Appendix C – Environmental Resources

Mitchell Lake, San Antonio, TX

General Investigations Feasibility Study

August 2021

US Army Corps of Engineers®
Fort Worth District

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Table of Contents

List of Figures

List of Tables

List of Attachments

1 Introduction

This appendix documents the resource significance and potential environmental impacts associated with the identified ecosystem restoration plan and final array of alternatives for the Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study. The appendix documents an assessment of the study area and the quantification of existing, future without the project, and future with project habitat quality for each of the plans.

Mitchell Lake is located in southern Bexar County within San Antonio, TX city limits. Historically, it was called Lake of the Ducks and was comprised of a complex of emergent wetlands dominated by tall emergent vegetation (Henderson and Lofgren 2008). The construction of a dam below the wetland complex in 1901, resulted in the formation of Mitchell Lake. The lake is approximately 650 acres of open water habitat and has an average depth of three to four feet. Historically, the City of San Antonio utilized Mitchell Lake for the disposal of raw sewage, sludge, waste activated sludge, and treated wastewater effluent from the Rilling Road Wastewater Treatment Plant. The northern portion of the lake withheld a significant amount of sludge. This area was subsequently diked and isolated in the early 1970s, known as the East and West polders or polders. Later, the sludge began to exceed the capacity of the polders requiring the creation five additional basins, known as Basins 1-5. In 1987, sludge disposal in the polders and basins ceased after the Rilling Road Wastewater Treatment Plant was decommissioned. The Leon Creek Water Recycling Center, southwest of Mitchell Lake, supplements flow into the lake to maintain a water elevation of 520.4 feet (above mean sea level). Due to the degraded water quality, there are no releases of water downstream of the dam with the exception of the flows resulting from large storm events.

The non-Federal sponsor (NFS), the San Antonio Water Systems (SAWS) requested the U.S. Army Corps of Engineers (USACE) evaluate Mitchell Lake to assess the feasibility of restoring the degraded habitat in and around Mitchell Lake, a goal they have expressed interest in implementing.

The environment within and around Mitchell Lake has suffered severe habitat degradation due to its historical status as a sewage disposal site and wastewater treatment plant. The Mitchell Lake study area encompasses approximately 6,718 acres. The lake and surrounding uplands and grasslands are leased by the Mitchell Lake Audubon Society, while the property is owned by SAWS. The Audubon Society utilizes the leased areas for recreation and educational purposes.

Mitchell Lake is currently owned and managed by SAWS. It has an earth-and-rock embankment dam at the southern end of its boundary, approximately 3,200 feet long and 30 to 60 feet wide. The polders and basins abut the northern shore of the lake. The East Polder is approximately 47 acres and West Polder is approximately 32 acres, both are located to the north of the basins. The basins are located between the lake and the polders and vary in size:

- Basin 1: 11 acres,
- Basin 2: 7 acres,
- Basin 3: 19 acres,
- Basin 4: 21 acres,
- and Basin 5: 22 acres.

1.1 Purpose and Need for the Action

The purpose of the study is to identify and implement aquatic ecosystem restoration measures to restore the structure and/or function of the historical wetland ecosystem within the study area that has been impaired through its operation as a sewage treatment facility.

The quantity and quality of wetland habitat no longer supports the historic level of organism diversity at all trophic levels. The degraded aquatic habitat within the study area fails to support the diversity of aquatic plants and macroinvertebrates that form the foundation of wetland biotic ecosystems. An increase in biomass and biotic diversity at the fundamental trophic levels is required to restore sustainable fish, amphibian, reptile, mammal, and avian communities.

1.2 Project Location

The proposed project is located in the San Antonio River Basin south of San Antonio, TX (Figure 1-1). It is located within the city limits of San Antonio, surrounded by agriculture and other rural uses; however, the land use in the adjacent area is transitioning to residential development.

The USACE recognizes that factors outside of the Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study footprint influence the feasibility and sustainability of any actions that might be undertaken. Likewise, any actions that might be undertaken in cooperation with USACE could have beneficial or adverse impacts on the surrounding area. Therefore, the study area includes the Mitchell Lake watershed. This resulting study area boundary consists of an area approximately one and a half miles on either side of Mitchell Lake and terminates along the Medina River.

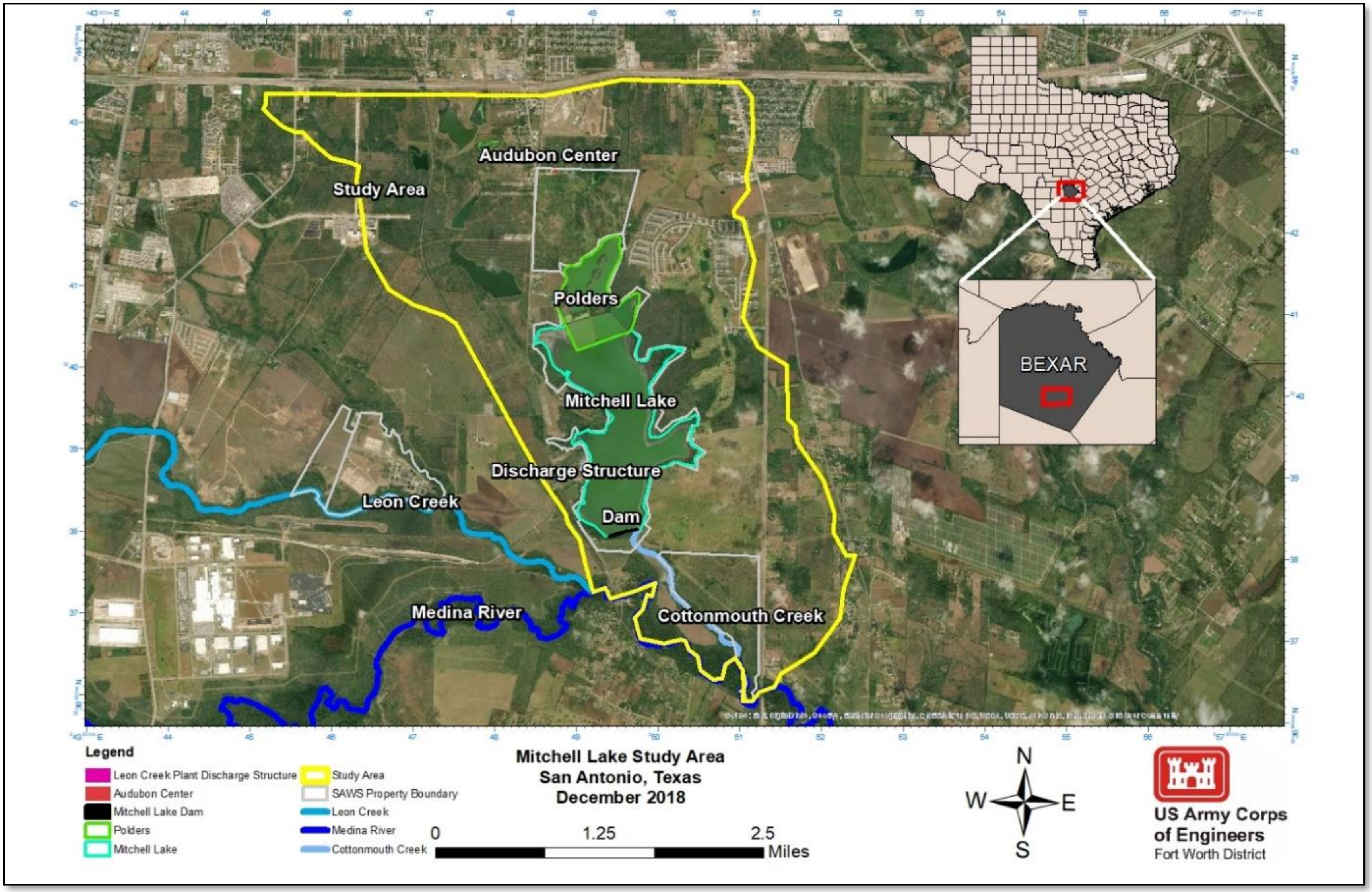

Figure 1-1. Mitchell Lake Study Area

2 Resource Significance

In compliance with the Council of Environmental Quality (CEQ) National Environmental Policy Act (NEPA) regulations (40 CFR 1500.1(b), 1501.7(a)(2) and (3), and 1502.2(b)), guidance for USACE ecosystem restoration projects require the identification of significant resources and attributes that are likely to be affected by one or more of the plans (U.S. Water Resources Council, 1983). “Significant” is defined as “likely to have a material bearing on the decision-making process” (Apogee Research, Inc., 1996). Resource significance is determined by the importance and non-monetary value of the resource based on institutional, public, and technical recognition in the study area. The criteria are defined as:

- Institutional Recognition: The importance of the resource or attribute is acknowledged in the laws, adopted plans, and other policy statements of public agencies or private groups.
- Public Recognition: The resource or attribute is considered important by some segment of the general public.
- Technical Recognition: The importance of the resource or attribute is based on scientific or technical knowledge or judgment of critical resource characteristics.

2.1 Institutional Recognition

Significance based on institutional recognition means that the importance of the environmental resource is acknowledged in the laws, adopted plans, and other policy statements of public agencies or private groups. The institutional recognition of resource significance for the Mitchell Lake Study area is demonstrated by the following laws, policies, treaties, plans, and cooperative agreements established for the conservation and protection of these environmental resources.

<u>Endangered Species Act</u>

The Endangered Species Act of 1973 (ESA), as amended, "provides a means whereby the ecosystems upon which endangered and threatened species depend may be conserved, and to provide a program for the conservation of these species." The Department of the Interior, acting through the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service is responsible for the protection of federally threatened and endangered species in the U.S. The ESA prohibits the take of listed animals and the interstate or international trade in listed plants and animals without a permit. The USFWS also maintains a list of Candidate species consisting of species where there is information that warrants proposing them for listing under ESA, but listing them is precluded due to higher priority species. The Federally listed species that have the possibility of occurring in the study area are the golden-cheeked warbler (*Setophaga chrysoparia*), red knot (*Calidris canutus*), piping plover (*Charadrius melodus*), least tern (*Sternula antillarum*), and whooping crane *(Grus americana)*(Table 2-1)(USFWS, 2019) (Attachment A). However, their occurrences may be limited due to the lack of suitable habitat within the project area. The red knot, piping plover, and least tern are shorebirds that may utilize Mitchell Lake during their migration as stopover habitat. It is anticipated that the Recommended Plan ecosystem restoration measures and alternatives, such as mudflat habitat creation and invasive species management would greatly benefit these species. A thorough examination of Threatened and Endangered species can be found in Attachment B.

Texas State Threatened and Endangered Species

In 1973, the Texas legislature authorized the Texas Parks and Wildlife Department (TPWD) to establish a list of fish and wildlife that are endangered or threatened with statewide extinction. In 1988, the Texas legislature added the authority for TPWD to establish a list of threatened and endangered plant species for the state. TPWD regulations prohibit the taking, possession, transportation, or sale of any state endangered or threatened animal species without the issuance of a permit (TPWD Code §68.015). In addition, the commercial sale, possession for commercial sale, or the sale of all or part of an endangered, threatened, or protected plant from public land is prohibited (TPWD Code §88.008).

Table 2-1 presents the Federal and state-listed threatened and endangered species that are known to occur in Bexar County with the potential of these species to utilize habitats within the study area (TPWD, 2019a)(Attachment C). However, due to poor habitat quality, there is very little likelihood of these species to occur or utilize the study area as their core habitat unless they are highly resilient species. The Recommended Plan involves mud flat restoration, which could directly benefit shorebirds such as the least tern, piping plover, and red knot.

Table 2-1. Federal and State Listed Species for Bexar County, Texas (USFWS, 2019 and TPWD, 2019a)

Name	Scientific Name	Federal Listing	State Listing	Habitat Present
Birds				
Golden-cheeked Warbler	*Dendroica chrysoparia*	E	E	No
Least Tern	*Sterna antillarum*	E	E	Yes
Piping Plover	*Charadrius melodus*	T	T	Yes
Red Knot	*Calidris canutus rufa*	T		Yes
Whooping Crane	*Grus Americana*	E	E	Yes
Black-capped Vireo	*Vireo atricapilla*		E	No
Reddish Egret	*Egretta rufescens*		T	Yes
White-faced Ibis	*Plegadis chihi*		T	Yes
Wood Stork	*Mycteria americana*		T	Yes
Bald Eagle	*Haliaeetus leucocephalus*		T	Yes
Zone-tailed Hawk	*Buteo albonotaus*		T	Yes
Tropical Parula	*Setophaga pitiayumi*		T	Yes
Amphibians				

Name	Scientific Name	Federal Listing	State Listing	Habitat Present
San Marcos Salamander	*Eurycea nana*	T		No
Texas Blind Salamander	*Typhlomolge rathbuni*	E		No
Cascade Caverns Salamander	*Eurycea latitans*		T	No
Comal Blind Salamander	*Eurycea tridentifera*		T	No
Black-spotted Newt	*Notophthalmus meridionalis*		T	Yes
Mexican Treefrog	*Smilisca baudinii*		T	Yes
Fishes				
Fountain Darter	*Etheostoma fonticola*	E		No
Widemouth Blindcat	*Satan eurystomus*		T	No
Toothless Blindcat	*Trogloglanis pattersoni*		T	No
Mollusks				
Golden Orb	*Quadrula aurea*	C	T	No[1]
Texas Fatmucket	*Lampsilis bracteata*	C		No[1]
Texas Pimpleback	*Quadrula petrina*	C		No[1]
Mammals				
Black Bear	*Ursus americana*		T	No
White-nosed Coati	*Nasua narica*		T	No
Reptiles				
Cagle's Map Turtle	*Graptemys caglei*		T	Yes
Texas Tortoise	*Gopherus berlandieri*		T	Yes
Texas Horned Lizard	*Phyrnosoma cornutum*		T	Yes
Texas Indigo Snake	*Drymarchon melanurus erebennus*		T	Yes
Timber Rattlesnake	*Crotalus horridus*		T	Yes

Name	Scientific Name	Federal Listing	State Listing	Habitat Present
Insects				
[no Common Name] Beetle	*Rhadine exilis*	E		No
[no Common Name] Beetle	*Rhadine infernalis*	E		No
Comal Springs Dryopid Beetle	*Stygoparnus comalensis*	E		No
Comal Springs Riffle Beetle	*Heterelmis comalensis*	E		No
Helotes Mold Beetle	*Batrisodes venyivi*	E		No
Arachnids				
Braken Bat Cave Meshweaver	*Cicurina venii*	E		No
Cokendolpher Cave Harvestmand	*Texella cokendolpheri*	E		No
Government Canyon Bat Cave Meshweaver	*Cicurina vespera*	E		No
Government Canyon Bat Cave Spider	*Neoleptoneta microps*	E		No
Madla's Cave Meshweaver	*Cicurina madla*	E		No
Robber Baron Cave Meshweaver	*Cicurina baronia*	E		No
Crustaceans				
Peck's Cave Amphipod	*Stygobromus (=Stygonectes) pecki*	E		No
Flowering Plants				
Bracted Twistflower	*Streptanthus bracteatus*	C		No
Texas Wild-rice	*Zizania texana*	E		No

Name	Scientific Name	Federal Listing	State Listing	Habitat Present
[1]Although the habitat may occur in the study area, the poor water quality and lack of fish host species precludes the mussels from inhabiting the aquatic habitats of Mitchell Lake and the Polders C: Candidate, E: Endangered, T: Threatened				

Fish and Wildlife Coordination Act of 1958

The Fish and Wildlife Coordination Act (FWCA) of 1934, as amended, recognizes the contribution of wildlife resources to the nation. The USFWS and TPWD have committed to dedicate time and resources in developing a set of measures toward the ultimate identification of a preferred plan that meets USACE, USFWS, TPWD, and the sponsor's objectives for restoration of aquatic habitat. The measures identified in the Recommended Plan will be considered by these agencies to have significant environmental outputs for fish and wildlife resources. The habitats that would be restored with implementation of the Recommended Plan will meet with intent and provisions of the FWCA by recognizing the vital contribution of wildlife resources to San Antonio, south-central Texas, and the Nation. Institutional significance is demonstrated by the extreme interest, commitment, and recognition given to this study by the USFWS, TPWD, and other outside resource agencies. The FWCA recognizes that incremental losses to wetlands and their habitats have become cumulatively important to nationally recognized resources and that mitigation of those losses is within the national interest. Similarly, the restoration of the habitats within the Mitchell Lake study area are shown to be incrementally nationally significant due to the decline of natural stopover habitat for migratory birds. The Final Coordination Act Report is located in Attachment D.

Migratory Bird Treaty Act

The U.S. has recognized the critical importance of this shared resource by ratifying international, bilateral conventions for the conservation of migratory birds. These migratory bird conventions impose substantive obligations on the U.S. for the conservation of migratory birds and their habitats, and through the Migratory Bird Treaty Act, the U.S. has implemented these migratory bird conventions with respect to the United States. The Migratory Bird Treaty Act prohibits the taking, possessing, importing/exporting, selling, and transporting of any listed migratory bird, its parts, nest, or eggs. Included in the protection provided by this act are all North American diurnal birds of prey, except bald and golden eagles which are provided protection under the Bald and Golden Eagle Protection Act.

Mitchell Lake is positioned on a natural migratory route and serves as a resting point for tens of thousands of birds each year. Despite its degraded conditions and ecological losses, the high quality opportunity of the ecosystem is evident as the area currently remains able to provide services to over 338 migratory bird species. The Recommended Plan would restore essential stopover habitat for migratory birds through native species plantings, invasive species management, and wetland restoration. The Recommended Plan would benefit migratory birds nationwide through these implementation efforts by restoring habitat that would assist with nesting and feeding breaks for the birds while also providing additional shelter during extreme storm events. The Trust Resources list for migratory birds and wetlands for Mitchell Lake is located in Attachment E.

Clean Water Act

The Clean Water Act (CWA) establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. The basis of the CWA was enacted in 1948 and was called the Federal Water Pollution Control Act, but the Act was significantly reorganized and expanded in 1972. "Clean Water Act" became the Act's common name with amendments in 1972 (U.S. EPA 2020).

Under the CWA, EPA has developed national water quality criteria recommendations for pollutants in surface waters. Because the Recommended Plan will impact surface waters, USACE is required to conduct a Section 404(b)(1) Guidelines of the Clean Water Act Analysis (see Attachment F). The excavation and grading of areas outside of existing wetland limits creates expanded wetlands within the study area. Wetlands have the ability to naturally treat impaired water through by filtration through wetland vegetation and microorganisms. By pumping water from Mitchell Lake to existing wetlands at the northernmost point of the study area and allowing it to naturally flow back to Mitchell Lake, the Recommended Plan will not only improve habitat quality for wildlife but also improve water quality.

<u>2018 Farm Bill</u>

The Highly Erodible Land Conservation and Wetland Conservation Compliance provisions were introduced in the 1985 Farm Bill, with amendments in 1990, 1996, and 2002. The purpose of the provisions is to remove certain incentives to produce agricultural commodities on converted wetlands or highly erodible land. Persons who convert a wetland making production of an agricultural commodity possible after November 28, 1990, will be ineligible for program benefits until the functions of the wetland that was converted is mitigated, unless an exemption applies. The 2018 Farm Bill expands wetland types eligible for restoration and management under wetland reserve easements. Under the Farm Bill, National Resource Conservation Service (NRCS) offers the Agricultural Conservation Easement Program (ACEP), a voluntary program that benefits both agricultural producers and the environment. Under the Wetland Reserve Easements component, NRCS helps to restore, protect, and enhance enrolled wetlands. NRCS enters into purchase agreements with eligible private landowners or American Indian tribes. NRCS and the landowner work together to develop and implement a wetlands reserve plan to guide the restoration easement process. This plan restores, enhances, and protects the wetland’s functions and values (NRCS ACEP 2020). This program is in direct correlation with the goals of the Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study. The implementation of this program by NRCS shows the significance of wetlands within the U.S. and the importance of maintaining and restoring these habitats. The Recommended Plan would restore wetlands within the San Antonio area, effectively acting in coordination with the 2018 Farm Bill.

<u>Executive Order 13112</u>

Executive Order (EO) 13112 called upon executive departments and agencies to take steps to prevent the introduction and spread of invasive species, and to support efforts to eradicate and control invasive species that are established. It also created a coordinating body – the Invasive Species Council, also referred to as the National Invasive Species Council – to oversee implementation of the order, encourage proactive planning and action, develop recommendations for international cooperation, and take other steps to improve the Federal response to invasive species. EO 13112 recognizes the significant contribution native species make to the well-being of the Nation's natural environment and directs Federal agencies to take preventive and responsive action to the threat of non-native species invasion and to provide restoration of native species and habitat conditions in ecosystems that have been invaded. Linked to the aquatic degradation is the loss of native wetland vegetation species, which in addition to being vital to the aquatic environment, supports native residential and migratory, game and nongame wildlife species at Mitchell Lake. The Mitchell Lake Recommended Plan directly addresses non-native invasive species by implementing goals and objectives that will assist in the management and removal of these species.

Executive Order 13751

This order amends EO 13112 and directs actions to continue coordinated Federal prevention and control efforts related to invasive species. This order maintains the National Invasive Species Council (Council) and the Invasive Species Advisory Committee; expands the membership of the Council; clarifies the operations of the Council; incorporates considerations of human and environmental health, climate change, technological innovation, and other emerging priorities into Federal efforts to address invasive species; and strengthens coordinated, cost-efficient Federal action. Invasive species management is a measure that will be implemented with the Recommended Plan, thereby following EO 13751.

Executive Order 11990

EO 11990 directs Federal agencies to take action in the conservation of wetlands. Agencies should take part in avoiding the possible degradation or destruction of wetlands and promote wetland health and vitality. The proposed aquatic ecosystem restoration study would contribute directly to EO 11990 to minimize the degradation and/or destruction of Federal wetlands and to improve the circumstances for natural wetlands and their benefits on the environment. The goal of this project is to improve the structure and function of the aquatic ecosystem at Mitchell Lake. The Recommended Plan includes restoration of approximately 99 acres of emergent and submergent wetland habitat.

Water Resources Development Act of 1990

Section 307(a) of the Water Resources Development Act of 1990 established an interim goal of no overall net loss of wetlands in the U.S. and set a long-term goal to increase the quality of wetlands, as defined by acreage and function. The Recommended Plan for Mitchell Lake will restore and create approximately 99 acres of wetlands within the study area. The proposed ecosystem restoration project will directly contribute to Section 307(a) by providing additional wetland habitat within the U.S.

Executive Order 13186

EO 13186 directs Federal agencies to promote the conservation of migratory bird populations, including restoring and enhancing habitat (USFWS 2019). Migratory Non-game Birds of Management Concern is a list maintained by the USFWS. The list helps fulfill a primary goal of the USFWS to conserve avian diversity in North America. Additionally, the USFWS' Migratory Bird Plan is a draft strategic plan to strengthen and guide the agency's Migratory Bird Program. The proposed ecosystem restoration would contribute directly to the U.S. Fish and Wildlife Service Migratory Bird Program goals to protect, conserve, and restore migratory bird habitats to ensure long-term sustainability of all migratory bird populations. Rangewide protection, restoration and improvement of terrestrial and aquatic habitats and landscapes are crucial to maintain and conserve migratory birds.

Because the Mitchell Lake study area supports species of concern and their habitats which are addressed in numerous avian joint ventures, conservation organizations, and interagency and international cooperative plans, their institutional significance is recognized from both a regional, national, and international perspective. Aquatic ecosystem restoration of the Mitchell Lake study area would support the goals of each of these plans and cooperative initiatives as the degraded habitat within the study area would increase the quality of breeding, foraging, wintering, and migration habitats for numerous bird species.

1989 “No-Net Loss of Wetlands” Policy

President George H.W. Bush established the National policy of “no-net loss of wetlands” in 1989. This set the groundwork to replace each newly impacted wetland with a replacement wetland of the same size and with similar wetland functions and values. With the implementation of this policy, George W. Bush announced in 2004, that “no-net loss” had been accomplished nationally and that we had a net-gain of wetlands (NRCS “Wetlands” 2020). The Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study restores existing wetlands and improves upon degraded habitats. Impacts to wetlands were realized with the 1985 Farm Bill and the 1989 “Not-Net Loss” Policy through the culmination of status and trends of wetland loss and combined Federal efforts to reduce wetland loss through restoration.

Audubon Red List

In 2007, the Audubon Society and the American Bird Conservancy published the Watchlist 2007 (Butcher et al., 2007) documenting a Red-list of bird species in the U.S. that were rapidly declining in numbers and/or had very small populations or limited ranges, and faced major conservation threats and a Yellow-list of bird species that were either declining or rare. Watchlist 2007 includes 15 Red-listed species and 48 Yellow-listed species that can be found in Bexar County (Coffey et al., 2011) on the Audubon Watchlist 2007 (Bucher et al., 2007).

- Red-list Species
  - Mottled Duck (*Anas fulvigula*)
  - Reddish Egret (*Egretta rufescens*)
  - Whooping Crane
  - Piping Plover
  - Mountain Plover (*Charadrius montanus*)
  - Buff-breasted Sandpiper (*Calidris subruficollis*)
  - Least Tern
  - Green Parakeet (*Aratinga holochroa*)
  - Bell’s Vireo (*Vireo belli*)
  - Black-capped Vireo (*Vireo atricapilla*)
  - Golden-winged Warbler (*Vermivora chrysoptera*)
  - Golden-cheeked Warbler Baird’s Sparrow (*Centronyx bairdii*)
  - Henslow’s Sparrow (*Centronyx henslowii*)
- Yellow-list Species
  - Scaled Quail (*Callipepla squamata*)
  - Bay-breasted Warbler (*Setophaga castanea*)
  - Swallow-tailed Kite (*Elaoides forficatus*)
  - Cerulean Warbler (*Setophaga cerulean*)
  - King Rail (*Rallus elegans*)
  - Prothonotary Warbler (*Protonotaria citrea*)
  - American Golden-Plover (*Pluvialis dominica*)

- Kentucky Warbler (*Geothlypis formosa*)
- Snowy Plover (*Charadrius nivosus*)
- Canada Warbler (*Cardellina canadensis*)
- Wilson’s Plover (*Charadrius semipalmatus*)
- Lark Bunting (*Calamospiza melanocorys*)
- Long-billed Curlew (*Numenius americanus*)
- Le Conte’s Sparrow (*Ammodramus leconteii*)
- Marbled Godwit (*Limosa fedoa*)
- Chestnut-collared Longspur (*Calcarius ornatus*)
- Red Knot
- Varied Bunting (*Passerina versicolor*)
- Sanderling (*Calidris alba*)
- Painted Bunting (*Passerina ciris*)
- Semipalmated Sandpiper (*Calidris pusilla*)
- Rusty Blackbird (*Euphagus carolinus*)
- White-rumped Sandpiper (*Calidris fuscicollis*)
- Swainson’s Hawk (*Buteo swainsoni*)
- Bridled Tern (*Onychoprion anaethetus*)
- Hudsonian Godwit (*Limosa haemastica*)
- Gull-billed Tern (*Gelochelidon nilotica*)
- Western Sandpiper (*Calidris mauri*)
- Black Skimmer (*Rynchops niger*)
- Stilt Sandpiper (*Calidris himantopus*)
- Short-eared Owl (*Asio flammeus*)
- Elf Owl (*Micrathene whitneyi*)
- Red-headed Woodpecker (*Melanerpes erythrocephalus*)
- Calliope Hummingbird (*Selasphorus calliopez*)
- Olive-sided Flycatcher (*Contopus cooperi*)
- Allen’s Hummingbird (*Selasphorus sasin*)
- Willow Flycatcher (*Empidonax traillii*)
- Blue-winged Warbler (*Vermivora cyanoptera*)
- Wood Thrush (*Hylocichla mustelina*)
- Swainson’s Warbler (*Limnothlypis swainsonii*)
- Varied Thrush (*Ixoreus naevius*)
- Smith’s Longspur (*Calcarius pictus*)

- Sprague’s Pipit (*Anthus spragueii*)
- Audubon’s Oriole (*Icterus graduacauda*)
- Prairie Warbler (*Setophaga discolor*)

<u>Department of Defense Partners in Flight</u>

The Department of Defense (DoD) Partners in Flight (PIF) program consists of a cooperative network of natural resources personnel from military installations across the U.S. DoD PIF works collaboratively with other avian conservation initiatives to conserve migratory and resident bird species and their habitat on DoD lands. In addition, DoD PIF works beyond installation boundaries to facilitate cooperative partnerships, determine the current status of bird populations, and prevent the listing of additional birds as threatened or endangered. There are 33 species on the DoD PIF list that occur in Bexar County. Table 2-3 shows the species that occur within Bexar County that are listed on the DoD PIF Priority List. The Recommended Plan would benefit most of the Bexar County bird species presented on the DoD PIF Priority List through native vegetation species plantings and invasive species management see below (Engleman et al., 2019 and DoD, 2015).

