San Benito Wetlands Phase IV

Final Report

GLO Contract No. 21-060-006-C666

Coastal Management Program – Cycle 25

Texas Water Resources Institute Final Report
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College Station, Texas

By

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General Land Office/Coastal Management Program
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City of San Benito

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San Benito Wetlands Project - Phase 4

GLO CONTRACT NO. 21-060-006-C666

Texas A&M AgriLife Extension Service - Texas Water Resource Institute (TWRI) initiated a wastewater reuse and tertiary treatment project with the City of San Benito (the City) in 2012. The goal of the project was to reduce amounts of bacteria, sediments, and other impairments entering the Arroyo Colorado tidal segment. Phases 1 and 2 of the project turned abandoned polishing ponds into wetlands that now filter nearly 4.25 million gallons of treated effluent from the City's operating water treatment plant each month. Phase 3 of the project increased the capacity of the wetland system by adding three 16.7-acre former settling ponds to the system. These ponds settle 62 million gallons of treated effluent in four months. Additionally, Phase 3 created public education opportunities, including informational signs describing the water treatment process on a pier at the site. In Phase 4, TWRI used CMP Cycle 25 funds to improve existing infrastructure, synthesize long-term water quality data, and continue to develop public outreach materials and restore wetland habitat areas. The City replaced deteriorated deck boards and rails on the pier over the settling ponds to enhance public access and allow for continued public wildlife viewing. Additionally, the City installed a water level gauge in Pond #1 to help the water treatment managers maintain a constant water level in the settling ponds despite high evaporation rates. TWRI enhanced public education by designing and installing interpretive signage regarding Coastal Natural Resource Areas, wetlands, habitat, and wildlife. TWRI hosted 4 coastal education workshops for the public and community leaders. TWRI hosted 21 citizen bird counts and developed a bird checklist for the public to use. Invasive species were removed from the project area and native wetland and riparian vegetation was planted to ensure the continued maintenance of wetland habitat. Finally, TWRI was able to calculate the load reductions from the Phase 3 ponds for bacteria, sediment, and nutrient levels being diverted from the Arroyo Colorado.

Task 1: Infrastructure Improvements

The City will replace deteriorated deck boards and railings along the pier to ensure public access and safety. The City will install six water level gauges (three for the high water mark and three for the low water mark) on the observation deck pilings using stainless steel metal straps.

Major accomplishments

The city of San Benito hired Araiza construction to refurbish the existing pier. They began renovating the pier on June 26, 2023 and completed the renovation on July 3, 2023. City staff installed the water level gauge on July 20, 2023.

Photos of the pier renovation and water level gage installed in large wetland cells

Task 2: Public environmental education/outreach

TWRI will install additional educational and interpretive signage on the updated pier (Task 1). Outreach materials will include an annual newsletter, monthly stakeholder email updates, public information through the media, social media, and website updates. Two workshops will be developed and conducted by TWRI and the Arroyo Colorado Watershed Partnership (ACWP) for the general public and community leaders. The Watershed Coordinator will work with

volunteers from the Arroyo Colorado Audubon Society, the Texas Master Naturalists and in cooperation with Texas Parks and Wildlife Department (TPWD), and U.S. Fish and Wildlife Service (USFWS) to host a citizen bird count at the site.

Major accomplishments

TWRI worked with the Arroyo Colorado Audubon Society & South Texas Master Naturalists to draft the text and design the draft interpretive signage. It took more than 8 months and 3 different drafts until the majority of the team members decided on the final versions. iZone Imaging was contracted to manufacture the signs and hardware.

TWRI hosted 3 workshops at the San Benito wetlands and a 4th workshop at the Harlingen Public Library. The 1st workshop was held on March 3, 2022. TWRI gave an Education & Outreach Workshop where he presented information on the history of the wetlands, wastewater effluent used to fill the ponds, refurbishing the ponds to be used as a coastal wetland, pipe and outfall installation and benefits of the wetlands to the coastal zone using interpretative signage at the park to the Laguna Vista Birding Club. A total of 25 members attended the presentation. After the presentation, the group conducted a bird count.

Members of the Laguna Vista Birding Club at the San Benito Wetlands on March 3, 2022

Laguna Vista Birding Club Bird Count March 3, 2022 San Benito Wetlands

The Laguna Vista Birding Club (LVBC) have weekly Birding Field trips January-July. The LVBC contacted Jaime Flores, TWRI PM, about gaining access the San Benito wetlands for one of their weekly field trips and to give the group a presentation on the history and development of the wetlands. The TWRI PM worked with the City of San Benito to coordinate the field trip for March 3, 2022. The TWRI PM arrived at the wetlands at 7:30 am to open the gates to the San Benito Wetlands to allow the LVBC members to drive in and park. After a brief meet and great, the TWRI PM had a safety meeting and conducted an E&O Workshop where he presented information on the history of the wetlands, wastewater effluent used to fill the ponds, refurbishing the ponds to be used as a coastal wetland, pipe and outfall installation and benefits of the wetlands to the coastal zone using interpretative signage at the park. The group decided to conduct the bird count at both the Phase I & II ponds and the Phase III ponds. A total of 25 LVBC members attended the bird count. There were able to count 42 different Taxa. One of the birders had a professional grade camera and lens and was able to take some great close-up photos of some the birds that were observed during the count. The birds identified are listed below.

