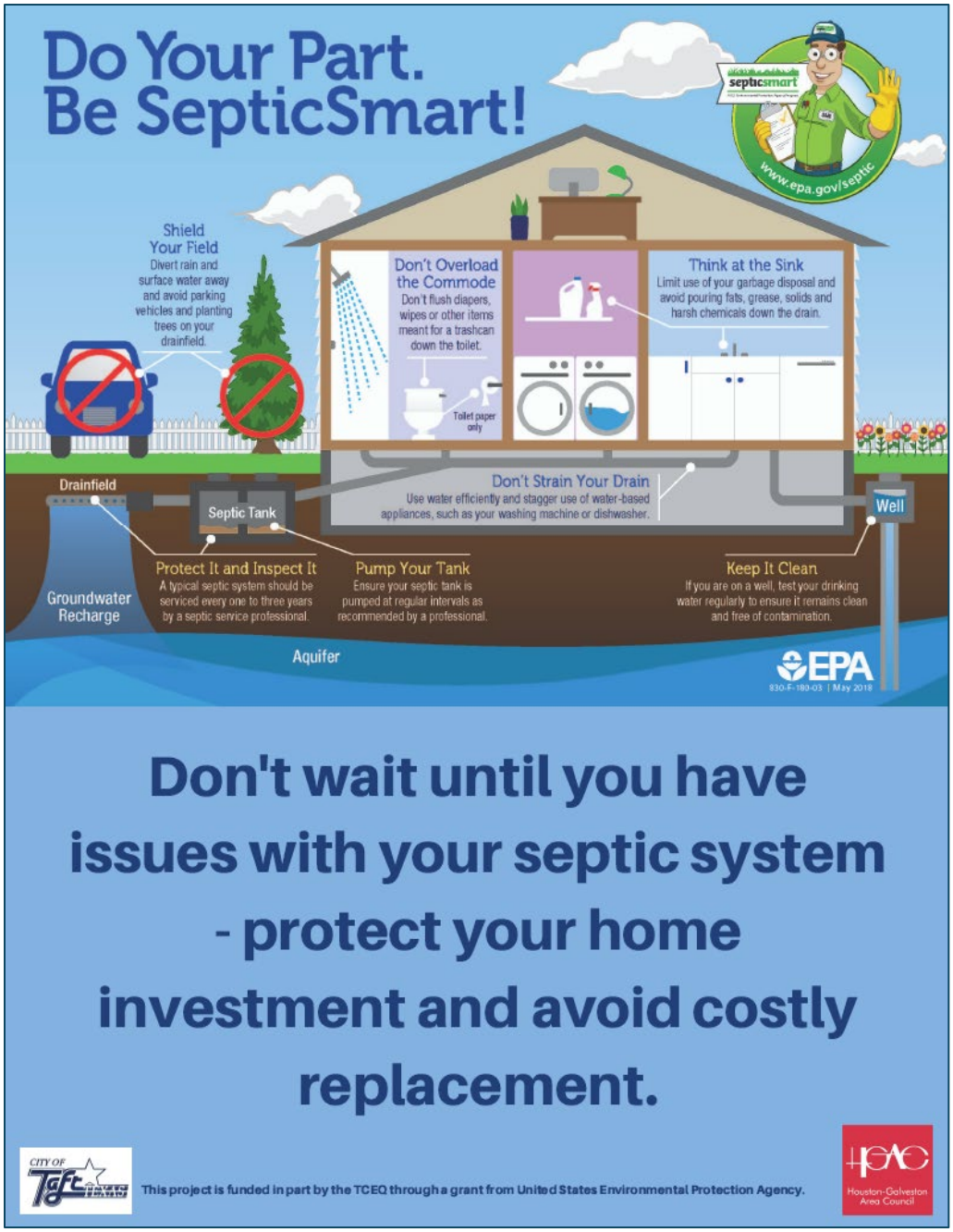

Figure 6. Customized material for City of Taft with logo at bottom left.

Subtask 3.3: Follow Up with Cities

In FY23 and FY24, TWRI conducted follow-up evaluations with the 10 participating cities in the 12-month window following their initial training. TWRI asked each user the following questions in a semi-guided interview:

1. Did you personally receive the training on how to use the website?
2. If so, have you used the materials in the last year?
3. How would you describe the response from the community to these materials?
4. What suggestions do you have to make these more useful for you and other community agents?

