The Nature Conservancy

Texas Wetland Action Mapping Plan

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The Nature Conservancy's Texas Wetland Action Mapping (WAM) Project Team

Dr. Lauren Hutch Williams, Texas Resilient Coast Program Director
Dr. Christine Shepard, Gulf Program Director of Science
Charlotte Nash, Texas Resilient Coast Project Manager
Jacquie Ferrato, Texas Spatial Analyst
Karrie Arnold, Gulf Program Conservation Information Manager

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A Collaborative Effort of the Texas WAM Working Group

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Executive Summary

Tidal wetlands—tidal marsh, brackish marsh, mangroves and tidal flats—are valuable coastal ecosystems in Texas, providing nursery habitat for commercial and recreational fisheries, refuge for endangered species like the whooping crane and critical storm surge and flood protection for coastal communities. However, tidal wetlands in Texas have been disappearing at an accelerating rate due to subsidence, sea level rise, erosion and coastal development. Without coordinated action, wetland loss will only intensify, despite numerous efforts by federal and state agencies, environmental nonprofits, land trusts, landowners and restoration practitioners.

To avoid further tidal wetland loss in Texas, The Nature Conservancy (TNC) and a broad coalition of partners worked together to implement the Texas Wetland Action Mapping (Texas WAM) project. This collaborative, science-based initiative has been underway since 2023 to coordinate statewide action via participatory mapping and priority alignment. Texas WAM aims to catalyze collaboration and funding opportunities for tidal wetland restoration and conservation in consensus-based priority areas. The *Texas Wetland Action Mapping Plan* is the first statewide plan focused on tidal wetland conservation and restoration developed in recent decades.

The Texas WAM working group was established with membership from 34 partner organizations. During a series of regional workshops and targeted planning sessions conducted over two years, the working group developed a shared set of goals and strategies and prioritized locations where working group members and partners could implement action. Action areas were selected using a participatory mapping process and planning tools developed by the Texas WAM project team to help guide wetland restoration and conservation investments across the coast.

Texas WAM Goals and Strategies

The overarching goal of Texas WAM is to reduce and reverse the trend of tidal wetland loss by aligning and accelerating partner-led conservation and restoration efforts. Through a collaborative planning process led by TNC, **six focal strategies for tidal wetland conservation and restoration** were identified:

1. **Protecting Wetlands**
2. **Implementing Living Shorelines**
3. **Restoring Hydrologic Flow**
4. **Employing Beneficial Use of Dredged Material**
5. **Protecting Wetland Migration Space**
6. **Improving Management of Wetland Migration Space**

These six strategies address threats to tidal wetlands and increase wetland resilience to future conditions. Protection efforts like outright acquisition or conservation easements ensure wetlands and their migration space are not lost to development. Living shorelines buffer wetlands from boat wakes and shoreline erosion, while beneficial use of dredged material helps marshes keep pace with relative sea level rise. Improved management of wetland migration space (through landowner outreach and best management practices) ensures that wetlands have strategic space to migrate inland as sea levels continue to rise. To inform working group discussions and decisions, the Texas WAM project team created opportunity maps that identify where each of the six conservation and restoration strategies could be implemented across the coast (Figure 1A). The maps use the best available spatial data and expert input, while also considering where wetlands are resilient and adjacent to undeveloped migration space.

To complement the opportunity maps, the WAM project team also developed five co-benefit maps, which highlight areas where wetland action could provide additional ecological and social benefits or support enhanced ecosystem services for coastal communities. Identifying locations where there is opportunity for wetland restoration and conservation and potential co-benefits allowed working group members to identify areas where action is likely to have high impact. **The co-benefit maps highlight areas likely to provide benefits related to:**

1. **Priority Habitat for Species of Greatest Conservation Need**
2. **Flood Mitigation**
3. **High Social Vulnerability to Hazards**
4. **Tidal Wetland Carbon Stocks**
5. **Improved Access to Potential Parks**

Wetland Action Areas

Texas WAM focused its process on partner-informed mapping and planning. Over twelve regional workshops and additional follow-up meetings, working group members refined goals and strategies, reviewed and provided feedback on opportunity maps and co-benefit maps, and engaged in guided participatory mapping exercises to select action areas that provide multiple co-benefits and the ability to potentially sustain wetlands over time. These action areas were revised iteratively and collaboratively to ensure their even distribution across the Texas coast, inclusion of wetland migration corridors, and feasibility of conservation and restoration actions.

The result of this collaborative approach is a portfolio of 17 action areas that capture about 79% of the mapped opportunities for wetland conservation and restoration across the state (Figure 1B). Although all tidal wetlands in Texas provide benefits to people and nature, the WAM working group selected the 17 action areas as locations along the coast where partners will work together to focus funding and project implementation for the current and future resilience of tidal wetlands. The action areas represent more than 1 million acres prioritized for their co-benefits to people and nature and potential for collaborative conservation and restoration implementation.

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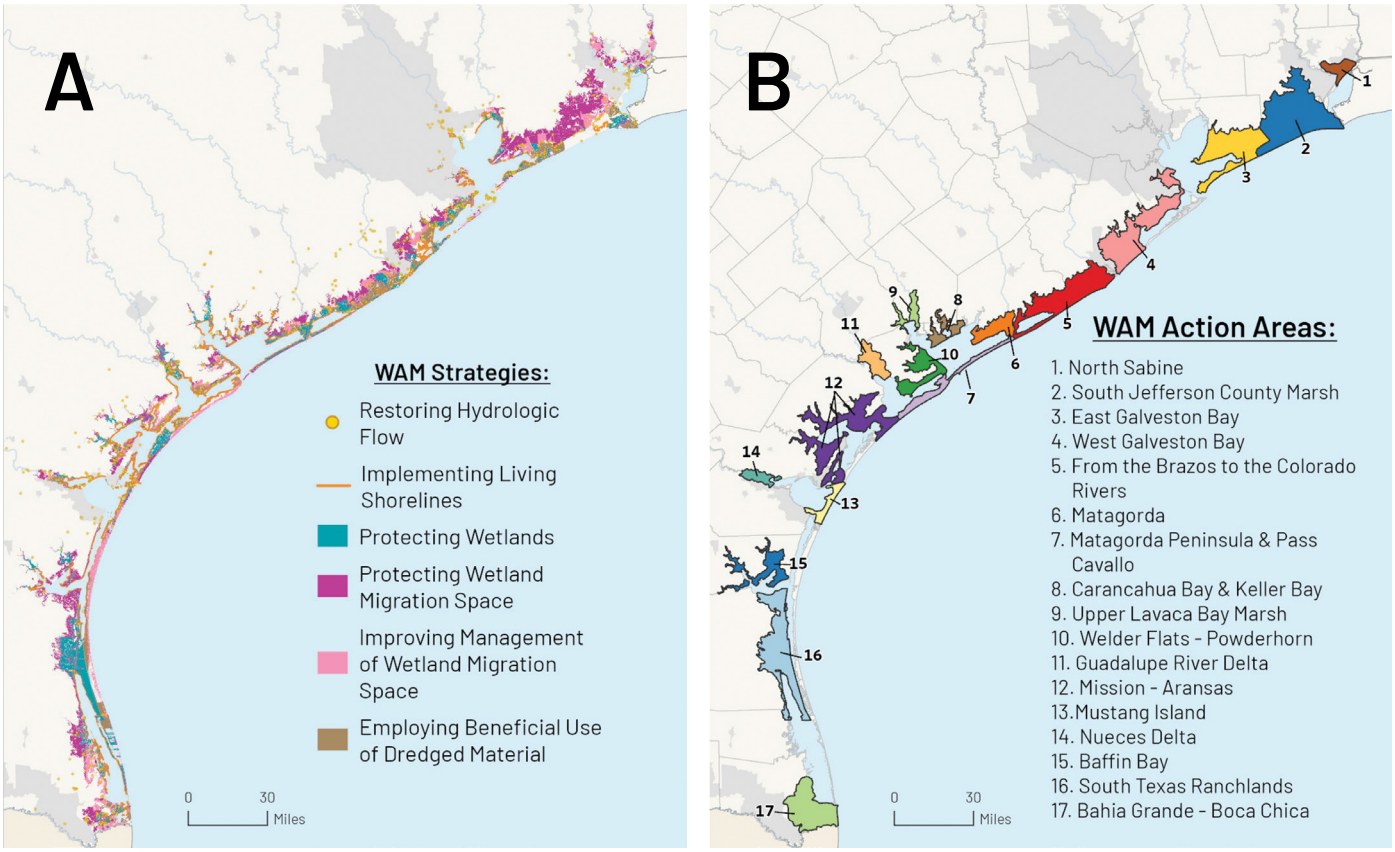

FIGURE 1: Texas WAM A) Identified Opportunities for Conservation and Restoration Strategies and B) Action Areas

Texas WAM Implementation and Next Steps

To continue to engage the Texas WAM working group and key stakeholders, the WAM team has drafted implementation guidance for advancing priority projects and strategies in each action area. Next steps are to:

- Engage co-lead organizations and partners in each action area to support project development and funding;
- Develop a monitoring and evaluation plan for future work phases and potentially for a subset of action areas, and;
- Pursue coordinated funding opportunities across multiple public and private sources to catalyze project implementation

Ongoing coordination and support for the WAM working group organizations and stakeholders across the 17 action areas will be essential to strengthening the resilience of tidal wetlands— for the benefit of both wildlife and the people of Texas.

Introduction

Spanning an estimated 802,201 acres, Texas tidal wetlands can look like cordgrass prairies, black mangrove scrub-shrub, halophyte high marsh or wind-tidal flats.[1] These ecosystems provide nursery areas for more than half of Texas' commercial fish and shellfish, habitat for threatened and endangered species like whooping cranes and Eastern black rails and flood and storm surge reduction to coastal Texas communities.[2] Over 400 million migratory birds use Texas coastal marshes to recharge on their journey through the Central Flyway twice each year, and over 22 million tons of carbon are stored in the soil of Texas tidal wetlands.[3]

Yet tidal wetlands in Texas face multiple threats, including relative sea level rise, erosion from storms and boat wakes, development pressure, impacts from hurricanes and storms, hydrologic modifications, resource extraction, barriers to tidal marsh migration and changes in federal wetland policy and protection. Salt marshes nationally are disappearing faster than all other wetland types, with the most severe losses occurring in Gulf Coast counties, according to the congressionally mandated *Status and Trends of Wetlands in the Conterminous United States 2009 to 2019* report. Tidal wetland loss will only accelerate as threats like coastal development and sea level rise intensify.

Despite current efforts, wetland loss is outpacing their restoration and conservation. The *Status and Trends* report warns that net loss of wetlands will continue, particularly in the Southeastern United States, "unless the way wetlands are managed and conserved changes."[4] Currently, there is no statewide tidal wetland protection plan for Texas that considers both current and future conditions along the Texas coast. The General Land Office's (GLO's) *Texas Coastal Resiliency Master Plan* (TCRMP) has many project ideas focused on wetland restoration and protection, but the last *Texas Wetlands Conservation Plan* was released by Texas Parks and Wildlife Department (TPWD) in the early 1990s.[5]

The Texas Wetland Action Mapping (Texas WAM) project seeks to increase the pace and scale of tidal wetland conservation and restoration in the state by aligning partners, funding and projects in strategic action areas that contribute to the near-term and long-term resilience of tidal wetlands.

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1 Fern et al., 2023
2 Lellis-Dibble et al., 2008
3 Fern et al., 2023; Feagin, 2022
4 Lang et al., 2024
5 Texas Parks and Wildlife Department, 1997; Texas General Land Office, 2023. Many regional and bay-system focused plans have been developed since then, some examples include the *Coastal Bend Bays Plan* (Coastal Bend Bays & Estuaries Program, 2020); *The Galveston Bay Plan, 2nd Edition* (Galveston Bay Estuary Program, 2018); the *Salt Bayou Wetland Restoration Plan* (Salt Bayou Marsh Workgroup, 2013); and the *Seabrook Wetland Conservation Plan* (Houston-Galveston Area Council, 2000).