- Bexar County species on the DoD PIF Priority List
  - Northern Bobwhite (*Colinus virginianus*)
  - Red-headed Woodpecker
  - Swallow-tailed Kite (*Elanoides forficatus*)
  - Prairie Falcon (*Falco mexicanus*)
  - Bald Eagle (Haliaeetus leucocephalus)
  - Olive-sided Flycatcher
  - Northern Goshawk (*Accipiter gentilis*)
  - Loggerhead Shrike (*Lanius ludovicianus*)
  - Golden Eagle (*Aquila chrysaetos*)
  - Sage Thrasher (*Oreoscoptes montanus*)
  - King Rail
  - Blue-winged Warbler
  - Wilson's Plover
  - Swainson's Warbler
  - Mountain Plover
  - Kentucky Warbler
  - Upland Sandpiper (*Bartramia longicauda*)
  - Cerulean Warbler
  - Long-billed Curlew
  - Prairie Warbler
  - Buff-breasted Sandpiper
  - Brewer's Sparrow (*Spizella breweri*)

- Least Tern
- Grasshopper Sparrow (*Ammodramus savannarum*)
- Gull-billed Tern
- Baird's Sparrow
- Burrowing Owl (Athene cunicularia)
- Harris's Sparrow (*Zonotrichia querula*)
- Common Nighthawk (*Chordeiles minor*)
- Painted Bunting
- Chuck-will's-widow (Antrostomus carolinensis)
- Dickcissel (Spiza americana)
- Eastern Whip-poor-will (*Antrostomus vociferous*)

<u>Partners in Flight</u>

PIF is a cooperative partnership between federal, state, and local government agencies, philanthropic foundations, professional organizations, conservation groups, industry, academia, and private individuals. Federal agency partners include the following:

- Federal Agencies;
    - U.S. Geological Survey,
    - National Park Service,
    - Bureau of Land Management,
    - U.S. Fish and Wildlife Service,
    - Department of Defense,
    - U.S. Forest Service,
    - U.S. Environmental Protection Agency,
    - Natural Resources Conservation Service,
    - U.S. Army Corps of Engineers,
    - U.S. Department of State
- State Wildlife Resource Agencies;
    - Texas Parks and Wildlife Department
- Private Interest Groups/Private Agencies
    - San Antonio Audubon Society

The goals of PIF are to create a coordinated network of conservation partners to secure sufficient commitment and resources to implement and support scientifically based landbird conservation plans at multiple scales. In an effort to prioritize conservation needs, PIF assessed the conservation vulnerability for landbird species and assigned a score to each species based on biological criteria such as population size, breeding distribution, non-breeding distribution, threats to breeding habitats, threats to non-breeding areas, and population trends (Rosenberg et al., 2016). There are 29 species in Bexar County that are on the PIF Watch List. The

Recommended Plan seeks to improve habitat for birds that are known to occur within Bexar County. These species would benefit from the ecosystem restoration measures that would be implemented.

- The Red Watch List – species with extremely high vulnerability due to small population and range, high threats, and rangewide declines has three species that correlate to Bexar County.
- The “not declining” Yellow Watch List – species not declining but vulnerable due to small range or population and moderate threats has three species that correlate to Bexar County.
- The “declining” Yellow Watch List – species with population declines and moderate to high threats has 23 species that correlate to Bexar County.

Bexar county species described by Engleman et al. 2019 on the PIF Watch List include and are designated by R – Recover (Red Watch List), ND – Prevent Decline (Yellow Watch List), D – Reverse Decline (Yellow Watch List), see below.

- Black-capped Vireo[R]
- Wood Thrush[D]
- Golden-winged Warbler[R]
- Sprague's Pipit[D] (*Anthus spragueii*)
- Golden-cheeked Warbler[R]
- Chestnut-collared Longspur[D] (*Calcarius ornatus*)
- Lucifer Hummingbird[ND] (*Calothorax Lucifer*)
- McCown's Longspur[D] (*Rhynchophanes mccownii*)
- Henslow's SparrowN[D]
- Prothonotary Warbler[D]
- Audubon's Oriole[ND]
- Connecticut Warbler[D] (*Oporornis agilis*)
- Black-billed Cuckoo[D] (*Coccyzus erythropthalmus*)
- Kentucky Warbler[D]
- Long-eared Owl[D] (*Asio otus*)
- Cape May Warbler[D] (*Setophaga tigrina*)
- Eastern Whip-poor-will[D]
- Cerulean Warbler[D]
- Rufous Hummingbird[D] (*Selasphorus rufus*)
- Prairie Warbler[D]
- Allen's Hummingbird[D] (*Selasphorus sasin*)
- Canada Warbler[D]

- Red-headed Woodpecker[D]
- Baird's Sparrow[D]
- Green Parakeet[D]
- Harris's Sparrow[D]
- Olive-sided Flycatcher[D]
- Bobolink[D] (*Dolichonyx oryzivorus*)
- Evening Grosbeak[D] (*Coccothraustes vespertinus*)

North American Waterfowl Management Plan

Established in 1986, the North American Waterfowl Management Plan (NAWMP) is an international plan to reverse the downward trend in waterfowl populations (NAWMP, 2018). The goal of the plan is to protect, restore, and improve wetland habitat and increase waterfowl population numbers. An update to the plan in 1998 was signed by the United States, Canada, and Mexico and lists wetland, aquatic systems, grassland, forest, and riparian areas as habitats critical to waterfowl. Thirty-six Important Waterfowl Habitat Areas have been identified by the USFWS, three of which are represented within Texas, and include east Texas, the gulf coast, and the playa lakes region. Central Texas, including the San Antonio area, provides a critical link between the three priority waterfowl habitat areas. The USFWS states that conservation efforts should include national and regional planning for both migratory and endemic waterfowl species. Between 1986 and 2009, $4.5 billion was invested to secure, protect, restore, improve and manage 15.7 million acres of waterfowl priority landscapes in North America. The NAWMP was updated again in 2018 and NAWMP Science Support Team (NSST) prioritized conservation needs for waterfowl species based on socioeconomic importance of the species, the species population trend, and the vulnerability of the population to decline. The Recommended Plan for the ecosystem restoration of Mitchell Lake will directly affect North American Waterfowl Management. The measures included in the plan would attract waterfowl and benefit those species by increasing the quality of forage found during their migration.

Bexar County species described by Engleman et. all in 2019 in the North American Waterfowl Management Plan Update (NAWMP, 2018) include:

- Canada Goose (*Branta canadensis*)
- Long-tailed Duck (*Clangula hyemalis*)
- Cackling Goose (*Branta hutchinsii*)
- Black Scoter (*Melanitta americana*)
- Snow Goose (*Chen caerulescens*)
- Surf Scoter (*Melanitta perspicillata*)
- Ross’s Goose (*Chen rossii*)
- White-Winged Scoter (*Melanitta fusca*)
- Mottled Duck
- Common Goldeneye (*Bucephala clangula*)
- Cinnamon Teal (*Anas cyanoptera*)
- Bufflehead (*Lophodytes cucullatus*)

- Wood Duck (*Aix sponsa*)
- Hooded Merganser
- Ring-necked Duck (*Aythya collaris*)
- Red-Breasted Merganser (*Mergus serrator*)
- Ruddy Duck (*Oxyura jamaicensis*)
- Common Merganser (*Mergus merganser*)
- Masked Duck (*Nomonyx dominicus*)

North American Bird Conservation Initiative

The North American Bird Conservation Initiative (NABCI) is a tri-national declaration of intent between the U.S., Canada, and Mexico to strengthen cooperation on the conservation of North American birds throughout their ranges and habitats. The U.S. NABCI Committee is a coalition of government agencies, private organizations, and bird initiatives in the United States comprised of representatives from the following entities:

- U.S. Fish and Wildlife Service
- Natural Resources Conservation Service
- Bureau of Land Management
- Department of Defense
- National Park Service
- U.S. Geological Survey
- U.S. Forest Service
- Farm Service Agency
- Wildlife Management Institute
- Association of Fish and Wildlife Agencies
- National Flyway Council
- Partners in Flight
- Association of Joint Venture Management Boards
- National Audubon Society
- The Nature Conservancy
- American Bird Conservancy
- Ducks Unlimited
- Waterbird Conservation for the Americas
- U.S. Shorebird Conservation Plan
- North American Waterfowl Management Plan
- Migratory Shorebird and Upland Game Bird Working Group
- Resident Game Bird Working Group

The NABCI divided North America into 67 ecologically distinct Bird Conservation Regions (BCRs) based on similar bird communities, habitats, and resource management issues. The Mitchell Lake study area is located near the intersection of three BCRs: Oaks and Prairies (BCR 21), Edwards Plateau (BCR 20), and Tamaulipan Brushlands (BCR 36). Because of the proximity of the study area to each of these BCRs, the avian community and habitats exhibit characteristics of each region.

OAKS AND PRAIRIES BCR

The Oaks and Prairie BCR encompasses over 45 million acres of Texas and Oklahoma encompassing the Blackland Prairie Ecoregion and the Cross Timbers Ecoregion. These ecoregions represent the southernmost extent of "true" prairies and the westernmost extent of deciduous forest in North America.

EDWARDS PLATEAU BCR

The Edwards Plateau BCR is demarcated by the Balcones Fault on the south and east boundary of the BCR and grades into the Great Plains and Chihuahuan Desert to the west and north. The Edwards Plateau BCR includes the eastern ranges for more arid, desert species as the region trends to more mesic climes provided in the prairie regions.

TAMAULIPAN BRUSHLANDS BCR

The Tamaulipan Brushlands BCR encompasses most of south Texas west of the Gulf Coastal Plains and extends into northeastern Mexico. The BCR provides habitat representing the northernmost extent of several tropical species ranges and the southernmost extent to numerous North American species.

<u>North American Waterbird Conservation Plan</u>

The Waterbird Conservation for the Americas (WCA) initiative was established in 1998 to address threats to waterbirds and their habitats (Kushlan et al., 2002). The goal of the WCA is to sustain and restore waterbird populations and breeding, migratory, and nonbreeding habitats in North America, Central America, and the Caribbean. The WCA identified and ranked the conservation concern for waterbird species throughout North America by BCRs. The conservation status of waterbirds known to occur in Bexar County can be found in Table 2-2. Waterbirds will be benefitted by the measures proposed for the Recommended Plan. Increased quality of wetlands, mudflats, and open water habitats will attract waterbirds and supplement their food and cover resources.

Table 2-2. North American Conservation Status of Waterbirds Known to Occur in Bexar County (Coffey et al., 2011).

	Bird Conservation Region (BCR)		
Species	***Oaks and Prairies***	***Edwards Plateau***	***Tamaulipan Brushland***
High			
Black Skimmer			X
Least Tern	X	X	
Little Blue Heron	X	X	X

	Bird Conservation Region (BCR)		
Species	***Oaks and Prairies***	***Edwards Plateau***	***Tamaulipan Brushland***
(*Egretta caerulea*)			
Snowy Egret (*Egretta thula*)	X		X
Tricolored Heron (*Egretta tricolor*)			X
Moderate Concern			
White Pelican (*Pelecanus erythrorhynchos*)			X
Anhinga (*Anhinga anhinga*)	X		X
Black-crowned Night-heron (*Nycticorax nycticorax*)	X	X	X
Bonaparte's Gull (*Chroicocephalus philadelphia*)	X		X
Eared Grebe (*Podiceps nigricollis*)	X	X	X
Forster's Tern (*Sterna forsteri*)	X		X
Neotropic Cormorant (*Phalacrocorax brasilianus*)	X		X
Roseate Spoonbill (*Platalea ajaja*)			X
White Ibis (*Eudocimus albus*)			X
Yellow-crowned Night-heron (*Nyctanassa violacea*)	X		X

U.S. Shorebird Conservation Plan

The U.S. Shorebird Conservation Partnership is a collaboration of state and federal agencies and non-governmental conservation organizations. The Shorebird Conservation Plan provides a framework to protect and restore shorebird populations and their migratory, breeding, and nonbreeding habitats (Brown et al., 2001).The plan categorizes the conservation concern and risk for North American shorebirds into five categories: 1) species not at risk, 2) species of low concern, 3) species of moderate concern, 4) species of high concern, and 5) highly imperiled species. Table 2-3 provides a list of Conservation Category 3, 4, and 5 shorebirds that are known to occur in Bexar County. Mudflat habitat is of prime importance to shorebird conservation. The increase of mudflat habitat based on the Recommended Plan will benefit shorebird populations within Bexar County and will provide beneficial effects on shorebirds nationwide.

Table 2-3. North American Shorebird Conservation Plan Species of Concern (Brown et al. 2001) Known to Occur in Bexar County (Coffey et al. 2011).

	Bird Conservation Region (BCR)		
Species	***Oaks and Prairies***	***Edwards Plateau***	***Tamaulipan Brushland***
High Imperiled			
Long-billed Curlew			X
Mountain Plover			X
Piping Plover			X
Snowy Plover			X
Species of High Concern			
American Woodcock (*Scolopax minor*)	X		
Marbled Godwit (*Limosa fedoa*)			X
Red Knot			X
Ruddy Turnstone (*Arenaria interpres*)			X
Sanderling			X
Short-billed Dowitcher (*Limnodromus griseus*)			X

	Bird Conservation Region (BCR)		
Species	***Oaks and Prairies***	***Edwards Plateau***	***Tamaulipan Brushland***
Solitary Sandpiper (*Tringa solitaria*)			X
Western Sandpiper (*Calidris mauri*)	X		
Whimbrel (*Numenius phaeopus*)			X
Wilson's Plover			X
Species of Moderate Concern			
American Avocet (*Recurvirostra Americana*)			X
Black-bellied Plover (*Pluvialis squatarola*)			X
Dunlin (*Calidris alpine*)	X		X
Greater Yellowlegs (*Tringa melanoleuca*)			X
Killdeer (*Charadrius vociferous*)	X	X	X
Least Sandpiper (*Calidris minutilla*)	X	X	X
Lesser Yellowlegs (*Tringa flavipes*)			X
Stilt Sandpiper (*Calidris himantopus*)			X
Willet (*Tringa semipalmata*)			X

USFWS Birds of Conservation Concern

The 1988 amendment to (Public Law 100-653, Title VIII) to the FWCA directs the USFWS to "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act of 1973." In response to this mandate, the USFWS (2008) compiled a list of Birds of Conservation Concern (BCC) on three scales: the BCRs, USFWS Regions, and a National scale. The USFWS utilized the conservation assessment scores in the PIF North American Landbird Conservation Plan, the United States Shorebird Conservation Plan, and the North American Waterbird Conservation Plan to identify abundance, population trends, distribution, threats, and the importance of an area to a species to identify Birds of Conservation Concern for each BCR. The goal of the BCC is to identify the highest conservation priorities within the populations of migratory and non-migratory bird species. Table 2-4 below cross references the BCC and birds identified in Bexar County.

Table 2-4. USFWS Birds of Conservation Concern and Species Known to Occur in Bexar County (Coffey et al., 2011)

	Bird Conservation Region (BCR)		
Species	***Oaks and Prairies***	***Edwards Plateau***	***Tamaulipan Brushland***
Little Blue Heron	X		
Swallow-tailed Kite	X		
Bald Eagle	X (b)	X(b)	
Harris' Hawk (*Parabuteo unicinctus*)			X
Swainson's Hawk			X
Peregrine Falcon (*Falco peregrinus*)	X(b)	X(b)	
Snowy Plover			X(c)
Mountain Plover		X(nb)	X(nb)
Lesser Yellowlegs			X(nb)
Solitary Sandpiper			X(nb)
Upland Sandpiper	X	X(nb)	
Long-billed Curlew	X(nb)	X(nb)	X(nb)
Hudsonian Godwit	X(nb)		

	Bird Conservation Region (BCR)		
Species	***Oaks and Prairies***	***Edwards Plateau***	***Tamaulipan Brushland***
Buff-breasted Sandpiper	X(nb)		
Gull-billed Tern			X
Green Parakeet			X(d)
Elf Owl			X
Burrowing Owl			X
Buff-bellied Hummingbird (*Amazilia yucatanensis*)			X
Red-headed Woodpecker	X		
Scissor-tailed Flycatcher (*Tyrannus forficatus*)	X		
Loggerhead Shrike	X		
Bell's Vireo	X(c)		X(c)
Verdin (*Auriparus flaviceps*)			X
Curve-billed Thrasher (*Toxostoma curvirostre*)			X
Sprague's Pipit	X(nb)		X(nb)
Tropical Parula (*Setophaga pitiayumi*)			X
Swainson's Warbler	X		
Summer Tanager (*Piranga rubra*)			X

	Bird Conservation Region (BCR)		
Species	***Oaks and Prairies***	***Edwards Plateau***	***Tamaulipan Brushland***
White-collared Seedeater (*Sporophila torqueola*)			X
Cassin's Sparrow (*Peucaea cassinii*)			X
Rufous-crowned Sparrow (*Aimophila ruficeps*)		X	
Lark Bunting			X(nb)
Henslow's Sparrow	X(nb)		
Harris' Sparrow	X(nb)	X(nb)	
McCown's Longspur (*Rhynchophanes mccownii*)		X(nb)	
Smith's Longspur	X(nb)		
Chestnut-collared Longspur		X(nb)	X(nb)
Varied Bunting			X
Painted Bunting			X
Dickcissel			X
Orchard Oriole (*Icterus spurius*)	X	X	
Hooded Oriole (*Icterus cucullatus*)			X
Altamira Oriole (*Icterus gularis*)			X
Audubon's Oriole			X

	Bird Conservation Region (BCR)		
Species	***Oaks and Prairies***	***Edwards Plateau***	***Tamaulipan Brushland***
(b) ESA delisted, (c) non-listed subspecies or population of Threatened or Endangered species, (d) Migratory Bird Treaty Act protection uncertain or lacking, (nb) non-breeding in this Bird Conservation Region			

2.2 Public Recognition

Significance based on public recognition means that some segment of the general public recognizes the importance of an environmental resource. Public recognition is evidenced by people engaged in activities that reflect an interest in or concern for a particular resource. Recognition of public significance for the Mitchell Lake study area can best be demonstrated by the actions of SAWS and National Audubon Society partnership.

The proposed Mitchell Lake Feasibility Study makes a significant contribution to a larger migratory bird conservation and restoration effort being implemented by Bexar County, the City of San Antonio, the San Antonio River Authority, and the Mitchell Lake Audubon Society. The above entities have made commitments to improving habitat across the San Antonio River watershed, approximately 2-5 miles from Mitchell Lake. The following is a brief listing for some of the recent, current, ongoing, and future projects for the San Antonio River watershed and Bexar County.

- Cibolo Creek, Leon Creek, Salado Creek, Olmos Creek, Eagleland, Mission Reach, Westside Creek, and River Road Studies: partnerships with USACE to identify ecosystem restoration opportunities within the San Antonio River watershed.
- On-going community input for the restoration of other water bodies in the San Antonio, TX area.
- December 2002, SAWS Board committed $1.5 million to improve roads and bridges in the Mitchell Lake study area to build a visitor's center in partnership with the Mitchell Lake Wetlands Society, the San Antonio Audubon Society, and the public.
- SAWS finalized a contract with the National Audubon Society to operate the Mitchell Lake Wildlife Refuge as a public use and education facility.

Several other public organizations around the country have immense interest in maintaining, restoring, and creating wetlands and assisting waterfowl and shorebird persistence by managing appropriate habitat for essential nesting cover and other needs which are all in direct correlation with the Recommended Plan.

- Society of Wetland Scientists – purpose is to promote understanding, conservation, protection, restoration, science-based management, and sustainability of wetlands.
- Wetlands International – a global not-for-profit organization dedicated to the conservation and restoration of wetlands.
- Delta Waterfowl – a leading conservation group that aims to produce ducks and secure the future of waterfowl hunting.

- Ducks Unlimited – conserves, restores, and manages wetlands and associated habitats for North America's waterfowl.
- National Fish and Wildlife Foundation – works with both public and private sectors to protect and restore the nation's fish, wildlife, plants, and habitats.
- Western Hemisphere Shorebird Reserve Network – conserves shorebirds and their habitats across the Americas through action at a network of key sites.

2.3 Technical Recognition

Significance based on technical recognition requires identification of critical resource characteristics such as scarcity, representativeness, status and trends, connectivity, critical habitat, and biodiversity. Therefore, technical recognition of resources varies across geographic areas and spatial scale. This section provides evidence supporting the technical significance of the resources, specifically the scarcity, status, and trends of the resources. Further support for the technical significance of resources in the Mitchell Lake Study area is documented below.

a) Scarcity – Nationally, the loss of wetland and riparian habitats is widely recognized. Over a period of 200 years, the lower 48 states lost an estimated 53-percent of their original wetlands. The USFWS conducted a study that required the examination of more than 5,000 randomly distributed four square mile sample plots of wetland habitat. This study led to the discovery that 93% of the sample plots were lost to development. These losses dramatically reduce the benefits wetlands provide such as water filtration, flood storage, and wildlife habitat (USFWS 2020). Texas has lost over 50% of its original wetlands along with twenty-one other states. Technology advancement and agricultural uses promoted this loss, along with other human uses like drainage, development, and mining (U.S. Geological Survey 2016).

b) Representativeness – The study area for Mitchell Lake has an abundance of non-native invasive species. By improving aquatic, wetland, and riparian habitat within the project area, USACE and SAWS would be able to exemplify the historic ecosystem within the San Antonio, TX area. In its current state, it will not recover from its past use as a disposal site of raw sewage, sludge, waste activated sludge, and treated wastewater effluent. Mitchell Lake is a unique area, abundant with birding and environmental education opportunities. The history of this area is similar to other wetlands in the U.S.; however, Mitchell Lake continues to provide resources for migrating birds and other types of wildlife while maintaining its degraded and low quality features.

c) Status and Trends – Efforts to reestablish wetlands have been focused on less intensively developed land or on undeveloped land. The likelihood of success on undeveloped lands is higher due to factors such as filling, flooding, or land leveling. The success of the Mitchell Lake aquatic, riparian, and wetland restoration is much higher compared to other projects due to the lack of residential or commercial development within the project areas but it may become sensitive to future development if left unchecked. Today, natural wetlands are still being lost, but at a much slower rate than in the past (Figure 2-1).

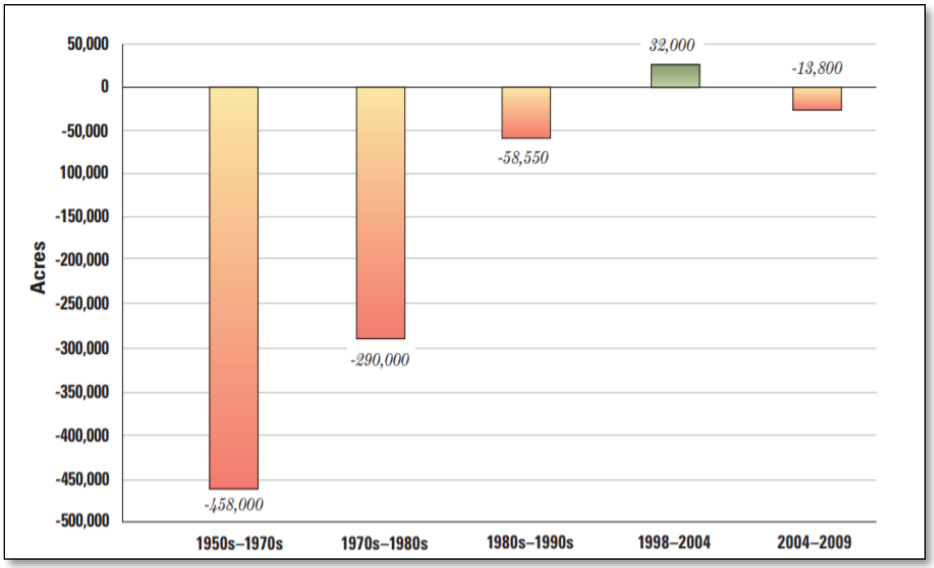

Figure 2-1. Average annual net wetland loss and gain estimates for the conterminous U.S., 1954 to 2009. Estimates of error are not graphically represented. Source: Frayer et al. 1983; Dahl and Johnson 1991; Dahl 2000; 2006; 2009.

d) Connectivity – Potential management measures could include the reestablishment of riparian, emergent, and submergent wetland habitats in strategic locations throughout the study area. The establishment of native woody, herbaceous, emergent and submergent wetland species would provide significant benefit to the movement of Neotropical migratory birds, waterfowl, and waterbirds throughout the study area and would play a role in providing adequate food, water, and shelter to replenish the energy and strength of migrators. The Recommended Plan will promote connectivity through the establishment of these habitats, effectively creating wetland corridors throughout the study area to improve the foraging and cover conditions for wildlife.

e) Limiting Habitat – As shown by the Institutional Recognition section, wetland habitat restoration has been heavily supported by Federal entities over the last 30 years.

   The USFWS estimates that up to 43% of North America’s threatened or endangered species depend on wetlands for survival. Although the Mitchell Lake study area does not have sustainable critical core habitat for federally threatened or endangered species, the implementation of the project will improve the resources required for Neotropical migratory bird stopover habitat. Implementation of this project would also increase the areal extent of wetlands, promoting biodiversity and high habitat quality for a variety of wildlife species. This project’s opportunity to increase the areal extent of wetland habitat will have a significant impact on wildlife species across the country. The San Antonio, TX area will continue to grow and will impact rare habitat types throughout Bexar County. The need for protection and restoration of the Mitchell Lake study area is very prevalent and significant due to scarcity of wetlands, impacts to Neotropical migratory birds, and increasing urban development.

f) Biodiversity – Many species utilize aquatic wetland habitat including primary producers, decomposers, insects, invertebrates, fishes, amphibians, reptiles, birds, and mammals.