Cardinal
Harris's hawk
Red-tailed hawk
American kestrel
Starling
Kiskadee
Mockingbird
Green kingfisher
Common yellowthroat
db cormorant
Ruddy duck
Osprey
Ruby-crowned kinglet
House sparrow
Northern shoveler
Yellow warbler
Tropical kingbird
White pelican
Turkey vulture
Curve-billed thrasher
Great egret

Great blue heron
Spotted sandpiper
Green heron
Vermilion flycatcher
Spoonbill
Snowy egret
Coot
Black-necked stilt
Lark sparrow
Savannah sparrow
Grackle
Ruby-crowned kinglet
Yellow warbler
Pied-billed grebe
Least grebe
Snowy egret
Red-winged black bird
Anhinga
Ring-necked duck
Tern species
Laughing gull

Groove Billed Ani

Birds observed during the March 3, 2022 bird count.
Top left and clockwise; Green Heron, Vermillion Flycatcher, Least Grebe, White Pelican

The 2nd workshop was held on July 19, 2022 and included a tour of the San Benito Wetlands for the Texas 4-H Water Ambassadors. The Texas 4-H Water Ambassadors Program was founded in 2017 with the support and encouragement of many Texas water industry leaders. The mission of the program is to "provide high school youth an opportunity to gain advanced knowledge and develop leadership skills related to the science, technology, engineering and management of water in Texas." A total of 17 4-H Water Ambassadors attended. TWRI gave the group a general overview of how the Wetlands Ponds were built to serve as the original Facultative Lagoon Wastewater Treatment system for the city of San Benito. The PM explained the purpose of the San Benito Wetlands: to "reuse" treated wastewaster or effluent to fill the abandoned lagoonal ponds to provide coastal wetland habitat while reducing the amount of bacteria, sediment and nutrients entering the Arroyo Colorado. The effluent is also being reused to maintain pond levels year round providing vital coastal wetland habitat for native and migratory birds, native mammals, reptiles and insects.

Texas 4-H Water Ambassadors Field Trip to the San Benito Wetlands-July 19, 2022

The TWRI PM in conjunction with the city of San Benito hosted a tour of the San Benito Wetlands for the Texas 4-H Water Ambassadors. The Texas 4-H Water Ambassadors Program was founded in 2017 with the support and encouragement of many Texas water industry leaders. The mission of the program is to "provide high school youth an opportunity to gain advanced knowledge and develop leadership skills related to the science, technology, engineering and management of water in Texas." To date, 135 youth from across the state have served as 4-H Water Ambassadors and are having a profound impact in their communities.

The PM gave the group a general overview of how the Wetlands Ponds were built to serve as the original Facultative Lagoon Waste Water Treatment system for the city of San Benito. Facultative lagoons are a type of waste stabilization pond used for biological treatment of industrial and domestic wastewater. The city utilized this system until the city's population began to exceed the capacity of the Lagoonal Pond system ability to safely treat the waste water. The city built a modern Waste Water Treatment Facility and abandoned the Lagoonal pond system. The PM explained the purpose of the San Benito Wetlands: To "reuse" treated wastewaster or effluent to fill the abandoned lagoonal ponds to provide coastal wetland habitat while reducing the amount of bacteria, sediment and nutrients entering the Arroyo Colorado. The Phase II ponds are a effluent polishing pond systems utilizing small-scale, constructed wetlands for enhanced wastewater treatment. The Phase II ponds consist of 14, 1 acre ponds. Effluent is pumped into Pond # 14 through a 6" diameter pipeline and the effluent sinuously flows through all of the rest of the ponds through channels and cuts made in the berms of the ponds before being discharged in to the Arroyo Colorado. The average depth of the phase II ponds is 2-3 feet. Native trees, plants, shrubs and grasses planted along the perimeter of the ponds help remove sediment, bacteria and nutrients from the effluent. The Phase III ponds consist of 3, 16.67 acre ponds totaling 50 acres. The Phase III ponds can hold approximately 650,000 gallons of effluent with zero discharge. It is a completely evaporative system. Effluent is only pumped into the ponds after the water level in the ponds have dropped 2-3 feet to the designated low water level. These ponds average a depth of 7 feet and are much larger and deeper than the Phase I & II ponds. The effluent is also being reused to maintain pond levels year round providing vital coastal wetland habitat for native and migratory birds, native mammals, reptiles and insects.

General Overview

Describing Phase III Ponds

Preparing to tour the wetlands

Describing Phase I & II Ponds

Phase II Ponds

Phase III Ponds and Pier

The 3rd workshop was held on July 18, 2023 and included a tour of the San Benito Wetlands for the Texas 4-H Water Ambassadors. TWRI provided the same general overview of how the ponds were built and then redeveloped into coastal wetlands using reuse water. A total of 18 Texas 4-H Water Ambassadors attended.