Texas WAM was developed to consider not only where the state's tidal wetlands are currently located, but their potential future location and distribution as well. Current tidal wetland complexes and their associated migration space were identified using TNC's Resilient Coastal Sites (RCS) of the Gulf of Mexico dataset and the coastal wetland landscape change modeling data created for the Texas GLO's most recent TCRMP.[6] The Texas WAM project team collated important datasets related to tidal wetlands, tidal wetland migration space, existing protected areas, shoreline conditions, tidal wetland co-benefits and known wetland conservation and restoration projects. The team then led a stakeholder working group through a participatory mapping process to identify consensus-based, high priority areas where collaboration, funding and implementation of wetland restoration and protection could be focused across the Texas coast.

Texas WAM Goals and Strategies

The overall goal of Texas WAM is to reduce and reverse the trend of tidal wetland loss in Texas.

This goal was adapted from the Interagency Coastal Wetlands Workgroup (ICWWG) goal to reduce and reverse the trend of coastal wetland loss and updated to reflect the Texas WAM project scope, which is limited to tidal wetlands defined as tidal marsh, brackish marsh and tidal flats.[7] Texas WAM was heavily informed by the ICWWG's *Recommendations for Reducing Wetland Loss in Coastal Watersheds of the United States*.[8] The ICWWG was created by the Environmental Protection Agency (EPA) in response to wetland losses reported in the National Oceanic and Atmospheric Administration (NOAA) and U.S. Fish and Wildlife Service (USFWS) 2008 *Status and Trends of Wetlands* report.[9] The WAM project team adapted the recommendations from the ICWWG report with input from the Texas WAM working group and added a goal to prioritize wetland action areas where multiple co-benefits align.

The goals developed by the Texas WAM working group to reduce and reverse the trend of tidal wetland loss in Texas, as shown in Figure 2, are to:

- Increase the acreage of tidal wetlands restored in coastal watersheds through restoration and improved management
- Reduce loss of tidal wetlands through protection
- Reduce loss of tidal wetland migration space to future development though protection
- Conduct targeted outreach and stakeholder engagement
- Prioritize wetland action areas where multiple co-benefits align

6 Anderson and Barnett, 2019; Subedee et al., 2023
7 As defined in Anderson and Barnett, 2019
8 Interagency Coastal Wetlands Workgroup, 2022
9 Stedman and Dahl, 2008

The Overall Goal of Texas WAM Is to Reduce and Reverse the Trend of Tidal Wetland Loss in Texas

Goals	Strategies
Increase the Acreage of Tidal* Wetlands Restored in Coastal Watersheds through Restoration and Improved Management	• Restoring Hydrologic Flow • Employing Beneficial Use of Dredged Material • Implementing Living Shorelines • Improving Management of Wetland Migration Space
Reduce Loss of Tidal Wetlands through Protection	• Protecting Wetlands
Reduce Loss of Tidal Wetland Migration Space to Future Development through Protection	• Protecting Wetland Migration Space
Conduct Targeted Outreach and Stakeholder Engagement	• Engaging the Texas WAM Working Group • Conducting outreach to landowners, land trusts, coastal managers and local governments
Prioritize Wetland Action Areas Where Multiple Co-Benefits Align	• Mapping areas that are likely to provide co-benefits and considering these co-benefits when selecting action areas

FIGURE 2: Texas WAM Goals and Strategies. Each conservation and restoration strategy (indicated by a) of the nine total has a corresponding opportunity map developed to show where there are opportunities to implement each protection and restoration strategy across the Texas coast.

Texas WAM Working Group and Process

The WAM process was proposed by the WAM project team and refined by the WAM working group to ensure the project outputs reflect the consensus of stakeholders engaged in coastal wetland restoration and protection efforts in Texas. The Texas WAM working group is comprised of representatives from state and federal resource management agencies, county governments, environmental nonprofits, land trusts, private landowners, environmental consultants and academics, representing 34 entities and agencies overall (see Figure 3, or Appendix A for a full participant list). During twelve in-person workshops, two follow-up calls and one webinar, the working group, along with others, provided feedback on the proposed WAM process, created the goal statements and identified the key threats to tidal wetlands and potential threat-reducing strategies. They also reviewed draft maps of opportunity for implementing restoration and conservation strategies (opportunity maps), submitted priority locations for their agencies and organizations and proposed action areas during a participatory mapping exercise. Finally, the working group reviewed and approved the final WAM action areas. A subset of working group members also volunteered to review the draft WAM action plan.

Texas WAM Working Group

Potential members were identified by the Texas WAM project team and invited to join the Texas WAM working group based on relevant expertise and work experience. Specifically, the Texas WAM project team targeted those conducting research or leading projects associated with each envisioned WAM strategy. At each workshop, the project team asked working group members to suggest potential participants for subsequent workshops, leading to increased perspectives over time.

A series of twelve in-person workshops was held from March 2024 to June 2025 on the upper, middle and lower coast. Through these workshops, working group members developed and strengthened relationships with other participants. Collaboration was a priority reason for working group member participation in the WAM project, along with increasing knowledge about Texas spatial data and the opportunity to provide input into the action plan.

Each step in building the WAM process was approved by the WAM working group before proceeding. The project team guided these discussions and asked targeted questions using a polling tool called Mentimeter. This live-survey platform allowed less vocal participants to provide input anonymously or choose to share publicly with co-participants. A summary of the questions and responses can be found in the workshop summaries included in Appendix B.

FIGURE 3: Texas WAM working group member organizations.

Texas WAM Mapping Process

Overall, the mapping process involved creating opportunity maps and co-benefit layers and engaging the WAM working group to identify high priority action areas for protection and restoration (Figure 4).

Opportunity maps were created for six tidal wetland conservation and restoration strategies:

- Protecting Wetlands
- Implementing Living Shorelines
- Restoring Hydrologic Flow
- Employing Beneficial Use of Dredged Material
- Protecting Wetland Migration Space
- Improving Management of Wetland Migration Space

The maps highlight where these strategies could be implemented across the Texas coast. Opportunity maps were not designed to prioritize any one area over the other, but rather to show all potential implementation opportunities for tidal wetland conservation and restoration strategies.

Maps were also created to summarize where co-benefits would likely be derived from WAM strategies across the coast. In total, five of these individual co-benefit maps, and one summary map, were created for the most important wetland co-benefits determined by the working group. Co-benefits maps were created for:

- Priority Habitat for Species of Greatest Conservation Need
- Flood Mitigation
- High Social Vulnerability to Hazards
- Tidal Wetland Carbon Stocks
- Improved Access to Potential Parks

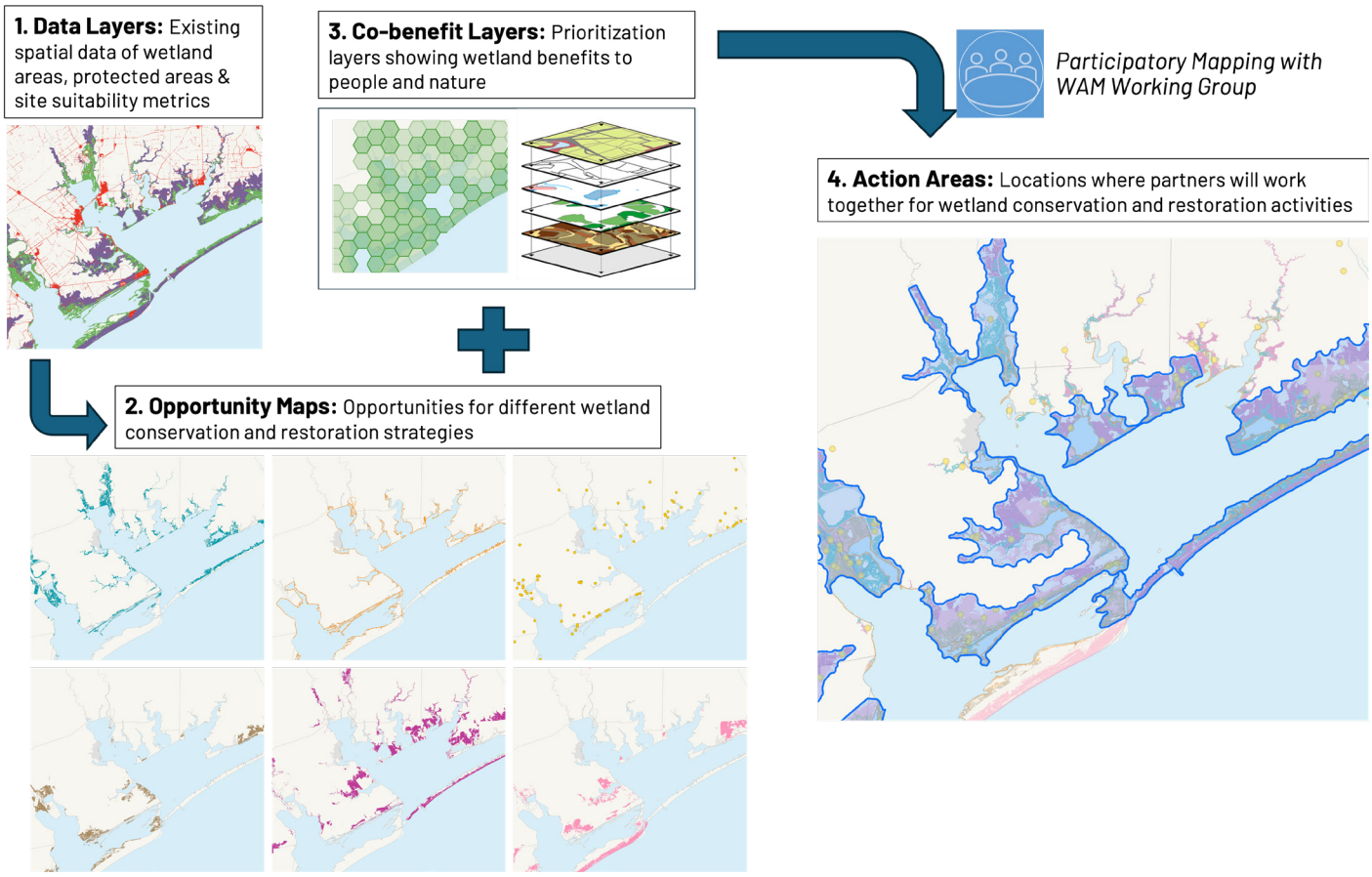

FIGURE 4: Texas Wetland Action Mapping (WAM) process.

At the second workshop series, the working group mapped their priority locations. Priority locations included areas identified as a priority by WAM member organizations, areas with existing projects that had an opportunity to expand, planned projects (identified in a plan or that had pending funding) or those deemed priorities based on local knowledge or expert opinion. Working group members were able to draw polygons on a map app or upload shapefiles of their priority locations. The priority locations were then combined into one map so participants could see other members' conservation and restoration activities or interests.

Texas WAM uses the planning regions from the Texas GLO's TCRMP, which divides the Coastal Zone Management Area into four planning regions. At the first workshop series in March 2024, participants stipulated that the action plan should identify 10-20 action areas which should be evenly distributed across the Texas coast. The WAM project team suggested a goal of 3-5 action areas per planning region to prevent the clustering of action areas only where there is already high organizational capacity and active coastal conservation and restoration. For example, in South Texas, there has historically been less capacity (i.e., fewer organizations and agency staff) for tidal wetland restoration and protection, despite having some of the most ecologically diverse tidal wetlands in the state.