Due to employee turnover, only four of the original staff trained on use of the website were available for follow-up evaluation. The feedback on the availability and impact of the materials was generally positive. The City of Beeville specifically stated that they had used the materials on their social media page (Figure 7). Other cities stated they had posted materials in public areas (e.g., library bulletin boards) and intended to continue using them. Suggestions for future material included simplified versions of messaging and translation of the materials into Spanish.

Figure 7. Screenshots of the City of Beeville using materials from the Coastal Communities website toolbox after the training by TWRI.

The six remaining cities contacted for follow-up evaluation had experienced staff turnover, and the original staff member trained on the website had left the position. In these cases, the staff who answered the phone were retrained on how to use the website and asked to share the website as a resource with other city employees who would find it relevant. A follow-up email was sent with links to the website, the training material PowerPoint, and contact information in case the new employee would like to request additional assistance or materials.

Subtask 3.4: Task Report

This task report describes the activities and deliverables completed as part of Task 3, including the following deliverables:

- 3.1 Training materials
- 3.1 Training summaries
- 3.2 Updated list of customized materials and cities receiving assistance
- 3.3 Status of follow up communication with cities
- 3.3 Summary of follow up discussions with cities and website analytics
- 3.4 Draft Task Report
- 3.4 Final Task Report

Task 4: Development, Delivery and Evaluation of OSSF Targeted Educational Materials

The objective of Task 4 was to identify OSSF owners within the Jackson County portion of Lavaca and Carancahua Bay watersheds as well as the Matagorda County portion of Carancahua Bay and Tres Palacios watersheds, in order to develop and deliver educational materials directly to OSSF owners to encourage routine OSSF inspection and maintenance and evaluate the success of the education campaign. This task contained the following Subtasks:

- Subtask 4.1: Identify OSSF Owners
- Subtask 4.2: Develop Targeted OSSF Educational Materials
- Subtask 4.3: Update Website
- Subtask 4.4: Deliver Educational Materials
- Subtask 4.5: Task Report

Subtask 4.1: Identify OSSF Owners

In FY21, TWRI and the Texas A&M AgriLife Biological and Agricultural Engineering (BAEN) specialists developed a mailing list of OSSF owners within the targeted watersheds in Jackson and Matagorda counties. The list was made using publicly available mailing addresses from County Appraisal Districts. Parcels located outside of city sewer service areas with low to highly developed land use/land cover were included as potential recipients. BAEN added the mailing addresses of participants within the counties who had previously attended in-person homeowner OSSF maintenance classes. The initial list for distribution contained 1,563 addresses.

A proposed mailing schedule was also created to plan out the four mailings that all addresses would receive. The first mailer was scheduled for February 2022, followed by May 2022, August 2022, and November 2022. The mailed evaluation following the postcard was scheduled for January – February 2023.

Subtask 4.2: Develop Targeted OSSF Educational Materials

TWRI developed an educational postcard (“mailer”) for targeted distribution to the recipients on the mailing list. The mailer was designed to include information about signs of a failing OSSF, harmful actions, and recommended maintenance actions (Figure 8). It also included a call to action and links to online educational information and contact information for BAEN OSSF specialists. The final mailer design was submitted and approved by the TAMU Institutional Review Board (IRB) for distribution as part of evaluation research with human subjects (IRB #2020-1509M).