The 4th workshop was held on September 14, 2023. TWRI gave a presentation on the history of the San Benito wetlands to the Arroyo Colorado Audubon Society (ACAS). The ACAS asked

the Jaime Flores to give the presentation as part of their kickoff to their 1st meeting of the year. A total of 40 ACAS members attended the meeting. The meeting was followed up by a field trip to the wetlands on September 16, 2023 by the ACAS to learn more about the development of the abandoned ponds into coastal wetlands and to conduct a bird count. A total of 27 ACAS members attended the field trip/bird count.

TWRI worked with the Arroyo Colorado Audubon Society to conduct 21 bird counts throughout the project period. During the bird counts, 1 ACAS member would enter the different type of birds identified and numbers of each species into an online eBird app on the phone. Once the bird count was complete, the list would be uploaded into the eBird database. The San Benito Wetlands has become a birding hot spot on the eBird database and website with 226 species identified at the San Benito wetlands.

TWRI worked with the Arroyo Colorado Audubon Society and the city of San Benito to host birding field trips to the San Benito Wetlands during the 29th Annual RGV Birding Festival on November 9-13, 2022. A total of 386 people from 38 states and 6 different countries visited the park during the birding festival.

TWRI completed 2 Arroyo Partnership Annual Newsletters during the project period.

The Arroyo Colorado Watershed Partnership
Newsletter

Winter 2022

Soil Testing Campaign in the Arroyo Colorado Watershed

By Jaime Flores

Soil testing is a simple and effective tool that agricultural producers and homeowners alike can use to help manage fertilizer and soil amendment applications. Basic soil tests provide information about the kind and amount of plant-available nutrients currently in the soil and how much additional fertilizer is needed for the growing plants. The information received can help save money. Knowing crops' nutritional needs can help determine the amount of fertilizer to apply, or not apply, to produce a successful yield.

A good soil testing program can lead to other savings as well. For example, surface and groundwater resources are protected through proper nutrient application. Surface runoff and water leaching into the soil and underlying aquifers are natural processes that can lead to pollution. Poor nutrient management combined with these natural processes contributes to environmental degradation that ultimately affects human populations. Excess nutrient leaching into groundwater used for drinking can cause negative health effects and increase potable water treatment costs. Nutrient loading in surface runoff can create excessive aquatic plant growth and low dissolved oxygen in waterbodies that may lead to fish kills. Fish kills are bad for the aquatic system and degrade recreational opportunities for area residents.

In the Lower Rio Grande Valley, the Arroyo Colorado and other area waterbodies are experiencing nutrient loading issues that have created water quality impairments. Some excess nutrients are classified as nonpoint source pollution and may come from agriculture runoff, on-site sewage facilities, illegal dumping and urban stormwater runoff. Soil testing and following the recommendations of the test when applying fertilizer are one way to reduce potential nutrient runoff from agricultural and urban settings alike.

The Texas A&M AgriLife Extension Service and the Texas Water Resources Institute are once again offering a free soil-testing campaign for agricultural producers in the Lower Rio Grande Valley. This program supports implementation of the Arroyo Colorado Watershed Protection Plan and will reduce nutrient loading to area waterbodies and producer's input costs. *(continued on page 6)*

Gabriel Cavazos, Conservation Agronomist, USDA-NRCS Hidalgo Co., demonstrating how to collect a soil sample. Photo by Jaime Flores.

Prepared in cooperation with the Texas Commission on Environmental Quality and the U.S. Environmental Protection Agency.

The Arroyo Colorado Watershed Partnership
Newsletter

Spring 2023

San Benito Wetlands drew international crowd during 29th Annual RGV Birding Festival

By Jaime Flores

The restoration of the 65 acres of wetlands and riparian habitat at the San Benito Wetlands is one of the most exciting on-going environmental projects in the Rio Grande Valley, and recently visitors from all over the world experienced it during the 29th Annual RGV Birding Festival.

The wetlands have attracted numerous rare birds in recent years, and in 2022 the RGV Birding Festival got special permission to visit the site during the festival for the first time since the wetlands had been restored. The initiative was a great success, and 386 visitors from 39 states and six countries visited the wetlands during the festival, Nov. 9-13, 2022.

Phase I of the wetland project began in 2009 with the restoration of four 1-acre polishing ponds. Over the course of 12 years and three additional phases, a total of 65 acres have been restored. As soon as the first ponds were completed and filled with water, birds and all types of wildlife began flocking to the wetlands. Since then, it has become a birding hotspot.

Members of the Arroyo Colorado Audubon Society discovered what an attraction the wetlands can be in November 2021 when they spotted a Fork-tailed Flycatcher in the area. The Fork-tailed Flycatcher is mainly found in Mexico, Yucatan and South America, and is a rare bird to be seen in the United States. For the next two weeks, birders from all over the world flocked to catch a glimpse of the flycatcher.

Additionally, a pair of Groove-billed Ani spent the 2021 winter, spring and most of summer close to the road bridge and were viewed at every bird count. *(continued on page 4)*

Birders flocking to view the Fork-tailed flycatcher. Photo by Jaime Flores.

Fork-tailed Flycatcher. Photo by Alicia Cavazos.

Prepared in cooperation with the Texas State Soil and Water Conservation Board and the U.S. Environmental Protection Agency.