The Texas Wetland Action Mapping Tool was created as an interactive way to explore the opportunity and co-benefit maps, priority locations of the working group and other relevant wetland conservation and restoration planning data (Figure 5, see Appendix C for details on all Texas WAM Tool layers). To better aggregate datasets for decision-making, a hexagonal grid of 679 planning units was created across the coastal zone. Each hexagon represents approximately 5,000 hectares in area, which is the average size of a tidal complex identified in the base data used (RCS of the Gulf of Mexico).

At the third workshop series, small groups of participants selected planning units based on their co-benefits, their ability to sustain wetlands in the near-term and their ability to sustain wetlands in the future. Afterward, the working group proposed draft action areas based on these planning units. The WAM project team evaluated the submitted draft action areas and worked to reduce the number and size of action areas to meet working group recommendations. Specifically, overlapping action areas and ecologically connected adjacent action areas were combined. Action areas or planning units with minimal opportunity for action were removed. In some cases, action areas were expanded to incorporate adjacent wetland migration space. Lastly, the action area boundaries were adjusted and refined to remove areas with little to no opportunity to implement the WAM strategies.

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In total, 20 refined wetland action areas were presented to the working group at the final workshop series for review, feedback and approval. During summer 2025, additional planning meetings were conducted for each action area, where the action area leads and partners met to refine the action area boundary and name, discuss project ideas and identify potential project funding sources. These additional planning meetings led to several adjacent action areas combined into one because they shared tidal wetland needs, local stakeholders and relevant strategies. This brought the final action area count to 17.

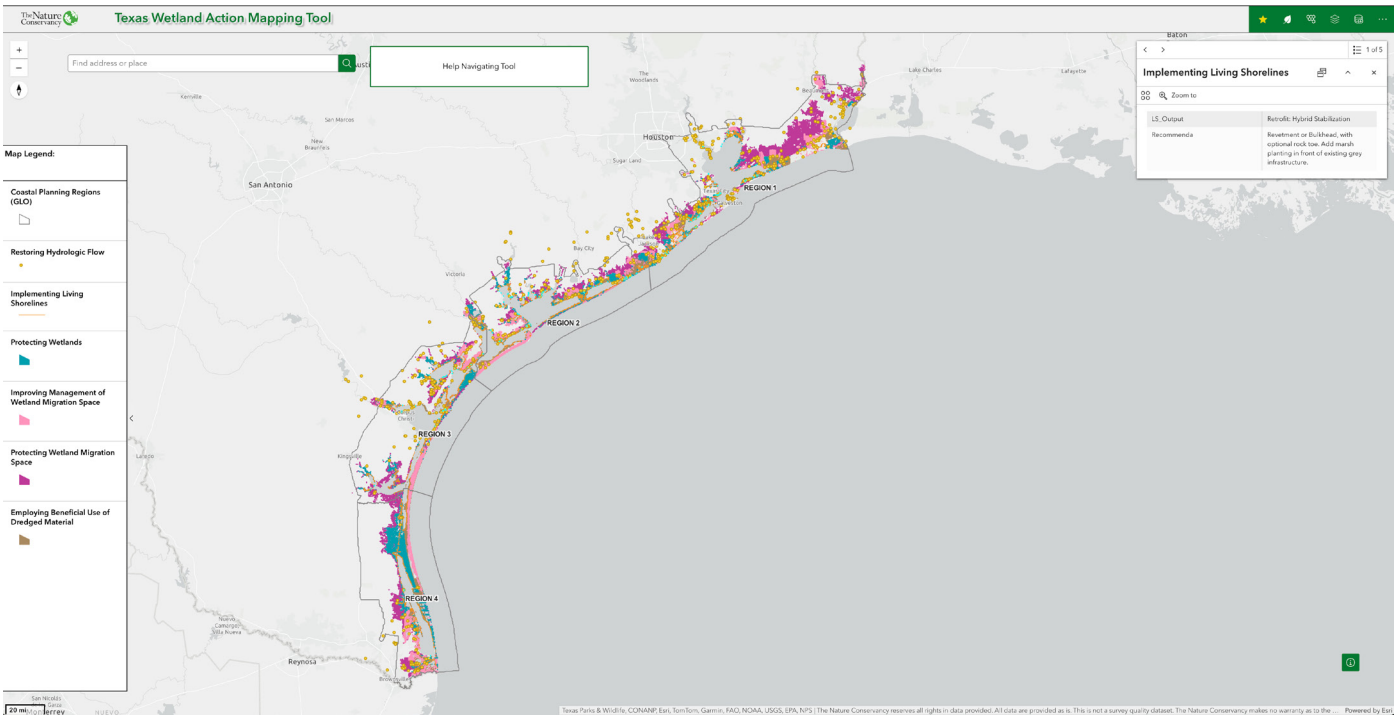


FIGURE 5: The Texas Wetland Action Mapping Tool provides an interactive way to explore data relevant to wetland restoration and conservation action planning for Texas.

Supporting Data and Opportunity Maps

Existing Spatial Data

TIDAL WETLANDS

Data from TNC's *Resilient Coastal Sites for Conservation in the Gulf of Mexico US* was used to map the approximate current extent of tidal wetlands.[10] The Resilient Coastal Sites (RCS) project was initiated by a TNC team in 2019 with oversight from a steering committee with representation from USFWS, NOAA and the U.S. Geological Survey (USGS), as well as agency staff and academics from each Gulf state. The RCS dataset was created based on the principle that, "Coastal sites vary wildly in their ability to accommodate rising seas based on inherent natural features and the degree of human influence on key ecological processes." The dataset considers these natural features and human influences to estimate the resilience or vulnerability to sea level rise of tidal wetlands across the Gulf Coast. The WAM project team chose to use the RCS data because of the attribute data for wetland resilience, and for other included metrics such as sediment availability, water quality and ecological connection. The RCS uses NOAA Coastal Change Analysis Program data cross-referenced with USFWS National Wetlands Inventory data to group closely adjacent tidal habitat of various types into discrete ecologically connected tidal complexes.

Resilience is defined in the RCS dataset as "the ability of a site to support biological diversity and ecological functions even as it changes in response to climate change and sea level rise."

RESILIENCE SCORES

Each ecologically connected tidal complex in the RCS has its own estimate of relative resilience. Resilience scores were determined for each tidal complex by quantifying physical properties such as the amount of migration space and diversity of different tidal wetland ecotypes, as well as condition attributes like undeveloped marsh edge, sediment balance and water quality. For Texas WAM, wetlands with a resilience score slightly above average or higher were considered resilient, which corresponded to 96% of Texas wetlands.

10 Anderson and Barnett, 2019

WETLAND MIGRATION SPACE

Wetland migration space is defined in the RCS as "the area of low-lying land adjacent to the tidal complex that is potentially suitable for supporting tidal habitats in the future and into which the current habitats could migrate in response to rising sea levels." For the RCS data, migration space was mapped by using data from the NOAA Sea Level Rise Viewer, which uses a modified bathtub approach that considers local and regional tidal variability for multiple sea level rise (SLR) scenarios. In total, four different SLR scenarios were evaluated from the NOAA SLR Viewer data: 1.5 feet, 3 feet, 4 feet and 6.5 feet. For Texas WAM, the migration space area is represented by all SLR scenarios combined into one layer. This method captured the total potential migration space extent, from the most inland extent under the 6.5-foot-rise scenario to the most seaward extent in the 1.5-foot scenario, which might have already become open water in scenarios with greater SLR.

PROTECTED AREAS LAYER

To understand which areas are currently protected through outright acquisition or conservation easement, data from the U.S. Geological Survey's Protected Areas Database of the United States 4.0 was combined with supplemental data from the National Conservation Easement Database, the Texas Agriculture Land Trust and the Texas Land Trust Council.

Opportunity Maps

Six opportunity maps were developed to represent where tidal wetland conservation or restoration strategies could be implemented across the Texas coast (Figure 6). The six maps were created to guide the selection of action areas by visually displaying where various conservation and restoration strategies could work synergistically in strategic locations.

Before the WAM working group process began, the project team hosted a webinar to kick the project off and a technical follow-up call to gather feedback on which conservation and restoration strategies to map for Texas. The WAM project team also consulted experts in each strategy, such as the U.S. Army Corps of Engineers (USACE) for the beneficial use of dredged material map, Harte Research Institute for Gulf of Mexico Studies (HRI) who created the GLO's Living Shorelines Suitability Model and USGS who is leading a project with USFWS to identify opportunities and barriers for wetland migration on the upper and mid- Texas coast. See Appendix C for more about the methods used to generate each map.

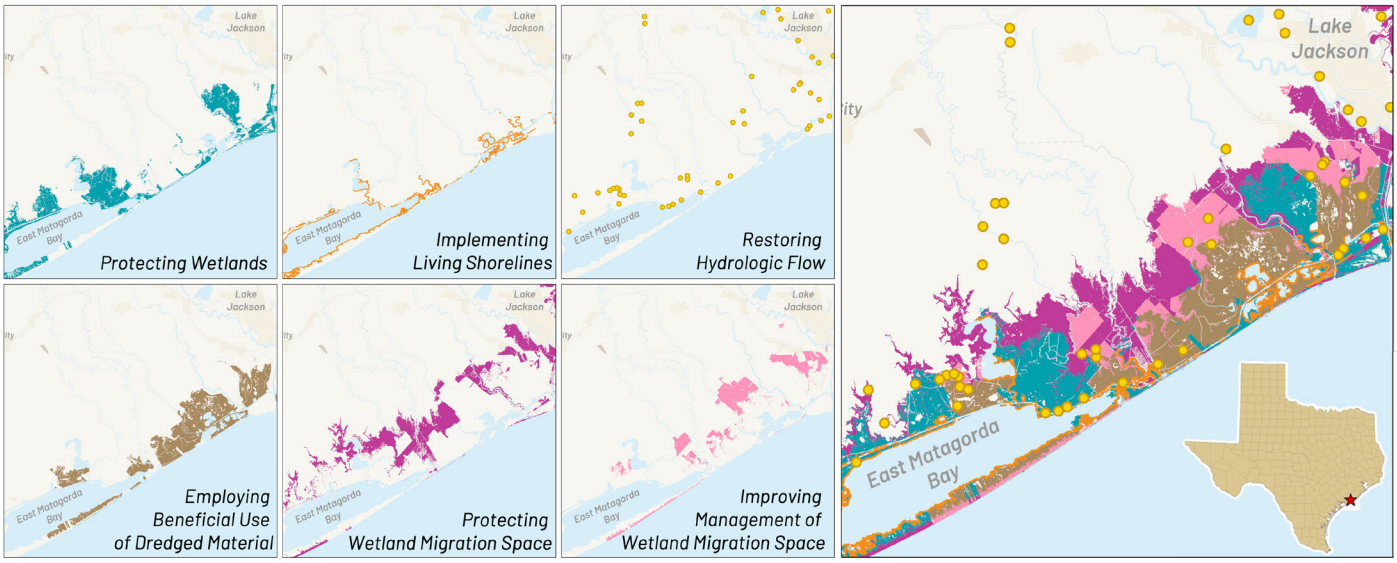


FIGURE 6: Opportunity maps created for each of the six Texas WAM strategies for the entire Texas coast. Figure example shows maps zoomed in on East Matagorda Bay.

PROTECTING WETLANDS

Tidal wetlands can be legally protected from future development or conversion through outright acquisition or conservation easement. The *Protecting Wetlands* opportunity map shows where existing tidal wetlands occur that are both resilient and not currently protected through a conservation easement or federal, state or land trust ownership. Wetlands with above-average resilience in the RCS were included as good candidates for protection based on their ability to migrate inland to adjacent lowlands with sea level rise.

