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COLLEGE OF AGRICULTURE
AND LIFE SCIENCES

TR-417
2012

Enhancing Water Quality and Dredged Material for the Port of Harlingen (Phase I)

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Prepared for
Texas General Land Office

January 2012

Texas Water Resources Institute Technical Report No. 417
Texas A&M University System
College Station, Texas 77843-2118

Texas Water Resources Institute
make every drop count

Acronyms
ACWP – Arroyo Colorado Watershed Partnership
ACWPP – Arroyo Colorado Watershed Protection Plan
APAI – Alan Plummer Associates, Inc.
DO – Dissolved Oxygen
GIWW – Gulf Intracoastal Waterway
GLO – General Land Office
TWRI – Texas Water Resources Institute
UTB – University of Texas at Brownsville

Funding provided by General Land Office as part of the Coastal Management Program.

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Executive Summary

The Arroyo Colorado is located in the Lower Rio Grande Valley of South Texas and flows through the middle of Hidalgo and Cameron counties. The lower 16 miles of the Arroyo Colorado form the boundary between Cameron and Willacy Counties, but the lower 26 miles form the tidally influenced segment.

This tidal segment is periodically dredged to accommodate barge traffic to the Port of Harlingen and is characterized by steep eroding slopes with bank heights up to 50 feet. The steep banks are partially the result of the placement of dredged spoil material on the banks of the stream. In the upper portions of the tidal segment, the steep banks are thought to occasionally impede the flow of air across the surface of the stream, which can reduce aeration and vertical mixing, factors that contribute to the low levels of dissolved oxygen (DO) observed in this portion of the stream. The average width of the tidal segment of the Arroyo Colorado is about 200 feet and the average depth is 13 feet. Being tidally influenced, it is brackish to saline (slightly salty to very salty) and usually stratifies under warm weather conditions, forming layers of warmer, fresher water on the surface and cooler, more saline water near the bottom. For most of its course, the tidal segment of the Arroyo Colorado has a significant degree of natural sinuosity. However, sinuosity in the tidal segment of the Arroyo Colorado severely diminishes in the final four miles of the stream as the Arroyo Colorado flows into a man-made channel that leads to the Intracoastal Waterway (GIWW) and the Lower Laguna Madre.

The Port of Harlingen is located in the heart of the impaired tidal segment of the Arroyo Colorado, which is classified by the Texas Commission on Environmental Quality as the segment between the confluence with the Laguna Madre in Cameron/Willacy County to a point 100 meters (110 yards) downstream of Cemetery Road in Cameron County. The Port Authority is the current local U.S. Army Corps of Engineers sponsor of the GIWW – Tributary Channel to Harlingen and is the sole commercial navigation port on the Arroyo Colorado. The Port of Harlingen provides terminal docks and other facilities for shipping into and out of the Rio Grande Valley. The Port also provides over 150 acres of on-and-off-channel sites for lease for transportation activities and warehousing. The Port of Harlingen is an important link in the comprehensive transportation network of the Rio Grande Valley, especially in agricultural commerce. Links to major rail systems keep products moving to Texas locations and throughout the United States and Mexico.

This project is the first phase of a larger effort to ultimately construct a two-bank wetland system at the Port of Harlingen. In this project, the Port of Harlingen and the Texas Water Resources Institute (TWRI) will conduct a site assessment for a constructed wetland to remove nutrients from spoils dredged from the turning basin at the Port of Harlingen, Texas.

Project Description

Maintaining and protecting the water quality of the Lower Laguna Madre, an important nursery for fish, shrimp and crab and a popular site for recreational fishing and boating, is imperative for the health of the Texas coast. However, the low DO concentrations in the Arroyo Colorado, the primary source of freshwater for the Lower Laguna Madre, have killed millions of fish over the

past few decades. Most of these fish kills occurred in the tidal segment of the Arroyo, which directly flows into the Lower Laguna Madre.

To address the DO impairment, the Arroyo Colorado Watershed Partnership (ACWP) developed the Arroyo Colorado Watershed Protection Plan (ACWPP), a comprehensive watershed-based strategy to improve water quality and aquatic and riparian habitat in the Arroyo Colorado. One of the top strategies for water quality improvement identified in the ACWPP is the construction of wetlands for removal of nutrients. In a joint effort to conduct a demonstration project utilizing a constructed wetland for nutrient management, the Port of Harlingen, TWRI, Alan Plummer and Associates, Inc. (APAI) and the University of Texas at Brownsville (UTB) will develop plans to construct a wetland system that will remove nutrients from spoils dredged from the turning basin at the Port of Harlingen, Texas.

The project site, located at the Port, is adjacent to a portion of the water-body that is defined as a coastal natural resource area and a coastal wetland in the Coastal Coordination Act. The location of the wetland is on an approximately 35-acre site where dredge spoils from the turning basin were previously dumped downstream of the Port of Harlingen on the northwestern bank of the Arroyo Colorado. By impacting this key location within the Arroyo Colorado (also within the Zone of Impairment) the resulting water quality improvements would help to restore the DO levels to acceptable water quality standards. Improving the DO levels in the Zone of Impairment is essential to water quality within the Lower Laguna Madre and maintaining its health as a vital coastal nursery and ecological and economic resource.

Funding has addressed two major funding categories and goals within the Coastal Management Program: water quality and quantity improvements, and enhancements of critical areas. Water quality issues associated with the Arroyo Colorado and the Lower Laguna Madre could be addressed through the construction of the 35-acre wetland that was designed to protect critical habitat and provide nutrient removal from dredge spoils from the turning basin from the Port of Harlingen. The spoils contain nutrients from two sources: 1) nonpoint source pollution during Port activities (loading, unloading, storm-water runoff), and 2) detachment from upstream sediment that settles out of the water column in the turning basin (a wider, deeper segment of the stream that has slower flow). By removing these nutrients, the spoils could be purchased and used as beneficial amendments in other areas of the watershed, which could provide revenue for sustaining the sediment basin and wetland system. In addition to improving water quality and the quality of the dredged material, this wetland system would provide valuable riparian habitat, a public bird watch area and long-term, continuous sediment maintenance of the turning basin for the Port.

Due to the size and scope of this project, it was determined that the tasks are to be addressed in phases. The first phase (~ 1 ½ years) included an ecological and hydrological site assessment, land survey, and conceptual plan for the design of the site components (wetland and sediment basins). This step will lead into the second phase of attaining necessary permits for the site identified in the first phase (~1 year) and the third phase of on the ground construction (~1 ½ years). Based on the success demonstrated by the initial system, the Port of Harlingen has additional acreage on which to expand this concept to both banks of the turning basin at the Port,

which would lead to even greater water quality and habitat improvements for the Lower Laguna Madre and Arroyo Colorado.

This project was the first phase of a larger effort to ultimately construct a two-bank wetland system at the Port of Harlingen. The larger effort will expand this initial project to both banks of the turning basin at the Port. Due to the time required to obtain permits and construct a wetland, the goal of this project was to conduct preliminary assessments, develop a conceptual design for the site, and begin the permitting process. In this project, we include an ecological site assessment and inventory, a wetland site suitability evaluation, hardscape and landscape design, and permit(s) inquisition.

Task 1: Project Management

TWRI facilitated this project by effectively coordinating and monitoring all technical and financial activities performed under the contract as well as active involvement with relaying the program activities to the Arroyo Colorado Watershed Partnership and Watershed Protection Plan. A detailed listing of activities related to the project administration can be found in Appendix A.

Specifically, TWRI provided project oversight that included technical and financial oversight to ensure that tasks and deliverables were acceptable and completed as scheduled and within budget. Fiscal oversight consisted of submitting reimbursement forms per the schedule that was established in by General Land Office (GLO). To facilitate good communication amongst project participants, TWRI held frequent meetings and teleconferences to ensure that issues, if any, could be resolved in a timely manner as not to affect the project timeline, and project personnel remained on task.

TWRI submitted quarterly progress reports to the GLO and all reports can be found on the Arroyo Colorado website (http://arroyocolorado.org/projects/port-of-harlingen). Quarterly reports contained an overview of project activities during each quarter, an overview of activities to be completed in the next quarter, and highlighted related issues or problems associated with the project.

Task 2: Conduct Ecological Assessment

Task 2, a major component of the project, was to conduct an ecological assessment (specific task activities are in Appendix B). This assessment was conducted to determine appropriate locations for wetland/sediment basins. Efforts are continuously made to preserve natural habitat where possible as well as incorporate natural components of the landscape. Therefore, plants in this location were identified and mapped in order to ensure that native, threatened, and endangered plants are preserved on the site and incorporated into the design. This assessment also delineated wetlands on the property and identified areas that are prone to erosion which should be avoided during construction.

Coordination meetings with the Port of Harlingen staff, APAI, TWRI, and UTB faculty were held, primarily via conference call, to discuss goals and objectives of the studies that were conducted.

Once the goals and objectives had been identified, UTB proceeded to conduct an ecological assessment (Appendix C) to 1) identify native and non-native flora and fauna, 2) delineate wetland areas, and 3) determine soil types and erosion concerns on the approximately 35-acre site located on the northwestern bank of the Arroyo Colorado at the Port of Harlingen, Texas. UTB also provided a final report and GIS map to APAI and the GLO that included species identification and highlighted which areas should be avoided and which should be incorporated into the design of the sedimentation basins and treatment wetlands.

After review of reports prepared by UTB documenting ecological studies, APAI coordinated with state and federal agencies regarding determination of new permits required for construction of a system of sedimentation basins and wetlands to polish decant water from the dredging operations as well as associated amenities including conveyance of outflows back into the Arroyo Colorado. Section 3.1.3 of the Conceptual Design Report describes the permitting needs.

