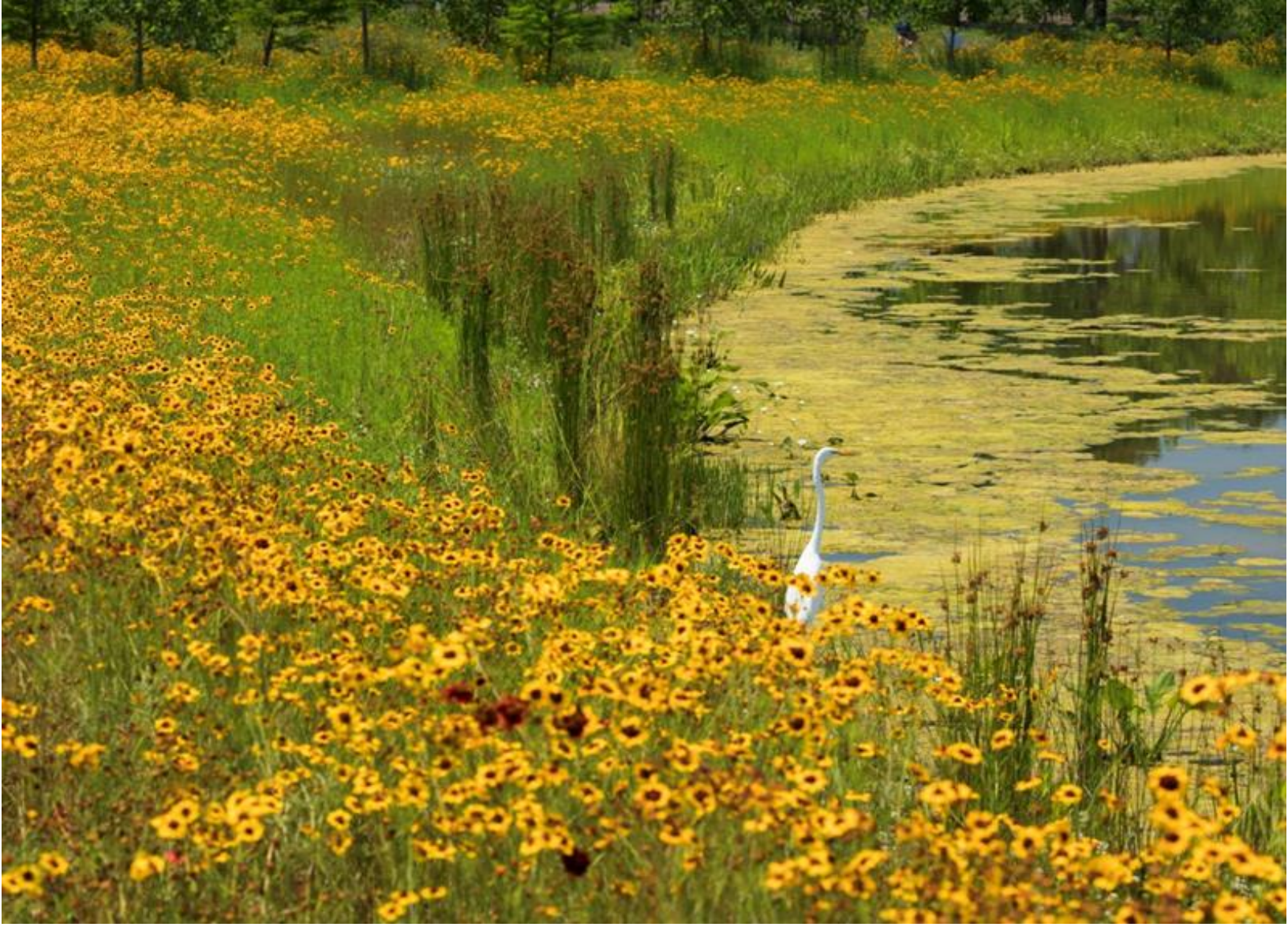

Exploration Green!