An example of a Texas tidal wetland protection project is the Coastal Heritage Preserve (Figure 7). Since 2012, Artist Boat, Inc. has completed 15 land acquisition transactions to protect coastal habitats on west Galveston Island in perpetuity. Spanning 1,039 acres in total, the Preserve includes a 3-mile stretch of West Bay shoreline and over 180 acres of tidal wetlands. Conservation of these wetlands from development and channelization ensures habitat and community resilience.

FIGURE 7: Coastal Heritage Preserve on west Galveston Island.

IMPLEMENTING LIVING SHORELINES

Living shorelines are stabilized coastal edges made of natural materials such as plants, rocks or dredged sediment material. These natural materials can be placed on their own or combined with articulated blocks, riprap or breakwaters. In instances where the shoreline has already been hardened, soft or hybrid stabilization methods can be retrofitted. The *Implementing Living Shorelines* opportunity map displays opportunities for constructing living shorelines adjacent to wetlands to reduce erosion and protect adjacent wetlands. This map is primarily based on the Living Shorelines Suitability Model created by HRI for the Texas GLO.

One example of a living shoreline adjacent to tidal wetland in Texas is at Schicke Point, along the northern shoreline of Matagorda Bay (Figure 8). A private landowner, in partnership with USFWS, completed construction of nearshore breakwaters in 2022 using funding through the Matagorda Bay Mitigation Trust. The low-profile rock breakwaters were designed to protect the existing approximately 68 acres of marsh along the peninsula from erosive forces. Over time, seagrass colonization and marsh expansion have been documented on the landward side of the breakwater.

FIGURE 8: Living shoreline and marsh expansion at Schicke Point. Low-profile rock rubble breakwaters with resulting sediment accumulation behind.

RESTORING HYDROLOGIC FLOW

Hydrologic flow within wetlands can be disrupted by infrastructure such as roads and levees. Hydrologic restoration involves reestablishing the flow of water to degraded wetlands, which can improve habitat, stabilize the soil and increase accretion rates (and thus enhance elevation resilience). This map shows opportunities for restoring hydrologic flow to wetlands by installing structures like culverts that enable water to traverse a barrier.

The *Restoring Hydrologic Flow* map is primarily based on data created by Dr. Jim Holmquist of the Smithsonian Environmental Research Center to identify impounded and drained wetlands that could be restored to estuarine conditions.[11] The opportunity map also includes potential hydrologic restoration projects identified in the Coastal Bend Bays and Estuaries Program's 2019 *Mapping Potential Habitat Restoration Sites to Restore Connectivity* report, the GLO's 2023 TCRMP, and from a list of partially funded projects provided by the GLO.[12]

Some of these hydrologic restoration opportunities may also provide climate mitigation benefits through reduced methane emissions. Although the opportunity map identifies potential restoration opportunities, we recognize that some of the mapped impoundments are intentional management decisions (for example, designed to provide habitat for migratory waterfowl). Therefore, it is recommended that hydrologic restoration opportunities on this map are ground-truthed with input from landowners and land managers as project planning within the action areas evolves.

One example of a Texas tidal wetland hydrologic restoration project is the Bahia Grande Hydrologic Restoration project, one of the largest hydrologic restoration efforts in North America (Figure 9). The Gayman Channel in the lower Laguna Madre was expanded to increase tidal connectivity between the Bahia Grande basin to the Gulf by nearly three-fold, restoring natural water exchange that had been cut off for decades to an approximately 10,000-acre wetland complex. This reconnection has transformed what was once a hypersaline, barren flat into a thriving estuarine system that supports expansive wetlands, seagrass meadows, oyster beds and critical habitat for fish and migratory birds.

FIGURE 9: Gayman Channel expansion at Bahia Grande.

11 Holmquist et al., 2022
12 Smith, 2019; Texas General Land Office, 2023

EMPLOYING BENEFICIAL USE OF DREDGED MATERIAL

Sediment dredged from navigation channels can be reused to replenish sediment supply to marshes. The U.S. Army Corps of Engineers recently established a goal to use 70% of their dredged sediments beneficially by 2030. Currently the Corps uses 30%-35% beneficially, and thus, there will be an increase in demand for implementing this strategy.[13]

The *Employing Beneficial Use of Dredged Material* opportunity map displays opportunities for using dredged material as a source of sediment supply in already protected, sediment-deficient wetlands that are within a 5-mile radius of a sediment source, such as a dredged channel or placement area. In Texas, all tidal wetlands are in a sediment deficit (according to their sediment balance score evaluated in the RCS data), so no wetlands were excluded based on their sediment availability. For the purposes of creating this map, it is assumed that implementing a beneficial use project is attainable if the wetland is already legally protected from development or conversion. However, there may be opportunities to use dredged material beneficially in areas that are not legally protected.

One example of a project employing beneficial use of dredged material in Texas is at J.D. Murphree Wildlife Management Area (Figure 10). To date, TPWD has completed five beneficial use of dredged material projects at J.D. Murphree over approximately 4,000 acres. These projects were designed to directly address marsh subsidence and erosion by lifting elevation back to levels able to support healthy plant growth and re-establishment of coastal marsh habitat. The coastal marsh created by these projects provides quality foraging, breeding and brood rearing habitat for all species of wildlife found along the Texas Gulf Coast as well as storm surge protection for infrastructure.

FIGURE 10: Beneficial use has been placed on over 4,000 acres of JD Murphree Wildlife Management Area to help address subsidence and erosion.

13 U.S. Army Corps of Engineers Galveston District, 2025

PROTECTING WETLAND MIGRATION SPACE

Wetland migration space is the area of low-lying land adjacent to tidal wetlands that is potentially suitable for supporting tidal habitats under future sea level rise scenarios. Without action, the Gulf could lose up to 98% of existing tidal wetlands to sea level rise. No government programs explicitly identify and purchase wetland migration corridors in Texas yet. However, there are several Regional Conservation Partnership Programs within the Natural Resources Conservation Service (NRCS) in Texas that could be used to protect migration space, including the Coastal Prairie Additive Conservation Partnership and the Texas Coastal Prairie Initiative. There is also opportunity to protect wetland migration corridors using USFWS Coastal Wetland Program grant funding. Additionally, Texas RESTORE Bucket 2/Funded Priorities List 4 identified protection and conservation of current wetland and future wetland migration corridors as one of five programmatic focal areas.

The *Protecting Wetland Migration Space* opportunity map displays opportunities for protecting wetland migration space adjacent to resilient wetlands. To create this opportunity map, the WAM project team used the wetland migration space data layer (described above in Existing Spatial Data section) after areas were removed that have either been protected or developed since the data was created.

One example of a wetland migration space protection project in Texas is TNC's conservation easement at Port Bay Ranch (Figure 11). The 1,200-acre property faces development pressure, as it abuts low-density development and a sand mining operation. Currently, 250 acres of the property consist of low and high marsh, while the remainder is salty prairie and shrubland. However, nearly all of the present-day upland areas are expected to convert to tidal wetlands under 1.5 meters of sea level rise by 2100.[14] While the current wetland area will likely convert to open water by 2100, the wetlands will hopefully be able to migrate inland to adjacent upland areas without a net loss of wetlands. Without protection through a conservation easement, these upland areas could have been developed, leaving the wetlands with fewer places to migrate.

FIGURE 11: Port Bay Ranch tidal wetlands and coastal prairie future migration space.

14 Classified as having 'high' geohazard potential in the Geospatial Resilient Economic Development (GeoRED) Hazard Impact & Planning Tool (Regional Resilience Partnership, 2025, GeoRED).

IMPROVING MANAGEMENT OF WETLAND MIGRATION SPACE

While some wetland migration space is legally protected through outright acquisition or conservation easement and essentially protected from future development, there is an opportunity to actively manage land to help facilitate inland migration of tidal wetlands with sea level rise through best management practices such as grading, planting or barrier removal. In some cases, it will be necessary to help facilitate tidal wetland migration, but it should be noted that inland migration may mean the loss of important freshwater wetland and grassland habitats in some areas. Thus, trade-offs will need to be considered when making management decisions on a landscape scale, and it will not be appropriate to facilitate inland migration of tidal wetlands in all geographies.

The *Improving Management of Wetland Migration Space* opportunity map highlights opportunities where wetland migration space is already protected, but where there is also the possibility of improved management of wetlands both now and into the future. To create this opportunity map, the WAM project team used the wetland migration space data layer and selected only those sites that are currently legally protected. Then, map representation was limited to migration space with above average resilience. The *Improving Management of Wetland Migration Space* map, when combined with the map of *Protecting Wetland Migration Space,* covers all resilient migration space in Texas.

One example of a project that improves management of wetland migration space in Texas is the USGS, USFWS and Gulf Coast Joint Venture project analyzing the landward migration of coastal wetlands at National Wildlife Refuges along the upper and mid-Texas coast.[15] The study highlights barriers and opportunities for migration based on elevation, urbanization and flood-control infrastructure (e.g., roads, levees and water control structures). Natural resource managers can utilize this information to understand where corridors may allow for upslope migration, where barriers may constrain migration and what upslope habitats may change. Studies such as these can inform management decisions on a changing landscape using methods such as the resist-accept-direct framework.

© Nicki Evans

15 Simons et al., 2025

Co-Benefits

The WAM project team developed co-benefit maps to help guide action area selection, as the working group indicated that wetland action areas should be prioritized where multiple co-benefits align. In total, five co-benefit maps were created with working group feedback: **Priority Habitat for Species of Greatest Conservation Need, Flood Mitigation, High Social Vulnerability to Hazards, Improved Access to Potential Parks** and **Tidal Wetland Carbon Stocks**. Additionally, a summary layer was created that displays where the co-benefit maps align (Figure 12).

Co-benefits are summarized to the planning unit level, which are 5,000 hectares in size (the average size of tidal complexes in Texas). Some co-benefits are scored by presence/absence of a benefit, with each planning unit receiving either a 1 for presence or a 0 for absence. Other co-benefits are visualized on a scale, where each planning unit received a score of 0, 0.25, 0.75 or 1 based on quartiles. More complete information on the methods for generating each co-benefit layer is included in Appendix C.

Priority Habitat for Species of Greatest Conservation Need

TPWD developed the Conservation Opportunity Areas dataset to help inform conservation priorities, goals and actions. The dataset prioritizes areas that are modeled as having high quality habitat for species of greatest conservation need (SGCN). Inputs to create this data included SGCN species occurrence data, landcover type connectivity and threats like natural resource extraction and urbanization. This dataset gives a habitat score based on conservation priority, which the WAM team transposed to the planning unit grid and categorized into four classes (low, medium, high and highest).

Flood Mitigation

This layer estimates the number of people that could potentially benefit from flood mitigation provided by adjacent wetlands. The area in which wetlands provide flood mitigation to the surrounding populations was roughly estimated by summarizing the number of people within 500 meters of wetland conservation and restoration opportunities. Next, the number of people within the flood mitigation area was calculated per planning unit using LandScan USA population data.

High Social Vulnerability to Hazards

The Centers for Disease Control and Prevention's (CDC's) Social Vulnerability Index identifies and quantifies communities with social vulnerability using socioeconomic factors (including poverty, lack of vehicle access and crowded housing) that adversely affect their ability to respond to natural or human-caused disasters. High social vulnerability was considered by the CDC as census tracts in the 90th percentile or above. For WAM, this data is summarized at the planning unit level for presence of high social vulnerability.

Tidal Wetland Carbon Stocks

Dr. Rusty Feagin's lab at Texas A&M University developed high-resolution maps of soil organic carbon (SOC) distribution across tidal wetlands by linking National Wetlands Inventory data with the U.S. Department of Agriculture's Soil Survey Geographic Database (SSURGO). The SSURGO dataset was used to determine bulk density and organic matter fraction, which was then converted into SOC. Results are shown as the average carbon dioxide equivalent, in metric tons per acre, going down to 1 meter of depth. This data is averaged across the estuarine wetland areas of the WAM planning units and summarized as either high SOC (above average) or low SOC (below average).