Task 3: Native wetland and riparian habitat restoration
TWRI will inspect the project area (i.e. the areas restored in Phases 1-3) to identify locations where invasive species exist. The City will remove any invasive vegetation from the project area through mechanical or chemical means, or a combination of both. A selection of native submergent, emergent, and riparian plants will be developed with guidance from experts, including plant ecologists, biologists, and restoration specialists from the USFWS and TPWD. Using this selection, the City will plant native wetland and riparian vegetation. The timeline for installation will be coordinated with seasonal water levels to meet the requirements of native submergent, emergent, and riparian vegetation for establishment.

Major accomplishments
The City began clearing the invasive vegetation from the planting area on February 16 and continued through February 19, 2022. The city continued to clear vegetation of the planting area on February 28-March 2, 2022 & March 18, 2022. TWRI worked with Mike Heep and his staff, to plant 412 native trees and plants on 3/17-18/22 & 3/23-25/22.

Site preparation, planting, and after planting results on the Phase III wetlands

Task 4: Water quality data synthesis

TWRI will develop a report that synthesizes and analyzes the cumulative water quality data collected over the lifetime of the project (Phase 1-4). The report will highlight how the wastewater reuse and tertiary treatment project has improved the water quality entering the Arroyo Colorado tidal segment from the wastewater treatment plant. TWRI will compare the water quality data collected before the wastewater reuse and tertiary treatment project (i.e. pre-2012) with the water quality data collected after the project was completed. Data collected by the Nueces River Authority data (collected at monitoring points upstream and downstream of the project site) may be used to complete this analysis. Additionally, TWRI will compare the water samples taken from treated effluent leaving the wastewater treatment plant and water samples from the settling/evaporation ponds to determine the improvement in water quality. The water quality parameters will include bacteria count and nutrient levels (e.g. nitrogen and phosphorous). The City will also monitor the water level gauges and, with expertise from TPWD and USFWS, the ACWP will work to determine appropriate seasonal water levels for wildlife, ecotourists, and management objectives. AgriLife will conduct semi-annual bird counts (at Christmas and in spring) to monitor bird usage of the project site and add any new birds to the citizen bird checklist (Task 2). Participation in educational opportunities will also be monitored. All data analysis and monitoring reports will be included in the Final Report (Task 5).

Major accomplishments

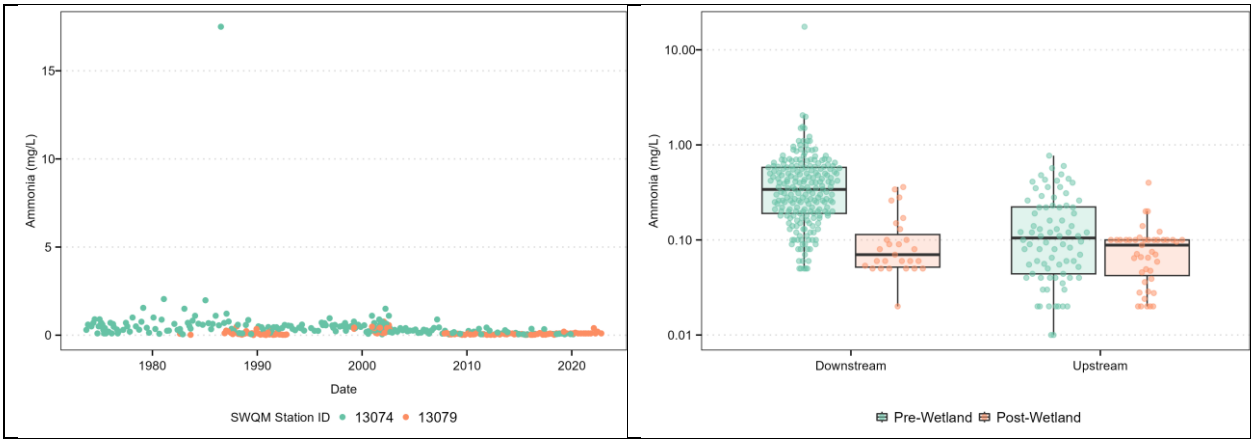
The City of San Benito conducts water quality monitoring routinely throughout the week according to their TCEQ wastewater discharge permit. The city has been conducting the water quality monitoring for this project since October 1, 2020. The city uses Integrity Testing Laboratory to conduct WWTF effluent analysis and reports data to TCEQ to comply with their wastewater discharge permit. The city also records the volume of effluent diverted to the wetland ponds using a flow meter and records the dates and amount of water in gallons. TWRI worked with the WWTF staff to review the lab results of the effluent that is pumped into the 50 acre, Phase 3 ponds and the total amount of gallons that have been pumped into the ponds since December 18, 2018 when the city first turned on the pump and began filling the ponds. TWRI was able to calculate load reductions for Ammonia, TSS and *E. coli*. During the course of this project, the city pumped 169,810,000 gallons of treated wastewater into the ponds as of April 2023. By doing this, ammonia, total suspended solids (TSS) and *E. coli* were diverted from the Arroyo Colorado and into the wetland ponds. In total, 735 lbs of ammonia, 3,421 lbs of TSS and over 2.6 billion colonies of *E. coli* were prevented from entering the Arroyo Colorado.