A Case Study in Effective Floodplain Management

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Introduction

Formally known as the Clear Lake City Water Authority (CLCWA) Detention Facilities and Associated Open Space and Park, Exploration Green (EG) stands as an ideal example of what is possible as a result of collaboration within a community to achieve long-term, sustainable mitigation of flood-related damage to residential, civic, and commercial structures, while improving quality of life for the people and businesses in the surrounding community.

Exploration Green is located on the southeast edge of Houston, Texas, just blocks from NASA's Johnson Space Center. The neighborhood surrounding EG was one of the first to be developed to house NASA employees, as well as the astronauts who flew those first historic missions. Originally set aside as a corporately owned public golf course, the land for the project was acquired by the CLCWA in 2011, after a six-year period of planning, community meetings, and negotiations.

Though principally residential, the neighborhood surrounding EG (and therefore affected by its water management functions) is also home to many community/commercial facilities, all of which are located within the EG drainage area.

- The local Constables office
- The local Police station
- A City Library branch
- More than 14 churches
- The Houston Fire Department 71
- The Harris County Tax Assessor's Office
- Six schools
- An elderly care facility
- A medical center
- A medical research center
- A veterinarian
- A variety of retail businesses

The project involves the conversion of the old public golf course into a public park with five large ponds that will serve as detention basins for excess water during flood events. A pre-existing drainage ditch that runs through the entire golf course is being expanded to create the extra storage capacity.

Phase I, completed in 2017, is the first of five planned phases that will incorporate recreational facilities, including bicycle and walking paths, nature areas, park benches, and picnic tables, with a visitor's center, and practice fields for use by neighborhood schools. The park creates an oasis of nature's calm in the midst of a busy suburban area, providing residents with a respite from life's daily stress.

As an integral part of developing the flood water retention capacity, EG re-established wetlands areas that were once a vital part of this region's bio-physical health. The wetlands, as they become established over time, will be home to more and more wildlife species, and provide critically needed natural filtration to help process the run-off water for the entire neighborhood.

Figure 1: Aerial view of Exploration Green – artist's rendering

Impact

When complete, EG will cover 200 acres of land, making it the largest park in the area. Under flood conditions, the combined storage capacity will be 1,680-acre feet of water, providing protection to over 16,000 homes in the immediate area. Stormwater runoff from the surrounding area (2,000 acres) flows directly to project site. Combined with Horsepen Bayou, EG water management practices affect 8,000 acres, with an estimated 30,000 people living within one-half mile of the park—all without the use of a single Federal dollar.

History

The area in and around Clear Lake City has an active history of flooding by any standard of measure. There have been seven 1-percent chance floods and four .5-percent chance floods since 1979, not including Hurricane Harvey. *Figure 2* shows the 1-percent and .5-percent flood zones and identifies several large areas with a history of flooding.