Improved Access to Potential Parks

The Southeast Conservation Adaptation Strategy (SECAS) Potential Access to Parks dataset prioritizes creating new parks that would increase access to open space within socially vulnerable, urban communities by providing new green spaces. The dataset identifies areas where residents lack access to a park within a 10-minute walk (while accounting for walkable road networks and access barriers like highways and fences), then prioritizes communities using demographic and environmental metrics. For WAM, SECAS new park opportunities were overlapped with WAM *Protecting Wetlands* and *Protecting Wetland Migration Space* opportunity maps to identify where the opportunity to protect wetlands or migration space could also provide access to green space for communities.

© Erich Schlegel

As I see it, the coast, where the land and water meet, comprises one system. One shapes and impacts the other and the converse is also true, creating a unique and productive coastal zone. As such, restoring, protecting and managing these estuaries and wetlands takes local knowledge, creativity and partnerships. The TNC WAM process bringing stakeholders together to identify key areas and needs is a vital step in the process of achieving greater conservation of this resource into the future.

—Felipe Prieto, Aransas National Wildlife Refuge

Co-Benefits Summary

Some co-benefits are scored for being present or absent and others are scored on a ranked scale (as described above). The co-benefits summary combines all five co-benefit scores into one map layer and assigns an overall score of low, medium or high. Higher scores indicate areas that are more likely to generate benefits related to the five co-benefits identified as high priority for WAM planning.

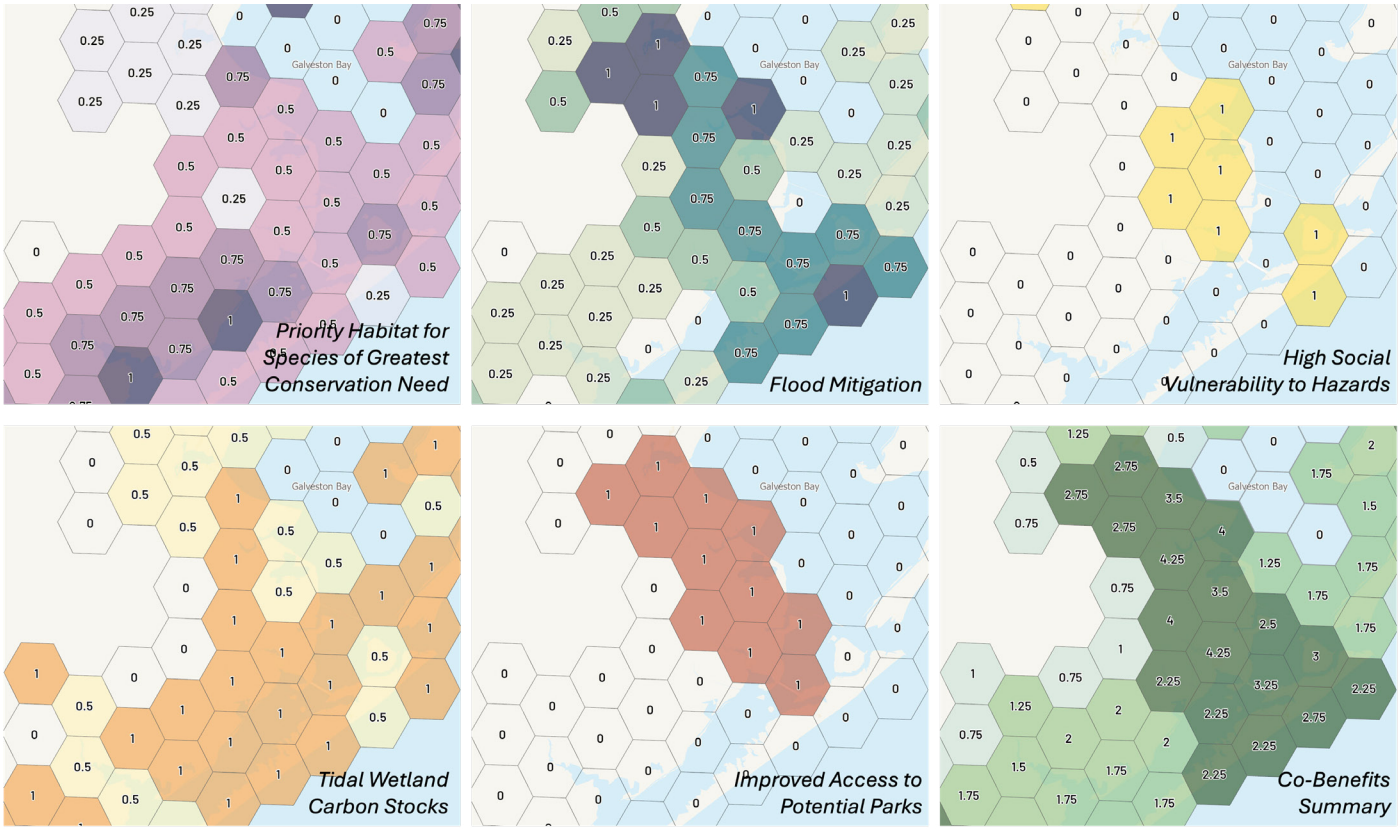


FIGURE 12: Co-benefit maps for the five co-benefits ranked as most important to the WAM working group. Maps were created for the entire Texas coast, example figure shows a portion of West Galveston Bay.

© Annie Mulligan

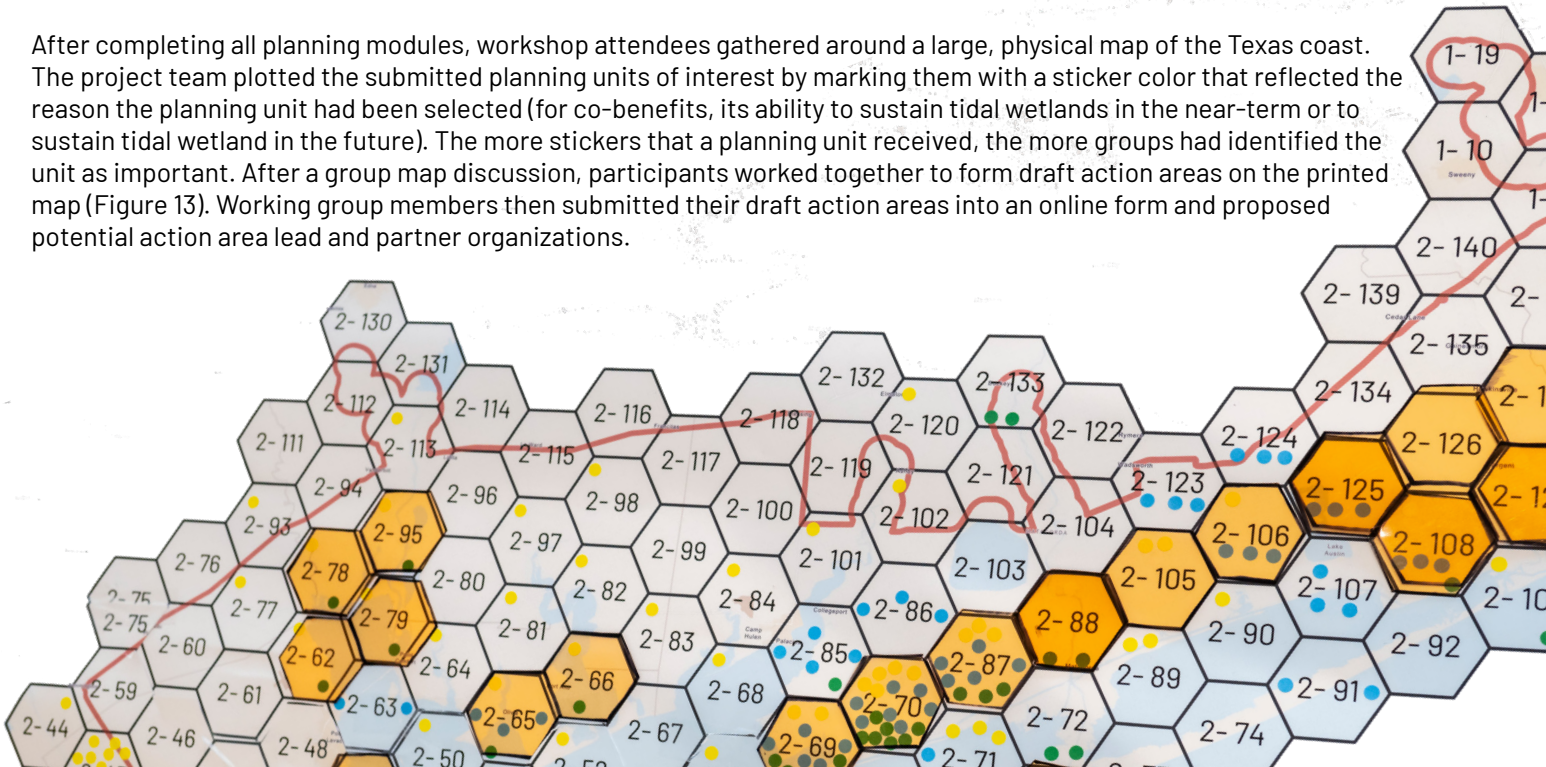
Action Areas

The 17 action areas represent the selected tidal wetland conservation and restoration focal areas across the Texas coast where there is opportunity for higher impact via collaboration (Figure 1B). The WAM working group selected action areas based on potential co-benefits, opportunity for wetland conservation and restoration and alignment with working group priorities. The intent of creating wetland action areas is to foster collaboration in specific locations across the Texas coast and does not preclude restoration or conservation activities taking place outside of the action areas.

Participatory Mapping Process to Identify Proposed Action Areas

Proposed action areas were first selected by workshop participants during a participatory mapping exercise at the third workshop in February 2025 (see Appendix C for more detail). A small group approach was used, with stakeholders sometimes interacting with those with whom they rarely partner. Workshop participants were guided through four modules, including modules to explore the newly created co-benefits maps, mapped organizational and WAM working group member priority locations and project locations for Tier 1 projects identified in the 2023 TCRMP. Finally, participants considered future scenarios by evaluating high priority planning units in the context of wetland migration space, geohazards, mangrove expansion areas and future urbanization patterns.

After completing all planning modules, workshop attendees gathered around a large, physical map of the Texas coast. The project team plotted the submitted planning units of interest by marking them with a sticker color that reflected the reason the planning unit had been selected (for co-benefits, its ability to sustain tidal wetlands in the near-term or to sustain tidal wetland in the future). The more stickers that a planning unit received, the more groups had identified the unit as important. After a group map discussion, participants worked together to form draft action areas on the printed map (Figure 13). Working group members then submitted their draft action areas into an online form and proposed potential action area lead and partner organizations.



All photos © Jacqueline Ferrato/TNC

FIGURE 13: Participatory mapping process at WAM Workshop 3.

Editing and Refining Proposed Action Areas

In total, 50 proposed action areas were submitted by workshop participants across the workshops on upper, mid- and lower Texas coast. The working group goal was to define 15-20 action areas distributed evenly across the entire Texas coast. Thus, the Texas WAM project team applied rules to refine the total number of action areas, which reduced the total number of action areas to 20 (Figure 14). Action areas that had significant overlap of planning units were merged, which was most edits made. Adjacent and ecologically connected action areas were also combined. Action areas with minimal opportunity, meaning those with limited tidal wetlands or migration space, were removed.