Although a wetland would normally provide habitat for fish species, the degradation of Mitchell Lake has caused increased dissolved oxygen levels that do not support fish within its waters. The species that may inhabit the area can utilize the Mitchell Lake study area seasonally or year-round for foraging areas, refugia habitats from predators and competitors, thermal refuge, and travel corridors. The Recommended Plan measures include native wetland and riparian species plantings and invasive species management. Improving biodiversity will occur through the removal of monocultures created by invasive species and also through the diversity of herbaceous, aquatic, shrub, and tree species. A plethora of vegetative species will result in increased diversity of insects, thereby increasing the diversity of birds and wildlife utilizing the area because of increased foraging and nesting opportunities.

3 Modeling

For the purpose of this report, plans mentioned and described will only include those that were used during the Cost Effectiveness and Incremental Cost Analysis (CE/ICA). During the plan formulation process, other measures, areas, and alternatives were considered and later screened out before the analysis, due to lack of constructability and feasibility to the project. The areas screened out of plan formulation are listed below:

- Area 4: Edward's Tank – This area is hydrologically disconnected from the remaining restoration areas, thereby limiting any synergistic benefits resulting from its restoration
- Area 5: Linear Wetlands – This area provides a relatively native and diverse vegetative community. Because of the quality and function of the linear wetlands, it was not carried forward for Plan formulation.
- Area 8: Islands – This area was screened out due to lack of Non-Federal Sponsor support and feasibility.

Seven areas will be discussed that are pertinent to the Feasibility Study and will be described in this appendix:

- Area 1: Bird Pond,
- Area 2: Central Wetlands,
- Area 3: Skip's Pond,
- Area 6: Polders,
- Area 7: Fringe Wetlands,
- Area 9: Dam Forested Wetlands, and
- Area 10: Downstream Wetlands.

Appendix B – CE/ICA will discuss in further detail, the Recommended Plan and the comparison of the plan's benefits and costs. Chapter 3 of Appendix C – Environmental Resources is limited to the discussion of the habitat benefits of each alternative.

3.1 Conceptual Model

A conceptual ecological model (CEM) is a qualitative representation of a system or sub-system that serves as a basis for organization of processes that can be utilized to understand and communicate the function of that process and the identification of factors impairing the optimal performance of the systems. These models, as applied to ecosystems are simple, qualitative models, represented by a diagram which describes general functional relationships among the essential components of an ecosystem.

A resource agency kick-off meeting was held on 7 November 2018 with the USACE, TPWD, USFWS, and the Texas Commission on Environmental Quality (TCEQ) to develop a CEM for the study to depict the condition of the existing environment described in Chapter 3 and identify factors that have resulted in the degradation of the Mitchell Lake habitats. The resulting CEM is presented in Figure 3-1.

The CEM provides a framework enabling the team to characterize the drivers and effects of impediments to ecosystem functions, potential measures to address these impediments, and methodologies to characterize and quantify ecosystem benefits resulting from any restoration actions. The CEM format utilized here follows a top-down hierarchy of information. The Mitchell Lake CEM does not attempt to explain all possible relationships or include all possible factors influencing the performance measure targets within natural systems in the study area. Rather, the model attempts to simplify ecosystem function by containing only information deemed most relevant to ecosystem restoration and monitoring goals.

The CEM includes the following components:

- **Drivers:** This component includes major external driving forces that have large-scale influences on natural systems. Drivers may be natural (e.g. climate change) or anthropogenic (e.g. hydrologic alteration) in nature. Anthropogenic drivers provide opportunities for finding relevant solutions to problems. Natural drivers, however, cannot be influenced directly by human interference. Some drivers are both anthropogenic and natural in nature. The Mitchell Lake CEM introduces six drivers: Urban Development, Adjacent Agriculture and Land Use, the Mitchell Lake Dam, Wastewater Operations, Wildlife and Ecological Function, and Climate Change.
- **Ecological Stressors:** This component includes physical or chemical changes that occur within the natural systems, which are produced or affected by drivers and are directly responsible for significant changes in biological components, patterns, and relationships in natural systems.
- **Ecological Effects:** This component includes biological, physical, or chemical responses within the natural system that are produced or affected by stressors. CEMs propose linkages between one or more ecological stressors and ecological effects and attributes to explain changes that have occurred in ecosystems.
- **Attributes:** This component is a prudent subset of all potential elements or components of natural systems representative of overall ecological conditions. Attributes may include populations, species, communities, or chemical processes.
- **Performance Measures**: This component includes specific features of each attribute to be monitored to determine the degree to which attribute is responding to projects designed to correct adverse effects of stressors (i.e. to determine success of the project).

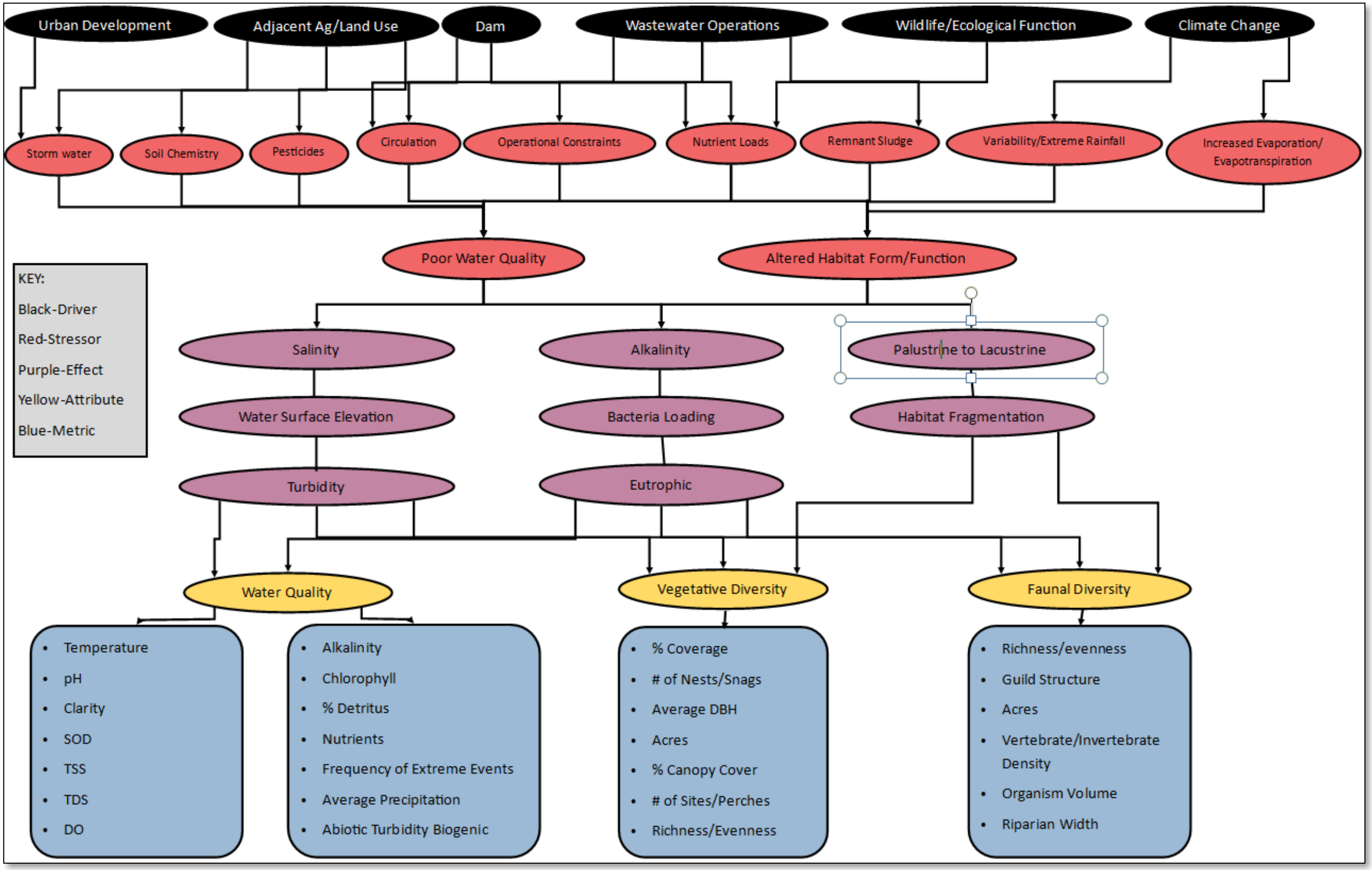

Figure 3-1. Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study Conceptual Ecological Model

3.2 Habitat Classification

3.2.1 Model Selection

Resource agencies and the USACE Ecosystem Restoration Planning Center of Expertise (ECO-PCX) assisted in the selection of ECO-PCX certified species' Habitat Suitability Index (HSI) models that would best represent the Mitchell Lake study area habitats. These models were used to evaluate existing conditions and habitat response to proposed restoration measures. The models were chosen based on geographic and cover type appropriateness. The selection of the habitat models was coordinated and approved by the ECO-PCX.

The TPWD Ecological Mapping System was utilized and refined using the ArcGIS mapping tool (Figure 3-2). A large array of habitat types were identified, but were refined into seven categories before conducting field work. These habitat types include: Upland Forest, Shrubland, Grassland, Emergent Wetland, Riparian Forest, Aquatic, and Riverine habitat.

Models initially included during plan formulation and the habitat assessment include:

- Emergent and Submergent Wetland – Marsh Wren and Bullfrog HSI
- Riparian Forest – Barred Owl, Fox Squirrel, Gray Squirrel, Shelterbelt HSI, and Avian Index of Biological Integrity (IBI)
- Grassland – Meadowlark and Cottontail HSI
- Shrubland – Cottontail and Brown Thrasher HSI
- Riverine – Qualitative Habitat Evaluation Index (QHEI)

The Shorebird Migration Model, described in further detail in Section 3.2.2, was added after the field habitat assessment was complete. This model was utilized to calculate the HSI values for the mudflat habitat located within the polders.

After an initial review of the models, it was determined by the team that all were not necessary (Fox Squirrel HSI, Shelterbelt HSI, Avian IBI, Meadowlark HSI, Cottontail HSI, Brown Thrasher HSI, and QHEI) for analysis of existing conditions, FWOP, and Future With Project (FWP) conditions based on current and future habitat conditions. The team looked for opportunities for riverine and riparian habitat restoration downstream of the dam, within the boundaries of Cottonmouth Creek, but the quality of habitat was better than expected. The data was collected, but not utilized because restoration of the areas would provide little to no benefit. The final models utilized for analysis are shown in Table 3-1.

Table 3-1. Final Array of Models Utilized for Feasibility Study

Model	Cover Type
Barred Owl HSI	Riparian Forest
Gray Squirrel HSI	Riparian Forest
Marsh Wren HSI	Emergent and Submergent Wetland
Bullfrog HSI	Emergent and Submergent Wetland
Shorebird Migration Model	Mudflat

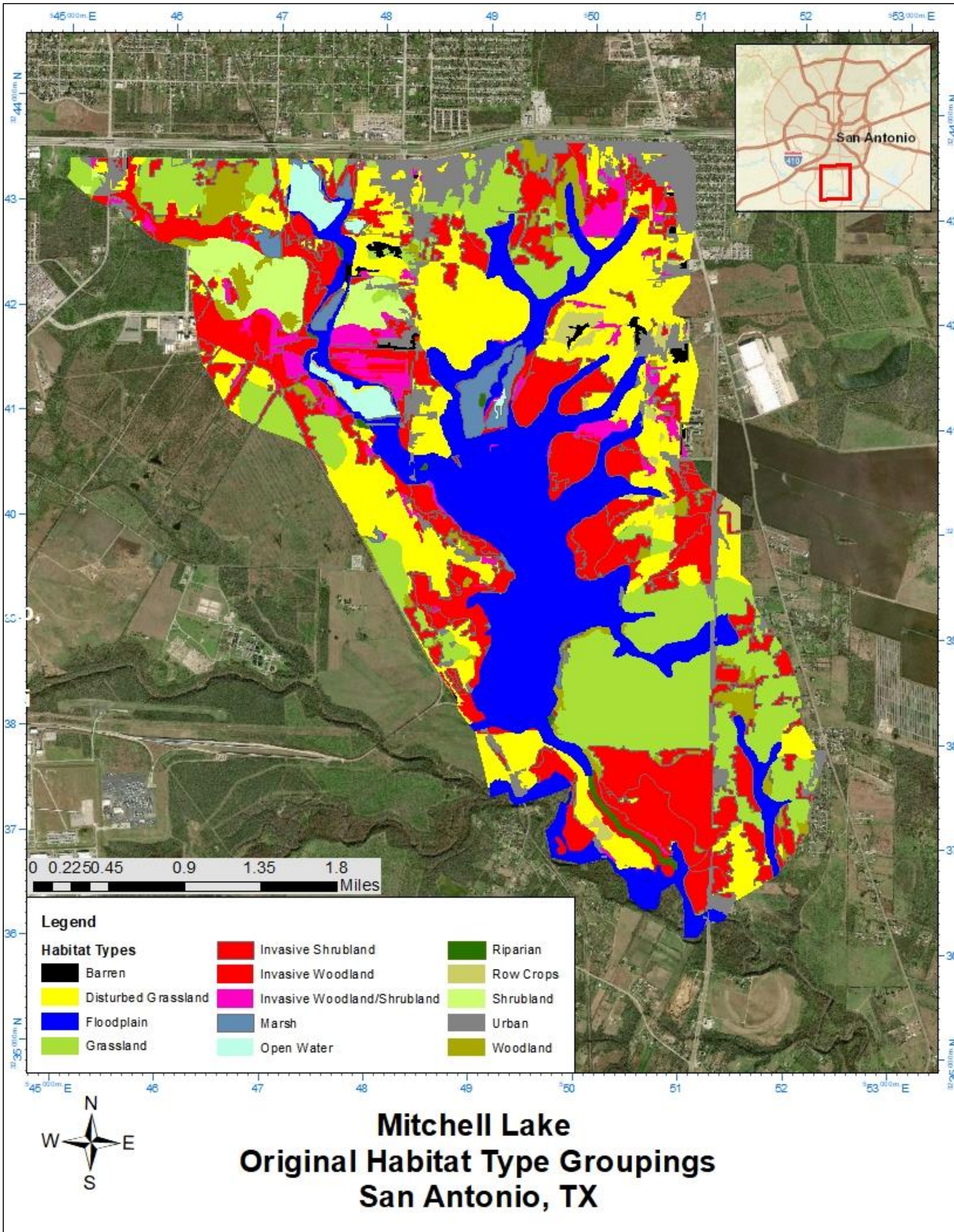

Figure 3-2. Habitat Type Groupings (TPWD 2019b)

3.2.2 Shorebird Migration Model

The Shorebird Migration Model was initially developed in 2002 (USACE 2018). The framework and associated environmental relationships were developed using peer-reviewed and published information from the literature for shorebird habitat in the North American Northern Plains/Prairie Pothole Region. The model was developed to cover all shorebirds found in the region because shorebird community management, rather than single species management, is the primary goal. Both migration seasons are included in the model because both are important for shorebird populations.

The model format combines procedures from Missouri's Wildlife Habitat Appraisal Guide and the USFWS' standards for developing HSI models. The model framework includes the spring and fall migration season and variables and suitability index relationships to represent the three functional habitat groups of migration habitat – food, security, and predictability. The model outcome is an HSI with a value from 0.0 to 1.0 (1.0 representing optimal habitat).

The Shorebird Migration Model and methodology (Table 3-2) are consistent with USACE policies and accepted procedures for ecosystem restoration planning. The model does not incorporate, facilitate, or encourage the use of non-ecosystem parameters or values. The model uses established principles of plans evaluation to produce outputs consistent with identification of the National Ecosystem Restoration plan.

Table 3-2. Shorebird Migration Model

Species	Life Requisite Suitability Indices (LRSI)		HSI Formula
Shorebird Migration Model	Food, Security, Predictability		
	Spring Life Requisite Variables		
	$S1_a$	Water Depths	
	$S1_b$	Availability	
	S_2	Aquatic Invertebrates (in accessible habitat)	
	S_3	Vegetative Cover	
	S_4	Disturbance	
	S_5	Hydrologic Conditions	
	S_6	Management Capabilities	
	Fall Life Requisite Variables		
	$F1_a$	Water Depths and Availability	
	$F1_b$	Timing for Water Depths and Availability	
	F_2	Aquatic Invertebrates (in accessible habitat)	
	F_3	Vegetative Cover	
	F_4	Disturbance	
	F_5	Hydrologic Conditions	
	F_6	Management Capabilities	

3.2.3 Habitat Evaluation Procedure

A baseline assessment using the Habitat Evaluation Procedure (HEP) was required before any habitat impacts to the study area could be identified. HEP involves defining the study area, delineating habitats (i.e. cover types) within the study area, selecting HSI models and/or evaluation species, and characterizing the study area based on the results of the HEP.

HEP was developed by the USFWS in order to quantify the impacts of habitat changes resulting from land or water development projects (USFWS 1980). HEP is based on suitability models that provide a quantitative description of the habitat requirements for a species or group of species. HSI models use measurements of appropriate variables to rate the habitat on a scale from 0.0 (unsuitable) to 1.0 (optimal).

Habitat quality is estimated using the habitat models selected to represent each specific habitat type(s). Each model consists of a list of variables or Suitability Indices (SIs) that are essential to satisfy the life requisites (e.g. reproduction, food, cover, etc.) of a particular species. Each SI can be expressed as a mathematical function with each habitat metric as an independent variable. Each SI ranges from 0.1 to 1.0, with 1.0 representing optimal condition for the variable in question. The SIs for each specific life requisite are then calculated using a mathematical formula to estimate the Life Requisite Suitability Index (LRSI) for each life requisite. The final Habitat Suitability Index (HSI) of the habitat type can then be calculated as a function of the LRSIs. The life requisites for each species are described in Table 3-3 through

Table 3-6.

Table 3-3. Life Requisite Suitability Indices for Barred Owl

Species	**Life Requisite Suitability Indices (LRSI)**		**HSI Formula**
Barred Owl	Reproduction		Equal to the reproduction suitability index $HSI = SIR = \sqrt[2]{SIV_1 \text{x} SIV_2} \text{x} SIV_3$
	Life Requisite Suitability Index Formulas & Variables		
	SIV$_1$	The relationship between the number of trees ≥51 cm DBH/0.4 ha and reproductive habitat quality for barred owls.	
	SIV$_2$	The relationship between mean DBH of overstory trees and reproductive habitat quality for barred owls	
	SIV$_3$	The relationship between percent canopy cover of over-story trees and reproductive habitat quality for barred owls.	
	Suitability Index (SI)		
	Reproduction Suitability Index (SIR)		
	Diameter at Breast Height (dbh)		

Table 3-4. Life Requisite Suitability Indices for Gray Squirrel

Species	**Life Requisite Suitability Indices (LRSI)**	**HSI Formula**
Gray Squirrel	Winter Food	$SIWF = \sqrt{SI_1 \times SI_2} \times SI_3$
	Cover/Reproduction	$SICR = \sqrt{SI_4 \times SI_5}$
Species		$HSI = \min\{SIWF, SICR\}$
	Life Requisite Suitability Index Formulas & Variables	
	SI_1	Proportion of the total tree canopy cover that is hard mast producing trees ≥25 cm dbh
	SI_2	Number of hard mast tree species
	SI_3, SI_4	Percent canopy cover of trees
	SI_5	Mean dbh of overstory trees

Table 3-5. Life Requisite Suitability Indices for Marsh Wren

Species	**Life Requisite Suitability Indices (LRSI)**	**HSI Formula**
Marsh Wren	Cover and Reproduction	$HSI = \sqrt[3]{SIV_1 \text{x} SIV_2 \text{x} SIV_3} \text{x} SIV_4$
	Life Requisite Suitability Index Formulas & Variables	
	SIV_1	Growth form of emergent hydrophytes
	SIV_2	Percent canopy cover of emergent herbaceous vegetation
	SIV_3	Mean water depth
	SIV_4	Percent canopy cover of woody vegetation

Table 3-6. Life Requisite Suitability Indices for Bull Frog

Species	**Life Requisite Suitability Indices (LRSI)**	**HSI Formula**
Bullfrog	Food, Winter Cover, Reproduction, and Interspersion	$HSI = \sqrt[3]{SIF x SIWC x SIR} x SII$
	Life Requisite Suitability Index Formulas & Variables	
	SIV_1	Mean distance from shore to water >1.5 m deep
	SIV_2	Percent canopy cover of aquatic vegetation in the littoral zone
	SIV_3	Percent shoreline cover
	SIV_4	Mean water transparency
	SIV_5	Maximum water depth greater than maximum ice depth
	SIV_6	Percent silt in substrate
	SIV_7	Mean current velocity at mid-depth during summer (cm/s)
	SIV_8	pH
	SIV_9	Mean water temperature at mid-depth during summer (ºC)
	SIV_{10}	Frequency of water level fluctuations >2 m
	SIV_{11}	Distance to permanent water (m)
	Value for the food component (SIF)	
	Suitability index for winter cover (SIWC)	
	Interspersion component value (SII)	

3.2.3.1 Habitat Units and Annualization of Habitat Quality

USACE quantifies the existing, FWOP, and FWP Ecosystem Restoration (ER) benefits using a Habitat Unit (HU) metric. HUs are calculated as the product of the HSI and the number of acres of the habitat of interest. HUs for each FWOP and FWP are then annualized over the 50-year period of analysis utilizing Equation 1 below.

Equation 1: Annualization of Habitat Units for the FWOP and FWP Conditions

$$\int_0^T HU\,dt = (T_2 - T_1)\left[\left(\frac{A_1H_1 + A_2H_2}{3}\right) + \left(\frac{A_2H_1 + A_1H_2}{6}\right)\right]$$

Where:

$$\int_0^T HU\,dt = Cumulative\ HUs$$

T1= first target year of time interval

T2 = last target year of time interval

A1 = area of available habitat at beginning of time interval

A2= area of available habitat as the end of time interval

H1 = HSI at the beginning of time interval

H2 = HSI at the end of time interval

3 and 6 = constants derived from integration of HSI x Area for the interval between any two target years

This formula was developed to estimate cumulative HUs when either the HSI/RBI and/or area between two time intervals (T_x to T_{x+1}). The sum of these time intervals over the period of analysis divided by the total number of years of that analysis (50 years for this study) provides an Average Annual Habitat Unit (AAHU). This annualization accounts for the temporal shifts in the log rhythmic rate of accumulating ecological benefits that is common when dealing with the unevenness found in nature (USFWS 1980).

As ecological systems are rarely static, The AAHUs for the FWOP may not be equal to the AAHUs of the existing condition. Therefore, the impact of a project is quantified by calculating the difference between the FWP scenarios and the FWOP. The difference in AAHUs between the FWOP and the FWP represents the net impact attributable to the project in terms of habitat quantity and quality.

Using the habitat models used to establish the existing habitat quality, an interagency team comprised of biologists from the USFWS, TPWD, and TCEQ projected what the future habitat conditions for the FWOP and FWP conditions by consensus based on best professional judgment.

Institute for Water Resources Planning Suite II

The Institute for Water Resources (IWR) Planning Suite II is a water resources investment decision support tool originally built for the formulation and evaluation of ecosystem restoration alternatives; however, it is now more widely used by all USACE business lines for evaluation of actions involving monetary and non-monetary cost and benefits.

The purpose of the IWR Planning Suite II is to assist with the formulation and comparison of plans for Ecosystem Restoration and Mitigation Plans. It has the capability of performing the Cost Effectiveness and Incremental Cost Analysis (CE/ICA), which is further described in Appendix B. The IWR Planning Suite II has an annualization tool to calculate the AAHUs for the FWOP and each FWP plan.

The IWR Planning Suite II Annualizer Tool was utilized to annualize the HUs of each area future without project condition and alternative future with project condition for the Mitchell Lake Aquatic ER Feasibility Study. This is the only USACE certified tool for annualizing NER outputs. In addition to the IWR Planning Suite II, ECO-PCX annualization spreadsheets were utilized to verify the average annual benefit outputs for each plan as well. All annualization calculations for AAHUs were confirmed using two separate methods.

3.2.4 Target Years

Target Year (TY) 0 habitat conditions are represented by the existing, or baseline, habitat conditions. The field and desktop collected data were used to quantify the habitat quality of that baseline condition. TY 0 conditions serve as a basis of comparison for both Future Without-Project (FWOP) and Future-With Project (FWP) scenarios.

Additional TYs were identified based on when implemented measures would be expected to elicit community responses represented by changes in the projected habitat variables.

TY 1 is used as a standard comparison year to identify and capture changes in habitat conditions that occur within one year after measures have been constructed. Amount of wetted area, reduction in invasive species, and water regimes are likely variables that may improve within this time period.

TY 5 was selected to capture the increase in habitat quality associated the restoration measures that provide ecological benefits relatively quickly such as natural plant establishment, aquatic vegetative abundance, and plant diversity.

TY 10 is used as a point after the initial growth of vegetation and the likely increase in size and benefits plantings have sustained.

Similarly, TY 25 was selected to capture the growth of aquatic and riparian habitats. Riparian plant abundance and diversity are also key response variables for this target year.

TY 50 is the planning life span of the project and is used as the last projected TY for the study. Restoration measures should produce mature habitat by this target year and represent the habitat types within the study area.

3.3 Data Collection

The habitat assessment for the Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study was conducted from 12 March to 14 March 2019 at the Mitchell Lake study area in San Antonio, TX. Although 48 sites were preselected before the field work was conducted, some points were added and/or removed from the assessment (Figure 3-3). Points added to the assessment were EM1, 22-Polder, EM2, EM3, EM4, and SH1. However, due to the large study area and time constraints on field visits, some of the points selected before field work were not applicable for this study. Points removed from further evaluation included 7, 9, 10, 17, 25-27, 30-35, and 47-48.

The points associated with the species and habitat models that were screened out of further use were not included in HSI model metric projections or annualization of Alternatives. Habitat assessment photos and the field data sheets used during the habitat assessment can be found in Attachments G and H, respectively.

A second field visit was conducted by USACE team members to determine the size and location of any existing wetlands within the study area. The existing wetlands were recorded by GPS and can be found in Figure 3-4.