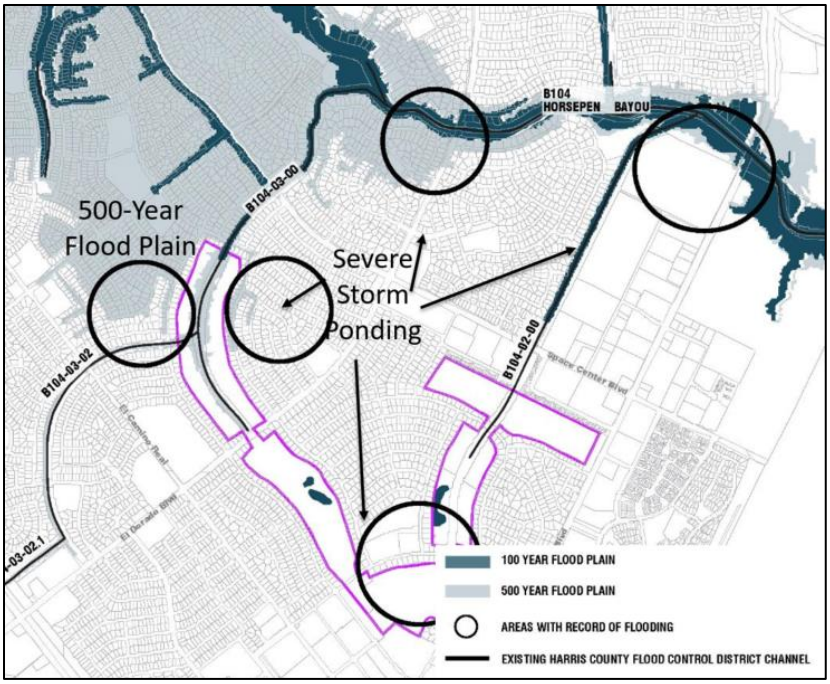

Figure 2: 100-year and 500-year flood zones near Exploration Green

With the associated risk so clearly identified, representatives from the CLCWA joined forces with the Clear Lake City Civic League (CLCCL) to fulfill their vision of a flood protection system that would offer benefits to the community well beyond the scope of floodwater management. When asked whether a benefit/cost analysis was conducted prior to beginning the project, their response was, "No, we didn't. The benefit was just so obvious."

Planning

In late 2004, the owners of the golf course announced plans to sell the land for commercial development. With a history of flooding in the forefront of their minds, members of the CLCCL were concerned that future development, whether residential or commercial, would only add to the problem.

The CLCWA contracted a hydrologist to conduct an impact study that would look at the entire 16,000 acres under the jurisdiction of the CLCWA, and then make recommendations as to the best way forward. The hydrologist's findings were then sent to Rice University for independent verification. In short, the study recommended finding a way to increase water retention capabilities, and that the best way to do that would be to purchase the golf course property. After a lengthy court process, CLCWA was able to purchase the property for $6.25 million. The previous owners were required to demolish the old club house and conduct a contamination cleanup.

The core group to spearhead the project included members of the CLCWA and the CLCCL. Most importantly, they began the project with a series of town hall meetings to find out what was important to the community, what their concerns were, and to enlist their support. Recognizing the need to protect the land from future development, CLCWA and CLCCL sought advice from the Houston Parks Board. As a

result, they established the Exploration Green! Conservancy (EGC), a 501-c-3 non-profit, in 2014. At this point, the Exploration Green! Conservancy took over the role previously performed by the CLCCL. Conservancy status provided two main benefits: it enabled the CLCWA, EGC, and Galveston Bay Foundation (GBF) to create a "conservation easement" that would protect the land in perpetuity (a requirement for any FEMA mitigation grant application involving property acquisition), and it provided the necessary status to make them eligible for grants not available to governmental organizations like the CLCWA.

In the early stages of planning the project, CLCWA developed a relationship with the SWA Group, an international landscape architecture firm. SWA offered valuable guidance on information gathering, which helped them develop positive relationships within the community, helped put ideas for the facility into context of what was workable, and helped create the master plan for the property.

What little opposition was voiced (coming primarily from business interests and residents whose property bordered on the golf course) was far outweighed by those who supported the idea, as evidenced by the volunteer turnout when the actual work began (see *Phase I*, below). From the beginning, project leaders worked closely with those who opposed the project to help ease their concerns. The goal was always to ensure that EG would benefit the entire community.

The original project plan split development into five distinct phases, with the goal of completing the project over a 15-year period. That target was largely based on the goal of trying to keep the impact that construction would have on the neighborhood to a minimum. It was estimated that 200,000 dump trucks (2.5 million cubic yards of dirt!) would need to be hauled out in order to achieve the retention capacity required. Total cost, debt management, and other considerations also played a part in the decision-making process. The extended completion date also precluded the need for a tax increase, likely a key element in gaining public support. It took a full three and a half years just to get the project permitted by the Texas Commission on Environmental Quality (TCEQ).

Phase 1 excavation began in 2016. The first detention basin was still being excavated when Harvey hit in August 2017 (*Figure 3*). Even in its unfinished state, the basin held an estimated 100 million gallons of water, saving the neighborhood from flooding. It is always easier to see the need for robust mitigation efforts in the wake of a disaster, especially one on the massive scale of a storm like Harvey. Community support grew, as did interest in seeing the project completion date accelerated. With the help of financial advisors, the CLCWA found ways to accomplish the new goal of completing the entire project by the end of 2022, without raising taxes.