Task 3: Alan Plummer Associates, Inc. (APAI) in cooperation with the Port of Harlingen will analyze the following data for the proposed project site as part of the technical review analysis. APAI will be responsible for gathering data.

APAI, in cooperation with the Port of Harlingen as part of the technical review, has analyzed hydrological data, soils data, previous geotechnical reports for the project area, available topographical data, and environmental/ecological reports for the proposed wetland site. During a coordination meeting, the Board of the Port of Harlingen determined that it was not in their best interest to conduct the survey of the 35-acre site due to budget restraints. As a result of this, data was acquired from the Texas Natural Resource Information System (TNRIS) and it was determined to be acceptable to continue project activities.

Upon determining that the data was acceptable, APAI reviewed the survey and other data provided by the Port of Harlingen and UTB, and has developed the conceptual layout of the wetland. APAI has provided copies of the draft conceptual plan to the Port of Harlingen Board and project team partners to review. On November 22, 2011, the project team met with the Board at the Port of Harlingen to present and discuss the layout of the wetland and the Conceptual Design Report. Concerns were expressed regarding the project site stating that if the Port were to expand, the project site would be the ideal location for this expansion. Secondly, the Board expressed that they currently do not have interest in assuming financial responsibility of some of the overall project objectives.

Within the conceptual design report, two sites were proposed, one being the project site and the second being and another spoils site (outlined in the report). The Board expressed interested in potentially conducting a project at the second site if the project team could conduct an economic analysis and show costs to the Port. The first site is no longer of interest. Overall, the Board and project team were pleased with the Conceptual Design Report and it has been finalized and attached in Appendix D and specific task activities can be located in Appendix E.

Conclusions

The *Enhancing Water Quality and Dredged Material for the Port of Harlingen (Phase I)* project accomplished the tasks outlined in the project and could be classified as an overall success. The development of the Ecological Assessment and Conceptual Design Report are the results of the collaboration between the project partners. TWRI, APAI, UTB, and the Port of Harlingen staff communicated and worked closely together to identify concerns/issues affecting the Port of Harlingen and the project developed a strategy to continue the next phases of the project. The completion of this project is one of the first steps toward the implementation of an important project to the Arroyo Colorado Watershed. This type of project is critical to meeting the goals outlined in the Arroyo Colorado Watershed Protection Plan. This type of project will help to improve the habitat along the riparian areas, reduce the amount of nutrients entering the Arroyo Colorado from the dredged spoils and improve the water quality and DO levels in the Zone of Impairment.

Appendix A

Subtask 1.1: Project Oversight

- TWRI made initial contact with Alan Plummer and Associates, Inc. (APAI), University of Texas at Brownsville (UTB) and Port of Harlingen regarding the project deliverables and initial delay in contract initiation. APAI and TWRI discussed expediting the process of subcontracts and activities even prior to main contract execution through potential coordination of trips by personnel to the study area. However, no such coordination or pre-meetings occurred.
- TWRI has also made initial contact with GLO regarding project activities and deliverables.
- TWRI made initial contact with Alan Plummer and Associates, Inc. (APAI), University of Texas at Brownsville (UTB) and Port of Harlingen regarding the project deliverables and initial delay in contract initiation. APAI and TWRI are discussing the arrangement of a meeting in April to coordinate with TWRIs quarterly trip to the Valley.
- TWRI has also made initial contact with GLO regarding project activities and deliverables.
- TWRI arranged a project meeting at the Port of Harlingen on February 10, 2011, where project activities were discussed and the project site was visited.
- TWRI met either in person or had phone conversations with all project partners discussing the status of each individual task.

Subtask 1.2: Fiscal/invoicing

- Accounts and subcontracts will be set up as soon as TWRI receives the main account from AgriLife.
- Subcontracts are still being set up. There was an invoice submitted for the month of February in the amount of $384.88.
- Subcontracts are still being set up. There was an invoice submitted for the month of March for $1,271.04; as well as an invoice submitted for the month of April for $2,159.26.
- As of July 1, 2010, $7,178.54 or 9% of the project funds have been spent.
- As of July 1, 2010, $9,670.76 or 12% of the project funds have been spent.
- As of January 31, 2011, $14,461.83 or 18% of the project funds have been spent.
- As of March 31, 2011, $31,378.20 or 39% of the project funds have been spent.

Subtask 1.3: Regular Meetings

- A project coordination meeting was held on November 3, 2010, and one is being scheduled for next quarter.
- A project coordination meeting was held on February 10, 2011, and one is being scheduled for next quarter
- A project coordination meeting will be held next quarter.

Subtask 1.4: Quarter Progress Reports

- Quarter 1 progress report was turned in on January 14, 2010.

- Quarter 2 progress report was turned in on April 9, 2010.
- Quarter 4 progress report was turned in on October 9, 2010.
- Quarter 5 progress report was turned in on January 14, 2011.
- Quarter 6 progress report was turned in on April 8, 2011.
- Quarter 7 progress report was turned in on July 8, 2011.

Appendix B

Subtask 2.1: A coordination meeting with Port of Harlingen staff, Alan Plummer Associates, Inc (APAI)., TWRI, and University of Texas at Brownsville (UTB) faculty (to be conducted by conference call) will be held to discuss goals and objectives of studies to be conducted.

- A coordination conference call was held on July 20, 2010, where it was discussed what the appropriate steps in accomplishing project goals would be.
- A coordination conference call was held on November 3, 2010, where it was discussed what the appropriate steps in accomplishing project goals would be.
- A coordination meeting was held on February 10, 2011, at the Port of Harlingen where it was discussed what the appropriate steps in accomplishing project goals would be.

Subtask 2.2: Ecological Assessment

- UTB has been visiting the site to begin the Ecological Assessment.
- Fieldwork for the entire area has been completed. The assessment is 80% done at this time.
- Fieldwork for the entire area has been completed. The Ecological Assessment report was provided for review June 20, 2011.

Subtask 2.3: Report and Map

- 80% of the map is completed, with follow-up ground truthing. The rest of the map will be completed by April 30.
- The Ecological Assessment report with figures was provided for review June 20, 2011. GIS files of the report figures were requested of UTB.

Subtask 2.4: Permit Requirement Coordination

- APAI reviewed the Ecological Assessment report provided by UTB on June 20, 2011, but information regarding delineation of jurisdictional waters of the U.S., identification and location of any threatened or endangered species observed on site, soils, and erosion concerns was not provided. This information was requested to facilitate determination of permit requirements and required coordination with federal and/or state regulatory agencies.

Appendix C

Ecological Assessment Report

INTRODUCTION

A watershed can be defined as both the terrain of land that drains into a specific body of water and the specific body of water receiving the drainage. The Arroyo Colorado Watershed (ACW) is located in the Lower Rio Grande Valley of South Texas and is the primary source of freshwater for the Lower Laguna Madre. The drainage area, which includes the last 16 miles of the Arroyo Colorado, is a sub-watershed of the Nueces-Rio Grande Coastal Basin, also known as the South (Lower) Laguna Madre Watershed (Jenkins). The ACW is approximately 706 square miles stretching over 500,000 acres, and encompassing three counties in South Texas; Hidalgo, Willacy, and Cameron (Fig. 1). The ACW helps control flooding and drainage to the surrounding cities, it carries commercial barge traffic, it provides sanctuary for birds, it is a nursery for many marine fish, crab, and shrimp species, and it provides for many recreational activities. Although the ACW allows for many benefits, the recent state of the water quality in the ACW had raised causes for concern. A few of these "impairments" include; high levels of bacteria, low levels of dissolved oxygen, and destruction of habitat for flood and drainage control and urban development.

Of the 500,000 acres of land the ACW covers, 333,000 acres are agricultural land (De La Garza). Therefore, fertilizers and animal waste are the main causes for the elevated levels of bacteria. However, wastewater discharge and urban storm water run-off also contribute. The continuous dredging for barge traffic destroys habitats and adds excess soil to the streambeds, which results in a reduction of the natural aeration processes, lowering the amount of dissolved oxygen in the water.

Habitat alterations, due to a number of factors, have been performed in the ACW which have resulted in the loss or degradation of wetlands and riparian environments along the stream resulting in the deterioration of the water quality in the Arroyo Colorado. Water quality in the Arroyo Colorado has

been monitored by the State of Texas since 1974 in order to comply with sections 305(b) and 303(d) of the Clean Water Act (EPA/CWA). According to the State of Texas and more precisely stated in the State's Water Quality Standards (30 TAC §§307.1-307.10) the current condition of the ACW is poor. As a result of, an organization was created known as the Arroyo Colorado Watershed Partnership. Their mission is to "reduce the additions of pollutants to the Arroyo Colorado to the maximum extent possible in order to meet state water quality standards and improve the natural terrestrial, riparian, and aquatic habitat associated with the Arroyo Colorado Watershed" (Jenkins). The ACW Partnership consists of over 500 individuals working in seven different groups focused on specific issues. These groups address issues involving wastewater infrastructure, agricultural issues, habitat restoration, phase II (further study) analysis, outreach and education, land use and development, and water quality monitoring (De La Garza).