While these numbers are considerable, the primary metric of the wastewater wetland's impacts is how, or did water quality improve in the Arroyo Colorado. To assess this effect, the entire data record for the two water quality monitoring stations that are located closest upstream (Station 13079) and downstream (Station 13074) of the San Benito WWTF outfall were gathered and analyzed to compare water quality before the first wetlands phase came online in 2011 and after. To assess these changes, the mean differences in ammonia, TSS and *E. coli* concentrations were compared using a two-way analysis of variance (ANOVA) with location (upstream:downstream) and wetland (pre-wetland:post-wetland) as levels. The ANOVA only indicates if there is evidence of a difference in means among the different levels, not which levels are different from each other. A post-hoc analysis using Tukey's Honest Significant Difference (HSD) was used to

evaluate differences between each level. Differences were considered significant at $\alpha = 0.05$. ammonia, TSS and *E. coli*, and were log transformed prior to analysis to ensure normality of model residuals. The results of these analysis therefore represent differences in the geometric means of the respective parameters. However, it must be noted that all land area contributing to the Arroyo Colorado upstream of these monitoring stations influences instream water quality. Changes in land use and management practices in these areas of the watershed have occurred during this same time period and resulted in the water quality changes observed.

Ammonia

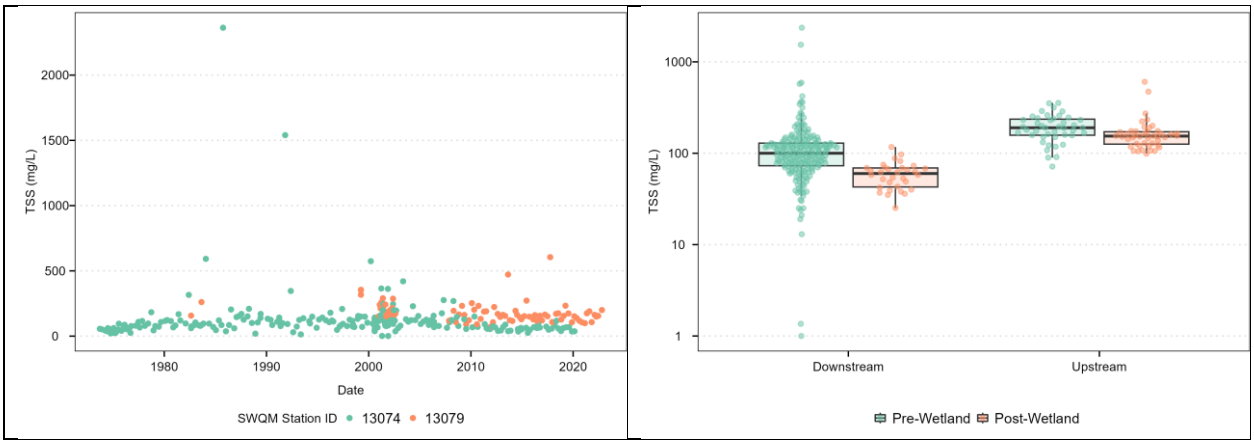
Time series data collected from both sites depicts different ammonia concentrations upstream and downstream of the WWTF and before and after the wetland was established. Two way ANOVA results for ammonia concentrations provide strong evidence of differences in the geometric mean concentrations at each level. The post-hoc Tukey's HSD indicates significant decrease in the log transformed ammonia at the downstream site after operation of wetlands (p-value = <0.001). The differences in log-transformed ammonia at the upstream site were not significantly different before and after the wetland (p-value = 0.071). This suggests that diverting treated wastewater into the wetland rather than discharging it to the creek could have contributed to improved ammonia concentrations in-stream.



Time series plot of ammonia concentrations (left) and box plots of ammonia concentration distributions upstream/downstream and pre/post wetland (right)

TSS

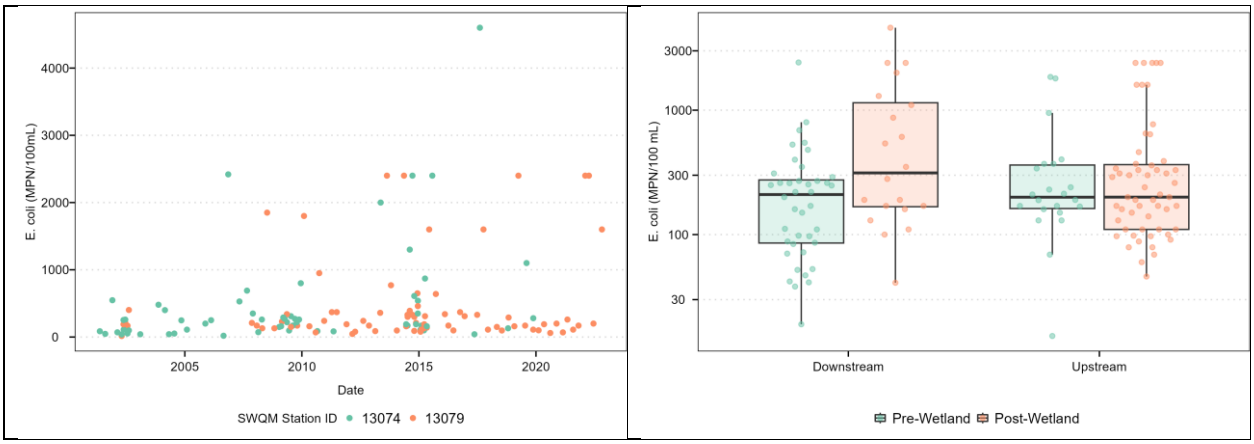
Time series TSS concentration data collected and analyzed with a two way ANOVA provides evidence of differences in the geometric mean concentrations between locations and the interaction between location and wetland. The post-hoc Tukey's HSD indicates significant decrease in log-transformed TSS at the downstream site after operation of wetlands (p-value <0.001). The differences in log-transformed TSS at the upstream site were not significantly different before and after the wetland (p-value = 0.666). This suggests that diverting treated wastewater into the wetland rather than discharging it to the creek could have contributed to improved TSS concentrations in-stream.