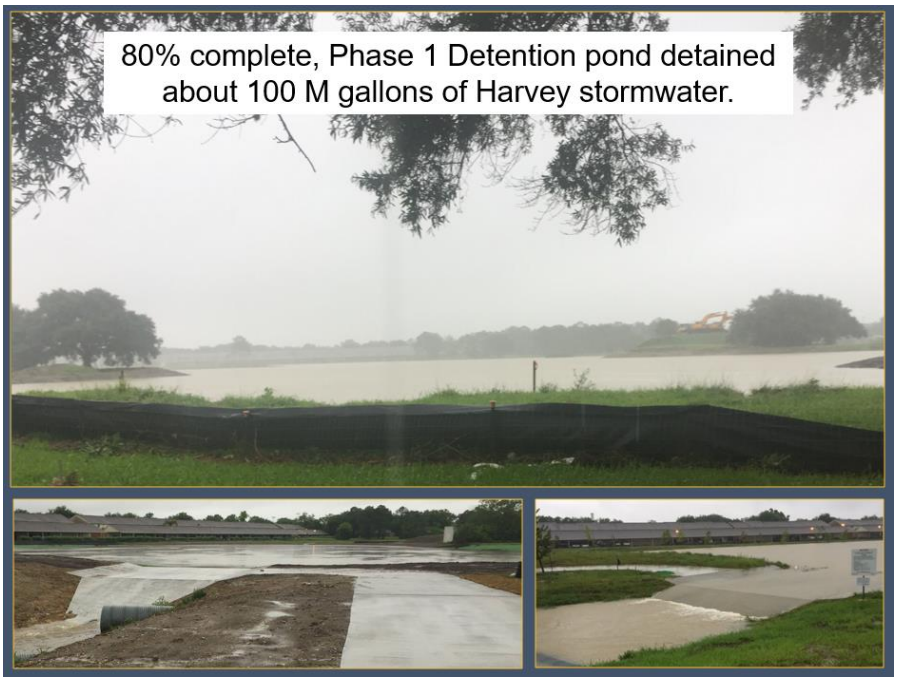

Figure 3: Detention pond 1 performed well, even prior to completion

Timeline

- 2005: Began process to purchase land
- 2011: Finalized land purchase
- 2013: Issued master plan
- 2014: Formed Exploration Green! conservancy
- 2014: Created conservation easement with GBF
- 2015: Received 501(c)(3)
- 2016: Phase 1 excavation begins
- 2017: Phase 1 excavation complete

Funding

Project Exploration Green was funded primarily through local bonds appropriations. The initial land purchase was accomplished with reserve funds held by the CLCWA, which lists the land as an asset, so the Conservancy that manages and maintains the park has no obligation to repay that cost.

To keep the cost to the public low, CLCWA maintains responsibility for maintenance of all park infrastructure, while the Conservancy is responsible for all amenities. Input from the community helped guide the structural relationship and division of responsibilities between the two organizations.

Funding for excavation, planting, wetlands restoration, and other expenses has come from grants received from Texas Parks and Wildlife, private foundations, and civic clubs, with total donations of about $1.5M received by the Conservancy (some as in-kind donations).

The CLCWA and EGC continue to work with Harris County Flood Control District (HCFCD) for their mutual benefit. The short strips of land that provide the connecting channels between EG and the Horsepen Bayou (*Figure 1*) are owned and maintained by the HCFCD, which has entered into an agreement with the EGC for that purpose. Harris County and the City Council of Houston donated funds for bike trails, and the City Council has committed to further funding as future phases are developed.

Funding for maintenance of the park is derived from CLCWA water rates paid by residential and commercial users within the district. The EGC maintains on-going fundraising efforts to support maintenance of facilities and amenities.