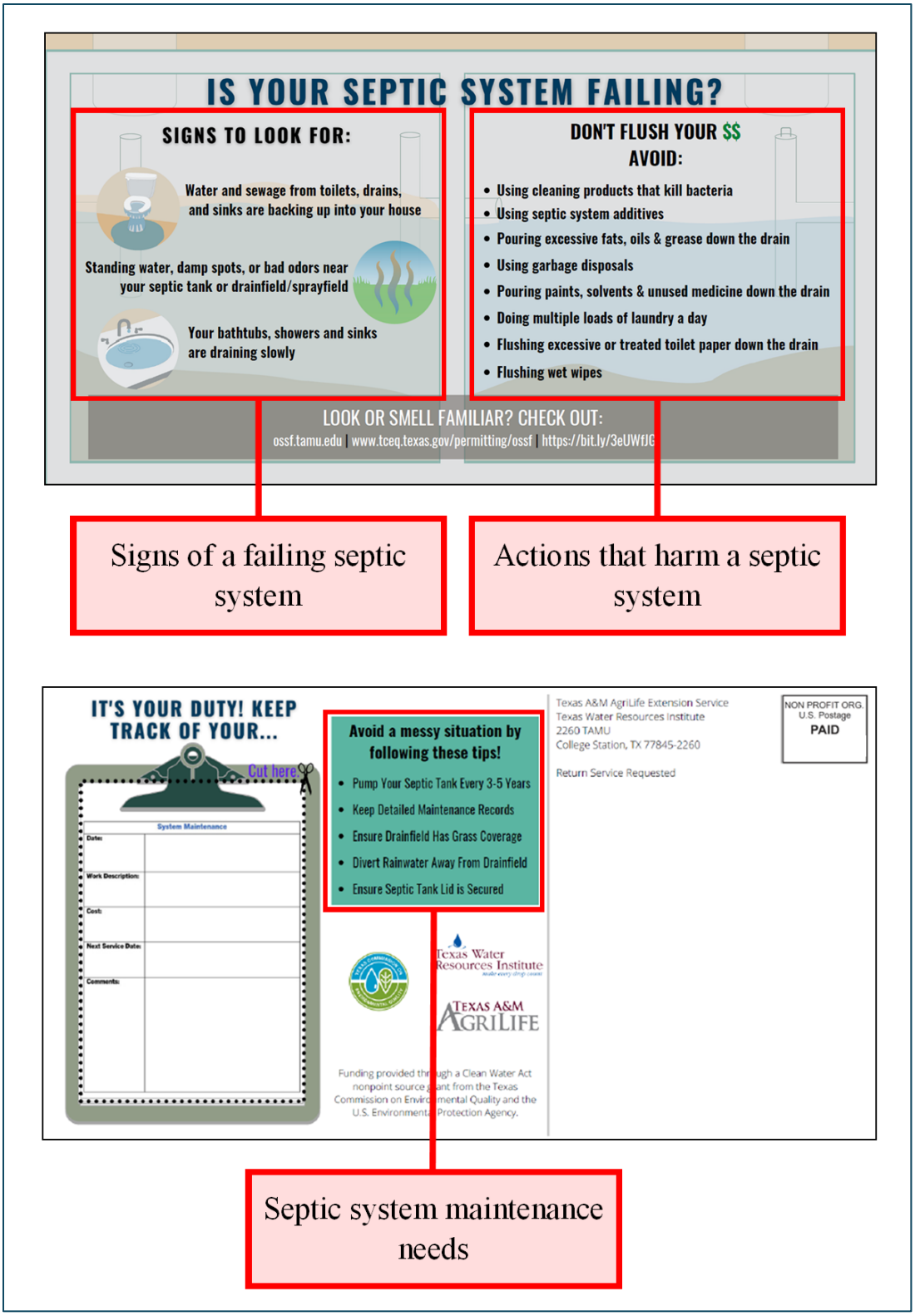

Figure 8. Final educational mailer design.

BAEN collected instructional video footage on OSSF inspection and maintenance actions for homeowners. Using this footage, TWRI produced three videos focused on introduction to OSSF basics, conventional system components and inspection, and aerobic system inspection and maintenance. The videos were posted to the TWRI YouTube channel and the BAEN OSSF website (www.ossf.tamu.edu).

Subtask 4.3: Update Website

In FY23, BAEN and TWRI worked to add information and materials to the BAEN OSSF website, including links to TCEQ contact information for licensed OSSF inspectors and local permitting authorities (Figure 9). The videos developed in Subtask 4.2 were posted to the website in FY25 (Figure 10).

Figure 9. Screenshot of ossf.tamu.edu homepage with links to OSSF inspectors and permitting authorities.

OSSF Maintenance Basics

How to Check and Maintain a Conventional (Anaerobic) OSSF System

How to Check and Maintain an Aerobic OSSF System

Figure 10. Screenshot of educational videos posted on ossf.tamu.edu.

Subtask 4.4: Deliver Educational Materials

The mailers developed in Subtask 4.2 were distributed beginning in FY22Q2 through FY23Q1 on a quarterly interval. In total, 1,563 addresses received the initial mailing. Mailers returned as undeliverable were removed from the list after each distribution. A total of 1,374 recipients were in the final mailing distribution and received all four mailers. In total, 6,074 contacts were made with the educational mailers within the target watersheds.