Time series plot of TSS concentrations (left) and box plots of TSS concentration distributions upstream/downstream and pre/post wetland (right)

E. coli

Time series *E. coli* concentrations over time analyzed via two way ANOVA of log transformed *E. coli* concentrations provide evidence of differences in the geometric mean concentrations between pre and post wetland conditions and possible differences with interactions between location and wetland. The post-hoc Tukey's HSD indicates significant increases in log-transformed *E. coli* at the downstream site after operation of wetlands (p-value = 0.014). The differences in log-transformed *E. coli* at the upstream site were not significantly different before and after the wetland (p-value = 0.968). This suggests that diverting treated wastewater into the wetland rather than discharging it to the creek could have contributed to increased *E. coli* concentrations in-stream. While this is not desired, it is not surprising. Treated wastewater effluent often has considerably lower *E. coli* concentrations than instream water quality. When treated wastewater enters these streams, it often dilutes the *E. coli* concentrations present despite the fact that it is still contributing additional *E. coli* to the stream.



Time series plot of *E. coli* concentrations (left) and box plots of *E. coli* concentration distributions upstream/downstream and pre/post wetland (right)

Task 5: Project Monitoring & Reporting
TWRI will prepare and submit all reports, deliverables, and requests for reimbursement as required in the contract, to CMPReceipts@GLO.TEXAS.GOV. Quarterly progress reports are due to CMPReceipts@GLO.TEXAS.GOV on the 10th day of every quarter of the year starting with January 10, 2021. Requests for reimbursement are to be submitted in a timely manner to CMPReceipts@GLO.TEXAS.GOV, as specified in the contract.
TWRI will provide a final report describing work completed under each task, all data analysis and discussion, conclusions, and include photos of outreach efforts.

Major accomplishments
TWRI submitted Quarterly Progress Report to the CMP PM throughout the project period.

Conclusions
The San Benito Wetlands Phase 4 was a huge success. All of the Task deliverables were completed and in some cases, such as the amount of Educational workshops and bird counts, the project team was able to surpass the totals listed in the grant. The wetlands were also opened for filed trips during the 29th Annual Rio Grande Valley Birding Festival for the first time ever. The Arroyo Colorado Birding Society who organizes and hosts the Birding Festival printed the following statement in their Birding Field Trip guide about the San Benito Wetlands, "The restoration of the wetlands and riparian habitat on some 65 acres at the San Benito Wetlands is one of the most exciting on-going environmental projects in the Rio Grande Valley". After conducting his own bird count at the wetlands during the Birding Festival, Richard Crossley stated, "the San Benito Wetlands has the potential to become a legendary birding destination in South Texas". Richard Crossley is an internationally acclaimed birder, photographer and award winning author of 'The Crossley ID Guide' series. Crazy, wildly passionate, driven and single-minded are just a few of the words used to describe his love of birding and the outdoors. Due to the success of the festival, the city will now be a permanent partner of the RGV Birding Festival and the wetlands will open to field trips during the Festival. The city will also open the wetlands for a guided bird count and tour of the wetlands during the Texas Master Naturalists Annual State Conference that is being held in the Rio Grande Valley this year in October. The city now recognizes how important and valuable the wetlands are to the city and the residents of the Rio Grande Valley. The city is planning to open the wetlands to the public year round as a city park next year. The city has also contacted TWRI about partnering together to seek funding to develop another 50 acres of wetlands utilizing the last 3 large ponds that are currently abandoned and to build bathrooms, a covered pavilion and parking lot at the wetlands. None of this would be possible if not for the GLO/CMP funding for Phases 2, 3 and 4. Together we were able to develop 60 acres of critical and much needed coastal wetlands in the coastal zone of Cameron County that will provide public access opportunities to the general public for years to come.