In order to improve the habitable environment and water quality conditions of the Arroyo Colorado, the ACW Protection Plan implements ten "Actions." However, only two of the ten are addressed in this project. Action number 9 addresses the necessity to build wetlands for treatment of pollutants from wastewater treatment facilities in close proximity and Action 10 addresses to build large off-channel wetlands for treatment from non-point source run-off from urban and agricultural areas (De La Garza). The terrestrial environment in the ACW includes native, non-native, and invasive vegetative species ranging from grasses to shrubs and trees. Invasive species, whether native or non-native, can be known to have a negative impact on certain species by spreading their monospecific stands preventing the growth of another species, by suppressing growth of another species by the release of toxins, or simply by competing for water and sunlight (Jenkins)

The purpose of this project is to identify threatened, endangered, native, non-native and/or invasive vegetation on a potential piece of land for the future development of a man-made wetland on the Arroyo Colorado in the Lower Rio Grande Valley. By identifying native versus non-native species, we

can determine the area of land that will be least likely impacted during the construction of this man-made wetland.

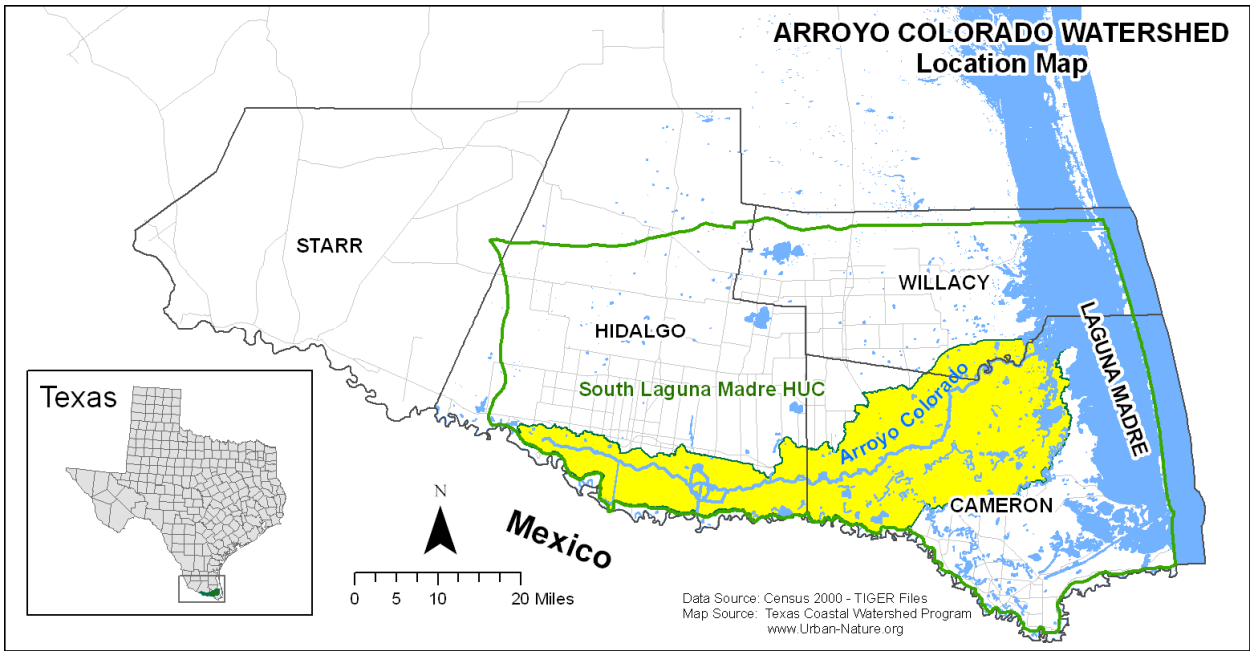

Figure 1. Arroyo Colorado Watershed located in the Lower Rio Grande Valley of South Texas.
Source: Water Quality in the Arroyo Colorado and its Watershed Protection Plan by: Laura De La Garza http://www.arroyocolorado.org/media/2523/TxAgIndustry.pdf

MATERIALS AND METHODS

The area of land surveyed for this project is located at the Port of Harlingen in Harlingen, Texas. The rectangular piece of land runs parallel to the Arroyo Colorado and is found on the western bank. The dimensions for the land surveyed are approximately 815 yards by 190 yards (Fig.2). For the purpose of this project, the area of land being surveyed was divided into two parts which are highlighted in Figure 2; Area 1 is outlined in red and Area 2 is outlined yellow.

Due to the size of the area of land being surveyed, Area 1 was further divided into five plots, with plot 1 starting at the south end of the area heading north to plot 5. The edges of these plots were logged into a GPS and marked using a piece of orange rope for visibility (Fig. 3). Once marked, the area in between was surveyed by walking west to east down to the rivers' edge. Using field guides and binoculars, all identifiable plant species within the plotted area were recorded. When fauna were

encountered they were identified to determine if they were endangered or threatened. If an area was unable to walk through or was too thick in vegetation, binoculars were used to identify as many of the species that were visible. Once the plot was surveyed, a predicted percentage was given to each species within the plot. This process was repeated for all five plots in Area 1. For Area 2, a different approach was used because there was limited access to the entire area. Majority of Area 2 was surveyed using binoculars for species identification. However, when looking at Fig. 2, the area running parallel to the river could be walked and the area running parallel to the field on the west side could be walked. The area in between was surveyed from elevated points on the outer edges surrounding Area 2.

Soil samples were collected for standard grain-size analysis to determine variation in soil types in the areas (Folk, 1974). Soil conditions were noted during collection. Evidence of erosion such as rills and uprooted vegetation were also noted.

Figure 2. The piece of land being surveyed for species identification located at the Port of Harlingen divided into Area 1 (red) sub-divided into plots 1-5 and Area 2 (yellow).

Figure 3. The orange rope used to locate the edges of Plots 1-5 in Area 1.

RESULTS

The results for this project were obtained by predicting the percentages for each individual species found in each plots 1-5 within Area 1. They were then combined with Area 2 which resulted in an overall percentage of each species identified for the entire area of land. While there were no non-native species identified, invasive species were observed. *Arundo donax (*giant reed) is an invasive species that prevents growth of surrounding species by spreading monospecific stands. Also, *Cenchrus ciliaris* (Buffel Grass) release toxins which inhibit growth of surrounding species. *Panicum maximum* (Guinea grass) is another invasive species that competes indirectly with sunlight and water preventing growth of other species.

The area running parallel to and closer in proximity to the river had trees dominating the area. These trees include *Parkinsonia aculeata* (Retama), *Prosopis glandulosa* (Honey Mesquite), *Callistemon viminalis* (Texas Weeping Bottle Brush), *Salix nigra* (Black Willow). The dense population of trees made it tough to walk through and didn't allow for the invasion of grasses. However, the further away from the river, the more grasses appeared to invade and the bare areas were observed. The dominate species observed throughout the entire area, included; *Parkinsonia aculeata* (Retama), *Prosopis glandulosa* (Honey Mesquite), *Callistemon viminalis* (Texas Weeping Bottle Brush), *Salix nigra* (Black Willow), and *Panicum maximum* (Guinea grass). Pictures of identified species can be found in Appendix

1 located at the end of this report. Table 1 summarizes the results within plots 1-5, Area 2, and the overall percentages of each species identified. The percentages were calculated individually within each plot therefore the percents are not equal to 100%. However, the overall area was based on combined predications from plots 1-5 and Area 2 for the purpose of equaling 100% to get a better perspective of the surveyed area.

Table 1. The results (in percent) for each species identified in Plots 1-5, Area 2, and the overall percentages.

Native Plant Species	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Area 2	Overall Area
Acacia smalli (Huisache)	10%	10%	5%	5%	10%	10%	5%
Parkinsonia aculeata (Retama)	25%	20%	10%	15%	20%	15%	25%
Prosopis glandulosa (Honey Mesquite)	40%	50%	45%	40%	50%	45%	30%
Acacia schaffneri (Tenaza)	2%	0%	1%	3%	1%	5%	5%
Pithecellobium ebano (Texas Ebony)	0%	1%	0.50%	2%	0%	0.05%	1%
Opuntia engelmannii (Prickly Pear Cactus)	0.03%	1%	0%	0%	0.025	0%	0.05%
Callistemon viminalis (Texas Weeping Bottle Brush)	15%	15%	25%	20%	10%	20%	25%
Yucca treculeana (Spanish Dagger)	0%	0.05%	0%	0%	0.03%	0.05%	0.00%
Salix nigra (Black Willow)	5%	1%	1%	5%	2%	2%	5%
Bumelia celastrina (Saffron Plum)	0%	0%	2%	5%	3%	1%	2%
Pistacia texana (Texas Pistache)	3%	2%	10%	5%	1%	2%	2%
% Trees Total	100%	100%	100%	100%	100%	100%	100%
Sorghum halepense (Johnson Grass)	10%	10%	20%	15%	10%	10%	10%
Cenchrus ciliaris (Buffel Grass)	5%	5%	5%	5%	5%	5%	10%
Arundo donax (Giant Reed)	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	15%
Typha domingensis (Cat Tail)	0%	0%	0%	5%	3%	7%	10%
Parthenium hysterophorus (False Ragweed)	0.50%	0.05%	0%	1%	0%	0%	1%
Panicum maximum (Guinea grass)	80%	80%	70%	70%	75%	75%	50%
Pllantago rhodosperma (Red-seeded Plantain)	2%	0%	0.50%	0.03%	0.05%	0.05%	1%
Bare Area	0%	2%	2%	1%	4%	0%	3%
% Grasses Total	100%	100%	100%	100%	100%	100%	100%

Fauna

No endangered or threatened animals were encountered during the surveys of the property. The typical tracks and trails of rodents and raccoons were observed. Birds typical of riparian habitats in the area, such as mockingbirds, thrashers, and kingfishers, flew through the study area. Nothing unusual or notable was noticed about the fauna using the property.