Rules were also created to adjust the size of proposed action areas. Planning units with little to no opportunity for action were removed, which reduced the overall size of some action areas. Some action areas were expanded to include wetland migration space (as requested by the working group). Before bringing the interim proposed action areas to the working group, the project team also refined the boundaries of the action areas to reflect the opportunity maps (Figure 14C). At the final workshops, participants provided feedback on the interim proposed action areas, suggested a lead organization for each action area and made plans for targeted project planning with additional stakeholders in each action area.

During summer 2025, Texas WAM leads and partners engaged in two follow-up meetings specific to each action area. The first meeting included refining the action area boundaries, confirming the lead/co-lead, agreeing on the action area name and identifying partners to invite to the second follow-up call. Additional local partners were invited to the second meeting, where the partner group outlined needs and opportunities, potential projects and funding sources. At some of the follow-up calls, stakeholders suggested combining certain adjacent action areas that have the same wetland threats and needs, which reduced the total number of action areas from 20 to 17. Fact sheets for each of the action areas were then created to summarize information from the follow-up meetings. See Appendix D for the action area summaries.

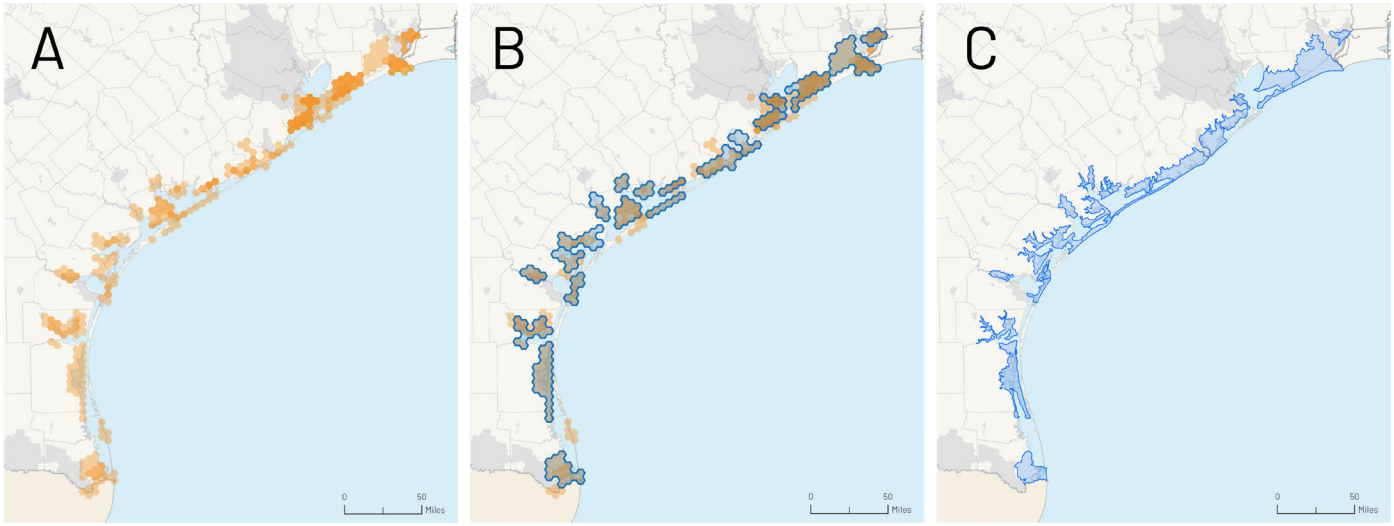


FIGURE 14: Action area refinement process: A) Planning units nominated for inclusion in action areas, B) Refined action areas after size and location adjustments, and C) Action area boundaries refined to the opportunity map boundaries.

Final Action Areas

The 17 action areas identified across the Texas coast capture approximately 78% of the total conservation and restoration opportunity across the four coastal planning regions (Figure 15, see Appendix D for regional and statewide fact sheets). Most of the land identified provides opportunity for *Protecting Wetlands* (341,871 acres) and *Protecting Wetland Migration Space* (566,814 acres) (Table 1). Among the characteristics of the action areas spread four regions are the following:

Region 1 is the largest region and captures the largest opportunity overall within the selected action areas: North Sabine, South Jefferson County Marsh, East Galveston Bay, West Galveston Bay and part of From the Brazos to the Colorado Rivers. This is especially true of the opportunity for *Protecting Wetland Migration Space* (292,373 acres) and for *Employing Beneficial Use of Dredged Material* (75,292 acres), two strategies that are well-suited for the high rates of subsidence on the upper Texas coast. Region 1 also contains many engaged partners and a large acreage of conserved lands around which marsh restoration can be anchored.

Region 2 has the largest number of action areas, including Matagorda, Matagorda Peninsula & Pass Cavallo, Carancahua & Keller Bay, Upper Lavaca Bay Marsh and parts of From the Brazos to the Colorado Rivers and Guadalupe River Delta. The action areas contain much of the barrier islands in this region, which protect both wetlands on the mainland and those on the backside of the barrier islands. As such, Region 2 contains the greatest mileage of opportunities for reducing shoreline erosion through *Implementing Living Shorelines* (647 miles). Region 2 also contains much of the habitat for endangered whooping cranes and Eastern black rail, which may bring unique funding sources for *Protecting Wetlands* (86,852 acres) and *Protecting Wetland Migration Space* (92,720 acres).

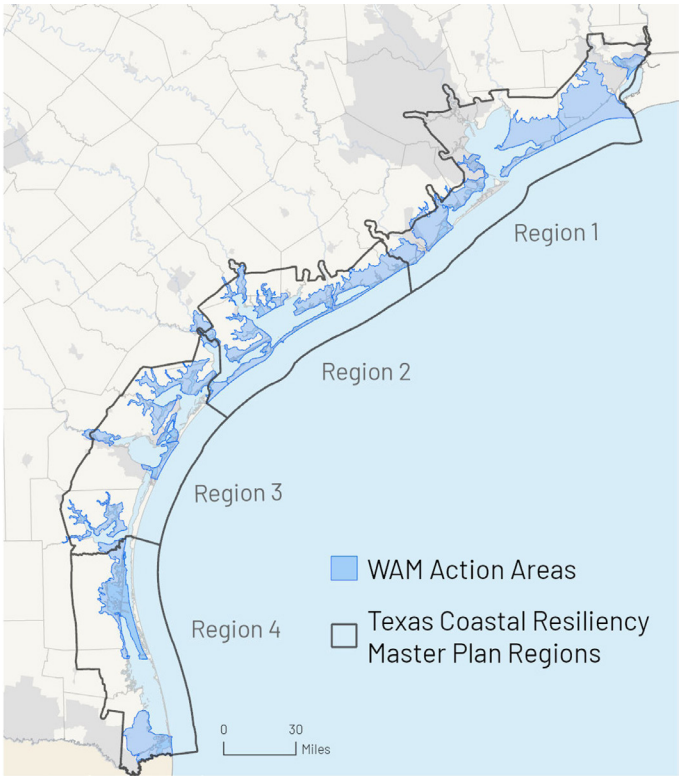


FIGURE 15: Final Texas WAM action areas across the four regions of Texas.

Region 3 contains Mustang Island as well as many tidal wetlands in deltaic systems including Mission – Aransas, Nueces Delta, Baffin Bay and parts of Guadalupe River Delta. These delta systems act as wetland migration corridors, and Region 3 has significant opportunity for *Protecting Wetland Migration Space* (99,075 acres) from regional high rates of coastal development. Region 2 has a large, well-organized stakeholder base and protected areas network. *Employing Beneficial Use of Dredged Material* (27,414 acres) or *Restoring Hydrologic Flow* (96 impoundments or potential projects) may be needed in the already protected wetlands in this region.

Region 4 has the fewest action areas covering the least amount of opportunity, yet some of the most ecologically diverse tidal wetlands. The Bahia Grande – Boca Chica action area is a biodiversity hotspot with ongoing efforts to restore hydrologic flow, both to increase tidal exchange and freshwater inflow from the resaca systems. The South Texas Ranchlands action area encompasses the large, historic private ranchlands in South Texas that were not originally captured through our mapping efforts but were added in at the last workshop on the lower coast. While in private ownership, these ranches have been protected from development and stewarded by many ecologically-minded landowners. There may be opportunity for *Implementing Living Shorelines, Restoring Hydrologic Flow* and *Improving Management of Wetland Migration Space* (though not legally protected).

TABLE 1: Opportunity Across the Texas Coast and Within WAM Action Areas by Region* and Coastwide

Opportunity Strategy	Entire Texas Coast	Region 1 Action Areas	Region 2 Action Areas	Region 3 Action Areas	Region 4 Action Areas	All Action Areas
Protecting Wetlands (acres)	411,042	87,277	86,852	52,345	115,398	**341,871**
Implementing Living Shorelines (miles)**	2,094	489	647	388	155	**1,680**
Restoring Hydrologic Flow (no. of impoundments or projects) †	647	185	85	99	42	**411**
Employing Beneficial Use of Dredged Material (acres)	246,994	75,292	68,531	27,414	17,028	**188,265**
Protecting Migration Space (acres)	685,457	292,373	92,720	99,075	82,646	**566,814**
Improving Management of Migration Space (acres)	264,564	72,278	61,380	28,974	23,189	**188,265**
All Opportunity (acres)	1,618,008	527,219	309,483	207,808	238,260	**1,282,771**

* Action area calculations were done per region and action areas across two regions had the opportunity split accordingly. ** Opportunities for Implementing Living Shorelines are summarized by miles of potential shoreline buffered. †Opportunities for Restoring Hydrologic Flow are displayed by number of impoundments or identified projects.

Implementation Guidance and Next Steps

The *Texas Wetland Action Mapping Plan* is guided by five goals and nine focal strategies for protecting and restoring coastal wetlands in Texas (Figure 2). To meet these goals, continued and enhanced collaboration and engagement will be critical. Additionally, creative funding sources will be needed to increase the pace and scale of restoration and protection of the state's tidal wetlands.

The implementation guidance below outlines next steps for the WAM project team and working group, including steps for future planning, funding and monitoring efforts. Objectives and outcomes, key deliverables, a timeline and roles and responsibilities are proposed. Additionally, guidance has been drafted for future strategic efforts including implementation of communication and engagement strategies. The level of implementation and future engagement will depend on funding secured and continued partner engagement in the next phase of WAM.

Desired Outcomes

Several desired outcomes have been identified, including to:

1. accelerate the implementation of wetland protection and restoration initiatives along the Texas coast by strengthening cross-sector collaboration and enhancing capacity to advance projects from conceptual development to engineering and design,

2. enhance communication with partnerships statewide and within individual WAM action areas, resulting in stronger collaboration and increased awareness of needs and funding opportunities and

3. increase participation and funding by implementing a targeted stakeholder engagement and communications strategy to engage new partners (such as private landowners) and new types of funders in the WAM process.

These desired outcomes will be proposed to the working group in the next phase of WAM and refined based on working group feedback.

Objectives

Three objectives are proposed for the next phase of WAM and will be refined with input from the working group. Proposed objectives are:

- **Catalyze project implementation** within action areas and track project progress within action areas over time
    - Work with the WAM working group to move 5-10 priority projects from concept into the preliminary design stage annually
    - Track projects identified by the WAM working group within the action areas for the next 10 years (through 2035). Document project lessons learned for future project success.
- **Continue to facilitate opportunities** for collaboration amongst WAM working group members, specifically to:
    - Facilitate semi-annual meetings with action area leads/co-leads
    - Facilitate annual workshops with the WAM working group
    - Facilitate enhanced engagement with stakeholders, such as private landowners and regional and local land trusts
- **Support coordination** with state and regional planning efforts, including flood planning and coastal resilience planning, and with state and federal regulatory agencies to integrate projects into other planning efforts and to streamline permit acquisitions.