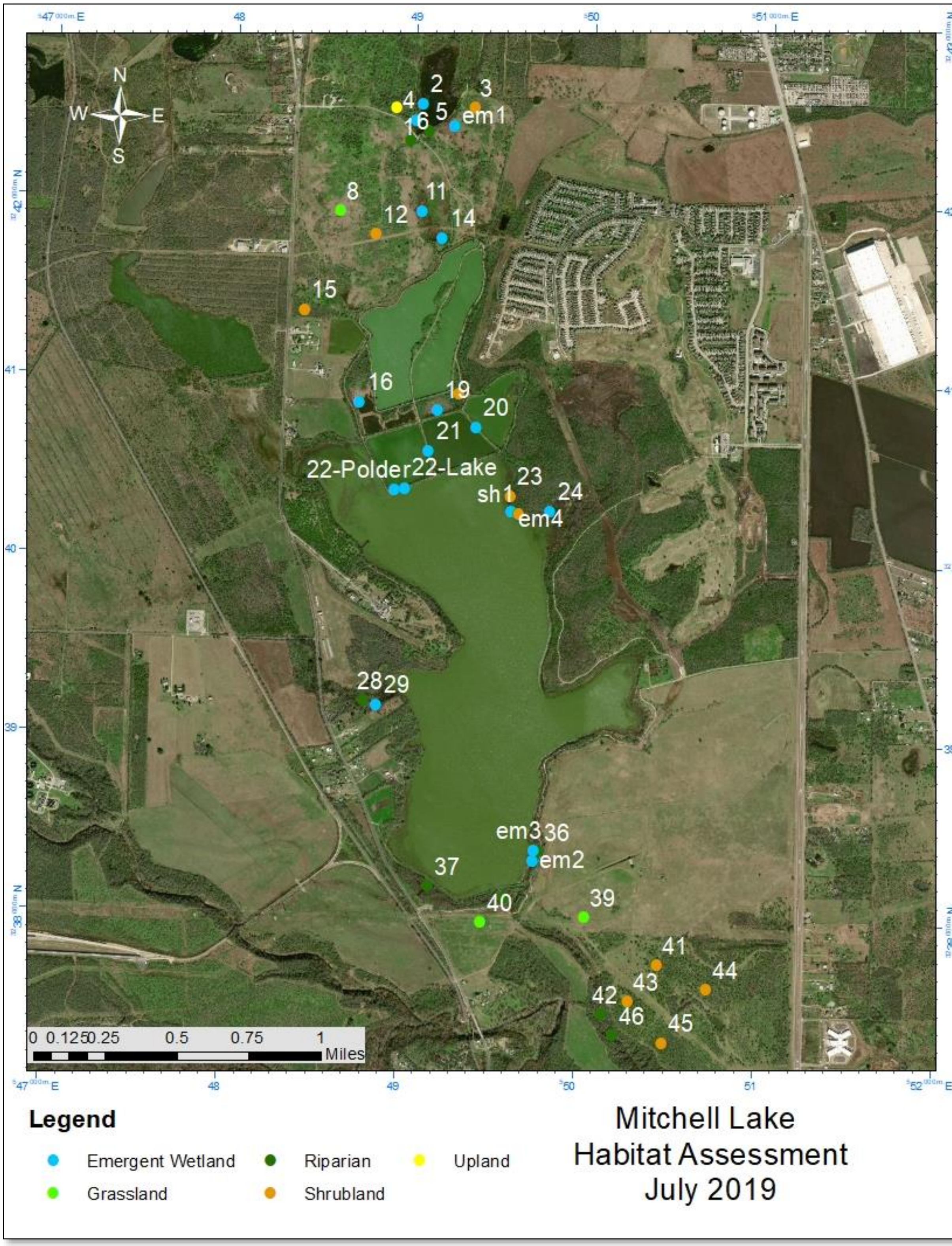

Figure 3-3. Habitat Assessment Survey Points

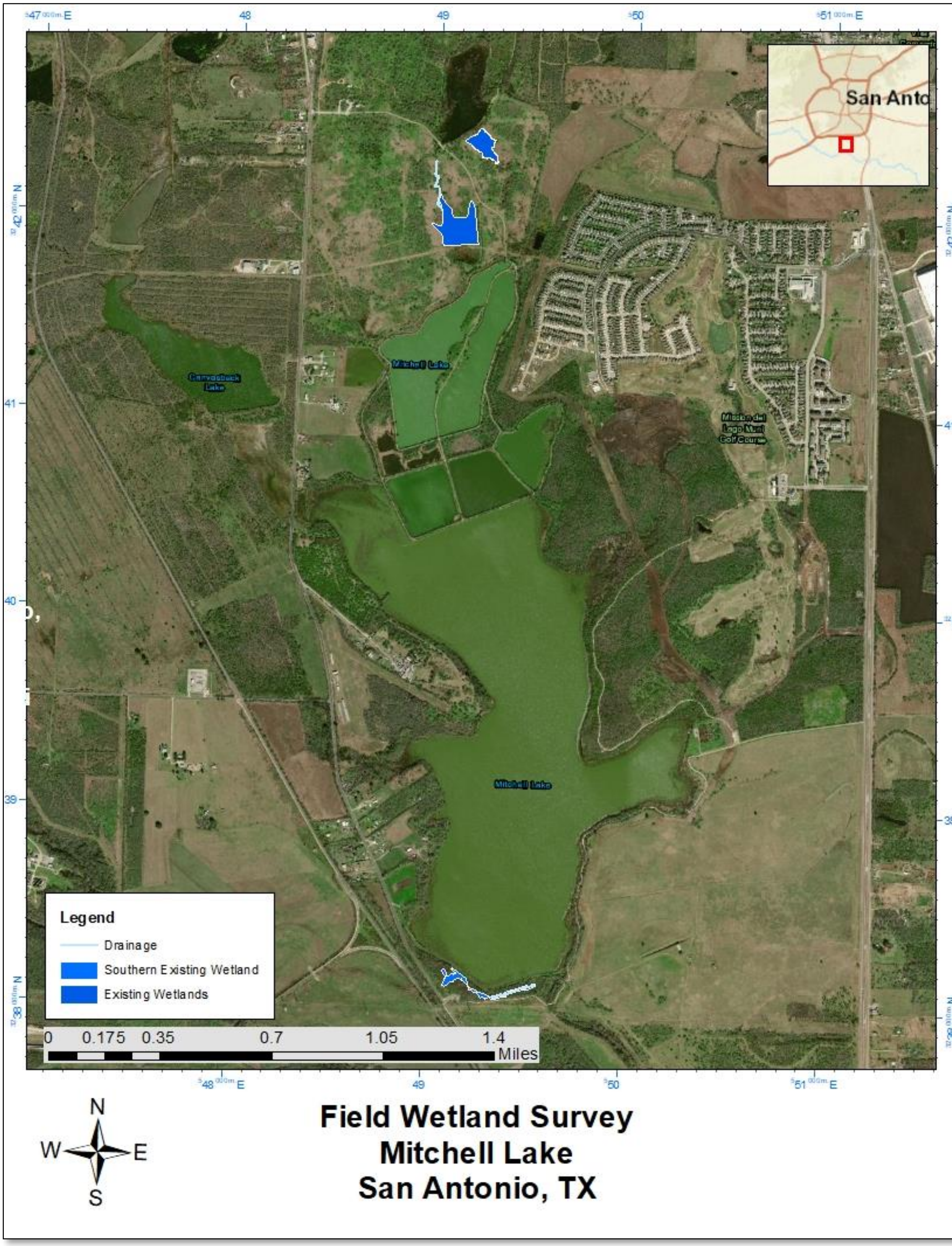

Figure 3-4. Existing Wetlands Surveyed in June 2019

3.4 Existing, Future Without and Future With Project Conditions

Under the FWOP condition there would be no ecosystem restoration within the Mitchell Lake study area, however, it is anticipated that normal activities by the public and natural ecological processes would continue to occur in the study area. Section 3.5 is a general description of the likely future conditions in the study area over the 50-year life in the future without project. The habitat types analyzed for the FWOP include: riparian forest, emergent wetland, and mudflat habitat. Life requisite values and metric variables will be mentioned throughout this section.

Section 3.6 will describe the likely future conditions in the study area over the 50-year life in the future with project. Because this is an ecosystem restoration project, the FWP is assumed to provide habitat benefits to all areas.

HSI model metric variables for the FWOP and FWP conditions were projected at a meeting on 22 and 23 June 2019. The projections for each of the HSI model metric variables were based on professional judgment and existing conditions. Representatives from the TCEQ, NRCS, USACE, SAWS, and the USFWS assisted with this process. Projections of FWOP and FWP of all areas can be found in Attachment I.

All project areas and alternatives, except the Polders utilize two HSI models to calculate the benefits of project implementation. The resulting HUs of the HSI models of each TY were averaged together for that Area. The averages of those HUs were input into the IWR Planning Suite II Annualizer tool. To clarify, HUs of the separate models were not added together, but simply averaged to avoid duplicating the benefits of project measures and implementation

3.5 Existing and Future Without Project Habitat Conditions

This section describes the existing conditions for various resources within the study area and the projected conditions of the study area without a project, over the next 50-year period. Habitat modeling efforts focused on the project areas using habitat quality to quantify a baseline of ecological structure and function for analysis to compare to the future with project conditions.

The FWOP includes dropping the Mitchell Lake elevation to 518.5 feet above msl. Due to this expected future condition, some of the metrics for the FWOP for the Marsh Wren HSI were impacted based on the physical parameters of the life requisite variables. It was assumed, based on this change that woody species were more likely to inhabit the newly open areas.

The project areas that were evaluated for the habitat analysis are shown in Figure 3-5. Project Areas Considered Within the Study AreaFigure 3-5.

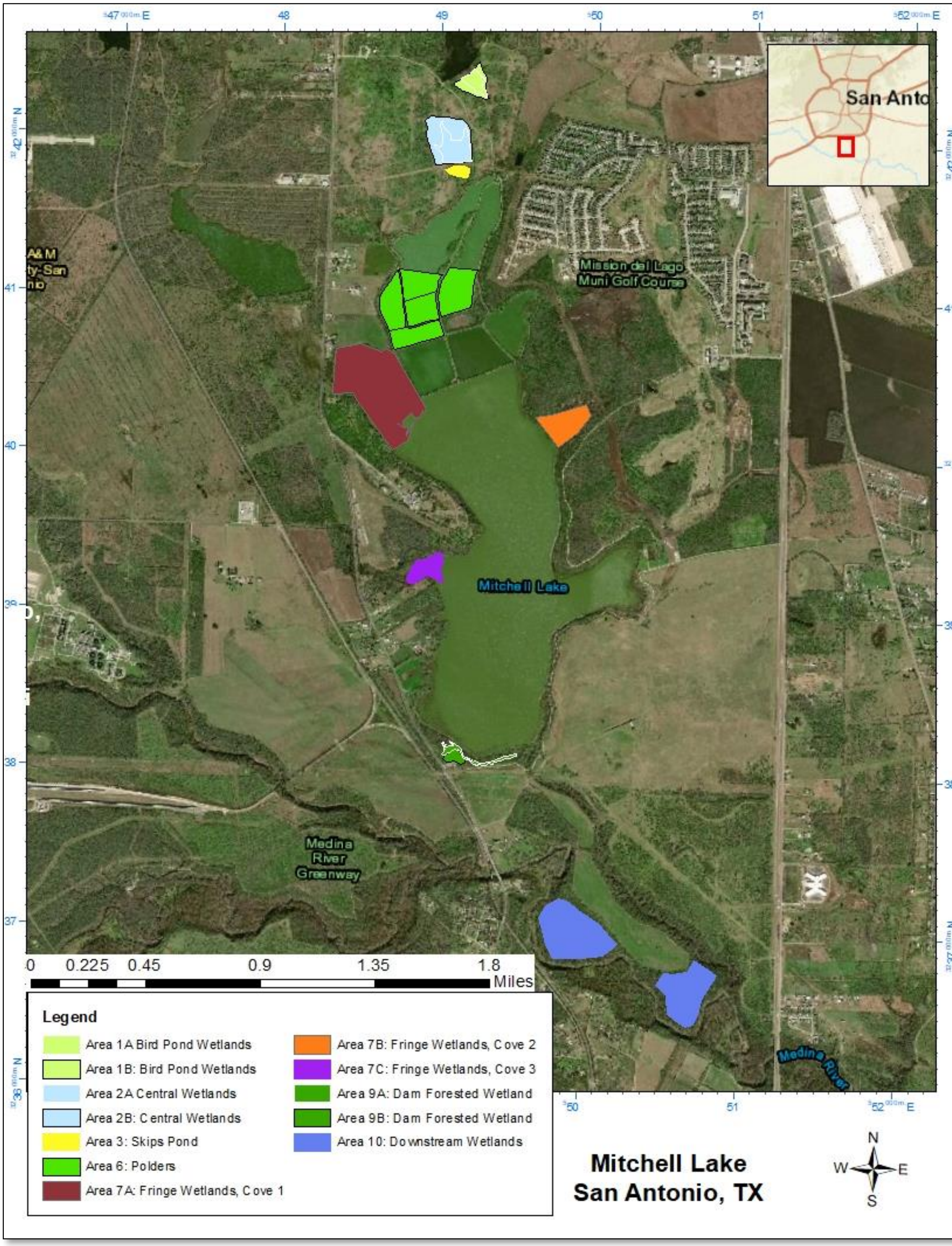

Figure 3-5. Project Areas Considered Within the Study Area

AREA 1: BIRD POND WETLANDS

Area 1: Bird Pond Wetlands (1A and 1B) is located at the northern extent of the study area adjacent to Bird Pond near the Mitchell Lake Audubon Center (Figure 3-6). The small existing wetland is located east of the levee/road on the downstream end of Bird Pond. The existing wetland (Area 1A) has limited habitat value due to the shallow surface water (<6 inches) and a monoculture of cattails. The lack of water surface level fluctuations has contributed to the dominance of cattails in this wetland.

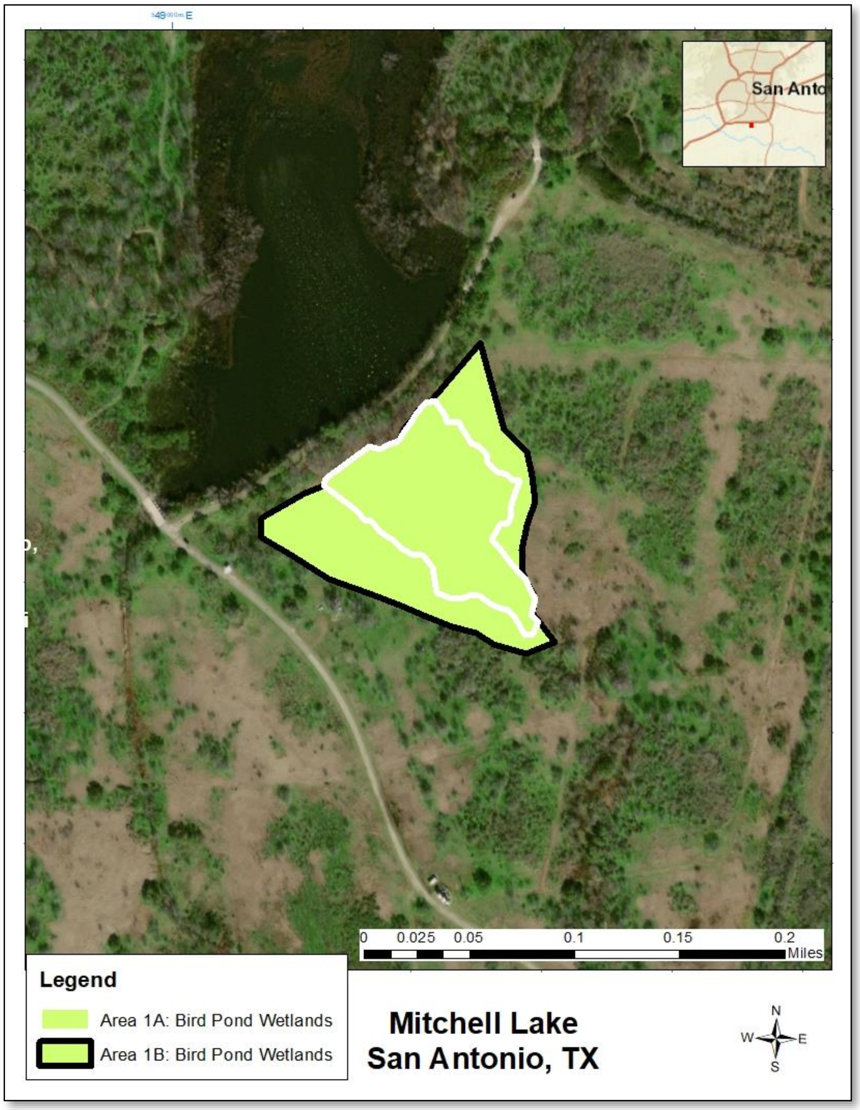

Figure 3-6. Bird Pond Wetlands Area 1A and 1B

Area 1A is approximately 3.17 acres. The Marsh Wren HSI scores for the existing wetland were equal to zero at all target years (Table 3-7). The main contributing factor was the life requisite variable related to growth form of emergent hydrophytes. Because this area lacked vegetative diversity during the habitat assessment the team lowered the value of that metric, resulting in a low HSI value for each TY. Lack of wetland species such as cordgrasses (*Spartina spp*.), and bulrushes (*Scirpus spp*.) contributed the low scoring for this wetland. This trend was assumed through all target years. The limiting factors for the baseline of the Bullfrog HSI model were percent shoreline cover and percent silt in substrate. Suitability for winter cover is a heavily weighted life requisite metric for the Bullfrog HSI. A low percent silt in substrate lowered the total HSI score.

The final AAHUs calculated for Marsh Wren and Bullfrog were then averaged together, resulting in a 0.86 AAHUS for the FWOP of Area 1A.

Area 1B includes 3.17 acres of the existing wetland (1A) and 3.25 acres of shrubland/upland habitat surrounding the existing wetlands. The areas were separated because the existing conditions are different from one another (shrubland/upland vs. emergent wetland habitat). Due to this difference, the models utilized for emergent wetlands will yield different results. The total acreage upon execution of the project would be 6.42 acres. The HSI scores for the Marsh Wren and Bullfrog HSI are equal to zero, because Area 1B does not contain any existing wet areas or wetland vegetation.

It should be noted that the Area 1B acreage in Table 3-7 does not reflect the actual acreage for Area 1B, but rather the acreage that was used to calculate the AAHUs of this area. To better reflect the site conditions, the new acreage of Area 1B was subtracted from the total acreage of Area 1A. The AAHUs of Area 1B were then added to the AAHUs of Area 1A to incorporate the difference without negatively or positively impacting the score (3.17 acres + 3.25 acres = 6.42 acres [Table 3-8]). The final AAHUs calculated for Marsh Wren HSI and Bullfrog HSI were then averaged together; resulting in 0.86 AAHUs in the FWOP for Area 1B (Table 3-8).

Table 3-7. Future Without Project Habitat Suitability Index and Habitat Units for Area 1A and 1B.

Model	TY												
		0		1		5		10		25		50	
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU
Marsh Wren HSI Area 1A	3.17	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Bullfrog HSI Area 1A		0.6	1.85	0.6	1.79	0.6	1.72	0.5	1.71	0.5	1.71	0.5	1.71
Marsh Wren HSI Area 1B	3.25	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Bullfrog HSI Area 1B		0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00

Table 3-8. Future Without Project Average Habitat Units and Average Annual Habitat Units for Areas 1A and 1B.

Model	TY							
		0	1	5	10	25	50	AAHU
	Final Acres	Average HU	Average HU	Average HU	Average HU	Average HU	Average HU	
Marsh Wren HSI Area 1A **Bullfrog HSI Area 1A**	3.17	0.92	0.89	0.86	0.86	0.86	0.86	0.86
Marsh Wren HSI Area 1B **Bullfrog HSI Area 1B**	6.42[1]	0.00	0.00	0.00	0.00	0.00	0.00	0.86[2]

[1]Because the final AAHU has to be combined, the acreage of 1A was added to the 1B expansion (3.17 acres + 3.25 acres = 6.42).

[2]Area 1B includes Area 1A; therefore, the AAHUs of Area 1A are added to the AAHUs of 1B.

AREA 2: CENTRAL WETLANDS

Area 2: Central Wetlands is directly south of Area 1: Bird Pond Wetlands. Area 2 consists of a complex of emergent wetlands connected to each other by swales with higher, interspersed upland areas (Figure 3-7). It is comprised of a shallow wetland with areas of deeper water (6-12 inches in depth) and dominated by cattail and willow baccharis.

The two wetland-complexes are connected to each other by a shallow nondescript drainage channel. This area consists of a complex of wetland connected to each other by wetland swales with higher, upland areas interspersed throughout the complexes. The Central Wetlands are part of the same wetland complex as Area 3: Skip's Pond (described below) but is separated from that area by a petroleum pipeline right-of-way between the two areas; therefore, the areas are treated separately.

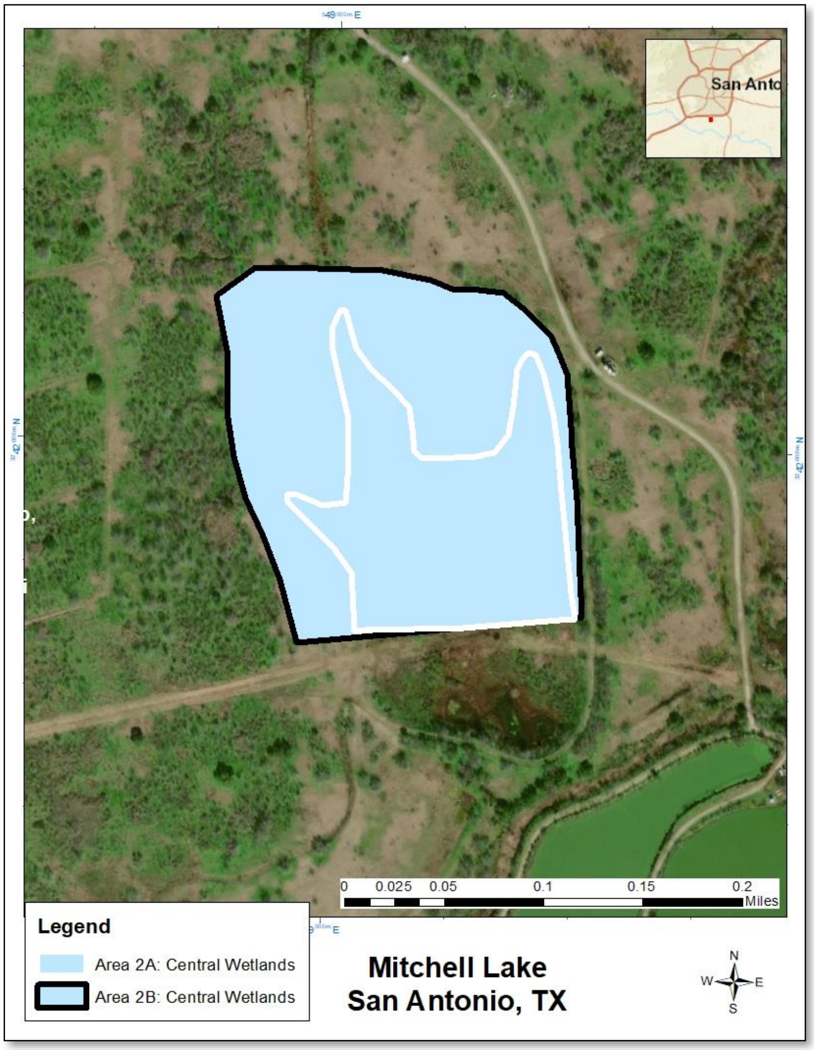

Figure 3-7. Central Wetlands Area 2A and 2B

The existing wetland is referred to as Area 2A. The current site conditions are low quality wetland habitat. The Marsh Wren HSI metric for growth form of emergent hydrophytes brought down the overall HSI score for the Marsh Wren HSI, while the Bullfrog HSI score was decreased by the percent silt in substrate metric (Table 3-9). The final AAHU score for the existing Central Wetland (1A) is 2.85 in the Future Without Project.

Area 2B incorporates the existing wetlands, 10.46 acres of Area 2A, and expands upon them, increasing the aerial extent of the proposed wetlands by 7.91 acres. The 7.91 acres of expansion in Area 2B are mostly shrubland/upland habitat with vegetation like palo verde, spiny hackberry, and bastard cabbage. Because there are already existing wetlands in this area, it is assumed a modification of elevation and contouring would allow for better wetland suitability, increasing the overall size of the wetlands in this area.

Similar to Area 1B, it should be noted that the acreage in the table below does not reflect the total acreage for the plan, but rather the acreage that was used to calculate the benefits of Area 2B.

The final AAHU score for Area 2B is 2.85 at TY 50 (Table 3-10).

Table 3-9. Future Without Project Habitat Suitability Index and Habitat Units for Area 2A and 2B.

Model	TY												
		0		1		5		10		25		50	
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU
Marsh Wren HSI Area 2A	10.46	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Bullfrog HSI Area 2A		0.6	6.12	0.6	5.92	0.6	5.70	0.5	5.68	0.5	5.68	0.5	5.68
Marsh Wren HSI Area 2B	7.91	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Bullfrog HSI Area 2B		0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00

Table 3-10. Future Without Project Average Habitat Units and Average Annual Habitat Units for Areas 2A and 2B.

Model	TY							
		0	1	5	10	25	50	AAHU
	Final Acres	Average HU	Average HU	Average HU	Average HU	Average HU	Average HU	
Marsh Wren HSI Area 2A / Bullfrog HSI Area 2A	10.46	3.06	2.96	2.85	2.84	2.84	2.84	2.85
Marsh Wren HSI Area 2B / Bullfrog HSI Area 2B	18.37[1]	0.00	0.00	0.00	0.00	0.00	0.00	2.85[2]

[1]Because the final AAHU has to be combined, the acreage of 2A was added to the 2B expansion (10.46 acres + 7.91 acres = 18.37).

[2]Area 2B includes Area 2A within its total acreage; therefore, the AAHUs of Area 2A are added to the AAHUs of 2B.

AREA 3: SKIP’S POND

Area 3: Skip’s Pond is a part of the same wetland complex as Area 2, but they are separated by a petroleum pipeline right-of-way (Figure 3-8). This area also supports different vegetation in comparison to Area 2. Therefore, the areas were annualized separately in regard to restoration efforts.

Skip’s Pond is comprised of deeper water emergent wetlands, up to 2 feet in depth. This area consists of vegetation such as buttercup, alligator weed, and bedstraw. The existing wetland does not hold high quality vegetation, which led to a negative impact on the Marsh Wren HSI score for overall suitability (Table 3-11). The existing wetland does not hold high quality vegetation. The Bullfrog HSI scores were relatively average, because of the percent in silt in substrate metric. The total AAHUs for this site were 0.59 (Table 3-12).

Figure 3-8. Skip's Pond

Table 3-11. Future Without Project Habitat Suitability Index and Habitat Units for Area 3.

Model	TY												
		0		1		5		10		25		50	
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU
Marsh Wren HSI	2.18	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Bullfrog HSI		0.6	1.27	0.6	1.23	0.6	1.19	0.5	1.18	0.5	1.18	0.5	1.18

Table 3-12. Future Without Project Average Habitat Units and Average Annual Habitat Units for Area 3.