Soils

The soils in the mapped areas are clay dominated loam. The areas dominated by invasive grasses (shown as blue on the last figure) have disturbed clay-rich soils. The areas where erosion is an issue are directly adjacent to the Arroyo Colorado. The erosion noted are rills and uprooted vegetation due to runoff from rainfall events (purple box on the last figure). This type of erosion is typical along stream banks. There are no wetlands or wetland type-soils on the property.

CONCLUSION

According to the results, there were not any non-native species identified in this project. However, there were invasive species identified which is motivation that this area will not be negatively impacted when the wetland is constructed. There were no threatened or endangered plants identified during this study. For the purposes of constructing a man-made wetland to increase the water quality of the Arroyo Colorado to the surrounding counties, I believe this is a well-selected area. Reasons for this area to be taken into consideration are that the center of the area is flat and consists mainly of invasive grasses which would make a good area for a wetland to be created (shown as blue on the last figure). The river bank is not too highly elevated which will allow for water to be easily pumped up to the flat area for purification and it will have a downhill slope to assist in being replaced when needed. In

conclusion, by gathering information on the types of plant species found on this area, we can assume that the area will be least likely affected by the construction of a man-made wetland. There are no areas to avoid construction although the cleared grassy areas would be easier for construction because large trees would not need to be removed.

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APPENDIX 1. PICTURES OF IDENTIFIED SPECIES

Callistemon viminalis (Texas Weeping Bottle Brush)

Parkinsonia aculeata (Retama)

Acacia smalli (Huisache)

Opuntia engelmannii (Prickly Pear Cactus)

Yucca treculeana (Spanish Dagger)

Prosopis glandulosa (Honey Mesquite)

Panicum maximum (Guinea grass)

APPENDIX 2. NATIVE AND INVASIVE VEGETATION

Appendix D

Conceptual Design Report

Enhancing Water Quality in Conjunction with Dredging Operations for the Port of Harlingen

Phase I

Conceptual Design Report

Prepared by

Alan Plummer Associates, Inc.

December, 2011

0834-006-01

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1 Introduction

The Port of Harlingen (POH) is a shallow draft barge port on the Arroyo Colorado, an ancient distributary channel of the Rio Grande River which serves as drainage conduit for crop irrigation, municipal wastewater returns, and as a floodway during periods of heavy precipitation in the lower Rio Grande Valley. In the late 1940s, the U.S. Army Corps of Engineers (USACE) dredged and channelized the lower 25.5 mile segment of the Arroyo Colorado from the POH to the lower Laguna Madre and the Gulf of Mexico Intracoastal Waterway for commercial barge traffic. It is this section of the Arroyo Colorado that sees the most recreational use, but also includes a section designated as impaired by the Texas Commission on Environmental Quality (TCEQ) due to low dissolved oxygen resulting from excessive nutrient loads.

Wharves at the POH are set up to handle bulk shipments of dry and liquid cargo (source). Normal capacity of dry hopper barges is 1,200 to 1,500 short tons. Liquid barges carry between 24,000 and 28,000 barrels. The POH wharf facilities consist of the following (1):

- 650 foot concrete general dry/liquid cargo wharf
- 100 foot dry bulk wharf
- 5 smaller docks (50' x 25') located near the turning basin and extending down the Harlingen channel
- Acreage for open storage

A dredged channel 125 feet wide and 12 feet deep is maintained from the Intracoastal Water Way to the Port of Harlingen. The dredged channel widens into a turning basin approximately 500 feet long and 450 feet wide adjacent to the POH docks. A vicinity map showing the general location of the Port facilities is included in Figure 1.1.

The POH docks are located in the heart of the impaired tidal segment of the Arroyo Colorado. Nutrients that consist primarily of nitrogen and phosphorous compounds which support algae growth have been discharged from this segment. Ultimately, these nutrients produce low dissolved oxygen levels that have resulted in fish kills as flow continues into the Lower Laguna Madre. The Arroyo Colorado Watershed Protection Plan (2) identifies sediment as a carrier of attached contaminants such as nutrients, metals, and organic compounds. Nutrients may remain associated with the sediment or be released over time and contribute to nutrient levels in the water column that support excessive growth of algae. In areas of lower water velocities, like the Port of Harlingen turning basin, the algae settle to the bottom with other organics where they decompose and contribute to oxygen depletion.

Nutrients associated with the sediment arrive from two primary sources: 1) nonpoint source pollution from Port loading, unloading, clean-up, and storm runoff and 2) detachment from upstream sediment that settles out of the water column in the wider, deeper, and slower moving water

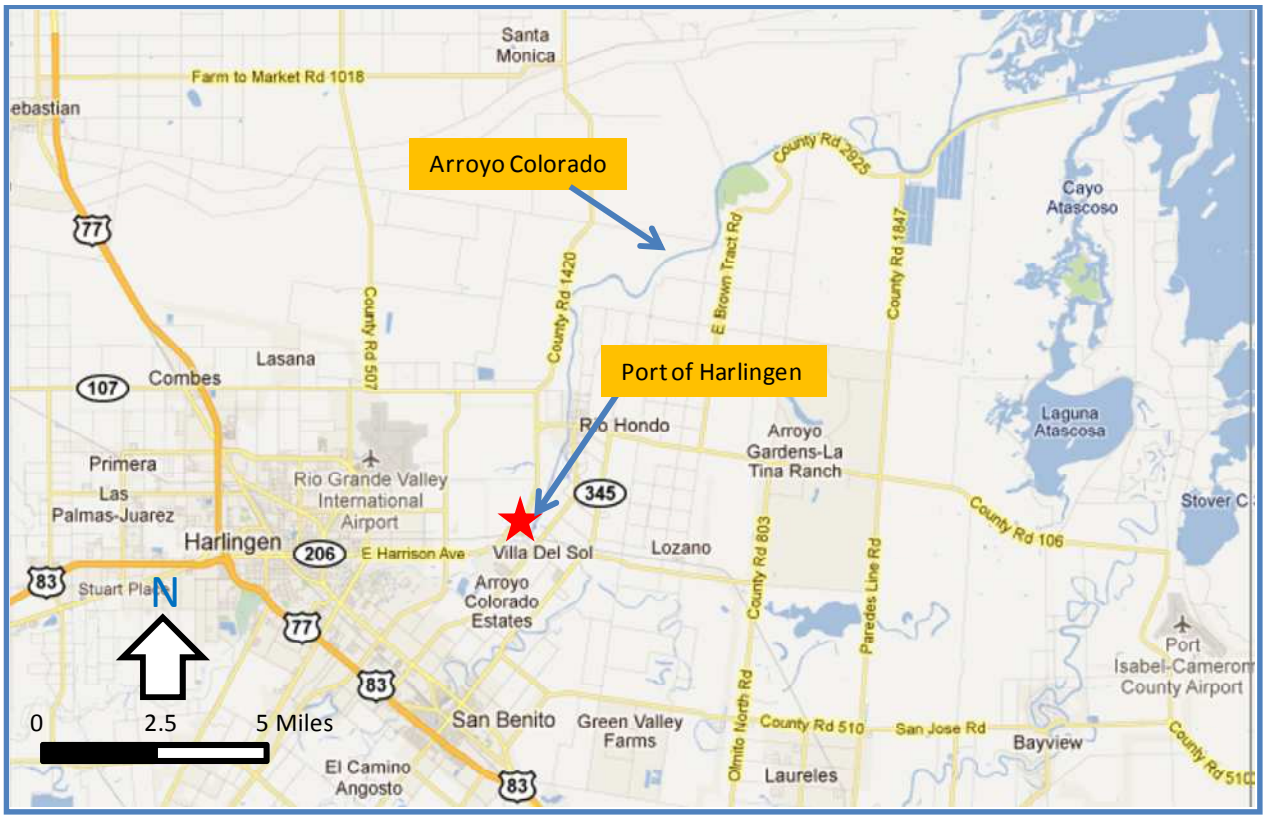


Figure 1.1 **Port of Harlingen Vicinity Map**

of the turning basin. This report presents information gathered in an investigation to use a system of sedimentation basins and constructed wetlands to capture nutrients and other contaminants that are incorporated in sediment and associated water removed from the POH turning basin and the length of channel immediately downstream of the basin during dredging operations.

Two potential wetland concepts are included. One alternative considers developing a wetland system on property owned by the POH that would receive dredge spoils from the POH turning basin and downstream channel on a regular basis. Dredge spoils would be removed on a schedule that provides operation as continuous as possible to provide the greatest water quality improvement benefit. It is anticipated that dredging operations conducted for one shift per day for up to five days per week would be the most aggressive program that would be recommended. Ideally, a dredging schedule would be implemented that would be correlated with the sediment accumulation rate. The rate of sediment accumulation could be estimated based on data regarding dredge spoil quantities removed periodically and the time between dredgings. More frequent dredging would capture and remove sediment deposits from the turning basin area before storm flows flush them downstream.

A second alternative presents a more generic wetland that could be adapted for installation in spoil placement areas along the length of the dredged channel. Water pumped from the Arroyo Colorado would be required to maintain these wetlands so that they would be available and functional to polish water produced by periodic dredge operations expected to occur every 4 to 10 years. Following nutrient capture in the wetland, water not lost by evapotranspiration would be returned to the Arroyo Colorado.