As noted above, some of the donations were in-kind. Trees for Houston donated 1,000 native trees for Phase 1 planting, with a commitment for an additional 4,000. This donation was complemented by the Storm Water Wetlands Program, which donated wetlands plants. Funds from the CLCWA helped purchase some of the amenities found in the park, and the Space City Rotary Club provided park benches, while the CLCCL provided funds for irrigation. Other contributors included the Coastal Management Program, Harris County Precinct 2, and the City of Houston. Individual contributions totaled more than $40,000.

Partnerships

The development of EG as a sustainable floodwater management system that provides the local community with recreational opportunities, reduced risk of flooding, and improved environmental quality was made possible by an on-going collaboration among these civic, private, and academic institutions:

- The Clear Lake City Water Authority
- The Exploration Green Conservancy
- The Galveston Bay Foundation
- Trees for Houston
- Sea Grant Texas at Texas A&M University
- Texas A&M AgriLife Extension
- The Texas Coastal Watershed Program

The recognition of those involved with the vision, development, and execution of the Exploration Green project would not be complete without highlighting the input of residents in the community. The value of their ideas, concerns, enthusiasm, labor, and on-going support cannot be overstated.

Water Quality

Water quality has been a concern in the Clear Lake City area for some time. Runoff from residential and commercial properties surrounding the golf course (including pesticides used on the course itself) drained directly into Horsepen Bayou. From there, the water, and whatever contaminants it may have been carrying, flowed into Armand Bayou and Clear Lake, eventually making its way to Galveston Bay.

While Galveston Bay, home to recreational and commercial fishing, world-renowned oyster beds, and a myriad of other recreational uses, maintains its good water quality status, both Horsepen and Armand bayous have been designated as "impaired" by the TCEQ. An "impaired" status can be caused by a variety of issues, most notably, unacceptable levels of fecal coliform (E. coli). These high levels can be caused by events such as sanitary sewer overflow or illicit discharges into the system.

Findings from on-going studies, including Total Maximum Load studies (which uses coliform levels as a measuring stick), emphasized the need for green infrastructure practices such as those incorporated into the wetlands design for EG. A new study will be launched in 2019 with the goal of providing quantifiable data regarding the effectiveness of EG's water filtration efforts.

Improvement of the water quality that flows from EG into Horsepen and Armand bayous will have a positive effect that extends well beyond the boundaries of the CLCWA. One of the primary benefits of a wetland area is the natural filtration of water, resulting in a reduction of bacteria levels. Since both bayous are also used for recreational purposes, efforts in EG will help keep these waters cleaner, reducing the possibility of negative health effects from accidental ingestion of water in the bayous.

As with any residential area, managing runoff wastewater from this large neighborhood is a major concern for the CLCWA. Early on, it was decided to use "reuse water" to maintain a constant water level for wetland grasses in the ponds planned for all five phases of the park. The term "reuse water" applies to the treated and purified discharge water coming from the CLCWA waste water treatment plant. In terms of water quality, it is significantly lower in bacterial count than any of the streams in the area; it is clear and odorless. Since the dedicated pipelines for reuse water at the EG site were in place before CLCWA purchased the land, there was minimal cost to supply this water to the site.

Pre-existing tie-ins connect the drainage system to EG, and EG to Horsepen Bayou. These tie-ins are designed to help control the inflow and outflow of water. Natural percolation and gravity allows these connections to provide the control needed to maintain water in the ponds at an adequate level.

Figure 4: Diagram of facilities and features in Phase 1

Phase I

The first phase of construction for Exploration Green (*Figure 5*) was approached methodically, to facilitate testing of design and construction methods. For example, when the main walking path was first mapped, it was discovered that its proximity to homes that bordered on the park might create privacy issues. As a result, the trail was moved to a lower elevation level that was farther away from the houses.

Figure 5: Arial view of Phase 1

Phase 1 was largely completed in the spring of 2017, except for the community education center and parking areas, which are still in the works. It features 8 acres of open water, 6 acres of wetlands, and 1.1 miles of pedestrian/cycling path, with park benches located around the perimeter of the pond.

Figure 6: Volunteers planting wetlands vegetation.