Subtask 4.5: Program Evaluation

In FY23, immediately following the final distribution of the mailer, TWRI began distributing evaluations to measure the campaign's impact and collect relevant OSSF maintenance data to inform future programming. A pre-notice postcard, information sheet, questionnaire with reply envelope, and reminder postcard were developed for the evaluation and approved by the TAMU IRB (IRB #2020-1509M) as part of human subjects research. The materials were distributed weekly beginning late January 2023 to the same mailing list as the mailers, following the Tailored Design Method (Dillman et al. 2014). A replacement survey was also distributed two weeks after the reminder postcard for addresses that had not responded.

The questionnaire was designed with questions pertaining to OSSF characteristics, mailer impact (retrospective pre/post-evaluation), behavioral intentions (for future maintenance), and homeowner demographics. Respondents were asked to report if they performed any maintenance actions, including inspections, repairs, or replacements of their OSSF system. Changes in knowledge were also collected using a four-point Likert-type item. The respondents were asked to measure their knowledge in the three categories of "signs that of a failing system", "actions that harm a system", and "system maintenance needs" on a four-point scale from 1 = *Poor* to 4 = *Excellent*. Knowledge was self-assessed using the Likert-type items with a retrospective post- then pre-test design, which first rates current knowledge (post-test) then asks respondents to rate their knowledge before the intervention (pre-test, ex: before intervention/mailers) (Rockwell & Kohn 1989). This data was analyzed using a one-sided Wilcoxon signed-rank test on each (Hollander et al. 2014). All other data was analyzed with descriptive statistics.

A total of 216 homeowners (16.3%) responded to the evaluation. Following review, 171 responses were usable with complete and relevant data. In the respondent population, 67.3% (n = 115) were male, 53.2% (n = 91) made less than $100,000 in income, and the average age was 64.3 (SD = 12.9). Most respondents (n = 141, 82.5%) were white or Caucasian while 7% (n = 12) identified as Hispanic. Most respondents had high school

graduate (*n* = 33, 19.3%), some college (*n* = 54; 31.6%), or college graduate (*n* = 48; 28.1%) education levels.

Homeowners were nearly evenly divided in tenure, with 39.2% (n = 67) having owned their home for 10 years or less, 29.2% (n = 50) for 11 – 20 years, and 31.6% (n = 54) for more than 20 years. There was an even distribution of conventional anaerobic systems and alternative aerobic systems. The median annual maintenance cost for owners of OSSF was $200.

Overall, the respondents who participated in the survey identified that print materials (*n* = 79) and online videos or written materials (*n* = 48 and *n* = 36, respectively) were their preferred methods of communication. Additionally, they felt OSSF maintenance needs (*n* = 81) and inspection methods (*n* = 61) were the most needed topics for educational materials. The most frequently used sources of information were local OSSF professionals (*n* = 91), local government offices (*n* = 25), and the Texas A&M AgriLife Extension Service (*n* = 22).

In total, 66 respondents (38.6%) recalled receiving the mailer. For these respondents, their self-assessed knowledge increased in each knowledge category (signs, harmful actions, maintenance needs) after receiving the mailer at a statistically significant interval ($p < 0.05$). The mailer prompted eight of these homeowners to have their system inspected, pumped, and/or repaired.

Respondents largely (*n* = 99; 59%) agreed with the intention to have their septic system inspected within the next three years. Seventy-four respondents (44.6%) agreed with the intention to have their system pumped within the same timeframe. The greatest barriers to septic system maintenance for homeowners were skills to identify a failing septic system (n = 21; 12.6%) and resources to maintain the system (n = 18; 10.9%).

Two scientific publications were created from this evaluation of mailers. One is in peer review and one is in draft at the time of this report. This evaluation of mailers and related data analyses were also presented as a poster at the 2024 Gulf of Mexico Alliance Conference in Tampa, FL, in February 2024.

Subtask 4.6: Task Report

This task report describes the activities and deliverables completed as part of Task 4, including the following deliverables:

- 4.1 Mailing list of OSSF owners
- 4.2 OSSF educational materials
- 4.3 OSSF project website updates

4.4 Proposed mailing schedule
4.4 Deliver OSSF educational materials
4.5 Program Evaluation results, including number of responses
4.6 Draft Task Report
4.6 Final Task Report

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