While water quality improvement in the Arroyo Colorado is the main goal of the program, other benefits provided by a wetland treatment program at the POH site should also be recognized. By providing a system of sedimentation basins and wetlands as presented for the first alternative, the POH will have a ready supply of nutrient rich soil amendment and/or fill material that could be sold to provide revenue. The wetland system would also provide valuable riparian wetland habitat, a public bird watching area, and facilitate consistent long-term maintenance of the turning basin for the POH.

Water quality improvement would also be the focus of the wetland alternative concept proposed for other spoil placement areas. In addition, converting even a portion of these barren containment zones to wetland would restore valuable habitat for wildlife and public enjoyment.

2 Wetland Site Assessment

The site selected for the proposed treatment wetland system is on property owned by the POH approximately 5,500 feet downstream of the turning basin and on the same side of the channel as the POH docks. Identified in Figure 2.1 as Placement area 22, the site has been used for placement of dredged materials in previous channel dredging operations. The site encompasses a total area of approximately 35 acres.

2.1 SITE TOPOGRAPHY

No recent survey data was found to be available for the site. Topographic contours generated for the site from a Digital Elevation Model (DEM) using spatial analyst are shown in Figure 2.2. According to the available information, the site has little variation in elevation across its length as the eight foot contour extends through the middle of the site almost from one end to the other. A slight downward slope occurs at the northeast corner of the site. A gradual downward slope also occurs along the edge adjacent to the Arroyo Colorado. However, the more steeply sloping bank was not considered for development of wetland area to avoid destabilizing the slope. As such, the bank area along with its cover of vegetation would be left undisturbed.

2.2 SITE HYDROLOGY

The hydrology of the site was examined to identify any flooding concerns and also to locate any natural drainage channels through and/or adjacent to the site. Any site subject to flooding would require consideration in the design to allow flood waters to flow through without damaging the containment levees. Any identified drainage ways would also need to be accounted for in the wetland layout. For this project, a convenient drainage way would offer an option to return the treated flow to the Arroyo Colorado without disrupting the bank with construction of a new discharge channel.

2.2.1 Flood Potential

FEMA maps available online were used to evaluate any flooding concerns. As shown in Figure 2.3, the proposed wetland site is outside the area established for the 100 year flood event. No design considerations are anticipated to account for potential flooding.

2.2.2 Site Drainage

A natural drainage way to the Arroyo Colorado is evident north of the proposed site as shown in Figures 2.1 and 2.2. This existing drainage way would provide a means of returning wetland-treated flows to the Arroyo Colorado. Drainage from the POH storage facility appears to be provided south of the proposed wetland site. No natural drainage appears to occur across the site that would potentially be considered jurisdictional waters of the U.S. or that would inhibit layout options.

2.3 ECOLOGICAL ASSESSMENT

An ecological assessment performed on the site found significant site disturbance and no remaining natural habitat in the areas that are proposed for potential wetland system

development. Much of the area was found to be populated with invasive, exotic species, particularly guinea grass and Johnson grass, which tend to choke out other plant types and create a habitat with little diversity. No evidence of jurisdictional waters was documented within the boundaries of the site. Nothing was identified in the ecological assessment that would prohibit development of a treatment wetland system on the site.

2.4 PERMITTING

Both Section 404 (Clean Water Act (33 USC1344)) and Section 10 (Rivers and Harbors Act of 1899 (33 USC 403) permits were found to be in effect for the POH dredging operation at their docks and for the USACE-directed dredging of the turning basin and channel These permits require that an extension be filed for renewal when they near expiration. As long as the permit to conduct the dredging is in effect and the dredging operation is carried out according to the permit requirements, POH is authorized to dredge as frequently as they need or desire. POH dredging work is normally performed under a separate contract at the same time and by the same dredging contractor hired by USACE for the turning basin and channel dredging. Dredge spoils from the docks, turning basin, and channel are deposited in dedicated placement areas under the jurisdiction of the USACE.

2.5 PLACEMENT AREA EASEMENTS

USACE has been granted a perpetual easement to use established placement areas for depositing dredge spoils. Land owned by the POH that is designated as a placement area cannot be altered without approval of the wetland development plan by the USACE. The construction of wetlands within placement areas would facilitate control and return of the decant water but would also result in minor reduction of the space available for containing dredge spoils. USACE would not favor any area reduction that might impact the periodic dredging operation.

The capacity of placement areas was established to insure the availability of sufficient area for spoil storage. Currently, spoils deposited are contained, with no discharge of liquids or solids to the Arroyo Colorado while dredging is being conducted. Normally, the area climate results in the evaporation of water pumped with the dredge material. If overflow of the collected water from the containment area becomes imminent, USACE contractors pump the residual water into the Arroyo Colorado, making sure that solids are not disturbed during the pumping process.

Initial contact with a USACE representative established doubt that they would be willing to allow work that would make any placement space unavailable for depositing spoils. However, sufficient space appears to be available for spoil placement in the vicinity of the POH that could also accommodate some wetland development. The spoil placement area required could be reduced if a more continuous dredging operation that incorporates better management and sale of the spoil solids and discharge of wetland-polished decant water can be implemented.

Figure 2.1 **Port of Harlingen Turning Basin and Channel**

Figure 2.2 **Site Topography Map**

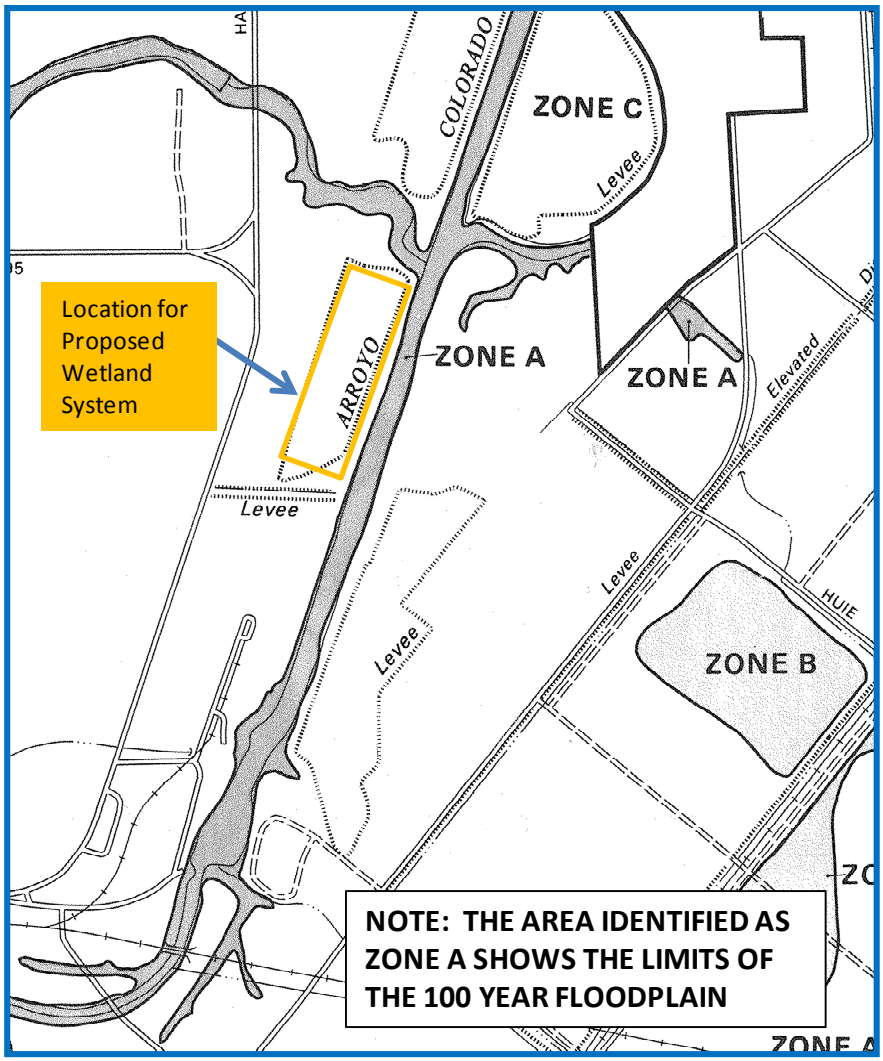


Figure 2.3 **Site Flood Map**

2.6 SOILS AND GEOTECHNICAL DATA

Soils information was acquired from the Natural Recourses Conservation Service (NRCS) Web Soil Survey. As shown in the soil survey map included as Figure 2.4, the entire proposed wetland site is identified with soil type Ustifluvents, clayey (USX). Other soils in the vicinity include Raymondville, clay loam (RE) to the west of the proposed wetland site and Mercedes, clay (MEB) in the drainage channel to the north of the site. Soil type USX is described by the NRCS as consisting of moisture limited alluvial flood plain deposits with significant clayey properties. These soils are somewhat poorly drained, are rarely flooded, and not subject to ponding. Type RE soils are moderately well drained and have a fourteen inch surface layer of clay loam with clay layers below. MEB soils occur in areas with slopes of 1 to 3 percent and are moderately well drained with a clay dominated profile. Table 2.1 provides a brief summary of the soil types found. The complete descriptions for these soils are provided in Appendix A.

The high incidence of clay material in the area soils makes them highly suitable for wetland construction. The clay can be used to create a nearly impermeable layer over the bottom of the wetland cells and on the containment levees to minimize seepage water loss.

Table 2.1 Soil Map Unit Summary

Map Unit Symbol	Map Unit Name	Typical Profile
USX	Ustifluvents, clayey	0 to 60 inches: Clay
RE	Raymondville clay loam	0 to 14 inches: Clay loam 14 to 37 inches: Clay 37 to 78 inches: Clay
MEB	Mercedes Clay, 1 to 3 percent slopes	0 to 18 inches: Clay 18 to 47 inches: Clay 47 to 74 inches: Clay
W	Water	NA

Figure 2.4 **Soil Survey Map**

3 Wetland Conceptual Design

Design concepts are presented for two possible approaches to the dredging operation. The first focuses on the proposed site owned by the POH near the port facility. The second proposes development of wetland cells at a generic dredge spoil placement site.