Wide community support and volunteer efforts are among the many things that set this project apart. All the labor required for landscaping was performed by community volunteers of all ages, including local residents, church groups, and scout troops. Over 2,000 volunteer hours were dedicated to planting trees and wetlands plants in Phase I. A small area of the park was set aside to serve as a plant nursery (now located in Section 3 of the park). Volunteers tend the nurseries year-round.

Local merchants have donated refreshments, and civic organizations such as Space Center Rotary and Clear Lake City Civic League have donated both funds and volunteer labor to the site.

Other highlights include:

- A diverse selection of native shrubs, aquatic plants, grasses, and wildflowers, including 60 species of oaks and other large trees
- Islands (planned for all five detention ponds) that provide protected wildlife habitat
- Enhanced habitat for resident and migrating birds, butterflies, and other wildlife
- Bird and wildlife watching and education for area visitors

Figure 7: Area residents enjoying a beautiful day at Exploration Green

Losses Avoided

An irony of a successful retention basin project, such as EG, is that a complete Loss Avoidance Study cannot be conducted, since the retention basins ensure that floodwaters do not "test" the surrounding neighborhood. It is, however, possible to estimate the potential cost of losses that could occur in this area, if the mitigating effects of the detention ponds were not in place.

The neighborhood immediately surrounding Exploration Green is the 77062 zip code, which includes approximately 10,000 homes. The median market value is $298,400, while the median square footage is

2,411. Based on 2016 RSMeans research data, and adjusting for inflation, the 2018 median replacement value for a home in this neighborhood, not including land costs, is $261,626.

Based on a conservative hypothetical situation, wherein 10 percent of the 10,000 homes (1,000) are exposed to a mere 6-inch depth of flooding, the cost for repairs, content replacement, and occupant displacement would come to $51,887 per home, for a total recovery cost of $51,887,000 for one relatively minor event. Compare that to the $40.8 million total expected cost for the Exploration Green project, and it becomes immediately evident that this is a project that will likely pay for itself many times over. These figures, of course, cannot take into account the intangible costs associated with disaster recovery, such as loss of irreplaceable personal belongings, the stress of forced relocation, reduced property values, and the general upheaval that comes with any disaster recovery.

Awards

In its brief history, Exploration Green has already been recognized for its innovative planning, landscaping, environmental, and ecological achievements.

- ✓ 2013 Mayor's Proud Partner Award from Keep Houston Beautiful
- ✓ 2013 Houston-Galveston Area Council (H-GAC) "Planning Award for Parks and Natural Areas"
- ✓ 2015 Trees for Houston "Arbor Award"
- ✓ 2015 American Society of Landscape Architects Award (to SWA)
- ✓ 2016 H-GAC Our Great Region "Connections Award"
- ✓ "Guardian of the Bay Award" from the Galveston Bay Foundation
- ✓ "National Resilience Award" from the 2018 National Disaster Resilience Conference

Exploration Green has also been featured in several local and national newspapers, including the Texas Tribune, Texas AgriLife, USA Today, Public Works magazine, and the Washington Post.

Looking Ahead

With Phase 1 essentially complete, work on Phase 2 has started with the first depth of excavation in progress as of this writing. Detailed engineering has begun for Phases 3 and 4, with construction slated to start in 2019. Target date for completion of the final phase is set for 2022.

Total expected expenses include $32M for excavation and terracing and $8.8M for irrigation, planting, trails, and other amenities. Once the project is complete it will have a storage capacity of 1,680 acre-feet, or ½-billion gallons of water.

When completed, the park will span 200 acres and feature:

- 38 acres of water surface area
- 39 acres of wetlands
- 5 habitat islands
- 101 acres of upland/island areas
- Permanent water depth of 6 feet
- An additional 8 feet of water storage capacity (totaling 14 feet)
- Over 6 miles of biking/walking trails

Exploration Green proudly stands as an extraordinary, award-winning project that has already resulted in benefits to the community on many levels, and provides an ideal model for effective, creative floodplain management that other communities across Texas, and the nation, can look to for guidance and inspiration.