Appendix-A

San Benito Wetlands - Bird List

Ducks & Geese

Black-bellied Whistling-Duck (YR-1)
Fulvous Whistling-Duck (YV-4)
Snow Goose (WV-4)
Ross's Goose (WV-5)
Greater White-fronted Goose (WV-5)
Muscovy Duck (domestic type) (YV-4)
Blue-winged Teal (WR-1)
Cinnamon Teal (WV-4)
Northern Shoveler (WR-1)
Gadwall (WR-2)
American Wigeon (WR-3)
Mallard (domestic type) (YV-3)
Mallard (WV-5)
Mexican Duck (YV-5)
Mottled Duck (YR-2)
Northern Pintail (WV-3)
Green-winged Teal (WR-2)
Canvasback (WV-4)
Redhead (WV-3)
Ring-necked Duck (WR-2)
Greater Scaup (WV-5)
Lesser Scaup (WR-2)
Bufflehead\ (WV-4)
Hooded Merganser (WV-5)
Ruddy Duck (WR-1)

Chachalacas

Plain Chachalaca (YR-3)

Quail

Northern Bobwhite (YV-3)

Pheasants

Wild Turkey (YR-4)

Grebes

Least Grebe (YR-1)
Pied-billed Grebe (YR-1)
Eared Grebe (WV-5)

Pigeons & Doves

Rock Pigeon (YV-1)

Eurasian Collared-Dove (YV-3)
Inca Dove (YR-3)
Common Ground Dove (YR-2)
White-tipped Dove (YR-3)
White-winged Dove (YR-1)
Mourning Dove (YR-1)

Cuckoos

Groove-billed Ani (SR-2, WV-3)
Yellow-billed Cuckoo (M/SR-3)

Nightjars

Lesser Nighthawk (SR-3)
Common Nighthawk (SR-3)
Common Pauraque (YR-4)

Swifts

Chimney Swift (SV-3)

Hummingbirds

Ruby-throated Hummingbird (M-3)
Buff-bellied Hummingbird (YV-4)

Rails

King Rail (YV-4)
Sora (WR-3)
Common Gallinule (YR-1)
American Coot (YR-1)
Purple Gallinule (M-5, formerly SR-4)

Cranes

Sandhill Crane (WV-4)

Shorebirds

Black-necked Stilt (YR-1)
American Avocet (M-3, YV-5)
Semipalmated Plover (YV-5)
Killdeer (YR-1)
Upland Sandpiper (M-4)
Whimbrel (M-5)
Long-billed Curlew (M/WV-3)
Ruddy Turnstone (YV-5)
Stilt Sandpiper (M-4)
Sanderling (WV-5)
Dunlin (WV-5)
Least Sandpiper (M-2, WR-3)
Western Sandpiper (M/WV-4)

Short-billed Dowitcher (M-5)
Long-billed Dowitcher (M-2, WV-4)
Wilson's Snipe (M/WR-3)
Wilson's Phalarope (MSp-4)
Spotted Sandpiper (M/WR-1)
Solitary Sandpiper (M/WV-3)
Greater Yellowlegs (M-2, WV-3)
Willet (YV-5)
Lesser Yellowlegs (M-3, WV-4)

Gulls & Terns

Bonaparte's Gull (WV-5)
Laughing Gull (YV-1)
Franklin's Gull (M-3, WV-5)
Ring-billed Gull (WV-3)
Herring Gull (WV-5)
Lesser Black-backed Gull (WV-5)
Gull-billed Tern (YV-4)
Caspian Tern (YV-3)
Forster's Tern (YV-2)
Royal Tern (YV-5)
Sandwich Tern (YV-5)

Storks

Wood Stork (MF-3)

Cormorants & Anhingas

Anhinga (WV-1, SV-2)
Double-crested Cormorant (W-1)
Neotropic Cormorant (YR-1)

Pelicans

American White Pelican (M/W-2, SV-4)
Brown Pelican (LV-4)

Herons & Ibis

American Bittern (WV-5)
Least Bittern (M-4, YV-5)
Great Blue Heron (YR-1)
Great Egret (YR-1)
Snowy Egret (YR-1)
Little Blue Heron (YV-3)
Tricolored Heron (YV-3)
Cattle Egret (YV-2)
Green Heron (YR-2)
Black-crowned Night-Heron (YR-1)

Yellow-crowned Night-Heron (YR-1)
White Ibis (YV-2)
White-faced Ibis (M/WV-3)
Roseate Spoonbill (YV-2)

Vultures, Hawks & Allies

Black Vulture (YR-2)
Turkey Vulture (YR-1)
Osprey (M/WV-3)
White-tailed Kite (YR-2)
Mississippi Kite (M-4)
Northern Harrier (WR-2)
Sharp-shinned Hawk (WV-3)
Cooper's Hawk (WV-3)
Harris's Hawk (YR-1)
White-tailed Hawk (YV-4)
Gray Hawk (YV-5)
Red-shouldered Hawk (WV-3)
Broad-winged Hawk (M-4)
Swainson's Hawk (M-3, SV-4)
Zone-tailed Hawk (YV-5)
Red-tailed Hawk (WR-2)

Owls

Barn Owl (YV-4/formerly YR-3)
Great Horned Owl (YV-4)
Eastern Screech-Owl (WV-4)
Burrowing Owl (WR-5)

Kingfishers

Ringed Kingfisher (YV-3)
Green Kingfisher (YV-3)
Belted Kingfisher (WV-3)

Woodpeckers

Yellow-bellied Sapsucker (M-4)
Golden-fronted Woodpecker (YR-1)
Ladder-backed Woodpecker (YC-2)
Northern Flicker (WV-5)

Falcons

Crested Caracara (YR-1)
American Kestrel (WR-2)
Merlin (WV-4)
Aplomado Falcon (YV-5)