3.1 POH SITE

As discussed in the introduction, the original design concept was developed for a 35 acre parcel of land owned by the POH to provide nutrient removal from a relatively continuous dredging operation aimed at removing spillage and sediment from the turning basin and channel immediately downstream. This program would focus attention on the section of the Arroyo Colorado suspected of having the highest accumulation of materials detrimental to water quality. Figure 3.1 shows a site layout for the proposed wetland. The details of the conceptual design are provided in the following sections.

3.1.1 Design Concept

The POH site concept would employ a 10-inch suction dredging machine that would remove sediment from the turning basin and channel and discharge dredge slurry at the rate of 600 to 700 gallons per minute to one of three sedimentation basins. Each sedimentation basin would be 150 feet wide, 250 feet long, and 8 feet deep with 2 feet of freeboard. With an assumed solids concentration of 10% in the dredge slurry and operation 6 hours per day 5 days per week, solids are expected to accumulate to the maximum depth in about 2 months. The discharge would then be switched to another basin. Underdrains consisting of perforated pipes surrounded by a bed of gravel in the bottom of each sedimentation basin would aid drying by allowing free water to drain from the solids. Drying would continue while the next basin in line is filled with dredged solids. Once the second basin is filled, the discharge would be switched to the third basin. After about 2 months of drying time, solids would be removed from the first basin and be available to sell. After removal of the dried solids, the first sedimentation basin would again be ready to begin receiving dredged solids. By this time, the third sedimentation basin is anticipated to be filled and ready to begin final decant and draining of water to facilitate drying and the solids in the second sedimentation basin should be dry and ready to be harvested.

Decant liquid produced in the sedimentation process would pass over a water level control weir and be conveyed to one of two wetland cells, each approximately 450 feet wide by 900 feet long. The two wetland cells would normally operate in series. A deep water zone 4 feet in depth at the inlet of each wetland cell would serve to evenly distribute the flow laterally across the width of the cell into a marsh area with an operating water depth of 6-12 inches. The marsh area would be planted with submerged (planted along the edges of deep water zones) and emergent vegetation. An outlet deep zone at the end of each wetland cell would gather the flow prior to discharge over a water level control weir. Nutrients would be removed from the dredged water by sedimentation, microbial uptake and transformation, and plant assimilation (uptake) prior to discharge of wetland-treated flow back to the Arroyo

Colorado. The wetland outflow would be conveyed to the Arroyo Colorado by a ditch that discharges to the natural drainage channel located north of the proposed wetland site. Wetland sizing for this site is based on the area available. The flow rate of the dredge would be matched as closely as possible to the available wetland treatment area of approximately 810,000 square feet or 20 acres to maximize nutrient removal. If the total area of both wetland cells is included for treatment, an average wetland depth of 12 inches is assumed along with a target detention time of 7 to 10 days the estimated range of flows conveyed to the wetland cells from the sedimentation basins is about 500 to 700 gallons per minute. The proposed constructed wetland at the POH site could serve as a pilot unit to determine what water quality improvement is achievable. This information could be used to estimate the water quality improvement that could be obtained by installing wetland cells at each spoil placement area as described in section 3.2 of this report.

3.1.2 Operation and Maintenance

The sedimentation basins would require periodic monitoring to make sure solids accumulation has not restricted the detention time to less than approximately 2 hours which would signal the need to switch to another basin. Monitoring would also be needed for the removal and sale of the dewatered sediment. An off-site stockpile area may be needed for storage of the sediment, depending upon market demand for the product. Containment would be needed for the off-site stockpile to prevent solids from being discharged to the Arroyo Colorado.

To maintain as continuous a flow through the wetland as possible, daily dredge operation through the normal work week would be desirable. A daily or alternate day operating schedule would likely require purchase of a dredging unit and assigning a crew of one full time and one part time worker while the dredge is in operation. Alternately, a dredge may be available for lease or rent locally that is not finding continuous use maintaining a boat moorage basin or other dredging need.

Another option for conducting the more continuous dredging operation would be contracting with a dredging company that has an existing operation in the area. This may be a more cost effective approach if a dredging company can be found that is willing to enter into a long term contract to do the work.

If discharge of dredge material is too infrequent, solar powered pumps could be provided to withdraw water from the Arroyo Colorado and supplement flow through the wetlands. These pumps would maintain the minimum water flow necessary to support desirable wetland plants according to Best Management Practices outlined in the Arroyo Colorado Watershed Protection Plan (ACWPP)(2). A flow of 100 gallons per minute is estimated to be needed to supply maintenance flows for a 20-acre wetland during an average July when the rate of potential evapotranspiration reaches 6.7 inches per month (3). The pumps would require monitoring and periodic maintenance. This may be provided by a stakeholder interested in furthering goals outlined in the ACWPP.

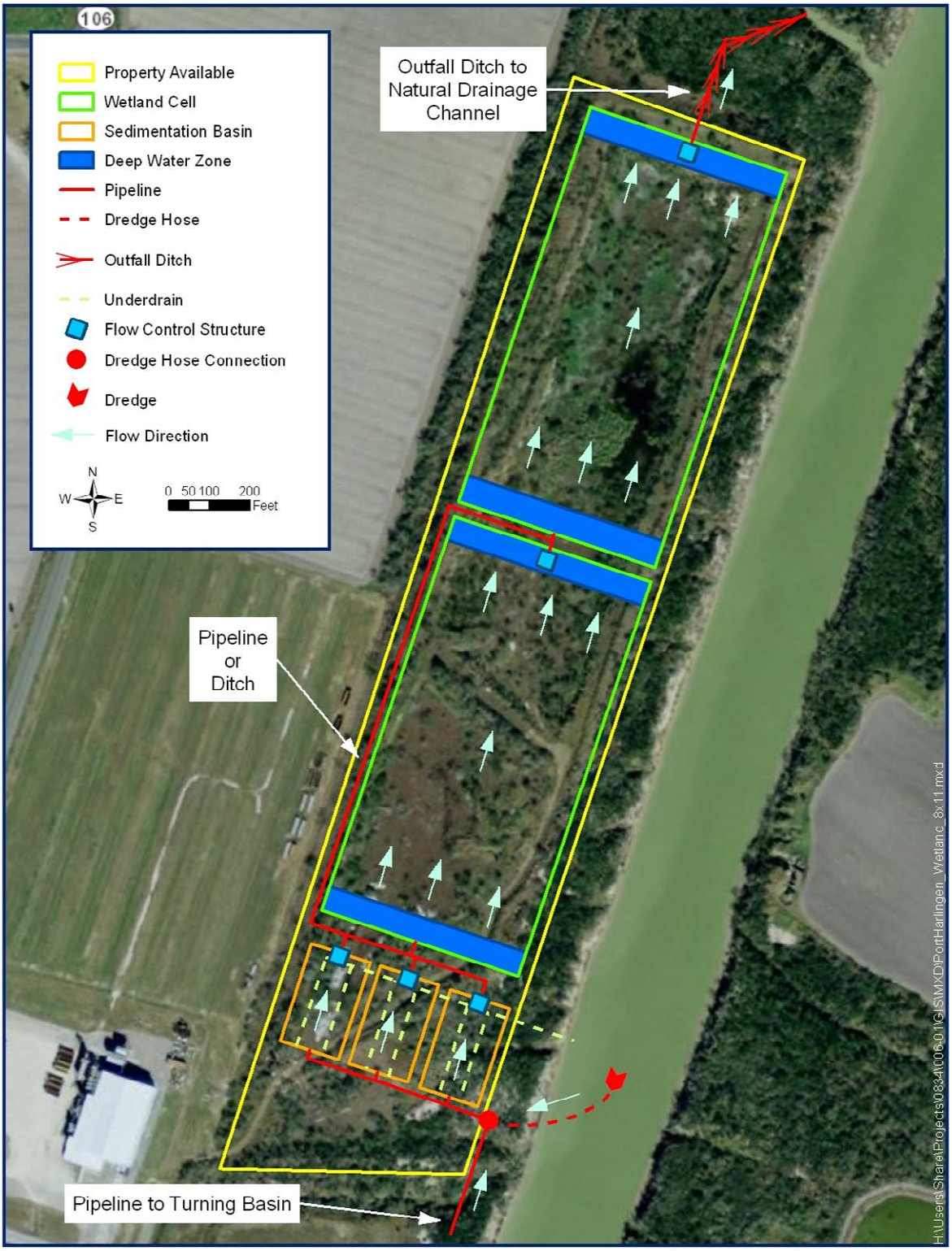


Figure 3.1 **POH Site Wetland Conceptual Layout**

3.1.3 Permitting

A focused dredging operation in the vicinity of the POH to provide flows that will maintain the health of wetland plants would not be expected to require any additional permitting other than a Section 404/10 permit from the U.S. Army Corps of Engineers (USACE) for the actual dredging operation. It is anticipated that extensions of the Section 404/10 permit authorizing current dredging activities would be available to authorize future dredging activities. In this case, the water flow would be a side stream created from a dredging operation undertaken to maintain the shipping channel and turning basin.