Key Deliverables

Key deliverables for the next phase of WAM are as follows:

- Annual WAM working group meetings
- Semi-annual action area lead/co-lead meetings
- Funding and contract development support for a prioritized list of potential projects through initial stages of engineering and design
- Updated Texas WAM Tool webpage and outreach campaign
- WAM Dashboard to monitor project status through different phases of implementation
- Communication materials to share with decision-makers for each WAM action area, each coastal region and the entire Texas coast (see Appendix D)

At the Annual WAM working group meetings, participants will review progress on projects within the action areas, reflect on progress toward the WAM goals and share lessons learned at different stages of project implementation. These in-person meetings across the Texas coast will facilitate working group member relationships and offer opportunities for collaboration. At the first annual meeting during Phase 2, the WAM working group will review and refine proposed outcomes and objectives and rank existing projects for initial design funding and WAM project team support (more details below). Topics discussed at subsequent annual meetings will be guided by working group feedback. Refinement of the focal strategies may also be conducted.

Semi-annual action area lead/co-lead meetings will be hosted (likely virtually) to gather information on project progress within each action area and to identify areas in need of focus by the WAM working group and project team. This could be based on factors such as a lack of capacity within an action area or high priority strategies amongst action area partners. Working group members will also be asked to compile project presentations with lessons learned to increase overall knowledge of strategy implementation and successful project implementation moving forward.

The WAM project team will leverage funds to move a subset of high-priority projects through initial phases of engineering and design. To support collaborators who may not have the capacity or resources to carry out the initial project scoping exercises, the WAM project team will develop and manage the contract with an engineering firm and coordinate with relevant partners to include their input on project design. The WAM project team will also work internally to develop the WAM Tool webpage and an open-access, externally facing dashboard to track changes within the action areas.

Timeline

Phase 2 of WAM will be implemented over a 2-year or 3-year period. The project team will first focus on making the WAM Tool publicly available. The project team will also develop a dashboard to track project status across action areas. Simultaneously, the WAM project team will begin to plan for the first bi-annual lead/co-lead meeting and the first WAM working group workshop of Phase 2 to be hosted by fall 2026 (approximately one year after the last Phase 1 workshop). Simultaneously, communication strategies will be refined, materials developed and strategies implemented.

Roles and Responsibilities

TNC will host WAM working group meetings and facilitate WAM lead/co-lead meetings. The WAM project team will also track project status and progress toward WAM goals.

Each action area has designated leads/co-leads and partners to support further project planning and implementation. For each, one or more lead organizations will help to facilitate collaborative efforts across the action area, coordinate with partners on project ideas and funding opportunities, advocate action area project inclusion in state and regional planning efforts and act as a liaison to the WAM project team. These lead partners are not necessarily charged with implementing any action area projects or with supporting funding applications for action area projects. Action area leads will attend the annual WAM working group meeting (in-person) and the bi-annual lead/co-lead meetings (virtually).

WAM working group members are expected to attend the in-person WAM working group annual meetings, coordinate with action area leads, provide project updates and recruit additional partners to increase diverse perspectives not yet captured by current group members.

Monitoring Plan

The Interagency Coastal Wetlands Workgroup (ICWWG) recommendations to reduce and reverse the trend of wetland loss advise entities to "support the collection, enhancement and dissemination of landscape-scale monitoring data."[16] ICWWG pilot studies also emphasized a need for landscape-scale monitoring data to better inform adaptive management and document change over time. This need has also been identified as one of the highest priorities in Texas by the Texas Coastal Management Program.[17] This recommendation was omitted from WAM Phase 1 because it was outside of project scope; however, the Texas WAM project team has proposed a similar objective for Phase 2 of WAM.

In Phase 2, the WAM project team will identify partners interested in developing a monitoring plan to document progress towards WAM goals, track project success within action areas and help identify areas in need of adaptive management. Ideally, these efforts will also increase understanding of the broader status and trends of wetlands across the Texas coast. Information on project status will be collected at action area lead/co-lead and WAM working group meetings and potentially through a project tracker form.

Future Funding

Phase 1 of the WAM project was funded with the generous support of the COmON Foundation. Funding for Phase 2 is needed to 1) support continued engagement of the WAM working group, 2) reach a broader group of stakeholders and partners and 3) implement and monitor tidal wetland conservation and restoration projects. The WAM project team will work with interested WAM working group members to secure funding to implement Phase 2. A summary of potential funding sources is included in Table 2. This table will be expanded in WAM Phase 2 and used to guide proposal development and stakeholder engagement resource development.

Different types of partnerships and funding sources will be required to implement each of the nine strategies (including the two strategies focused on education and outreach). The GLO has funds through their Coastal Management Program and Coastal Erosion Response Program for protection, restoration and enhancement of coastal environments, including wetlands. Additionally, the USFWS works on both private and public lands and can fund wetland restoration and protection projects through their Coastal Program. Meanwhile, USACE, GLO and Ducks Unlimited are critical partners for *Employing Beneficial Use of Dredged Material* to restore wetlands in Texas. Ducks Unlimited is leading the Beneficial Use of Dredged Material Advisory Group through a process to create a Texas Beneficial Use Master Plan.[18] Further, critical lessons could be gleaned from the work the USGS Wetland and Aquatic Research Center is implementing in collaboration with USFWS to understand barriers and opportunities for landward migration of coastal wetlands along Texas' upper and middle coast.[19] Understanding how land managers are considering wetland migration space in their decisions is critical for implementing the *Improving Management of Wetland Migration Space* strategy.

Partners will need to get creative with the funding pathways used to develop projects to increase the pace and scale of restoration and protection activities. For example, Department of Defense Readiness and Environmental Protection Integration funds can be utilized for *Protecting Wetland Migration Space* by working with unique partners such as the Coastal Bend Council of Governments, the Naval Air Station in Kingsville and the Coastal Bend Bays and Estuaries Program.[20] Understanding each partner's needs is critical to thinking outside of the box so that implemented projects support unique interests and provide numerous co-benefits.

Unique funding sources that prioritize co-benefits not typically part of project design, such as flood mitigation benefits or carbon storage, can catalyze project implementation and broaden funding support. Designing projects that provide multiple co-benefits also helps project developers engage with a broader group of partners and stakeholders. In addition to the co-benefits for which maps were created to support Texas WAM decision-making, many workshop participants also recommended considering coastal fisheries and ecotourism economic benefits, water quality benefits and storm protection benefits when developing project ideas. Integrating these types of co-benefits into project design can help to build robust projects that provide numerous benefits and are fundable through multiple pathways.

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16 Interagency Coastal Wetlands Workgroup, 2022
17 National Oceanic and Atmospheric Administration and Texas General Land Office, 2025
18 Ducks Unlimited, 2025
19 U.S. Geological Survey, 2025
20 U.S. Department of Defense, 2025

Communication

One of the goals established by the WAM working group was to conduct *'Targeted Outreach and Stakeholder Engagement.'* The WAM project team implemented many types of outreach to establish the WAM working group and engage a broader group of stakeholders at each step of the WAM process. Included below are high-level communication strategies for both specific stakeholders and a broader audience. These strategies will be refined in Phase 2 with support from working group members and previous relevant efforts such as the *Texas Wetland Conservation Plan*.

The Interagency Working Group noted that challenges to wetlands can occur due to several factors, including a lack of understanding of where wetlands are, what ecosystem services and co-benefits wetlands provide and which programs are available to conserve and restore wetlands. To address these factors, we propose communication strategies that educate landowners and land managers about current wetland extents and predicted future migration space in addition to sharing programmatic resources for conserving and restoring wetlands.

TABLE 2: Potential Funding Sources for WAM Phase 2

	Funding Source	Program
Federal	Environmental Protection Agency	Coastal Watershed Grant
	National Fish and Wildlife Foundation	Coastal Resilience, ConocoPhillips SPIRIT of Conservation Program
	National Oceanic and Atmospheric Administration	Transformational Habitat Restoration
	U.S. Department of Agriculture Natural Resources Conservation Service	Wetland Reserve Easements (WRE), Environmental Quality Incentives Program (EQIP), Wildlife Habitat Incentive Program (WHIP), Working Lands for Wildlife, National Water Quality Initiative, Wetland Reserve Easements (WRE) and Regional Conservation Partnership Programs (RCPP)
	U.S. Department of Defense	Readiness and Environmental Protection (REPI), Sentinel Landscapes Program
	U.S. Fish and Wildlife Service	North American Wetlands Conservation Act (NAWCA), Recovery Land Acquisition grants, National Coastal Wetlands Conservation Grant Program and Coastal Program grants
State	Texas General Land Office	Coastal Erosion Planning and Response Act (CEPRA), Coastal Management Program (CMP), Gulf of Mexico Energy Security Act (GOMESA) and Community Development Block Grant (CDBG)
	Texas Historical Commission	Texas Preservation Trust Fund
	Texas Parks and Wildlife Department	Landowner Incentive Program (LIP), LIP Partners Watershed Funding Series Outdoor Recreation Legacy Partnership (ORLP), Agricultural Land Easement, Section 6 funding and Texas Farm and Ranch Land Conservation Program
	Texas State Soil and Water Conservation Board	319 Non-Point Source
	Texas Water Development Board	Flood Infrastructure Fund (FIF)
Regional	Coastal Bend Bays and Estuaries Program	
	Galveston Bay Estuary Program	
	Houston Endowment Arts and Parks	
	Matagorda Bay Mitigation Trust	
Other	Gulf of America Alliance	Gulf Star Program*
	Industry	
	Private Foundations	
	RESTORE Act / Texas Trustee Implementation Group	
	Sentinel Landscapes Partnership	
	Texas Prairie Wetlands Project	

*TNC has received some seed funding to conduct targeted outreach across the Gulf to communities and land trusts with significant acreage of tidal migration space. Lessons learned from this process will be applied in Texas.

Private Landowner Engagement

Most of the land on the Texas coast is privately owned. Decisions by private coastal landowners can significantly influence the resilience of tidal wetlands. For example, in South Texas, ranchers have stewarded large acreages of wetlands and kept them from being developed, even without any formal designations, acknowledgments or incentives. Educating landowners about the value of wetlands, potential for wetland migration and consequences of wetland loss could encourage additional conservation and restoration for wetlands at risk of conversion or drowning due to the impacts of sea level rise.

To outreach efficiently, landowners managing large tracts of land with large acreages of wetland protection and restoration opportunity will be identified and engaged in Phase 2. Engagement will occur through trusted partners and existing relationships and will focus on landowner management concerns and challenges. Emphasis will be placed on landowner autonomy to implement strategies and projects on the land they steward.

Further input to this landowner engagement strategy will come from entities that implement landowner education and financial incentive programs (such as Texas A&M AgriLife Extension Service, TPWD, USFWS and NRCS), from researchers at local universities, from other nearby landowners with experience in conservation programs and from organizations such as the National Grazing Lands Coalition. This strategy will build off previous planning efforts through outreach and technical assistance for landowners using existing incentive programs and through encouragement of land management that incentivizes wetland conservation and restoration. Efforts will also be made to avoid engaging with landowners during busy seasons, such as hunting season in South Texas.

Land Trust Engagement

Land trusts can use the WAM Tool, opportunity maps and action areas to help identify key parcels for wetland protection and restoration that align with their organizational goals. The WAM project team will invite members of Texas land trusts actively working on the coast to a Fall 2025 webinar that will summarize the Texas WAM working group process, Texas WAM Tool, *Texas Wetland Action Plan* and next steps. Additionally, the WAM project team plans to present at the upcoming Texas Land Conservation Conference in February 2026. Additional efforts will be implemented as this strategy is refined.