Peregrine Falcon (WV-3)

Parrots & Parakeets

Red-crowned Parrot (YV-3)
Green Parakeet (YV-4)
Budgerigar (escapee)

Tyrant Flycatchers

Eastern Wood-Pewee (M-3)
Alder Flycatcher (M-4)
Least Flycatcher (M-4)
Black Phoebe (WR-3)
Eastern Phoebe (M/WR-2)
Say's Phoebe (WV-5)
Vermilion Flycatcher (WR-2)
Brown-crested Flycatcher (SR-2)
Great Kiskadee (YR-1)
Tropical Kingbird (YR-2)
Couch's Kingbird (YR-2)
Western Kingbird (M-4)
Eastern Kingbird (M-3)
Scissor-tailed Flycatcher (M-2, SR-2, WV-3)
Fork-tailed Flycatcher (FM-5)

Vireos

White-eyed Vireo (YR-3)
solitary vireo sp.(WV-5)

Shrikes

Loggerhead Shrike (YR-2)

Jays, Crows & Ravens

Green Jay (YR-2)

Titmice

Black-crested Titmouse (YR-2)

Verdins

Verdin (YR-3)

Larks

Horned Lark (WR-3)

Martins & Swallows

Northern Rough-winged Swallow (M-2, WV-3)
Purple Martin (M-2, SV-3)

Tree Swallow (M-2, WV-3)
Bank Swallow (M-3)
Barn Swallow (M/SR-2)
Cliff Swallow (M-3)
Cave Swallow (SV-2, WV-3)

Kinglets

Ruby-crowned Kinglet (WV-3)
Golden-crowned Kinglet (WV-5)

Gnatcatchers

Blue-gray Gnatcatcher (M-2, WV-3)

Wrens

House Wren (WR-2)
Sedge Wren (WV-4)
Marsh Wren (WR-3)
Carolina Wren (YV-3)
Bewick's Wren (YR-2)

Starlings

European Starling (YR-C)

Mimids

Gray Catbird (M/WV-3)
Curve-billed Thrasher (YR-2)
Long-billed Thrasher (WR-2, SV-3)
Sage Thrasher (WV-5)
Northern Mockingbird (YR-1)

Thrushes

Eastern Bluebird (WV-4)
Clay-colored Thrush (YV-4)
American Robin (WV-5)

Old World Sparrows

House Sparrow (YR-1)

Pipits

American Pipit (WV-3)
Sprague's Pipit (WV-5)

Finches

House Finch (YV- 4)
Lesser Goldfinch (YV-3)
American Goldfinch (WV-4)

New World Sparrows

Grasshopper Sparrow (WV-4)
Olive Sparrow (YR-2)
Chipping Sparrow (M/WV- 4)
Clay-colored Sparrow (M-4)
Lark Sparrow (S-2, W-3)
White-crowned Sparrow (M-5)
Vesper Sparrow (WV-4)
Savannah Sparrow (WR-1)
Lincoln's Sparrow (WR-1)
Swamp Sparrow (WR-3)

Chats

Yellow-breasted Chat (M-4)

Blackbirds

Yellow-headed Blackbird (M-5)
Western Meadowlark (WV-3)
Eastern Meadowlark (YR-2)
Orchard Oriole (M-4)
Hooded Oriole (YR-4)
Altamira Oriole (YR-3)
Baltimore Oriole (M-4)
Red-winged Blackbird (YR-1)
Bronzed Cowbird (YR-2)
Brown-headed Cowbird (YR-3)
Great-tailed Grackle (YR-1)

Wood Warblers

Orange-crowned Warbler (M/WR-2)
Nashville Warbler (M/WV-3)
Common Yellowthroat (WR-2)
Yellow Warbler (M-3)
Yellow-rumped Warbler (M/WR-1)
Wilson's Warbler (M/WV-3)

Cardinals, Grosbeaks & Allies

Summer Tanager (M-4)
Western Tanager (M-5)
Northern Cardinal (YR-2)
Blue Grosbeak (M-4)
Indigo Bunting (M/WV-4)
Painted Bunting (M-4)
Dickcissel (M-4)

226 species

Key

species in bold – a South Texas regional specialties
species in italics – a rarity at the Wetlands (fewer than 5 reliable records)

Y – possible any month of the year
Sp – spring
S – summer
F – fall
W – winter
[note: seasonal designations are not exclusive - they simply indicate the time of year of greatest numbers and, for summer or winter resident species, a relatively stable population e.g. some Double-crested Cormorants, winter residents in the list, arrive in late September and might not leave until early May]

R – resident for at least the summer or winter with breeding or feeding territory in or close to the Wetlands
V – a casual visitor
M – a migrant normally seen only in spring and/or fall

1 – 90-100% chance of locating the species on a visit to the Wetlands at the appropriate time of year
2 – 50-90% chance of locating the species on a visit to the Wetlands at the appropriate time of year
3 – 20-50% chance of locating the species on a visit to the Wetlands at the appropriate time of year
4 – less than 20% chance of locating the species on a visit to the Wetlands at the appropriate time of year
5 – a rarity at the Wetlands (fewer than 5 reliable records)

Michael Marsden

July 23