Model	TY							
		0	1	5	10	25	50	AAHU
	Acres	Average HU	Average HU	Average HU	Average HU	Average HU	Average HU	
Marsh Wren HSI	2.18	0.64	0.62	0.59	0.59	0.59	0.59	0.59
Bullfrog HSI								

AREA 6: POLDERS

The polders are directly north of Mitchell Lake. Area 6 is separated into two polders and five basins (Figure 3-9). The upper polder complex currently consists of five decant basins designated one through five and two polders (East and West). The polders complex has two pumping stations at the southern end of Basins 5 and 4 to allow for water circulation flows. Three pumps at the southwest corner of Basin 5 allow water to be pumped from the Mitchell Lake to the Polders complex. The water is pumped into Basin 5 then flows into Basin 1, which then flows into the West Polder. From there water will circulate to the East Polder, then to Basin 3 and finally into Basin 4. There is a single pump at the pump station on the southeast corner of Basin 4 that allows for the water to be discharged back into Mitchell Lake.

Common species found along the levees of the polders and basins included: sugarberry, western ragweed, hedge parsley, bedstraw, spiny hackberry, and palo verde. The areas within the polders and basin had little to no vegetation or consisted of open water habitat. Vegetative diversity within this area is incredibly low and consists of low quality wildlife habitat.

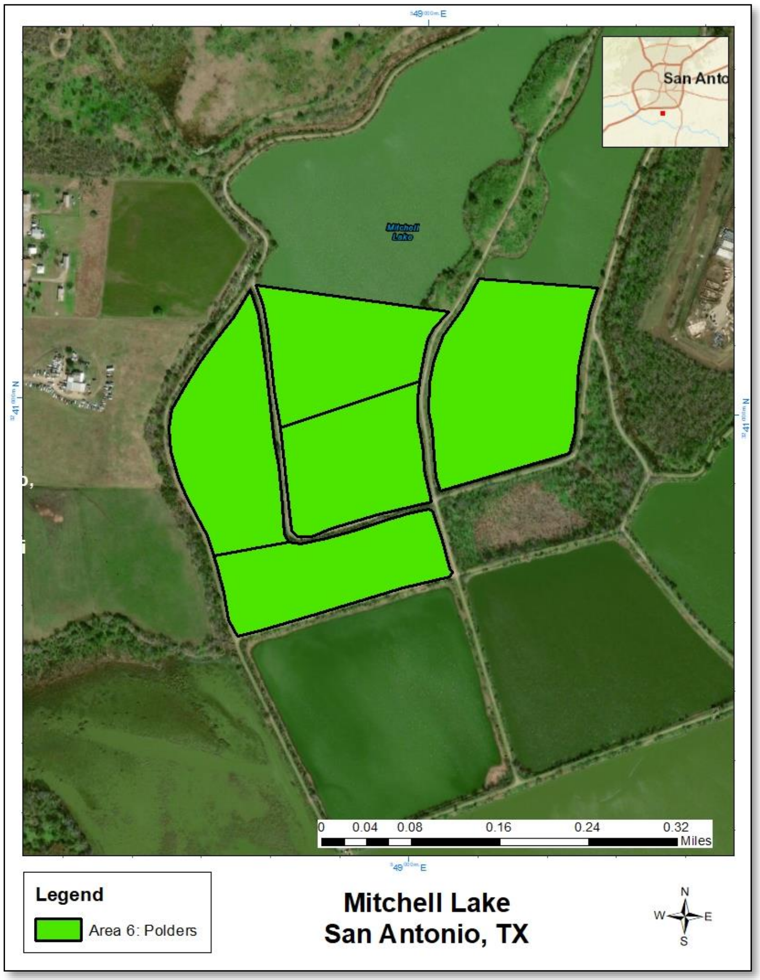

Figure 3-9. Polders

Suitability for migrating shorebirds is above average; however, limiting factors such as water depths and availability and timing for water depths and availability lowered the total HSI score (Table 3-13). The polders and basins are continually dry or have depths greater than 18 cm with little useable shoreline. The AAHUs for FWOP is 30.21 at TY 50.

Table 3-13. Future Without Project Habitat Suitability Index, Habitat Units, and Average Annual Habitat Units for Area 6.

Model	TY													
		0		1		5		10		25		50		AAHU
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	
Shorebird Migration	49.52	0.6	30.21	0.6	30.21	0.6	30.21	0.6	30.21	0.6	30.21	0.6	30.21	30.21

AREA 7: FRINGE WETLANDS

Area 7: Fringe Wetlands is characterized by its proximity to the border of the open water habitat of Mitchell Lake. Future management of Mitchell Lake will result in the adjustment of the water surface elevation to 518.5 feet msl. Lowering the water levels will effectively decrease the amount of emergent and submergent wetland vegetation and increase the percent canopy cover of woody vegetation over the 50-year planning period. Plant growth is negatively impacted by the varying dissolved oxygen and pH levels within Mitchell Lake.

The Fringe Wetlands are separated into coves, which can all be implemented as stand-alone areas or included in combination with each other (Figure 3-10). Cove 1 is approximately 53.68 acres on the northwest portion of Mitchell Lake. Cove 2 is approximately 11.84 acres on the northeast portion of Mitchell Lake. Cove 3 is on the southwest section of Mitchell Lake, within close proximity of the dam and is approximately 6.84 acres.

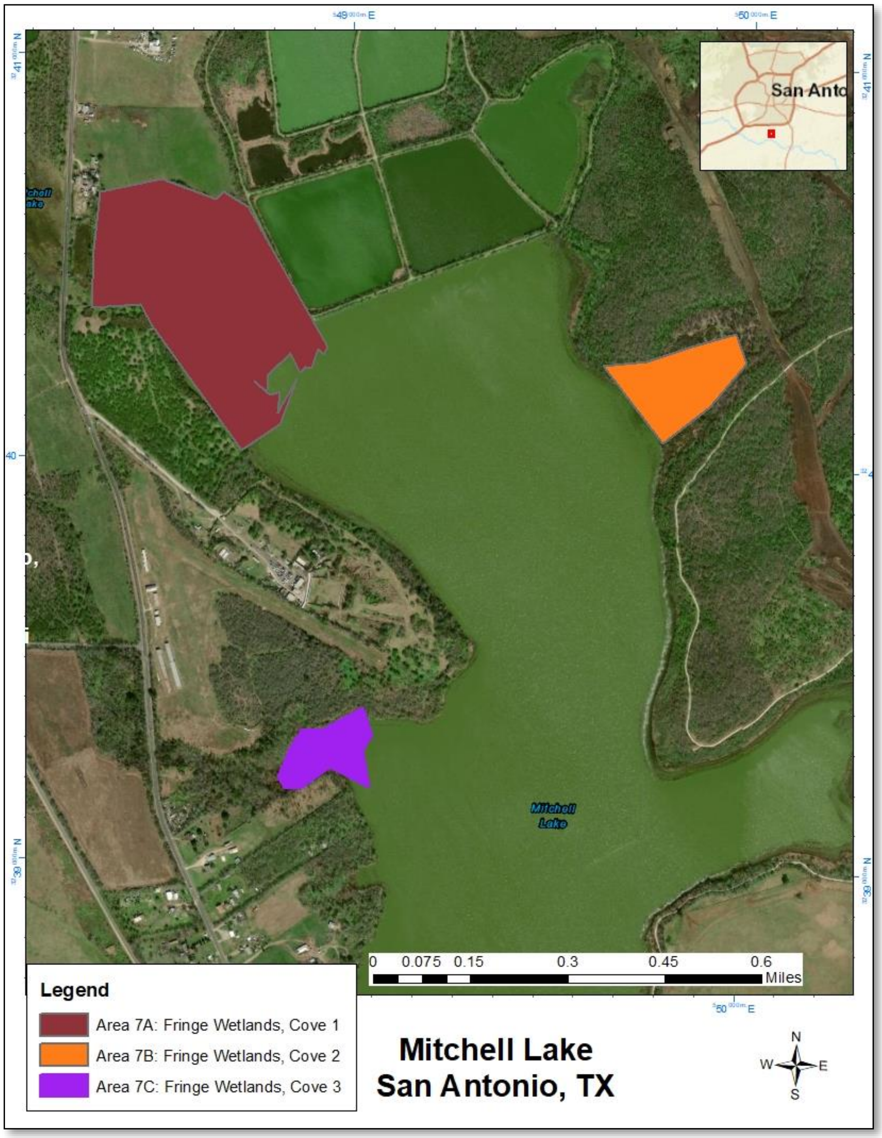

Figure 3-10. Fringe Wetlands Coves 1, 2, and 3

The borders of the lake have very limited plant diversity, lack of diversity impacts the overall Marsh Wren HSI score (Table 3-14). Other limiting factors for all of the coves include percent cover of emergent herbaceous vegetation and mean water depth.

The limiting life requisite variables for the Bullfrog HSI model were percent shoreline cover and percent silt in substrate. Percent silt in substrate affected the suitability of the area for winter cover.

There are no assumed differences between each of the coves regarding suitability, but the difference in AAHUs for each cove can be accounted for by their total acreages. Cove 1 FWOP AAHU is 13.43, Cove 2 is 2.96, and Cove 3 is 1.71 (

Table 3-15).

Table 3-14. Future Without Project Habitat Suitability Index and Habitat Units for Area 7 (Coves 1, 2, and 3).

Model	TY												
		0		1		5		10		25		50	
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU
Marsh Wren HSI Cove 1	53.68	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Bullfrog HSI Cove 1		0.5	28.12	0.5	25.34	0.5	25.34	0.5	26.16	0.5	26.93	0.5	28.12
Marsh Wren HSI Cove 2	11.84	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Bullfrog HSI Cove 2		0.5	6.20	0.5	5.59	0.5	5.59	0.5	5.77	0.5	5.94	0.5	6.20
Marsh Wren HSI Cove 3	6.84	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Bullfrog HSI Cove 3		0.5	3.58	0.5	3.23	0.5	3.23	0.5	3.33	0.5	3.43	0.5	3.58

Table 3-15. Future Without Project Average Habitat Units and Average Annual Habitat Units for Area 7 (Coves 1, 2, and 3).

Model	TY							
		0	1	5	10	25	50	AAHU
	Acres	Average HU	Average HU	Average HU	Average HU	Average HU	Average HU	
Marsh Wren HSI Cove 1 Bullfrog HSI Cove 1	53.68	14.06	12.67	12.67	13.08	13.46	14.06	13.43
Marsh Wren HSI Cove 2 Bullfrog HSI Cove 2	11.84	3.10	2.79	2.79	2.89	2.97	3.10	2.96
Marsh Wren HSI Cove 3 Bullfrog HSI Cove 3	6.84	1.79	1.61	1.61	1.67	1.72	1.79	1.71

AREA 9A and 9B: DAM FORESTED WETLANDS

The Dam Forested Wetlands are maintained by seepage through the dam and are dominated by hackberry woodlands (Figure 3-11). An existing drainage channel resulting from dam seepage has created low lying wet areas in relative depths, which has resulted in a linear series of in-channel emergent and forested wetlands with several ponded areas along the upstream section of the drainage.

Figure 3-11. Dam Forested Wetlands Areas 9A and 9B

Area 9A is characterized by the existing low areas below the dam that most closely represent a southern bottomland hardwood system. Area 9B includes the existing forested wetlands (9A), but also incorporates 1.93 acres of additional woodland surrounding 9A. Area 9B accounts for the increase of the areal extent of forested wetlands below the Mitchell Lake Dam. The limiting factors for Barred Owl HSI in this area include the number of trees greater than 20 inches per acre and the mean DBH of overstory trees until TY 10 (Table 3-16). Area 9A FWOP AAHUs is 0.71 and 9B is 1.25 (Table 3-17).

Table 3-16. Future Without Project Habitat Suitability Index and Habitat Units for Area 9.

Model	TY												
		0		1		5		10		25		50	
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU
Barred Owl HSI Area 9A	2.55	0.2	0.55	0.2	0.55	0.3	0.64	0.3	0.84	0.5	1.19	0.7	1.76
Gray Squirrel HSI Area 9A		0.1	0.25	0.1	0.25	0.1	0.24	0.1	0.25	0.1	0.24	0.1	0.24
Barred Owl HSI Area 9B	4.48	0.2	0.97	0.2	0.97	0.3	1.12	0.3	1.48	0.5	2.09	0.7	3.09
Gray Squirrel HSI Area 9B		0.1	0.44	0.1	0.44	0.1	0.43	0.1	0.43	0.1	0.43	0.1	0.43

Table 3-17. Future Without Project Average Habitat Units and Average Annual Habitat Units for Areas 9A and 9B.

<table>
<tr><th rowspan="3">Model</th><th colspan="8">TY</th></tr>
<tr><th></th><th>0</th><th>1</th><th>5</th><th>10</th><th>25</th><th>50</th><th rowspan="2">AAHU</th></tr>
<tr><th>Acres</th><th>Average HU</th><th>Average HU</th><th>Average HU</th><th>Average HU</th><th>Average HU</th><th>Average HU</th></tr>
<tr><td>Barred Owl HSI
Area 9A</td><td rowspan="2">2.55</td><td rowspan="2">0.40</td><td rowspan="2">0.40</td><td rowspan="2">0.44</td><td rowspan="2">0.55</td><td rowspan="2">0.72</td><td rowspan="2">1.00</td><td rowspan="2">0.71</td></tr>
<tr><td>Gray Squirrel HSI
Area 9A</td></tr>
<tr><td>Barred Owl HSI
Area 9B</td><td rowspan="2">4.48</td><td rowspan="2">0.71</td><td rowspan="2">0.71</td><td rowspan="2">0.78</td><td rowspan="2">0.96</td><td rowspan="2">1.26</td><td rowspan="2">1.76</td><td rowspan="2">1.25</td></tr>
<tr><td>Gray Squirrel HSI
Area 9B</td></tr>
</table>

<u>AREA 10: DOWNSTREAM WETLANDS</u>

In order to determine the benefits for this plan, the Future Without Project conditions were projected with the current existing conditions, i.e. upland within the respective model metrics for emergent wetland habitat. The habitat within this area is assumed to be upland, due to the surrounding areas. See Figure 3-12 for the Downstream Wetlands approximate location. Due to its current status as upland habitat, it produced below average scores in the emergent wetland habitat models (Marsh Wren and Bullfrog HSI)(Table 3-18). The AAHU for Area 10: Downstream Wetlands is 0.00 (Table 3-19).

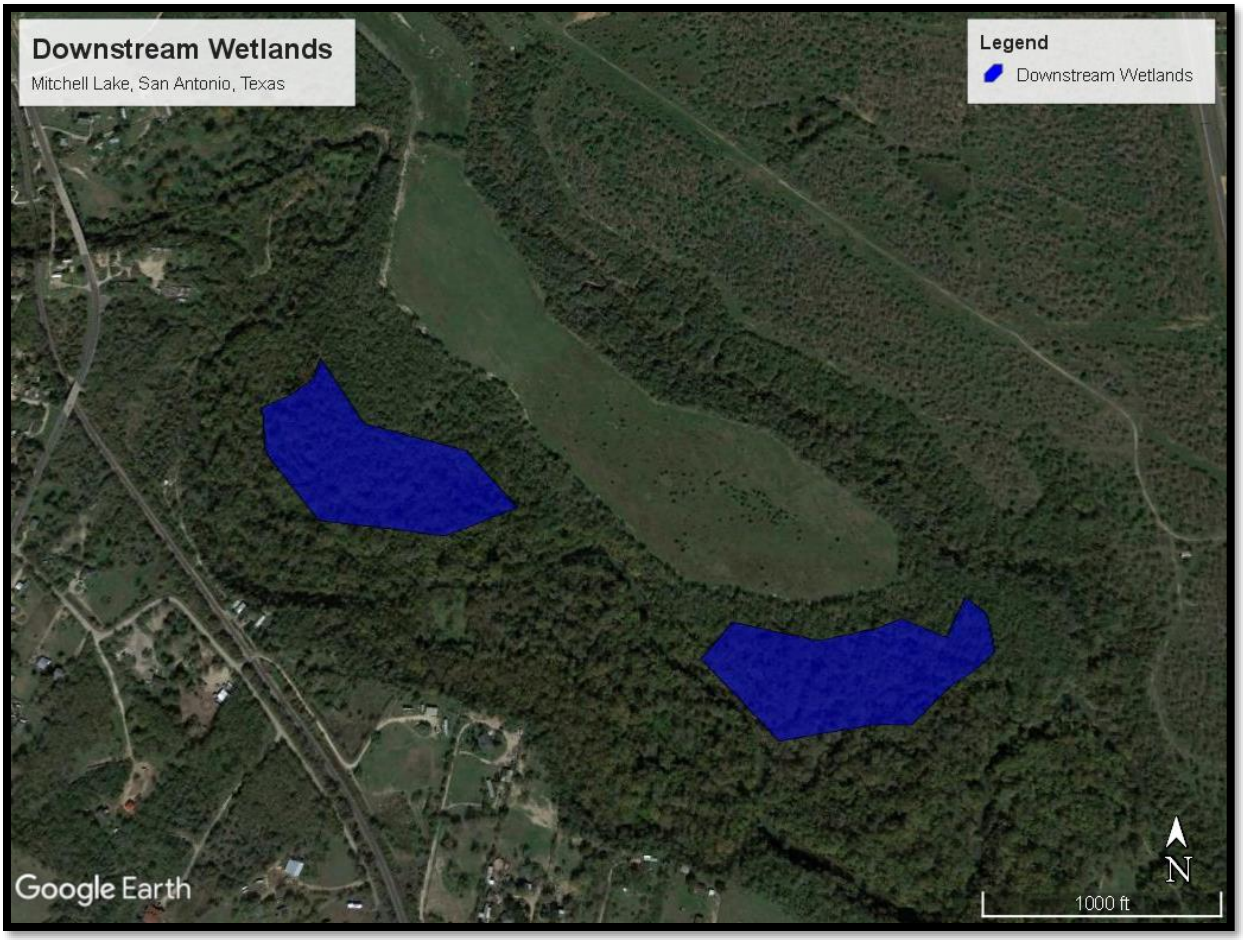

Figure 3-12. Downstream Wetlands Area 10

Table 3-18. Future Without Project Habitat Suitability Index and Habitat Units Area 10.

Model	TY												
		0		1		5		10		25		50	
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU
Marsh Wren HSI	19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bullfrog HSI		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 3-19. Future Without Project Average Habitat Units and Average Annual Habitat Units for Area 10.

Model	TY							
		0	1	5	10	25	50	AAHU
	Acres	Average HU	Average HU	Average HU	Average HU	Average HU	Average HU	
Marsh Wren HSI	19	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bullfrog HSI								

3.6 Future With Project Habitat Conditions

Various aquatic ecosystem restoration measures were developed for each project area. Measures included efforts, such as invasive species removal and native vegetation plantings. Measures were not considered complete alternatives on their own, as they would not individually restore ecological structure and function to the environment. Combinations of measures were developed for each project area, referred to as alternatives from here on, which would restore aquatic ecosystem habitat as described in the FWP conditions sections below. These alternatives were then used to compare the project area FWOP and FWP habitat modeling results to help inform plan selection.

All areas and acreages are assumed to be the same as the Future Without Project. The ecological benefits for each alternative are dependent on the measures that are assumed to be implemented at the site.

ALTERNATIVES 1A and 1B: BIRD POND WETLANDS

The restoration goal for Alternative 1A is the restoration of the existing wetland adjacent to Bird Pond, while 1B includes the restoration of the existing area and expansion around it. As mentioned above, the degraded wetland is shallow, dominated by cattails, and has little or no variation in water depth. The restoration strategy is to increase the depth of the wetland, establish water supply to sustain the wetland, manage the water to inundate the wetland with seasonal pulses, and establish a diverse native wetland vegetation community.

Alternatives 1A and 1B FWP conditions incorporate the following measures:

- Invasive Vegetation Management,
- Clearing/Excavation,
- Low Quality Vegetation Removal,
- Native Emergent Wetland Planting,
- Seasonal Pulses,
- Habitat Structure Augmentation,
- Installation of Bat/Nest Boxes,
- Installation of Pipeline, and

- Water Control Structure.

Except for the Bat/Nest Boxes measure, each one of these measures provide hydraulic and ecological components that are critical for the creation of a resilient, sustainable wetland.

The clearing/excavation measure would create the variable water depths required to support a diverse wetland habitat and eliminate the homogenous shallow depths that promote cattail monocultures. The installation of a pipeline measure would provide a dependable water supply to ensure that the wetland is inundated to a level that supports a diverse vegetative community. Similarly, the water control structures required for the seasonal pulses measure would provide water management to vary the depths of the wetland seasonally to manage for the diverse vegetative community and to control the monoculture of cattails.

The woody material cleared as part of the clearing/excavation measure would be stock piled and placed back into the excavated wetland as fallen logs or debris piles to increase to create wildlife habitat structure in the wetland. In addition, excavation of the existing wetlands near large trees could be designed to preserve the tree allowing the conversion of the trees to standing snags by treating the tree with an aquatic labeled herbicide.

Site-specific, native emergent plant species would be planted to establish a diverse community. In an effort to minimize the establishment of invasive species after the final grading of the wetlands, management, and control of invasive species would be required to ensure establishment of the diverse planted vegetation. An integrated invasive species management plan would be developed and implemented utilizing chemical, mechanical and/or biological controls.

Table 3-20 below depicts the increase of HSI scores beginning at Year 1. The Marsh Wren HSI scores stay relatively low due to the amount of woody vegetation that has been projected to cover the area. However, restoration of the area for Alternative 1A and expansion of wetlands for Alternative 1B will result in above average HSI scores for the Bullfrog HSI and increase the Marsh Wren HSI score FWP from 0 to 0.4 in TY 50. The AAHU for Alternative 1A is 2.39 and the AAHU for Alternative 1B is 6.42 (Table 3-21).

Table 3-20. Future With Project Habitat Suitability Index and Habitat Units for Alternatives 1A and 1B.

Model	TY												
		0		1		5		10		25		50	
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU
Marsh Wren HSI **Alternative 1A**	3.17	0.0	0.00	1.0	3.14	0.9	2.85	0.8	2.38	0.4	1.27	0.4	1.27
Bullfrog HSI **Alternative 1A**		0.6	1.80	0.9	2.93	1.0	3.04	1.0	3.07	1.0	3.09	1.0	3.09
Marsh Wren HSI **Alternative 1B**	3.25	0.0	0.00	0.5	1.50	0.9	2.76	0.7	2.31	0.4	1.24	0.4	1.24
Bullfrog HSI **Alternative 1B**		0.0	0.00	0.9	2.77	0.9	2.93	1.0	3.08	1.0	3.14	1.0	3.17

Table 3-21. Future With Project Average Habitat Units and Average Annual Habitat Units for Alternatives 1A and 1B.

<table>
<tr><th rowspan="3">Model</th><th colspan="8">TY</th></tr>
<tr><th></th><th>0</th><th>1</th><th>5</th><th>10</th><th>25</th><th>50</th><th rowspan="2">AAHU</th></tr>
<tr><th>Final Acres</th><th>Average HU</th><th>Average HU</th><th>Average HU</th><th>Average HU</th><th>Average HU</th><th>Average HU</th></tr>
<tr><td>Marsh Wren HSI
Alternative 1A</td><td rowspan="2">3.17</td><td rowspan="2">0.90</td><td rowspan="2">3.03</td><td rowspan="2">2.94</td><td rowspan="2">2.73</td><td rowspan="2">2.18</td><td rowspan="2">2.18</td><td rowspan="2">2.39</td></tr>
<tr><td>Bullfrog HSI
Alternative 1A</td></tr>
<tr><td>Marsh Wren HSI
Alternative 1B</td><td rowspan="2">6.42*</td><td rowspan="2">0.00</td><td rowspan="2">2.13</td><td rowspan="2">2.84</td><td rowspan="2">2.69</td><td rowspan="2">2.19</td><td rowspan="2">2.20</td><td rowspan="2">6.42</td></tr>
<tr><td>Bullfrog HSI
Alternative 1B</td></tr>
<tr><td colspan="9">*Because the final AAHU has to be combined, the acreage of 1A was added to the 1B expansion (3.17 acres + 3.25 acres = 6.42).
*Alternative 1B includes Alternative 1A; therefore, the AAHUs of Alternative 1A are added to the AAHUs of 1B.</td></tr>
</table>

ALTERNATIVES 2A AND 2B: CENTRAL WETLANDS

The measures implemented for Alternatives 2A and 2B are identical to the combination of measures listed for Alternatives 1A and 1B above, thus the Central Wetlands will follow the same trend for HSI scores as the Bird Pond Wetlands (Table 3-22). The rise in HUs compared to Alternatives 1A and 1B is due to the difference in acreage.

Alternatives 2A and 2B FWP conditions incorporate the following measures:

- Invasive Vegetation Management,
- Clearing/Excavation,
- Low Quality Vegetation Removal,
- Native Emergent Wetland Planting,
- Seasonal Pulses,
- Habitat Structure Augmentation,
- Installation of Bat/Nest Boxes, and

- Installation of Pipeline.

With the implementation of the measures listed above, the metrics for life requisite variables for Marsh Wren HSI and Bullfrog HSI increase over a 50-year period. This results in an AAHU of 7.88 for Alternative 2A and 13.54 for Alternative 2B (Table 3-23).

Table 3-22. Future With Project Habitat Suitability Index and Habitat Units for Alternatives 2A and 2B.

Model	TY												
		0		1		5		10		25		50	
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU
Marsh Wren HSI Alternative 2A	10.46	0.0	0.00	1.0	10.36	0.9	9.41	0.8	7.85	0.4	4.18	0.4	4.18
Bullfrog HSI Alternative 2A		0.6	5.95	0.9	9.66	1.0	10.01	1.0	10.15	1.0	10.19	1.0	10.19
Marsh Wren HSI Alternative 2B	7.91	0.0	0.00	0.5	3.64	0.9	6.72	0.7	5.62	0.4	3.01	0.4	3.01
Bullfrog HSI Alternative 2B		0.0	0.00	0.9	6.74	0.9	7.12	1.0	7.49	1.0	7.64	1.0	7.71

Table 3-23. Future With Project Average Habitat Units and Average Annual Habitat Units for Alternatives 2A and 2B.

Model	TY							
		0	1	5	10	25	50	AAHU
	Final Acres	Average HU	Average HU	Average HU	Average HU	Average HU	Average HU	
Marsh Wren HSI **Alternative 2A** **Bullfrog HSI** **Alternative 2A**	10.46	2.98	10.01	9.71	9.00	7.19	7.19	7.88
Marsh Wren HSI **Alternative 2B** **Bullfrog HSI** **Alternative 2B**	18.37*	0.00	5.19	6.92	6.55	5.32	5.36	13.54*

*Because the final AAHU has to be combined, the acreage of 2A was added to the 2B expansion (10.46 acres + 7.91 acres = 18.37).

*Alternative 2B includes Alternative 2A; therefore, the AAHUs of Alternative 2A are added to the AAHUs of 2B.

<u>ALTERNATIVE 3: SKIP'S POND</u>

Alternative 3 would incorporate the same measures and scales as described above for Alternatives 1A, 1B, 2A, and 2B except for the installation of a pipeline due to a petroleum pipeline separating the Central Wetlands from Skip's Pond. Due to the probable increase in woody vegetation, the Marsh Wren HSI score is negatively impacted beginning in Year 25 (Table 3-24). The AAHU for Alternative 3 over a 50-year period is 1.64 (Table 3-25).