Broader Communications

Information about the WAM working group process and key deliverables will be made available on TNC's website in November 2025. As part of the WAM process, a selection of data layers created for Texas were also expanded to cover the Gulf Coast and will be available on TNC's updated Gulf Coastal Resilience Tool in early 2026. These data layers could be used to lead similar working group processes in other Gulf states or geographies.

The Texas Wetland Action Mapping Tool provides an interactive way to explore data relevant to wetland restoration and conservation action planning for Texas. The tool brings together suitability information for conservation and restoration strategies and co-benefit information to help inform where action might be both feasible and impactful.

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Conclusion

Seventeen action areas have been identified across coastal Texas through the Texas Wetland Action Mapping (WAM) project. These areas have the potential to function as communities of practice focused on tidal wetland protection and restoration. The action areas capture nearly 78% of the conservation and restoration opportunity across the coast, allowing stakeholders to better focus fundraising and project implementation efforts in a coordinated manner. As communities of practice, the action areas can serve as anchor points to strengthen relationships among working group members and support the development of additional local and regional partnerships to fortify tidal wetland conservation and restoration initiatives across Texas.

The Texas WAM project produced multiple outputs that can inform and enhance tidal wetland conservation and restoration across the coast. The opportunity maps highlight where key strategies for reducing and reversing tidal wetland loss can be implemented. The co-benefit maps represent where implementation of the WAM strategies are likely to generate benefits to people and nature. Including co-benefits in project design can help project developers design more robust projects that provide numerous ecosystem services and appeal to many types of partners and funding streams. Further, the project ideas identified in each action area, either generated by Texas WAM working group members or sourced from existing plans, serve as initial concepts for project collaboration and will continue to be developed into Phase 2 of WAM. The opportunity maps and co-benefit maps will be available on the Texas WAM Tool to inform continued working group member planning outside of the completed WAM planning process and will be shared more broadly to support the decision-making of others.

Prior to the Texas WAM planning process, no collaborative effort existed to explore the mapped opportunities to protect and manage tidal wetland migration space across the entire Texas coast. The need for a Texas-wide strategic plan for protection of tidal wetland migration space was highlighted during the participatory mapping process, where many of the proposed action areas included tidal wetlands but limited initial consideration of the future position and extent of those tidal wetland areas. Once WAM working group members became more familiar with the potential future scenarios impacting the tidal

wetlands, additional tidal wetland migration space was incorporated into the action areas to help ensure that adequate space adjacent to tidal wetlands would be protected from development.

While the 17 action areas identify focal locations for implementation, the WAM working group work expressed strong interest in making progress towards the established WAM goals by the year 2030. The majority of the WAM working group members have committed to supporting a Phase 2 of WAM that involves raising additional funding, initiating project implementation and meeting continually in action area groups and as a working group. Additionally, Texas WAM Phase 2 will engage private landowners through a tailored engagement strategy that more directly communicates the value of and incentives for protecting and restoring wetlands on their property. Site-specific opportunity maps at the parcel and local level will be included in engagement strategy.

As the project team looks to the future, we are excited to leverage the relationships and expertise of Texas WAM working group members and partners to refine and generate new project ideas in each of the action areas. We are committed to helping members of the WAM working group seek funding to move high-priority projects through initial phases of land title research and engineering and design. We will continue to facilitate Texas WAM working group and action area meetings. By uniting 34 working group organizations and numerous other stakeholders across 17 action areas—encompassing over 1 million coastal acres—we can address tidal wetland loss and deterioration in Texas and strengthen coastal resilience for generations to come.

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The WAM effort has shown what's possible when partners come together with a shared vision for Texas coastal wetlands. Through participatory mapping, we've been able to identify priority action areas where collaboration can have the greatest impact. We're especially looking forward to an increased focus on protecting and managing tidal wetland migration space in areas where this has not yet been a focus, like Baffin Bay.

—Dr. Kiersten Stanzel, Coastal Bend Bays and Estuaries Program

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References

Anderson, M. G., & Barnett, A. (2019). *Resilient Coastal Sites for Conservation in the Gulf of Mexico US*. The Nature Conservancy, Eastern Conservation Science. https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/edc/Documents/GulfOfMexico_Resilient_Coastal_Sites_31Oct2019.pdf

Coastal Bend Bays & Estuaries Program. (2020). *Implementation Strategy for the Coastal Bend Bays Plan.* Coastal Bend Bays & Estuaries Program Publication. https://www.cbbep.org/manager/wp-content/uploads/FINAL-Bays-Plan-2nd-Ed-Feb-2020-small.pdf

Ducks Unlimited. (2025). *Texas Beneficial Use Master Plan.* Anchorqea.com. https://gis.anchorqea.com/TEXBUMP/

Feagin, R. A. (2022). *Texas Blue Carbon Opportunities: Wetland Biogeochemistry and Carbon Offset Optimization Strategies*.

Fern, R. R., Baron, M. D., England, A. E., Giese, J. C., Kraai, K. J., Lancaster, J. D., Oldenburger, S. L., Shipes, J. C., Wilson, B. C., & Wyckoff, S. R. (2023). The State of Texas Wetlands: A Review of Current and Future Challenges. *Texas Water Journal*, 14(1), 136–174. https://doi.org/10.21423/twj.v14i1.7163

Galveston Bay Estuary Program. (2018). *The Galveston Bay Plan, 2nd Edition: Comprehensive " Conservation and Management Plan for the Galveston Bay Estuary*. Texas Commission on Environmental Quality'. https://gbep.texas.gov/wp-content/uploads/2019/08/CCMP_2ndEdition_FINAL-TCEQ-Approved-DRAFT.pdf

Holmquist, J.R., M. Eagle, R.L. Molinari, S. Nick, L.C. Stachowicz, & K. Kroeger. (2022). *Blue Carbon-based Natural Climate Solutions, Priority Maps for the U.S., 2006-2011*. ORNL DAAC, Oak Ridge, Tennessee, USA. https://doi.org/10.3334/ORNLDAAC/2091

Houston-Galveston Area Council. (2000). *Seabrook Wetland Conservation Plan*. https://www.h-gac.com/getmedia/09540e80-2c98-49d1-8f84-7ee8449c6abd/plans_seabrook_wetland_conservation_plan.pdf

Interagency Coastal Wetlands Workgroup. (2022). *Recommendations for Reducing Wetland Loss in Coastal Watersheds of the United States*. EPA Publication EPA-840-R-22001. https://www.epa.gov/system/files/documents/2022-06/ICWWG%20Recs_Final_508.pdf

Lang, M. W., Ingebritsen, J. C., & Griffin, R. K. (2024). *Status and Trends of Wetlands in the Conterminous United States 2009 to 2019*. U.S. Department of the Interior; Fish and Wildlife Service. https://www.fws.gov/sites/default/files/documents/2024-04/wetlands-status-and-trends-report-2009-to-2019_0.pdf

Lellis-Dibble, K. A., McGlynn, K. E., & Bigford, T. E. (2008). *Estuarine Fish and Shellfish Species in U.S. Commercial and Recreational Fisheries: Economic Value as an Incentive to Protect and Restore Estuarine Habitat*. U.S. Dep. Commerce, NOAA Tech. Memo. NMFSF/SPO-90. https://repository.library.noaa.gov/view/noaa/3612

National Oceanic and Atmospheric Administration, & Texas General Land Office. (2025). *Coastal Management Program Assessment and Strategy 2026 to 2030*. https://www.glo.texas.gov/coastal/protecting-coast/coastal-management-program

Regional Resilience Partnership. (2025). *GeoRED*. Geored.org. https://geored.org/

Salt Bayou Marsh Workgroup. (2013). *Salt Bayou Watershed Restoration Plan*. Texas Parks and Wildlife Department. https://tpwd.texas.gov/publications/pwdpubs/media/salt_bayou_plan.pdf

Simons, B.M., Enwright, N.M., Stuht, C.M., Osland, M.J., Moon, J.A., Stagg, C.L., Wilson, B.C., Lehnen, S.E., Lancaster, & J., Sanspree, C.R., 2025, *Wetland transformations for three relative sea-level rise scenarios along the middle and upper Texas Coast, wetland current condition map and wetland transformation maps by decade, sea-level rise scenario, and coastal wetland drowning threshold (ver. 2.0, August 2025).* U.S. Geological Survey data release, https://doi.org/10.5066/P1494MRV

Smith, E. H. (2019). *Mapping Potential Habitat Restoration Sites to Restore Hydrologic Connectivity*. Coastal Bend Bays & Estuaries Program. https://www.cbbep.org/manager/wp-content/uploads/1918-Final-Hydrologic-Restoration-Report-with-cover-page.pdf

Stedman, S., & Dahl, T. E. (2008). *Status and Trends of Wetlands in the Coastal Watersheds of the Eastern United States: 1998 to 2004*. National Oceanic and Atmospheric Administration, National Marine Fisheries Service and U.S. Department of the Interior, Fish and Wildlife Service. https://repository.library.noaa.gov/view/noaa/3959/noaa_3959_DS1.pdf

Subedee, Mukesh, Marissa Swift, Lihong Su, Pu Huang, Jessica Magolan, & James Gibeaut. (2023). *Geospatial model output of the coastal wetland landscape change modeling under two projected sea level rise scenarios along the Texas Coast*. Distributed by: GRIIDC, Harte Research Institute, Texas A&M University–Corpus Christi. https://doi.org/10.7266/4vn3xzdq

Texas General Land Office. (2023). *Texas Coastal Resiliency Master Plan*. https://www.glo.texas.gov/sites/default/files/resources/glo/coast/coastal-management/coastal-resiliency/resources/files/2023-tcrmp-book.pdf

Texas Parks and Wildlife Department. (1997). *Texas Wetland Conservation Plan*. Resource Protection Division. https://www.landcan.org/pdfs/pwd_pl_r2000_0005.pdf

U.S. Army Corps of Engineers Galveston District. (2025). *Beneficial Use Overview*. Arcgis.com. https://usace-galveston-district-beneficial-use-ceswg.hub.arcgis.com/pages/b257e695188849a4b66f91431f35c193

U.S. Department of Defense. (2025). *Readiness and Environmental Protection Integration > Buffer Projects > REPI Challenge*. Repi.mil. https://www.repi.mil/Buffer-Projects/REPI-Challenge/

U.S. Geological Survey. (2025). *Barriers and Opportunities for Landward Migration of Coastal Wetlands along Texas' Upper and Middle Coast*. USGS. http://www.usgs.gov/centers/wetland-and-aquatic-research-center/science/barriers-and-opportunities-landward-migration#overview

Appendices

All appendices can be found online at https://rb.gy/f4mwae.

Appendix A: Texas WAM Workshop Participant List

Working Group Organization List

Workshop Participant List

Appendix B: Texas WAM Workshop Summaries

Workshop 1 Summary

Opportunity Map Follow-Up Call Summary

Workshop 2 Summary

Workshop 3 Summary

Workshop 4 Summary

Appendix C: Texas WAM Technical Documents and Methodologies

Opportunity Map Methods

Co-Benefit Layer Methods

Participatory Mapping Worksheet

Appendix D: Fact Sheets

Action Area Fact Sheets

1. North Sabine
2. South Jefferson County Marsh
3. East Galveston Bay
4. West Galveston Bay
5. From the Brazos to the Colorado Rivers
6. Matagorda
7. Matagorda Pass & Pass Cavallo
8. Carancahua Bay & Keller Bay
9. Upper Lavaca Bay Marsh
10. Welder Flats—Powderhorn
11. Guadalupe River Delta
12. Mission—Aransas
13. Mustang Island
14. Nueces Delta
15. Baffin Bay
16. South Texas Ranchlands (fact sheet upcoming)
17. Bahia Grande—Boca Chica

Regional Fact Sheets

1. Region 1
2. Region 2
3. Region 3
4. Region 4

Statewide Fact Sheet

1. Texas