Pumping water from the Arroyo Colorado to maintain the wetland between infrequent dredging operations would require a water rights permit from the TCEQ. A water rights permit would be required to authorize the diversion from the Arroyo Colorado due to the water consumption experienced as evaporation occurs from the exposed water surface and transpiration occurs from the wetland vegetation within the wetland system. Only sufficient water to sustain the wetland vegetation between dredging operations and maintain a minimal flow through the wetland system would be diverted from the Arroyo Colorado. As presented in section 3.1.1 of this report, a flow of about 100 gallons per minute is expected to be needed during July for a wetland area of 20 acres. This flow would provide for evaporative losses estimated for the worst case condition in July at 75 gpm plus 25% to maintain a minimum flow of 25 gpm through the wetland. The actual quantity of water diverted from the Arroyo Colorado to maintain the wetland system when dredging operations are not being conducted would depend on the frequency of the focused dredging operation and the time of year that dredging was performed. If dredging occurred at least a few days per week, no maintenance flow would be needed.

3.2 ALTERNATIVE GENERIC SITE CONCEPT

An alternative generic site wetland system concept is presented that better accommodates the current dredging practices being conducted by the POH under its contract with the USACE.

3.2.1 Design Concept

This alternative concept includes utilization of the existing dredge spoil areas as large “settling basins” with the decant water being polished by wetlands that will be developed within the lowermost portion of the spoil area footprint. Under this concept, discreet sedimentation basins would not be constructed, although minor shaping of the spoil area would likely occur in order to direct the dredge discharge water into the wetland. This could be accomplished through constructing two or more collection swales or by simply decanting the water directly into the wetland. The settled water would initially enter the wetland at a deep water zone, excavated to provide a water depth of about 4 feet. The deep water zone would evenly distribute the water across the width of the wetland cell. As shown in Figure 3.2, a pair of wetland cells could be placed in the lowermost portion of an existing spoil area, roughly parallel to the Arroyo Colorado and oriented so that water from the wetland cells flows into adjacent outlet deep water zones before entering an outfall ditch which

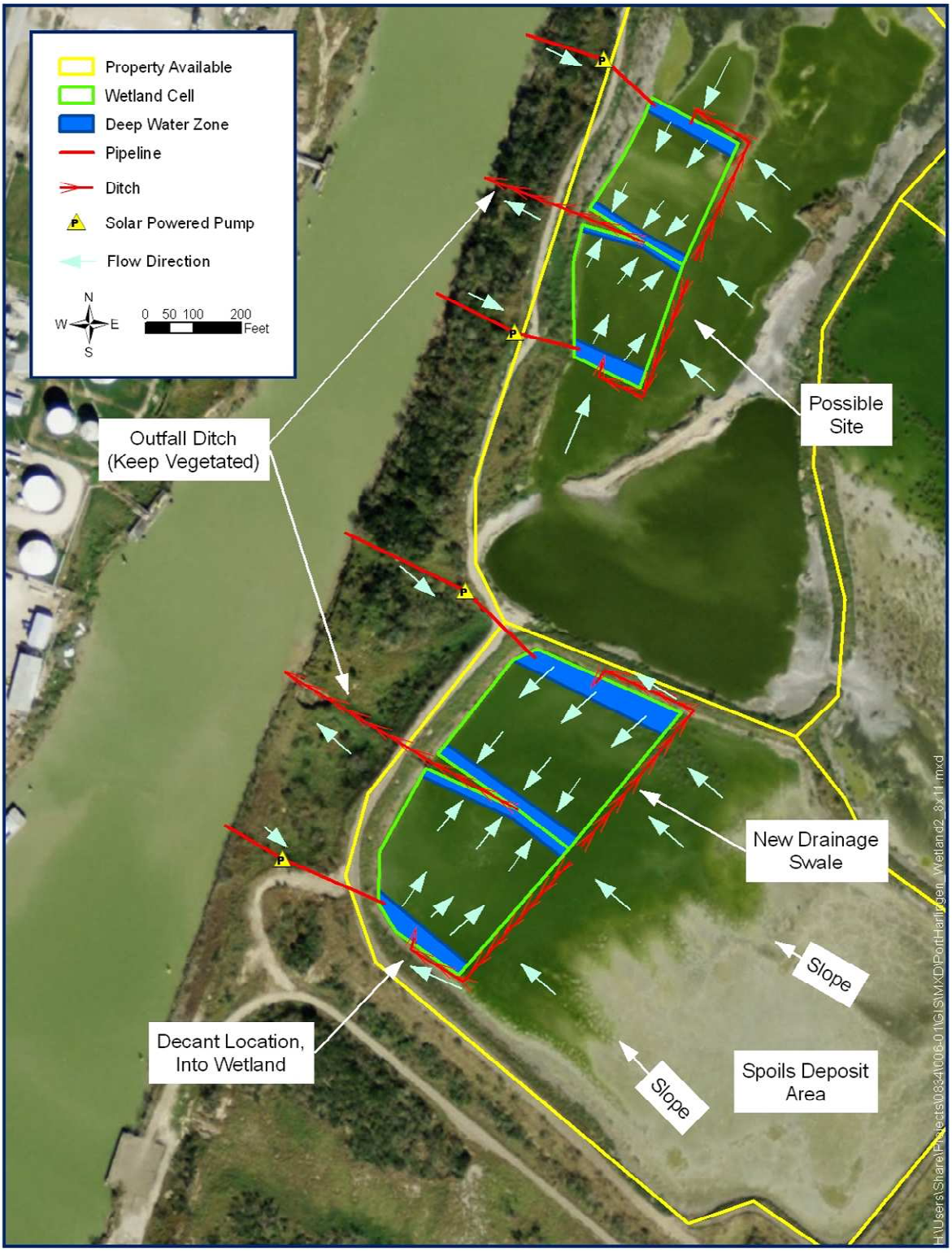


Figure 3.2 **Generic Site Wetland Conceptual Layout**

would convey the combined flow to the Arroyo Colorado. The outfall to the Arroyo Colorado would be located to take advantage of existing drainage patterns. The 20-inch dredge employed historically for past operations funded by the USACE would be expected to produce maximum flows of 13,000 gallons per minute. Because of the periodic high flow rates, wetland sizing for this option would be based on criteria for storm water treatment.

Based on historical USACE funded dredging operations, a time period of 4 to 10 years would elapse between discharges to any wetland system under the alternative concept. Due to the climate of the region and the location of the wetlands within the dredge spoil area, a water source would need to be provided in order to keep the wetlands viable during this interim period so that they would be capable of fulfilling their intended function for water quality improvement when dredging operations commence. This could be accomplished through installation of a solar powered pumping system that would provide water from the Arroyo Colorado to the wetland. As estimated in previous sections of the report, approximately 100 gallons per minute of maintenance flow would be needed to sustain 20 acres of wetlands during periods of summer time evaporative losses. System flow-through to maintain 20 acres of wetland is estimated to be 25 gpm. The remaining 75 gpm would be lost to evapotranspiration.

One should note that the layout presented in Figure 3.2 could be altered as needed to conform to the specific characteristics and limitations that may be present within each dredge spoil site.

3.2.2 Operation and Maintenance

As was described for the POH site option, the solar pumps would require monitoring and periodic maintenance. This may be provided by one or more stakeholders interested in promoting water quality improvement in the Arroyo Colorado. The wetland cells also would require some attention to monitor plant growth and the presence of undesirable animal populations. Action may be necessary to control the population of animals destructive to wetlands habitat such as nutria.

3.2.3 Permitting

The long term pumping of water from the Arroyo Colorado to maintain treatment wetlands for water quality improvement would require consultation with the TCEQ for obtaining a water rights permit(s). As discussed in section 3.1.3, some consumptive use would occur due to evaporation and transpiration losses. The consumptive use is estimated to be a seasonal maximum of 75 gpm for each 20 acres of wetland. Continued extension of the current USACE 404/10 permit authorizing the dredging activities would be required, but additional USACE Section 404/10 permitting is not anticipated as the wetland treatment cells would be developed within the designated spoil disposal areas and would not impact waters of the United States.

4 Summary and Conclusions

This report provides information on two options for combining channel dredging operations with constructed treatment wetlands to provide water quality improvement within the Arroyo Colorado. One option focuses attention on the channel in the vicinity of the Port of Harlingen where reduced velocities allow nutrient laden sediment and spillage from dock operations to collect. The more frequent channel dredging proposed as part of this option would remove these materials and provide opportunity for nutrient removal from the Arroyo Colorado over time. The primary drawback for this option is the need to have ready access to a small dredge and operating crew. In addition, a funding source would need to be established both for the continuous dredging operation and the construction and maintenance of the wetland system.

The second option proposes that constructed wetlands be established on a broader scale to treat return flows produced by the periodic USACE dredging program already in place. This option would require periodic maintenance for a system of solar powered pumps to provide maintenance flows to the wetland cells. The requirement for a water rights permit may provide challenges in implementing this option.

Perpetual easements granted to the USACE establish their control over all activities in the spoil placement areas. Any work to implement the proposed constructed wetland projects would require USACE review of proposed plans and development of an agreement with USACE that documents the responsibilities and participation of all parties in maintaining the dredging operations currently under USACE responsibility.

Water quality benefits can be realized using the natural biological and physical processes inherent in a wetland ecosystem. Other benefits that may be provided include development of habitat areas for wildlife and potential opportunities for public enjoyment and passive recreation. For the proposed project site, property with clay dominated soils appears to be available for constructed wetland development. The available property currently provides locations for stock piling dredged materials but minimal water quality improvement functions for the Arroyo Colorado or habitat benefits for the area wildlife. The proposed constructed wetland system on the POH property would provide a promising opportunity for evaluating the ability of constructed wetlands to provide treatment capacity to meet some difficult water quality challenges while also providing other multiple benefits including a diverse wildlife habitat which would also support ecotourism to the area.