Alternative 3 FWP conditions incorporate the following measures:

- Invasive Vegetation Management,
- Clearing/Excavation,
- Low Quality Vegetation Removal,
- Native Emergent Wetland Planting,
- Native Submergent Wetland Plantings,

- Seasonal Pulses,
- Habitat Structure Augmentation,
- Installation of Bat/Nest Boxes,
- Installation of Pipeline (only needed if Alternative 2A or 2B are implemented), and
- Water Control Structure.

Table 3-24. Future With Project Habitat Suitability Index and Habitat Units for Alternative 3

Model	TY												
		0		1		5		10		25		50	
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU
Marsh Wren HSI	2.18	0.0	0.00	1.0	2.16	0.9	1.96	0.8	1.64	0.4	0.87	0.4	0.87
Bullfrog HSI		0.6	1.24	0.9	2.01	1.0	2.09	1.0	2.11	1.0	2.12	1.0	2.12

Table 3-25. Future With Project Average Habitat Units and Average Annual Habitat Units for Alternative 3

Model	TY							
		0	1	5	10	25	50	AAHU
	Acres	Average HU	Average HU	Average HU	Average HU	Average HU	Average HU	
Marsh Wren HSI	2.18	0.62	2.09	2.02	1.87	1.50	1.50	1.64
Bullfrog HSI								

ALTERNATIVE 6: POLDERS

Alternative 6 utilizes the existing polders of the old Mitchell Lake wastewater treatment facility. Currently, these polders are maintained as open water habitats with some exposed areas in the Basins. Implementation of the proposed action would manipulate the water levels in the polders to create mudflats for migratory shorebird foraging habitat. The polder cells incorporated in Alternative 6 would be cycled to prevent the complete drying of the polder sediments and ensure water supply is available to inundate the drained polders. The improvement of overall water depths and availability and timing for water depths and availability improved the FWP in comparison to the FWP. The FWP AAHU for Alternative 6 is 48.35 (Table 3-26).

Alternative 6 FWP conditions incorporate the following measures:

- Polder Operational Management,

- Installation of Bat/Nest Boxes,
- Installation of Pump, and
- Construction of Berms.

Table 3-26. Future With Project Habitat Suitability Index, Habitat Units, and Average Annual Habitat Units for Alternative 6.

Evaluation Method	TY													
		0		1		5		10		25		50		AAHU
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	
Shorebird Migration Model	49.52	0.6	30.21	1.0	48.53	1.0	48.53	1.0	48.53	1.0	48.53	1.0	48.53	48.35

ALTERNATIVES 7A, 7B, 7C, 7D, 7E, 7F, AND 7G: FRINGE WETLANDS

The limited and degraded wetlands found within Mitchell Lake are at risk of being eliminated and converted to upland/riparian habitats due to the proposed lowering of lake level elevation to 518.5 feet msl. The implementation of the Proposed Action would involve invasive species management/removal and the planting of native emergent, submergent, and riparian species. Three coves have been identified as part of the alternatives recommended for restoration within the fringe wetlands. These coves contain a scattered population of large trees adjacent to and within the existing wetland fringe habitats. A select number of these trees could be converted to standing snags for wildlife habitat. Due to the varying DO and pH levels within Mitchell Lake, it will be necessary to plant native species that can endure these conditions. It is currently assumed that native emergent/submergent wetland vegetation will be available for propagation and will be suitable for planting within Coves 1, 2, and 3.

The alternatives for the Fringe Wetlands single out and/or combine the three coves identified for restoration. Each cove has a different benefit associated with its restoration (Table 3-27), based on the amount of acreage associated with the cove. The FWP AAHU for Cove 1 is 43.33, Cove 2 is 9.56, and Cove 3 is 5.52. Because Alternatives 7D, 7E, 7F, and 7G are varying combinations of Coves 1, 2, and 3; they will not be specifically discussed in the tables below. See Table 3-33 for the final AAHUs of 7D, 7E, 7F, and 7G.

- 7A: Restoration of Cove 1
- 7B: Restoration of Cove 2
- 7C: Restoration of Cove 3
- 7D: Combination of Coves 1 & 2 Restoration
- 7E: Combination of Coves 1 & 3 Restoration
- 7F: Combination of Coves 2 & 3 Restoration
- 7G: Combination of Coves 1, 2 & 3 Restoration

Alternative 7A, 7B, 7C, 7D, 7E, 7F, and 7G FWP conditions incorporate the following measures for Coves 1, 2, and 3:

- Native Riparian Plantings,

- Invasive Vegetation Management,
- Native Emergent Wetland Plantings,
- Native Submergent Wetland Plantings,
- Habitat Structure Augmentation, and
- Installation of Bat/Nest Boxes.

Because there are varying combinations of Cove 1, 2, and 3 restoration, only the final AAHU for Alternatives 7A, 7B, and 7C are listed in Table 3-27 and

Table 3-28.

Table 3-27. Future With Project Habitat Suitability Index and Habitat Units for Alternatives 7A, 7B, and 7C

Model	TY												
		0		1		5		10		25		50	
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU
Marsh Wren HSI 7A (Cove 1)	53.68	0.0	0.00	0.0	0.00	0.4	23.62	0.8	43.48	0.8	40.80	0.8	40.80
Bullfrog HSI 7A (Cove 1)		0.6	30.24	0.9	46.80	0.9	48.56	0.9	49.58	0.9	49.84	0.9	49.84
Marsh Wren HSI 7B (Cove 2)	11.84	0.0	0.00	0.0	0.00	0.4	5.21	0.8	9.59	0.8	9.00	0.8	9.00
Bullfrog HSI 7B (Cove 2)		0.6	6.67	0.9	10.32	0.9	10.71	0.9	10.93	0.9	10.99	0.9	10.99
Marsh Wren HSI 7C (Cove 3)	6.84	0.0	0.00	0.0	0.00	0.4	3.01	0.8	5.54	0.8	5.20	0.8	5.20
Bullfrog HSI 7C (Cove 3)		0.6	3.85	0.9	5.96	0.9	6.19	0.9	6.32	0.9	6.35	0.9	6.35

Table 3-28. Future With Project Average Habitat Units and Average Annual Habitat Units for Alternatives 7A, 7B, and 7C.

Model	TY							
		0	1	5	10	25	50	AAHU
	Acres	Average HU	Average HU	Average HU	Average HU	Average HU	Average HU	
Marsh Wren HSI 7A (Cove 1); Bullfrog HSI 7A (Cove 1)	53.68	15.12	23.40	36.09	46.53	45.32	45.32	43.33
Marsh Wren HSI 7B (Cove 2); Bullfrog HSI 7B (Cove 2)	11.84	3.34	5.16	7.96	10.26	10.00	10.00	9.56
Marsh Wren HSI 7C (Cove 3); Bullfrog HSI 7C (Cove 3)	6.84	1.93	2.98	4.60	5.93	5.77	5.77	5.52

ALTERNATIVES 9A AND 9B: DAM FORESTED WETLANDS

Measures appropriate for Alternatives 9A and 9B are the same measures identified for Alternatives 1A, 1B, 2A, and 2B above, with a few changes. The existing forested wetlands below the dam are dominated by hackberry which provide limited wildlife habitat. The Future With Project condition would entail the thinning of hackberry trees for use as structural habitat and the creation of standing snags.

Although the both HSI model scores rise through the years, due to the measures implemented, the impacts are fairly minimal and yield low results in regard to HUs due to the amount of acreage involved with this area (Table 3-29). Alternative 9A FWP AAHU is 1.19 and Alternative 9B FWP AAHU is 2.08 (Table 3-30).

Alternatives 9A and 9B FWP conditions incorporate the following measures:

- Native Riparian Plantings,
- Invasive Vegetation Management,
- Clearing/Excavation,
- Low Quality Vegetation Removal,
- Native Emergent Wetland Plantings,
- Seasonal Pulses,
- Habitat Structure Augmentation, and
- Installation of Bat/Nest Boxes.

Table 3-29. Future With Project Habitat Suitability Index and Habitat Units for Alternatives 9A and 9B.

Model	**TY**												
		0		**1**		**5**		**10**		**25**		**50**	
	Acres	**HSI**	**HU**	**HSI**	**HU**	**HSI**	**HU**	**HSI**	**HU**	**HSI**	**HU**	**HSI**	**HU**
Barred Owl HSI Alternative 9A	2.55	0.2	0.55	0.1	0.28	0.2	0.41	0.3	0.65	0.5	1.32	0.6	1.47
Gray Squirrel HSI Alternative 9A		0.1	0.25	0.3	0.81	0.3	0.81	0.3	0.81	0.6	1.40	0.7	1.80
Barred Owl HSI Alternative 9B	4.48	0.2	0.97	0.1	0.49	0.2	0.73	0.3	1.14	0.5	2.31	0.6	2.59
Gray Squirrel HSI Alternative 9B		0.1	0.44	0.3	1.42	0.3	1.42	0.3	1.42	0.6	2.45	0.7	3.17

Table 3-30. Future With Project Average Habitat Units and Average Annual Habitat Units for Alternatives 9A and 9B.

Model	TY							
		0	1	5	10	25	50	AAHU
	Acres	Average HU	Average HU	Average HU	Average HU	Average HU	Average HU	
Barred Owl HSI Alternative 9A Gray Squirrel HSI Alternative 9A	2.55	0.40	0.54	0.61	0.73	1.36	1.64	1.19
Barred Owl HSI Alternative 9B Gray Squirrel HSI Alternative 9B	4.48	0.71	0.95	1.07	1.28	2.38	2.88	2.08

ALTERNATIVE 10: DOWNSTREAM WETLANDS

Implementation of Alternative 10 would involve the creation of wetlands downstream of the Mitchell Lake dam. Native emergent wetland species plantings, seasonal pulses, and habitat structure augmentation measures have a large impact on this area which have resulted in average to above average HSI scores throughout the TYs (Table 3-31). Alternative 10 FWP AAHU is 13.6 (Table 3-32).

The Alternative 10 FWP would implement the following measures:

- Clearing/Excavation,
- Native Emergent Wetland Plantings,
- Seasonal Pulses,
- Habitat Structure Augmentation,
- Installation of Bat/Nest Boxes,
- Construction of Berms, and
- Water Control Structure.

Table 3-31. Future With Project Conditions for Alternative 10

Model	TY												
		0		1		5		10		25		50	
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU
Marsh Wren HSI	19	0.0	0.00	0.5	8.74	0.9	16.15	0.7	13.49	0.4	7.22	0.4	7.22
Bullfrog HSI		0.0	0.00	0.9	16.18	0.9	17.11	1.0	18.00	1.0	18.34	1.0	18.51

Table 3-32. Future With Project Average Habitat Units and Average Annual Habitat Units for Alternative 10.

Model	TY							
		0	1	5	10	25	50	AAHU
	Acres	Average HU	Average HU	Average HU	Average HU	Average HU	Average HU	
Marsh Wren HSI	19	0.00	12.46	16.63	15.74	12.78	12.87	13.60
Bullfrog HSI								

3.7 Benefits

Environmental restoration benefits are calculated by determining the difference between FWOP AAHUs from the FWP AAHUs. Although the measures for most of the areas/alternatives are similar, there are vast differences between the amounts of AAHUs gained, due to the varying acreage of each area/alternative. The greatest AAHU benefit based on existing conditions and the Future With Project conditions is in Alternative 7: Fringe Wetlands (Table 3-33). The restoration of this large area has a high probability of improving conditions for wildlife utilizing emergent and emergent/submergent wetland habitat.

Table 3-33. Alternative Benefits

Project Area	Alternative	FWOP AAHU	FWP AAHU	Annual Benefits AAHU	FWP Acres
Bird Pond Wetlands	1A: Restoration of Existing Wetlands	0.86	2.39	1.53	3.17
	1B: Expansion/Restoration of Existing Wetlands and Restoration of Additional Wetlands	0.86	4.71	3.85	6.42
Central Wetlands	2A: Restoration of Existing Wetlands	2.85	7.88	5.03	10.46
	2B: Expansion/Restoration of Existing Wetlands and Restoration of Additional Wetlands	2.85	13.54	10.69	18.37
Skip's Pond	3: Restoration of Existing Wetlands	0.59	1.64	1.05	2.18
Polders	6: Management/Modification of Existing Polders/Basins	30.21	48.35	18.14	49.52
Fringe Wetlands	7A: Restoration of Cove 1 (Wetland/Riparian Plantings)	13.43	43.33	29.9	53.68
	7B: Restoration of Cove 2 (Wetland/Riparian Plantings)	2.96	9.56	6.6	11.84
	7C: Restoration of Cove 3 (Wetland/Riparian Plantings)	1.71	5.52	3.81	6.84
	7D: Combination of Coves 1 & 2	16.39	52.89	36.5	65.52
	7E: Combination of Coves 1 & 3	15.14	48.85	33.71	60.52
	7F: Combination of Coves 2 & 3	4.67	15.08	10.41	18.68
	7G: Combination of Coves 1, 2 & 3	18.1	58.41	40.31	72.36
Dam Forested Wetlands	9A: Restoration of Existing Wet Riparian Habitat	0.71	1.19	0.47	2.55
	9B: Expansion/Restoration of Existing Wet Riparian Habitat and Restoration of Additional Riparian Habitat	1.25	2.08	0.83	4.48
Downstream Wetlands	10: Creation of Wetlands Downstream of Mitchell Lake	0.0	13.6	13.6	19

4 Sustainability of the Alternatives

The upper chain of wetlands of the proposed Mitchell Lake Ecosystem Restoration require a supplemental water supply in order to maintain the target aquatic habitat and facilitate the management of the wetlands. The supplemental water would be provided by Mitchell Lake and transported to the upper wetland (Bird Pond Wetlands) via a pump and waterline. A series of water control structures would be constructed to manage water levels of each wetland and manage flows from the Bird Pond Wetlands to the Central Wetlands to Skip's Pond and ultimately back into Mitchell Lake.

The conceptual design of the restored wetlands consists of optimizing emergent wetland habitat for stopover migration and nesting habitat for migratory birds by letting the water levels seasonally fluctuate. The target depths of water in the wetlands would increase during the spring and be allowed to dry out over the summer months. The water management strategy for the Bird Pond and Central Wetlands are provided in Table 4-1.

Table 4-1. Wetland Water Level Management for Bird Pond and Central Wetlands

Month	Target Depth (in.)	Management Actions
January	0	No pumping, leave dry
February	12	Prescribed burn mid-February, begin pumping
March	36	Pump until 36 inches
April	36	Pump to maintain depth
May	33[1]	No pumping, let water level decrease
June	30	No pumping, let water level decrease
July	26	No pumping, let water level decrease
August	21	No pumping, let water level decrease
September	19	No pumping, let water level decrease
October	18	No pumping, drain wetlands third or fourth week of the month
November	0	No pumping, leave dry
December	0	No pumping, leave dry
[1]Estimated depth based on evapotranspiration and precipitation		

In many emergent wetlands, southern cattails (*Typha domingensis*) are considered noxious and can completely dominate the wetlands creating a monoculture. The reduction of diversity within the cattail monoculture corresponds to a lack of diversity for wildlife species as well (Anderson et al., 2019; Kostecke et al., 2005; Murkin et al., 1982). Because the restoration goals are to maximize wildlife value, particularly avian species, and create a diverse emergent wetland complex, the management of cattails is an integral part of the operations and maintenance of the wetlands. An effective way to manage for cattails in emergent wetlands is through seasonal water management and prescribed burning (Apfelbaum et al., 1985; Ball, 1990; Sojda and Solberg, 1993). As presented in Table 4-1, the water management in the chain of wetlands is designed so that the wetlands dry over the winter allowing the cattail rhizomes to potentially freeze. Prior to refilling the wetlands in the spring, the wetlands would be burned utilizing approved prescribed burning techniques to further minimize the growth of cattails and other noxious woody vegetation. The burns could potentially be integrated into the prescribed burning program that the Mitchell Lake Audubon Center uses to manage the prairie habitats adjacent to the wetlands. An average water depth of 36 inches would be maintained in the wetlands through the first months of the growing season which would prohibit the establishment and growth of cattails in the majority of the wetlands. The water levels would be allowed to drop beginning in the late spring and the wetlands would be drained in mid to late October.

In order to determine the amount of water that would be needed to fill and manage the wetlands, we need to determine the supplemental water needs balanced against gains from precipitation and losses from evaporation and the transpiration of the wetland vegetation. Because wetland hydrology currently exists at the three wetlands, the assumption is that no additional supplemental water would be required to saturate the wetland soils before they would start to fill up. Therefore, a simple water balance equation was used to calculate the supplemental water needs (water deficit) to maintain the desired seasonal depths:

$$WD = P_m - ETo_m - SS_i$$

Where WD = the water deficit for maintaining a target water level,

P_m = Monthly precipitation

ETo_m = Monthly evapotranspiration rate

and, SS_i = Water required for the initial saturation of wetland soils (for the Bird and Central Wetlands, this value is 0).

The evapotranspiration rate is the sum of the evaporation rate (ETo) of the water surface and the water demand of the wetland vegetation for photosynthesis. Monthly ETo rates and precipitation rates for San Antonio, TX were used to calculate the monthly changes in water depths or deficits without the addition of supplemental water (Table 4-2).

Table 4-2. Water Balance Variables for San Antonio, TX

Month	ETo Rate (in.) [1]	Precipitation (in.)[2]	Water Deficit (in.)
January	2.42	1.96	-0.66
February	2.90	1.79	-1.11
March	4.42	2.31	-2.11
April	5.47	2.10	-3.37
May	6.47	4.01	-2.46
June	6.97	4.14	-2.83
July	7.31	2.74	-4.57
August	6.99	2.09	-4.90
September	5.64	3.03	-2.61
October	4.44	4.11	-0.33
November	2.85	2.28	-0.57
December	2.36	1.91	-0.45
[1]Texas A&M AgriLife Extension (2020) [2]National Weather Service (2020)			

In order to calculate the volume of water required to maintain the target depths of the Bird Pond Wetlands and the Central Wetlands, the area of the wetlands (6.42 and 18.37 acres respectively) were multiplied by the water deficit for the months requiring supplemental water (February through April). Skip's Pond was not included in the calculations as the pond is perennially inundated and is on the downstream end of the wetland complex. The monthly water volumes required to maintain seasonal target depths are provided in Table 4-3.

Table 4-3. Supplemental Water Requirements for the Bird Pond and Central Wetlands

Month	Target Depth	Supplemental Water Required to Maintain Depth (in.)	Bird Wetlands Water Required (ac-ft)	Central Wetlands Water Required (ac-ft)	Total Water Required (ac-ft)
January	0.00	0.00	0.00	0.00	0.00
February	12.00	13.11	7.01	20.07	27.08
March	36.00	26.11	13.97	39.97	53.94
April	36.00	3.37	1.80	5.16	6.96
May[1]	33.54	0.00	0.00	0.00	0.00
June	30.71	0.00	0.00	0.00	0.00
July	26.14	0.00	0.00	0.00	0.00
August	21.63	0.00	0.00	0.00	0.00
September	18.63	0.00	0.00	0.00	0.00
October[2]	18.30/0.00	0.00	0.00	0.00	0.00
November	0.00	0.00	0.00	0.00	0.00
December	0.00	0.00	0.00	0.00	0.00
		Total	22.79	65.20	87.98

[1]No supplemental water added, therefore, decrease in depth is attributable to the water deficit

[2]Water depth is reported as before draining/after draining

In order to manage the Mitchell Lake chain of wetlands for temperate and Neotropical migratory birds and waterfowl and sustain a native tule wetland habitat, approximately 88 acre-feet of supplemental water would be required during an average year. Supplemental water demand would be higher during periods of drought; however, if water is not available during those times, the plant species included in the design of the wetlands are site specific and drought tolerant. Therefore, the wetland habitats would be expected to recover once normal precipitation events return.

4.1 Operations and Maintenance

It is assumed that if the non-federal sponsor (NFS) does not pursue operations and maintenance (O&M) of non-structural / non-mechanical measures beyond the 10-year period after the date on which the Secretary makes a determination of success, some ecological benefits of the non-structural measures: invasive vegetation management, native submergent wetland plantings, native riparian plantings and native emergent wetland plantings could be negatively impacted.

Invasive vegetative species are prevalent within the study area, however; focused management on the establishment of native vegetative species should diminish the likelihood of the reestablishment of invasive species within the specified project areas. Native species, once established, should be able to maintain influence and deter the spread of invasive species around Mitchell Lake.

Unforeseen circumstances, such as significant storm events, can cause disturbances to the ecosystem. Disturbed areas, lacking enough native vegetative cover, are more likely to become inhabited by fast-growing invasive species. The NFS should remain vigilant and enact management where possible and if it is still within their means to do so within the 50-year life of the project. Coordination with the Mitchell Lake Audubon Society regarding success of native species would help support the success of the Mitchell Lake Aquatic Ecosystem Restoration.

There is a low to medium risk of reestablishment of invasive species if the NFS does not continue to follow the non-structural operation and maintenance guidance, but this risk is heavily dependent on future conditions. Ecosystems are continually changing and natural disturbances (wildfires, insects, diseases, etc.) may occur that can create open spaces, allowing for the introduction of new species. If disturbances are discovered and treated as quickly as possible before introduced invasive species spread, there should be no large-scale impacts to the benefits of the ecosystem restoration at Mitchell Lake. However, if significant disturbances occur past the 10-year Operation and Maintenance requirement and the NFS does not treat them within a relevant timeframe (within one growing season); it is likely the full benefits of the ecosystem restoration would not be realized within the 50-year life of the project.

5 References

Alan Plummer Associates, Inc. 2016. Mitchell Lake – Constructed Wetlands Below the Dam Preliminary Feasibility Study. 25 pp. Prepared for: San Antonio Water System.

Anderson, S.L., D.A. McGranahan, T.J. Hovick, and A.R. Hewitt. 2019. Passerine and secretive marsh bird responses to cattail management in temperate wetlands. Wetlands Ecology and Management 27: 283-293.

Apfelbaum, S.I. 1985. Cattail (*Typha* spp.) Management. Natural Areas Journal 5(3):9-17.

ARCADIS U.S., Inc. 2014. Hydrologic and Hydraulic Analysis, Mitchell Lake Dam, Cottonmouth Creek, Bexar County, Texas, 30 December 2014. Prepared for: San Antonio Water System.

Ashworth, JB and J Hopkins. 1995. Aquifers of Texas. Texas Water Development Board Report 345. 69 pp. https://www.twdb.texas.gov/publications/reports/numbered_reports/doc/R345/R345Complete.pdf. Accessed on 08 January 2020.

Audubon Society. 2019. Mitchell Lake Audubon Center. https://Mitchelllake.audubon.org Accessed 15 Feb 2019.

Ball, J.P. 1990. Influence of Subsequent Flooding Depth on Cattail Control by Burning and Mowing. J. Aquat. Plant Manage. 28:32-36.

Bureau of Economic Geology. 1987. Geologic Atlas of Texas, San Antonio Sheet. http://www.twdb.texas.gov/groundwater/aquifer/GAT/san-antonio.htm Accessed 21 July 2019.

Brown, S., C. Hickey, B. Harrington and R. Gill. 2001. United States Shorebird Conservation Plan. Manomet Center for Conservation Sciences, Manomet, Massachusetts, May, 2001. 60 pp. https://www.shorebirdplan.org/wp-content/uploads/2013/01/USShorebirdPlan2Ed.pdf. Accessed on 08 January 2020.

City of San Antonio. 2019. Medina River Greenway (Pleasanton Rd to Mattox Park). https://www.sanantonio.gov/portals/0/Files/Parks/Facilities/Trails/Greenway/MedinaRiver-Phase4.pdf. Accessed 07 October 2019.

Coffey, Sheridan, et al. 2011. Birds of Bexar County Texas: A Seasonal Field Checklist. San Antonio Audubon Society. http://saaudubon.org/BC_birdlist_7_1_14_44a.pdf. Accessed on 21 December 2018.

Dahl, T.E. 2011. Status and trends of wetlands in the conterminous United States 2004 to 2009. U.S. Department of the Interior; Fish and Wildlife Service, Washington, D.C. 108 pp.

Engleman, Dodge, et al. 2019. Birds of Bexar County Texas Field Checklist. San Antonio Audubon Society. https://static1.squarespace.com/static/5a9484cf5b409b74dffe7b7b/t/5d347d17de51ea0001dc37e5/1563720987684/BexarCountyBirdChecklist_Complete2019.pdf. Accessed 27 November 2019.

Henderson, Dwight, and Ruth Lofgren (2008). Mitchell Lake Wildlife Refuge: An Illustrated History. San Antonio: Mitchell Lake Wetlands Society.

Kostecke, R.M., L.M. Smith, and H.M. Hands. 2005. Macroinvertebrate response to cattail management at Cheyenne Bottoms, Kansas, USA. Wetlands 25:758-763.

Kushlan, J.A., M.J. Steinkamp, K.C. Parsons, J. Capp, M.A. Cruz, M. Coulter, I. Davidson, L. Dickson, N. Edelson, R. Elliot, R.M. Erwin, S. Hatch, S. Kress, R. Milko, S. Trapp, J. Wheeler and K. Wohl. 2002. Waterbird Conservation for the Americas: The North American Waterbird Conservation Plan, Version 1. Waterbird Conservation for the Americas, Washington D.C., USA. 78 pp.

K. V. Rosenberg, J. A. Kennedy, R. Dettmers, R. P. Ford, D. Reynolds, J.D. Alexander, C. J. Beardmore, P. J. Blancher, R. E. Bogart, G. S. Butcher, A. F. Camfield, A. Couturier, D. W. Demarest, W. E. Easton, J.J. Giocomo, R.H. Keller, A. E. Mini, A. O. Panjabi, D. N. Pashley, T. D. Rich, J. M. Ruth, H. Stabins, J. Stanton, T. Will. 2016. Partners in Flight Landbird Conservation Plan: 2016 Revision for Canada and Continental United States. Partners in Flight Science Committee. 119 pp.

Lofgren, Ruth (1990). Restoring an Ecological Treasure. In “The Bright Scrawl”, publication of The Junior League of San Antonio, Winter 1990 edition.

Menger, Rudolph (1913). Nature Observations and Reminiscences. San Antonio: Guessaz & Ferlett Company.

Murkin, H.R., R.M. Kaminski, ad R.D. Titman. 1982. Responses by dabbling ducks and aquatic invertebrates to an experimentally manipulated cattail marsh. Canadian Journal of Zoology. 60(10):2324-2332.

National Oceanic and Atmospheric Administration. 2019. Storm Events Database. https://www.ncdc.noaa.gov/stormevents/ Accessed 23 July 2019.

National Weather Service. 2020. Monthly Weather Summary for San Antonio, TX, National Weather Service Forecast Office Austin/San Antonio, TX. https://w2.weather.gov/climate/index.php?wfo=ewx. Accessed 8 May 2020.

Natural Resources Conservation Service. 2018. Agricultural Conservation Easement Program. Accessed on 06 February 2020.

Natural Resources Conservation Service. 2019. Web Soil Survey. https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx. Accessed 07 October 2019.

Natural Resources Conservation Service. 2020. Introduced, Invasive, and Noxious Plants. https://plants.usda.gov/java/noxious?rptType=State&statefips=48. Accessed on 22 January 2020.

Natural Resources Conservation Service. 2020. Wetlands. https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/water/wetlands/. Accessed on 06 February 2020.

Natural Resources Conservation Service. 2020. Wetlands Reserve Program. https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/home/?cid=STELPRDB1049327. Accessed on 06 February 2020.

North American Waterfowl Management Plan Update. 2018. Connecting People, Waterfowl, and Wetlands. https://www.fws.gov/migratorybirds/pdf/management/NAWMP/2018NAWMP.pdf. Accessed 27 November 2019.

North, GR, J Schmandt, and J Clarkson. 2011. The Impact of Global Warming on Texas. A report of the Task Force on Climate Change in Texas. 242 pp.

Raba-Kistner Consultants, Inc. 1992. Mitchell Lake Enlargement, Geologic and Hydrogeologic Investigation Report. Project Number ASL89-007-00. Prepared for: San Antonio Water System.

San Antonio River Water Authority. 2019. San Antonio River Basin. San Antonio River Authority. 2019. https://www.sara-tx.org/education-outreach/understanding-the-basin/. Accessed 15 February 2019.

Sojda, R.S. and K.L. Solberg. 1993. Management and Control of Cattails. Waterfowl Management Handbook. Fish and Wildlife Leaflet 13.4.13.

Texas A&M AgriLife Extension. 2020. Historic ETo Reference. TexasET Network. https://texaset.tamu.edu. Accessed 8 May 2020.

Texas Almanac. 2019. Major Aquifers of Texas. https://texasalmanac.com/topics/environment/aquifers-texas. Accessed 07 October 2019.

Texas Commission on Environmental Quality (TCEQ). 2017. Compliance of San Antonio area counties with the National Ambient Air Quality Standards (NAAQS). https://www.tceq.texas.gov/airquality/sip/san/san-status. Accessed 15 Feb 2019.

Texas Parks and Wildlife Department. 2019a. Rare, Threatened, and Endangered Species of Texas by County. Bexar County. https://tpwd.texas.gov/gis/rtest/. Accessed on 17 December 2018.

Texas Parks and Wildlife Department. 2019b. Texas Ecoregions. https://tpwd.texas.gov/education/hunter-education/online-course/wildlife-conservation/texas-ecoregions. Accessed 21 July 2019.

Texas Water Development Board. 2019. Edwards (Balcones Fault Zone) Aquifer. http://www.twdb.texas.gov/groundwater/aquifer/majors/edwards-bfz.asp. Accessed 19 July 2019

U.S. Climate Data. 2019. Climate Sana Antonio – Texas. https://www.usclimatedata.com/climate/san-antonio/texas/united-states/ustx1200. Accessed 19 July 2019.

U.S. Environmental Protection Agency. 2019. Frequent Questions about 2015 Coal Ash Disposal Rule. https://www.epa.gov/coalash/frequent-questions-about-2015-coal-ash-disposal-rule. Accessed 23 July 2019.

U.S. Environmental Protection Agency. 2020. Summary of the Clean Water Act. https://www.epa.gov/laws-regulations/summary-clean-water-act. Accessed on 25 March 2020.

U.S. Army Corps of Engineers. 2017. Shorebird Migration Habitat Model. U.S. Army Corps of Engineers, Ecosystem Restoration Center of Expertise, Rock Island Illinois. Excel Spreadsheet. Prepared for: U.S. Army Corps of Engineers.

U.S. Army Corps of Engineers. 2018. Recommended Regional Use Certification of the Shorebird Migration Model. Prepared for: U.S. Army Corps of Engineers.

U.S. Fish and Wildlife Service. 1980. Ecological Services Manual – Habitat as a Basis for Environmental Assessment. 15 September 1980.

U.S. Fish and Wildlife Service. 1987a. Habitat Suitability Index Models: Barred Owl. Biological Report 82(10.143). September 1987. 17 pp.

U.S. Fish and Wildlife Service. 2019. Birds of Conservation Concern. https://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php. Accessed 11 August 2019.

U.S. Fish and Wildlife Service. 2020. Information, Planning, and Consultation System, Environmental Conservation Online System. https:ecos.fws.gov. Accessed 22 September 2020.

-------1987b. Habitat Suitability Index Models: Gray Squirrel. Biological Report 82(10.135). July 1987. 16 pp.

-------1987c. Habitat Suitability Index Models: Marsh Wren. Biological Report 82(10.139). June 1987. 13 pp.

-------1987d. Habitat Suitability Index Models: Bullfrog. Biological Report 82(10.138). June 1987. 22 pp.

U.S. Fish and Wildlife Service. 2020. Wetlands Status and Trends Reports Fact Sheet. https://www.fws.gov/wetlands/documents/Wetlands-Status-and-Trends-Reports-Fact-Sheet.pdf. Accessed on 06 February 2020.

U.S. Geological Survey. 2016. Loss of Wetlands in the Southwestern United States. https://geochange.er.usgs.gov/sw/impacts/hydrology/wetlands/. Accessed on 25 March 2020.

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ATTACHMENT A

United States Department of the Interior

FISH AND WILDLIFE SERVICE
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In Reply Refer To: August 13, 2021
Consultation Code: 02ETAU00-2019-SLI-1005
Event Code: 02ETAU00-2021-E-03957
Project Name: Mitchell Lake

Subject: Updated list of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that *may* occur within the county of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

Please note that new information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Also note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq*.), Federal agencies are required to utilize their authorities to carry out programs for the conservation of federally listed as threatened or endangered species and to determine whether projects may affect these species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

While a Federal agency may designate a non-Federal representative to conduct informal consultation or prepare a biological assessment, the Federal Agency must notify the Service in writing of any such designation. The Federal agency shall also independently review and evaluate the scope and content of a biological assessment prepared by their designated non-Federal representative before that document is submitted to the Service.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by a federally funded, permitted or authorized activity, the agency is required to consult with the Service pursuant to 50 CFR 402. The following definitions are provided to assist you in reaching a determination:

- *No effect* - the proposed action will not affect federally listed species or critical habitat. A “no effect” determination does not require section 7 consultation and no coordination or contact with the Service is necessary. However, if the project changes or additional information on the distribution of listed or proposed species becomes available, the project should be reanalyzed for effects not previously considered.
- *May affect, but is not likely to adversely affect* - the project may affect listed species and/or critical habitat; however, the effects are expected to be discountable, insignificant, or completely beneficial. Certain avoidance and minimization measures may need to be implemented in order to reach this level of effect. The Federal agency or the designated non-Federal representative should consult with the Service to seek written concurrence that adverse effects are not likely. Be sure to include all of the information and documentation used to reach your decision with your request for concurrence. The Service must have this documentation before issuing a concurrence.
- *Is likely to adversely affect* - adverse effects to listed species may occur as a direct or indirect result of the proposed action. For this determination, the effect of the action is neither discountable nor insignificant. If the overall effect of the proposed action is beneficial to the listed species but the action is also likely to cause some adverse effects to individuals of that species, then the proposed action “is likely to adversely affect” the listed species. The analysis should consider all interrelated and interdependent actions. An “is likely to adversely affect” determination requires the Federal action agency to initiate formal section 7 consultation with our office.

Regardless of the determination, the Service recommends that the Federal agency maintain a complete record of the evaluation, including steps leading to the determination of effect, the qualified personnel conducting the evaluation, habitat conditions, site photographs, and any other related information. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered

Species Consultation Handbook" at: http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF.

Migratory Birds

For projects that may affect migratory birds, the Migratory Bird Treaty Act (MBTA) implements various treaties and conventions for the protection of these species. Under the MBTA, taking, killing, or possessing migratory birds is unlawful. Migratory birds may nest in trees, brushy areas, or other areas of suitable habitat. The Service recommends activities requiring vegetation removal or disturbance avoid the peak nesting period of March through August to avoid destruction of individuals, nests, or eggs. If project activities must be conducted during this time, we recommend surveying for nests prior to conducting work. If a nest is found, and if possible, the Service recommends a buffer of vegetation remain around the nest until the young have fledged or the nest is abandoned.

For additional information concerning the MBTA and recommendations to reduce impacts to migratory birds please contact the U.S. Fish and Wildlife Service Migratory Birds Office, 500 Gold Ave. SW, Albuquerque, NM 87102. A list of migratory birds may be viewed at https://www.fws.gov/birds/management/managed-species/migratory-bird-treaty-act-protected-species.php. Guidance for minimizing impacts to migratory birds for projects including communications towers can be found at: https://www.fws.gov/birds/management/project-assessment-tools-and-guidance/guidance-documents/communication-towers.php. Additionally, wind energy projects should follow the wind energy guidelines

https://www.fws.gov/birds/management/project-assessment-tools-and-guidance/guidance-documents/wind-energy.php) for minimizing impacts to migratory birds and bats.

Finally, please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 et seq.), and projects affecting these species may require development of an eagle conservation plan https://www.fws.gov/birds/management/project-assessment-tools-and-guidance/guidance-documents/eagles.php.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Austin Ecological Services Field Office
10711 Burnet Road, Suite 200
Austin, TX 78758-4460
(512) 490-0057

Project Summary

Consultation Code: 02ETAU00-2019-SLI-1005
Event Code: 02ETAU00-2021-E-03957
Project Name: Mitchell Lake
Project Type: ** OTHER **
Project Description: Ecosystem restoration of Mitchell Lake in San Antonio, TX. Project will possibly incorporate aquatic ecosystem restoration methods including invasive species removal, native plantings, wetland creation, dam/ spillway and or polder modification, and etc. The feasibility study has begun. Engineering, design, and construction has not been initiated. This project is located south of San Antonio, TX.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@29.284715525042877,-98.48958789466792,14z

Counties: Bexar County, Texas

Endangered Species Act Species

There is a total of 18 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Note that 2 of these species should be considered only under certain conditions.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Birds

NAME	STATUS
Golden-cheeked Warbler (=wood) *Dendroica chrysoparia* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/33	Endangered
Piping Plover *Charadrius melodus* Population: [Atlantic Coast and Northern Great Plains populations] - Wherever found, except those areas where listed as endangered. There is **final** critical habitat for this species. The location of the critical habitat is not available. This species only needs to be considered under the following conditions: ▪ Wind Energy Projects Species profile: https://ecos.fws.gov/ecp/species/6039	Threatened
Red Knot *Calidris canutus rufa* There is **proposed** critical habitat for this species. The location of the critical habitat is not available. This species only needs to be considered under the following conditions: ▪ Wind Energy Projects Species profile: https://ecos.fws.gov/ecp/species/1864	Threatened
Whooping Crane *Grus americana* Population: Wherever found, except where listed as an experimental population There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/758	Endangered

Amphibians

NAME	STATUS
San Marcos Salamander *Eurycea nana* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/6374	Threatened
Texas Blind Salamander *Eurycea [=Typhlomolge] rathbuni* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/5130	Endangered

Fishes

NAME	STATUS
Fountain Darter *Etheostoma fonticola* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/5858	Endangered

Insects

NAME	STATUS
[no Common Name] Beetle *Rhadine exilis* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/6942	Endangered
[no Common Name] Beetle *Rhadine infernalis* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/3804	Endangered
Helotes Mold Beetle *Batrisodes venyivi* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/1149	Endangered

Arachnids

NAME	STATUS
Braken Bat Cave Meshweaver *Cicurina venii* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/7900	Endangered
Cokendolpher Cave Harvestman *Texella cokendolpheri* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/676	Endangered
Government Canyon Bat Cave Meshweaver *Cicurina vespera* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/7037	Endangered
Government Canyon Bat Cave Spider *Neoleptoneta microps* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/553	Endangered
Madla Cave Meshweaver *Cicurina madla* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/2467	Endangered
Robber Baron Cave Meshweaver *Cicurina baronia* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/2361	Endangered

Flowering Plants

NAME	STATUS
Bracted Twistflower *Streptanthus bracteatus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/2856	Candidate
Texas Wild-rice *Zizania texana* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/805	Endangered

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

ATTACHMENT B

Threatened and Endangered Species Assessment

Mitchell Lake, San Antonio, TX

General Investigations Feasibility Study

May 2021

US Army Corps of Engineers®
Fort Worth District

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Table of Contents

1 Introduction

The United States Army Corps of Engineers (USACE), in cooperation with the San Antonio Water System (SAWS), is conducting the Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study to determine the feasibility of modifying the Mitchell Lake area to conduct ecosystem restoration and water resource opportunities. As part of the Feasibility Study, the USACE has prepared an integrated Feasibility Report and Environmental Assessment (FR/EA) in compliance with the National Environmental Policy Act (NEPA), USACE regulation ER-200-2, 33 Code of Federal Regulations (CFR) 230, and other Federal, state, and local environmental policies and procedures.

This Threatened and Endangered Species Assessment was prepared to fulfill the USACE's requirements under Section 7(c) of the Endangered Species Act (ESA) of 1973, as amended, and to provide information to assist the United States Fish and Wildlife Service (USFWS) in reviewing the project's effects on federally listed threatened and endangered species, species proposed or candidates for listing, and designated critical habitat. The project is not expected to adversely affect any listed species; therefore, consultation with the USFWS is expected to be informal, and no Biological Opinion (BO) is expected to be required for the project.

1.1 Background Information

Mitchell Lake is located in southern Bexar County within the San Antonio city limits. Historically, it was called Lake of the Ducks and was comprised of a complex of emergent wetlands dominated by tall emergent vegetation (Henderson and Lofgren 2008). The construction of a dam below the wetland complex in 1901, resulted in the formation of Mitchell Lake. The lake is approximately 650 acres of open water habitat and has an average depth of three to four feet. Historically, the City of San Antonio utilized Mitchell Lake for the disposal of raw sewage, sludge, waste activated sludge, and treated wastewater effluent from the Rilling Road Wastewater Treatment Plant (Robert J. Brandes Consulting 2016). The northern portion of the lake withheld a significant amount of sludge. This area was subsequently diked and isolated in the early 1970s, known as the East and West polders or polders. Later, the sludge began to exceed the capacity of the polders requiring the creation of five additional basins, known as Basins 1, 2, 3, 4, and 5. In 1987, sludge disposal in the polders and basins ceased after the Rilling Road WasteWater Treatment Plant was decommissioned. The Leon Creek Water Recycling Center, southwest of Mitchell Lake, supplements flow into the lake to maintain a water elevation of 519 feet. Due to the degraded water quality, there are no releases of water downstream of the dam with the exception of the flows resulting from the runoff of large storm events.

The environment within and around Mitchell Lake has suffered severe habitat degradation due to its historical status as a sewage disposal site and wastewater treatment plant. The Mitchell Lake study area encompasses approximately 6,718 acres. The lake and surrounding uplands and grasslands are leased by the Mitchell Lake Audubon Society, while the property is owned by SAWS. The Audubon Society utilizes the leased areas for recreation and educational purposes.

Mitchell Lake is an approximately 600 acre impoundment currently owned and managed by SAWS. It has an earth-and-rock embankment dam at the southern end of its boundary, approximately 3,200 feet long and 30 to 60 feet wide. The polders and basins abut the northern shore of the lake. The East Polder is approximately 47 acres and West Polder is approximately 32 acres, both are located to the north of the basins. The basins are located between the lake and the polders and vary in size:

- Basin 1: 11 acres,
- Basin 2: 7 acres,
- Basin 3: 19 acres,
- Basin 4: 21 acres,
- and Basin 5: 22 acres.

1.2 Structure of Threatened and Endangered Species Assessment

Chapter 2 provides a description of existing conditions in the study area. Threatened and endangered species of potential occurrence in Bexar County are described in Chapter 3. Finally, Chapter 4 discusses the potential effects of the Recommended Plan on threatened and endangered species and provides the USACE's determinations of effect. A description of measures, alternatives, and the Recommended Plan can be found in Chapter 4 of the Integrated Feasibility Report and Environmental Assessment.

2 Environmental Baseline

2.1 Location

The proposed project is located in the San Antonio River Basin south of San Antonio, TX 78221. It is located within the city limits of San Antonio, surrounded by agriculture and other rural uses; however, the land use in the adjacent area is transitioning to residential development.

The USACE recognizes that factors outside of the Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study footprint influence the feasibility and sustainability of any actions that might be undertaken. Likewise, any actions that might be undertaken in cooperation with USACE could have positive or negative impacts on the surrounding area. Therefore, the study area includes the Mitchell Lake watershed (Figure 1). This resulting study area boundary consists of an area approximately one and a half miles on either side of Mitchell Lake and terminates along the Medina River.

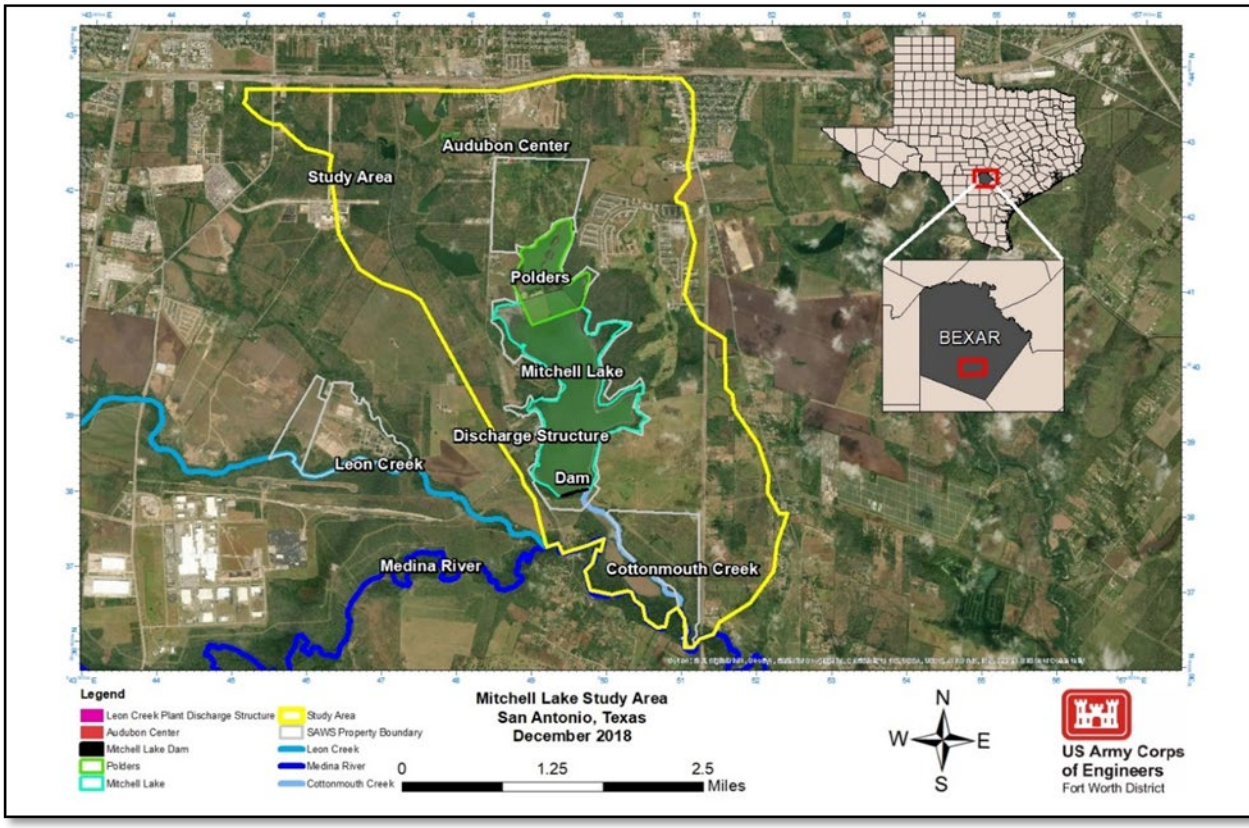

Figure 1. Mitchell Lake Study Area

The Mitchell Lake study area is dominated by non-native invasive species and native nuisance species resulting in habitats with low plant diversity. Woody vegetation in the study area was dominated by sugarberry (*Celtis laevigata*), palo verde (*Parkinsonia spp*.), willow baccharis (*Baccharis salicina*), huisache (*Vachellia farnesiana*), and mesquite (*Prosopis spp*.). Cedar elm (*Ulmus crassifolia*), mulberry (*Morus spp*.), willow (*Salix spp*.), box elder (*Acer negundo*), and spiny hackberry (*Celtis ehrenbergiana*) comprised an extremely minor component of the vegetative community and were not observed at all sites. Herbaceous vegetation was dominated by sow thistle (*Sonchus spp*.), hedge parsley (*Torilis arvensis*), western ragweed (*Ambrosia psilostachya*), and bedstraw (*Galium spp*.).

Wetland and aquatic plant species include cattail (*Typha domingensis*) and spikerush (*Eleocharis spp*.), duckweed (*Lemna spp*.) and smartweed (*Polygonum spp*.).

Invasive species included johnsongrass (*Sorghum halepense*), bermudagrass (*Cynodon dactylon*), chinaberry (*Melia azedarach*), alligator weed (*Alternanthera philoxeriodes*), and bastard cabbage (*Rapistrum spp*.).

2.2 Nearby Wildlife Refuges and Management Areas

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. There are no refuge lands within the study area.

2.3 Description of On-Site and Off-Site Habitats

The TPWD Ecological Mapping System was utilized and refined using the ArcGIS mapping tool to define the habitats within the Mitchell Lake study area (Figure 2). A large array of habitat types were listed, and were narrowed down for analysis purposes. Multiple site visits were conducted in order to better understand the potential project areas and their habitats. In general, the data collected showed low quality shrubland, upland, grassland, and emergent wetland habitat existing within the Mitchell Lake study area along with extremely low quality open water habitat.

2.3.1 On-Site Habitat

Bexar County includes three physiographic provinces: the Edwards Plateau, Blackland Prairie, and Interior Coastal Plain. The Edwards Plateau is located to the northwest and Interior Coastal Plain encompasses the southeastern part of Bexar County. The Balcones Escarpment and Fault Zone makes up the dividing line between the Edwards Plateau and the Blackland Prairie (TWDB 2019). The Mitchell Lake study area is located exclusively within the Texas Blackland Prairie.

The historical landscape of the study area was centered on a “Tule” wetland complex dominated by bulrush species and surrounded by Blackland Prairie. These wetlands were inundated with the construction of the Mitchell Lake Dam and the conversion of the reservoir to wastewater treatment facility. The Blackland Prairie is characterized by deep, fertile black soils (TPWD 2019). The Blackland Prairies supported a tallgrass prairie dominated by big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), Indiangrass (*Sorghastrum nutans),* and switchgrass (*Panicum virgatum*). Due to the fertile soils and proximity to the water from Mitchell Lake, much of the study area has been utilized for agricultural purposes.

2.3.2 Off-Site Habitat

Mitchell Lake is currently surrounded by agriculture fields and other rural uses. This area is still relatively undeveloped compared to the rest of San Antonio, TX; however, urbanization is expected to increase in the near future and is slowly transitioning to residential development.

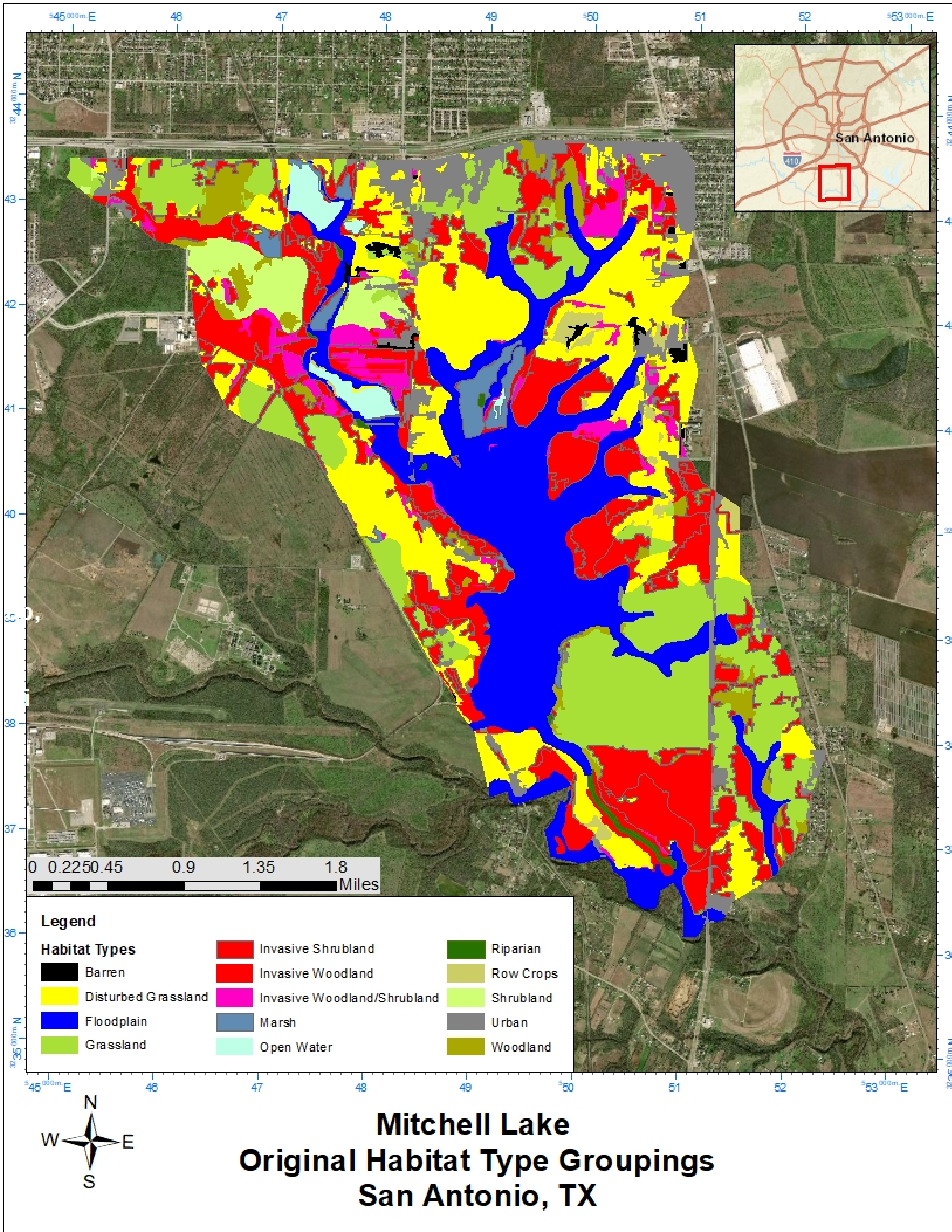

Figure 2. TPWD Ecological Mapping System Habitat Groupings

3 Status of the Species and Critical Habitat

This section provides an assessment of the existing biological resources within the Mitchell Lake study are to address the potential effects of implementing the Plans. The federally protected species potentially present in the study area are listed in Table 1.