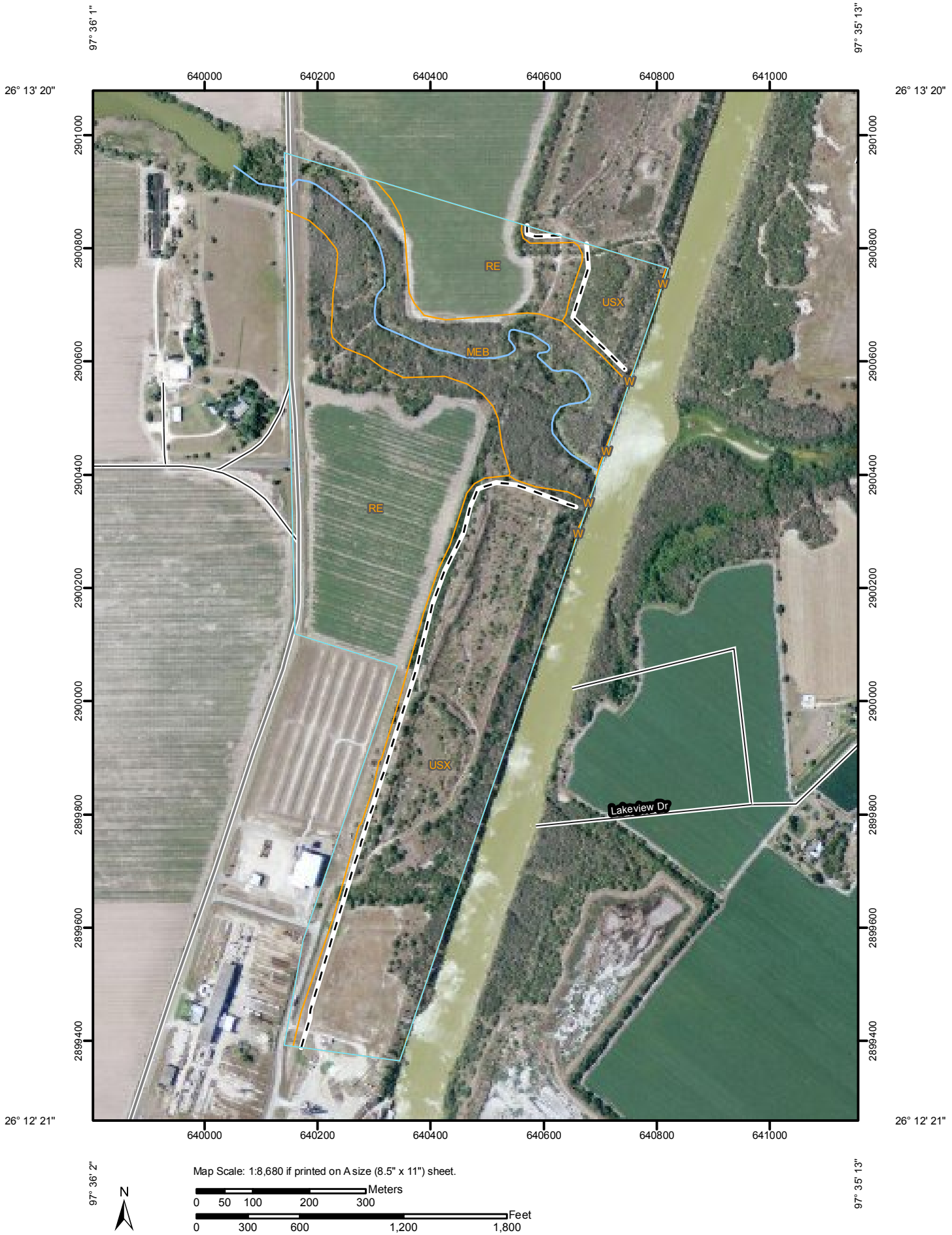
REFERENCES

1. *http://www.portofharlingen.com/Facilities.htm*, September, 2011
2. *A Watershed Protection Plan for the Arroyo Colorado Phase I,* The Arroyo Colorado Watershed Partnership, 2007, Pages 45 and 62.
3. *http://texaset.tamu.edu/pet.php.* September, 2011.

Appendix A

Soil Map, Legend, and Descriptions

Soil Map—Cameron County, Texas
(Port of Harlingen West Dredge Spoil Area)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:8,680 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 14N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Cameron County, Texas
Survey Area Data: Version 7, Oct 26, 2009

Date(s) aerial images were photographed: Data not available.

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Cameron County, Texas (TX061)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
MEB	Mercedes clay, 1 to 3 percent slopes	30.9	20.5%
RE	Raymondville clay loam	60.2	39.9%
USX	Ustifluvents, clayey	59.6	39.5%
W	Water	0.2	0.1%
Totals for Area of Interest		**150.9**	**100.0%**

Map Unit Description

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this report, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. All the soils of a series have major horizons that are similar in composition, thickness, and arrangement. Soils of a given series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Additional information about the map units described in this report is available in other soil reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the soil reports define some of the properties included in the map unit descriptions.

Cameron County, Texas

USX—Ustifluvents, clayey

Map Unit Setting

Elevation: 0 to 50 feet
Mean annual precipitation: 24 to 26 inches
Mean annual air temperature: 73 degrees F
Frost-free period: 340 to 345 days

Map Unit Composition

Ustifluvents and similar soils: 90 percent
Minor components: 10 percent

Description of Ustifluvents

Setting

Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Dredge spoils

Properties and qualities

Slope: 0 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Maximum salinity: Moderately saline to strongly saline (16.0 to 32.0 mmhos/cm)
Sodium adsorption ratio, maximum: 30.0
Available water capacity: Very low (about 0.6 inches)

Interpretive groups

Land capability (nonirrigated): 8s
Ecological site: LOAMY BOTTOMLAND 20-35" PZ (R083DY505TX)

Typical profile

0 to 60 inches: Clay

Minor Components

Lomalta

Percent of map unit: 5 percent
Landform: Depressions

Sejita

Percent of map unit: 5 percent
Landform: Depressions

Data Source Information

Soil Survey Area: Cameron County, Texas
Survey Area Data: Version 7, Oct 26, 2009

Cameron County, Texas

RE—Raymondville clay loam

Map Unit Setting

Elevation: 20 to 200 feet
Mean annual precipitation: 23 to 33 inches
Mean annual air temperature: 72 to 73 degrees F
Frost-free period: 300 to 340 days

Map Unit Composition

Raymondville and similar soils: 85 percent
Minor components: 15 percent

Description of Raymondville

Setting

Landform: Delta plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous clayey alluvium

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 8.0
Available water capacity: Moderate (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): 2s
Land capability (nonirrigated): 2s
Ecological site: CLAY LOAM 25-35" PZ (R083DY494TX)

Typical profile

0 to 14 inches: Clay loam
14 to 37 inches: Clay
37 to 78 inches: Clay

Minor Components

Racombes

Percent of map unit: 5 percent

Willacy

Percent of map unit: 5 percent

Hidalgo
Percent of map unit: 5 percent

Data Source Information

Soil Survey Area: Cameron County, Texas
Survey Area Data: Version 7, Oct 26, 2009

Cameron County, Texas

MEB—Mercedes clay, 1 to 3 percent slopes

Map Unit Setting

Elevation: 10 to 150 feet
Mean annual precipitation: 24 to 34 inches
Mean annual air temperature: 73 to 75 degrees F
Frost-free period: 300 to 365 days

Map Unit Composition

Mercedes and similar soils: 90 percent
Minor components: 10 percent

Description of Mercedes

Setting

Landform: Delta plains
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Calcareous clayey alluvium

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Gypsum, maximum content: 10 percent
Maximum salinity: Very slightly saline to moderately saline (4.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum: 12.0
Available water capacity: Moderate (about 7.9 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability (nonirrigated): 3e
Ecological site: CLAY FLAT 25-35" PZ (R083DY492TX)

Typical profile

0 to 18 inches: Clay
18 to 47 inches: Clay
47 to 74 inches: Clay

Minor Components

Mercedes

Percent of map unit: 5 percent

Raymondville
Percent of map unit: 3 percent

Hidalgo
Percent of map unit: 2 percent

Data Source Information

Soil Survey Area: Cameron County, Texas
Survey Area Data: Version 7, Oct 26, 2009

Appendix E

Subtask 3.1: A coordination meeting with Port of Harlingen Staff, APAI, and TWRI will be held to discuss goals and objectives of analysis to be conducted (via conference call).

- Need to set up phone conference for July.
- Coordination meeting via conference call was conducted July 20, 2010.
- Coordination meeting via conference call was conducted November 3, 2010.

Subtask 3.2: Survey

- Comments regarding previously submitted proposal from Jones & Carter for conducting survey of proposed project site were emailed to Butch Palmer (Port of Harlingen) on September 30, 2010. Included in email were recommendations regarding survey grid density and other survey requirements.

- Comments regarding previously submitted proposal from Jones & Carter for conducting survey of proposed project site were faxed to Butch Palmer (Port of Harlingen) on November 16, 2010. Included in email were recommendations regarding survey grid density and other survey requirements.

- LIDAR topographic data was procured for the project site. The LIDAR topographic data will be utilized for developing the conceptual layout.

Subtask 3.3: Conceptual layout of the wetland

- Awaiting the ecological survey data and other data to be provided by the Port of Harlingen to enable development of conceptual layout.