Table 1. Federally Listed Threatened and Endangered Species (USFWS, 2020)

Name	Scientific Name	Federal Listing	Habitat Present
Birds			
Golden-cheeked Warbler	*Dendroica chrysoparia*	E	No
Piping Plover	*Charadrius melodus*	T	Yes
Red Knot	*Calidris canutus rufa*	T	Yes
Whooping Crane	*Grus Americana*	E	Yes
Amphibians			
San Marcos Salamander	*Eurycea nana*	T	No
Texas Blind Salamander	*Typhlomolge rathbuni*	E	No
Fishes			
Fountain Darter	*Etheostoma fonticola*	E	No
Mollusks			
Texas Fatmucket	*Lampsilis bracteata*	C	No[1]
Texas Pimpleback	*Quadrula petrina*	C	No[1]
Insects			
[no Common Name] Beetle	*Rhadine exilis*	E	No
[no Common Name] Beetle	*Rhadine infernalis*	E	No
Comal Springs Dryopid Beetle	*Stygoparnus comalensis*	E	No
Comal Springs Riffle Beetle	*Heterelmis comalensis*	E	No

Name	Scientific Name	Federal Listing	Habitat Present
Helotes Mold Beetle	*Batrisodes venyivi*	E	No
Arachnids			
Braken Bat Cave Meshweaver	*Cicurina venii*	E	No
Cokendolpher Cave Harvestmand	*Texella cokendolpheri*	E	No
Government Canyon Bat Cave Meshweaver	*Cicurina vespera*	E	No
Government Canyon Bat Cave Spider	*Neoleptoneta microps*	E	No
Madla's Cave Meshweaver	*Cicurina madla*	E	No
Robber Baron Cave Meshweaver	*Cicurina baronia*	E	No
Crustaceans			
Peck's Cave Amphipod	*Stygobromus (=Stygonectes) pecki*	E	No
Flowering Plants			
Bracted Twistflower	*Streptanthus bracteatus*	C	No
Texas Wild-rice	*Zizania texana*	E	No

[1]Although the habitat may occur in the study area, the poor water quality and lack of fish host species precludes the mussels from inhabiting the aquatic habitats of Mitchell Lake and the Polders

C: Candidate, T: Threatened, E: Endangered

3.1 All Other Species

Although the species mentioned in Chapter 4.0 have the potential of occurring within the study area, the extreme water quality precludes amphibians, fishes, mollusks, and crustaceans from inhabiting the aquatic habitats of Mitchell Lake and the Polders.

Golden-Cheeked Warbler

Golden-cheeked warbler habitat consists of old-growth and mature growth Ashe juniper-oak woodlands in rocky terrain (NatureServe 2018B). Within the U.S, the species can only be found with the Edwards Plateau Ecoregion during breeding season. It is a migratory species that spends its winters in Honduras and Guatemala. The species is small, yellow and black songbird that preys on insects. There are numerous occurrences of GCWA the study area, the last sighting was recorded in 2019 (eBird 2019). This occurrence is most likely due to utilizing the area as a resting place during migration than as its permanent residence due to the low quality habitat and lack of Ashe juniper-oak woodlands within the study area.

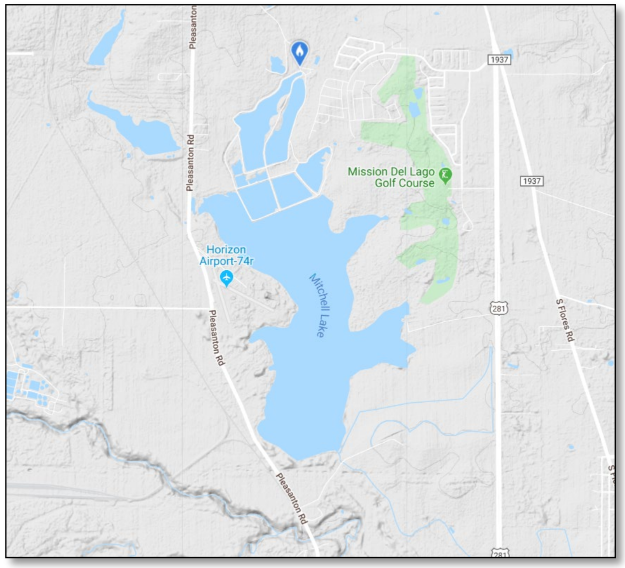

Figure 3. Golden-Cheeked Warbler Sighting (Image provided by eBird (www.ebird.org) and created [17 October 2019])

San Marcos Salamander

The San Marcos salamander occurs in Spring Lake and in rocky areas up to 500 feet downstream of the dam at Spring Lake (USFWS 1996). Moss and algae provide hiding places for the salamanders and habitat for small animals that serve as their food source. Clean, clear, flowing water of constant temperature is required for suitable habitat. The San Marcos salamander eats tiny aquatic crustaceans, aquatic insects, and snails. The total population size was estimated to be 53,200 individuals, with at least 5,200 individuals occurring within the spring systems of Comal County and San Marcos (USFWS 1996).

Habitat consists of algal mats (Tupa and Davis 1976), where rocks are associated with spring openings (Nelson 1993). Sandy substrates devoid of vegetation and muddy silt or detritus laden substrates with or without vegetation are apparently unsuitable habitats for this species. Specimens are occasionally collected from beneath stones in predominantly sand and gravel areas. In view of the abundance of predators (primarily larger fish, but also crayfish, turtles, and aquatic birds) in the immediate vicinity of spring orifices, protective cover such as that afforded by algal mats and rocks is essential to the survival of the salamander. The flowing spring waters in the principal habitat are near neutral (pH 6.7 to 7.2), range from 69.8 to 73.4 degrees Fahrenheit (°F), and are clear with low Dissolved Oxygen (DO) levels (Tupa and Davis 1976; Najvar 2001, Guyton and Associates 1979; Groeger et al. 1997).

Prey items for the San Marcos salamander include amphipods, tendipedid (midge fly) larvae and pupae, other small insect pupae and naiads (an aquatic life stage of mayflies, dragonflies, damselflies, and stone flies), and small aquatic snails (USFWS 1996).

Reduced flow of water from the springs is the greatest threat to the survival of the San Marcos salamander. The growth of cities has led to higher water use by people and increased problems with water pollution and silt accumulation. Introduction of exotic species is also a threat because they may destroy aquatic vegetation, prey on endangered animals, or compete with them for food.

Texas Blind Salamander

Texas blind salamanders are small white, blind, and translucent with red external gills. It lives in dark caves, with clear cool waters within the Edwards Aquifer near San Marcos, Texas. The external gills helps the species gather air from water and its diet consists of small crustaceans and invertebrates (TPWD 2019A).

Fountain Darter

Fountain darters are a small brown and white fish that can only be found within the San Marcos and Comal River headwaters. Within these areas they can be found in and around dense vegetation, preferably that of algal mats in slow moving waters. Their diet consists of small aquatic invertebrates (TPWD 2019B).

Golden Orb

The golden orb is an orange, yellow, or yellowish brown shelled freshwater mussel with green rays. It almost exclusively inhabits flowing waters in moderate-size streams and rivers with sand, gravel, and cobble bottoms with moderate depths. It is intolerant of impoundment or soft mud, shifting sand, or scoured bottoms. This species appears to be restricted to Nueces-Frio and Guadalupe-San Antonio River drainages and the San Marcos River (NatureServe 2019C).

Texas Fatmucket

Texas fatmucket is a small, ovate, brown, freshwater mussel. It occurs in the Colorado and Guadalupe-San Antonio drainage basins and with a possibility of occurring in the Central Brazos river basins. Its habitat consists of shallow (<1m) flowing creeks, rivers, and streams that flow over sand and gravel beds with bedrock underneath. This species is intolerant of impounded waters (NatureServe 2019D).

Texas Pimpleback

The Texas pimpleback is a large freshwater mussel with a moderately thick and inflated shell that generally reaches 2.4 to 3.5 inches in length. With the exception of growth lines, the shell of the Texas pimpleback is generally smooth. The Texas pimpleback typically occurs in moderately sized rivers, usually in mud, sand, gravel, and cobble, and occasionally in gravel-filled cracks in bedrock slab bottoms (Horne and McIntosh 1979; Howells 2002). The species has not been found in water depths greater than 6.6 feet. Texas pimplebacks have not been found in reservoirs, which indicates that this species is intolerant of deep, low-velocity waters created by artificial impoundments (Howells 2002). Texas pimplebacks appear to tolerate faster water more than many other mussel species (Horne and McIntosh 1979).

Karst-Dwelling Species

These species are threatened by the rapid urbanization of the San Antonio area due to the impacts of urban expansion on their habitat. Development can destroy caves and karst features through outright digging or filling or through indirect effects such as storm water run-off and pollutant leaks or spills (USFWS 2008). Due to the lack of cave and karst features within the Mitchell Lake study area, they are not likely to occur within the study area.

- *Rhadine exilis* - small, essentially eyeless ground beetle with a slender body, approximately 7.4 mm in length.

- *Rhadine infernalis* – small, essentially eyeless reddish-brown ground beetle with a narrow neck and a body approximately 8 to 8.6 mm in length.
- Helotes Mold Beetle – tiny, reddish-brown beetle up to 2.4 mm in length.
- Cokendolpher Cave Harvestman – small, eyeless daddy long-leg with a pale orange body.
- Robber Baron Cave Spider – small, essentially eyeless spider that can be found in the Robber Baron Cave in Alamo Heights.
- Braken Bat Cave Meshweaver – small, essentially eyeless spider in Bexar County.
- Madla Cave Meshweaver – small, essentially eyeless spider with reduced pigment that can be found in eight caves in or near Government Canyon, Helotes, and the University of Texas at San Antonio.
- Government Canyon Bat Cave Meshweaver - small, essentially eyeless spider that can be found around the Government Canyon State Natural Area.
- Government Canyon Bat Cave Spider – small, essentially eyeless spider that can be found in approximately two caves in the Government Canyon State Natural Area.

Comal Springs Dryopid Beetle

Small brown aquatic beetle that does not swim. It lives in sub terrestrial habitat within two springs in Central Texas and relies on a steady, natural spring flow for all of its life (USFWS 2008).

Comal Springs Riffle Beetle

A small aquatic beetle growing to a maximum length of approximately 0.2 cm. The entire life cycle of the Comal Springs Riffle Beetle is dependent on the headwaters of the Comal and San Marcos Rivers (USFWS 2008).

Peck's Cave Amphipod

Peck's cave amphipod is a small yellowish semi-translucent eyeless amphipod. Its habitat is located in the subterranean springs of the Comal, Fern Bank and Hueco Springs. The critical habitat designation for this species has high water quality, relatively consistent water flow, a carbonate based water chemistry, and water temperatures ranging from 68ºF to 75ºF (NatureServe 2019H).

Bracted Twistflower

Bracted twistflower is 3-6ft tall annual herb that produces a purple flower. It can be found on slopes and canyon valleys with low density oak-juniper forests on shallow, well drained, gravelly clays and clay loams over limestone bedrock (NatureServe 2019I). Bracted twistflower is not expected to occur in the project areas as it is very limited in abundance and distribution.

Texas Wild-rice

An aquatic perennial grass with a few leaves and flowering stalk that rises above the water's surface up to a height of one meter. It is known to inhabit relatively shallow, clear, flowing waters of spring origin with a constant temperature of 69.8-77 ºF. Texas wild-rice is a critically imperiled flowering plant with only one known site of occurrence. It can inhabit a few kilometers of the San Marcos River, where it was abundant until the 1950s. The small population rarely flowers or seeds in the wild. This plant has been heavily impacted by human modification in regards to water levels and quality. It is regularly trampled and removed by recreationalists in the area and is also impacted by the non-native nutria (*Myocastor coypus*) (NatureServe 2019J).

3.2 Red Knot

The red knot is a medium to large shorebird with a weight of 5 ounces, a body length of 9 to 10 inches, and a wingspan of 20 to 22 inches. During the breeding season, it has a rust-colored face, chest, and undersides, and dark brown wings. In winter, it has a gray head, chest, and upperparts and a white belly. It has long greenish legs and a pointed black bill. Males and females look similar, and juveniles resemble nonbreeding adults. The red knot was listed as threatened on December 11, 2014 (79 FR 73706).

The greatest threat to the red knot population is habitat loss in the U.S., followed by reduction of preferred prey items in nesting areas and along migration routes (USFWS 2014). The red knot breeds in tundra habitat of the central Canadian arctic, between May and mid-July, and winters along the U.S. coastline from North Carolina to Texas and south to Tierra del Fuego in South America between July and May; however, non-breeding red knots are known to remain in Texas year-round. Wintering habitat includes tidal flats, beaches, and oyster reefs, where they feed primarily on small invertebrates, particularly clams (Newstead 2012, Newstead et al. 2013, USFWS 2011). Long-term systematic population surveys are lacking for this species, but current estimates suggest Texas wintering populations may range between 50 and 2,000, with numbers increasing from survey counts in the early 1990s to recent counts in 2012. The increase in numbers does not necessarily reflect an increase in the population, but may be due to an increase or variation in survey effort. Although rigorous population estimates are lacking, preliminary trends indicate prolonged decline followed by stabilization of small populations (USFWS 2014). The last sighting of red knots within the study area was in 1997 (eBird 2019).

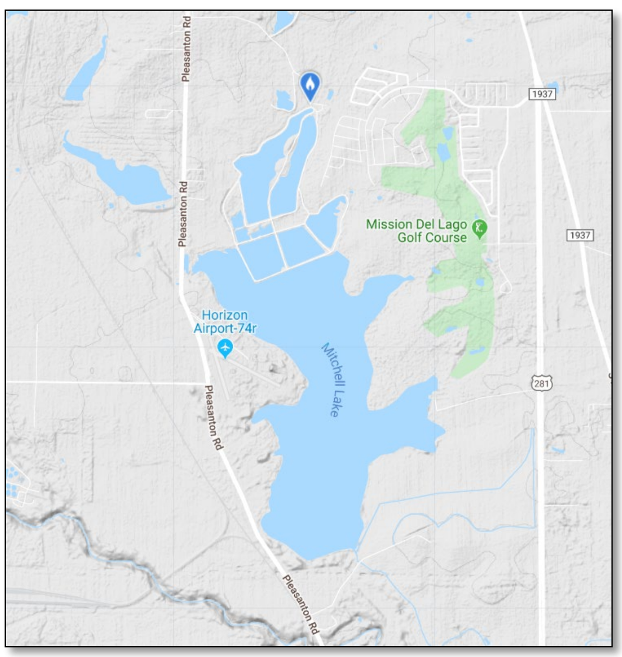

Figure 4. Red Knot Occurrence Location (Image provided by eBird (www.ebird.org) and created [17 October 2019])

3.3 Piping Plover

The piping plover is a migratory shorebird listed as endangered in the watershed of the Great Lakes and threatened in the remainder of its range (the Northern Great Plains, Atlantic coast, Gulf coast, the Bahamas, and the West Indies) (USFWS 1985). The Northern Great Plains population of piping plover spends up to 10 months a year on its wintering ground along the Gulf coast and arrives on prairie breeding grounds in early May. During migration periods, they use large rivers, reservoir beaches, mudflats, and alkali flats (Haig 1986). They feed on aquatic and terrestrial invertebrates. The migration and wintering period may last as long as 10 months (mid-July through mid-May). Migration to breeding grounds may occur from mid-February through mid-May, with peak migrations in March. Wintering piping plovers forage on invertebrates located on top of the sand or just below the surface along wrack lines (organic material including seaweed, seashells, driftwood, and other materials deposited on beaches by tidal action). Specific prey items may include polychaete marine worms, crustaceans, fly larvae, beetles, and bivalve mollusks (USFWS 2012).

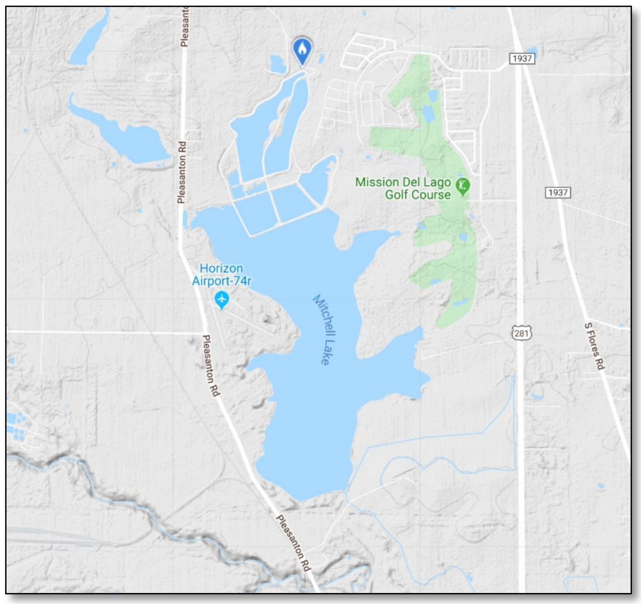

Figure 5. Piping Plover Occurrence Location (Image provided by eBird (www.ebird.org) and created [17 October 2019])

3.4 Whooping Crane

Whooping cranes are white, tall, have black legs and a reddish black head. Their habitat consists of marshes, shallow lakes, lagoons, salt flats, grain and stubble fields, and barrier islands (AOU 1983, Matthews and Moseley 1990). Autumn migration normally begins in mid-September flying from Wood Buffalo National Park in central Canada, with most birds arriving on the wintering grounds at Aransas National Wildlife Refuge between late October and mid-November. Spring migration occurs during March and April. It has a diverse diet consisting of crabs, snails, fish, frogs, lizards, worms, insects, berries, grains, and acorns. Lakes, ponds, and other open water bodies in Central Texas may be briefly used as stopover habitat by whooping crane (NatureServe 2019A).

4 Effects of the Recommended Plan

The ESA prohibits “take” of any federally listed species [16 United States Code (USC) § 1538(a))], where take is defined as “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (16 USC §1532(19)). The ESA requires that federal agencies ensure that any activity that an agency funds, authorized, or carries out does not jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat (16 USC §1536). The USFWS and NMFS have legislative authority under the ESA to list and monitor the status of wildlife species whose populations are considered to be imperiled (16 USC §1533). Species listed as "endangered" or "threatened" by the USFWS and NMFS (henceforth, "listed species") are provided full protection. This protection not only prohibits the direct take of a protected species, but also includes a prohibition of indirect take, such as destruction of designated critical habitat. Federal listings for protected animals and plants are provided in separate chapter of the CFR: 50 CFR 17.11 for animals and 50 CFR 17.12 for plants. The federal process also includes identifying "candidates" for listing under the ESA. While on the candidate list, species are not provided any federal protection but may be protected by state law. ESA implementing regulations (50 CFR 402) require federal agencies to complete a BA to determine whether a proposed project may affect a listed species.

In addition to direct and indirect effects, a BA also considers cumulative effects, which include the effects of future state, tribal, local, or private actions that are reasonably certain to occur in the Action Area, which is defined as the area that will be affected by a proposed activity or project. Future federal actions that are unrelated to the proposed action are not considered because they would require separate consultation pursuant to Section 7 of the ESA (USFWS and NMFS 1998). It is assumed that all species within the Mitchell Lake study area fall under the jurisdiction of USFWS.

For listed species, one of three possible determinations of effect is made (USFWS and NMFS 1998):

- No effect—the proposed action will have no adverse or beneficial effects on the species or critical habitat.
- May affect, but is not likely to adversely affect—the proposed action may affect listed species and/or critical habitat; however, the effects are expected to be discountable, insignificant, or beneficial.
- May affect, is likely to adversely affect—adverse effects to listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent activities, and the effect is not discountable or insignificant.

The Recommended Plan was evaluated and the anticipated effects of the action determined in accordance with the ESA. The following sections discuss the anticipated direct and indirect effects of the Recommended Plan on each species that has the potential to occur in the study area.

4.1 All Other Species

The proposed Mitchell Lake Aquatic Ecosystem Restoration project and associated construction will have *no effect* on San Marcos Salamander, Texas Blind Salamander, Fountain Darter, Texas Fatmucket, Texas Pimpleback, *Rhadine exilis*, *Rhadine infernalis*, Comal Springs Dyopid Beetle, Comal Springs Riffle Beetle, Helotes Mold Beetle, Bracken Cave Meshweaver, Cokendolpher Cave Harvestman, Government Canyon Bat Cave Meshweaver, Government Canyon Bat Cave Spider, Madla Cave Meshweaver, Robber Baron Cave Meshweaver, Peck's Cave Amphipod, Bracted Twistflower, and Texas Wild-rice due to the lack of habitat availability, poor water quality, and generally low quality habitat at Mitchell Lake.

Although the potential for the golden-cheeked warbler to occur within the study area is very small, there is some potential for this species to occupy the area for a brief period during migration. However, the lack of suitable habitat and likelihood of permanent residents in the area leads to an action determination of *no effect*.

4.2 Red Knot and Piping Plover

The project does not entail wind energy aspects. Although there have been unofficial recorded sightings within the study area of these species, the likelihood of their occurrence is low. They are more likely to occur in the study area during migration to rest and forage. They should mostly be given consideration in regards to wind energy projects; therefore, there will be *no effect* on red knot or piping plover.

4.3 Whooping Crane

Construction activities will create temporary, short-term increases in noise levels. However, whooping cranes prefer to forage away from human disturbance. Therefore, they are not likely to occur in the study areas during typical operations and maintenance of the existing facilities, nor are they expected to be present during construction activities or maintenance dredging activities. Additionally, the habitat available at Mitchell Lake is not conducive for Whooping Crane nesting and permanent residence. Whooping Crane are not likely to occur at Mitchell Lake, unless they are utilizing the area for stopover habitat. Overall, the project will have *no effect* on whooping cranes.

5 Summary of Recommended Determination Effects

The Recommended Plan is anticipated to have *no effect* on 24 of the 24 federally listed threatened or endangered species.

Name	Scientific Name	Listing Status	Potential to Occur in Study Area	Recommended Plan Effect Determination
Birds				
Golden-cheeked Warbler	*Dendroica chrysoparia*	E	Yes	No Effect
Piping Plover	*Charadrius melodus*	T	Yes	No Effect
Red Knot	*Calidris canutus rufa*	T	Yes	No Effect
Whooping Crane	*Grus Americana*	E	Yes	No Effect
Amphibians				
San Marcos Salamander	*Eurycea nana*	T	No	No Effect
Texas Blind Salamander	*Typhlomolge rathbuni*	E	No	No Effect
Fishes				

Name	Scientific Name	Listing Status	Potential to Occur in Study Area	Recommended Plan Effect Determination
Fountain Darter	*Etheostoma fonticola*	E	No	No Effect
Mollusks				
Texas Fatmucket	*Lampsilis bracteata*	C	No	No Effect
Texas Pimpleback	*Quadrula petrina*	C	No	No Effect
Insects				
[no Common Name] Beetle	*Rhadine exilis*	E	No	No Effect
[no Common Name] Beetle	*Rhadine infernalis*	E	No	No Effect
Comal Springs Dryopid Beetle	*Stygoparnus comalensis*	E	No	No Effect
Comal Springs Riffle Beetle	*Heterelmis comalensis*	E	No	No Effect
Helotes Mold Beetle	*Batrisodes venyivi*	E	No	No Effect
Arachnids				
Braken Bat Cave Meshweaver	*Cicurina venii*	E	No	No Effect
Cokendolpher Cave Harvestmand	*Texella cokendolpheri*	E	No	No Effect
Government Canyon Bat Cave Meshweaver	*Cicurina vespera*	E	No	No Effect
Government Canyon Bat Cave Spider	*Neoleptoneta microps*	E	No	No Effect
Madla's Cave Meshweaver	*Cicurina madla*	E	No	No Effect
Robber Baron Cave Meshweaver	*Cicurina baronia*	E	No	No Effect
Crustaceans				

Name	Scientific Name	Listing Status	Potential to Occur in Study Area	Recommended Plan Effect Determination
Peck's Cave Amphipod	*Stygobromus (=Stygonectes) pecki*	E	No	No Effect
Flowering Plants				
Bracted Twistflower	*Streptanthus bracteatus*	C	No	No Effect
Texas Wild-rice	*Zizania texana*	E	No	No Effect

6 References

American Ornithologists' Union (AOU). 1983. Check-list of North American Birds, 6th edition. Allen Press, Inc., Lawrence, Kansas. 877 pp.

Canadian Wildlife Service and U.S. Fish and Wildlife Service (CWS and USFWS). 2007. International recovery plan for the whooping crane. Ottawa: Recovery of Nationally Endangered Wildlife (RENEW), and U.S. Fish and Wildlife Service, Albuquerque, New Mexico.162 pp.

eBird. 2019. eBird: An online database of bird distribution and abundance [Google Chrome]. eBird, Ithaca, New York. Available: http://www.ebird.org. Accessed on 17 October 2019.

Groeger, A. W., Brown P. F., Tietjen T. E., and Kelsey T. C. 1997. Water quality of the San Marcos River. Texas Journal of Science 49:279-294.

Guyton, W. F. and Associates. 1979. Geohydrology of Comal, San Marcos, and Hueco springs. Texas Department of Water Resources, Report 234 Handbook of Texas Online 2012.

Haig, S. M., C. L. Ferland, F. J. Cuthbert, J. Dingledine, J. P. Goossen, A. Hecht, and N. McPhillips. 2005. A complete species census and evidence for regional declines in piping plovers. Journal of Wildlife Management 69.1:160-173.

Horne, F. R. and S. McIntosh. 1979. Factors influencing distribution of mussels in the Blanco River of central Texas. *The Nautilus* 94:119-133.

Howells, R. G. 2002. *Freshwater mussels (Unionidae) of the pimpleback complex (Quadrula spp.) in Texas.* Texas Parks and Wildlife Management Data Series 197. Austin, Texas.36 pp.

Kuyt, E. 1992. Aerial radio-tracking of whooping cranes migrating between Wood Buffalo National Park and Aransas National Wildlife Refuge, 1981-1984. Occasional Paper Number 74. Canadian Wildlife Service. Ottawa, Canada.

Matthews, J.R. and C.J. Moseley (eds.). 1990. The Official World Wildlife Fund Guide to Endangered Species of North America. Volume 1. Plants, Mammals. xxiii + pp 1-560 + 33 pp. appendix + 6 pp. glossary + 16 pp. index. Volume 2. Birds, Reptiles, Amphibians, Fishes, Mussels, Crustaceans, Snails, Insects, and Arachnids. xiii + pp. 561-1180. Beacham Publications, Inc., Washington, D.C

Najvar, P. A. 2001. The effects of diel water quality fluctuations on reproduction and growth in the San Marcos salamander. M.S. thesis, Southwest Texas State University, San Marcos.

NatureServe. 2019A. Whooping Crane: Ecology Life History. Available on the internet at: http://explorer.natureserve.org/servlet/NatureServe?searchName=Grus+americana. Accessed on 22 October 2019.

NatureServe 2019B. Golden-cheeked Warbler: Ecology & Life History. Available on the internet at:http://explorer.natureserve.org/servlet/NatureServe?searchName=Dendroica+chrysoparia+. Accessed on 22 October 2019.

NatureServe 2019C. Golden Orb: Ecology & Life History. Available on the internet at: http://explorer.natureserve.org/servlet/NatureServe?searchName=Quadrula%20aurea. Accessed on 22 October 2019.

NatureServe 2019D. Texas Fatmucket: Ecology & Life History. Available on the internet at: http://explorer.natureserve.org/servlet/NatureServe?searchName=Lampsilis+bracteata. Accessed on 22 October 2019.

NatureServe 2019E. Texas Fawnsfoot: Ecology & Life History. Available on the internet at: http://explorer.natureserve.org/servlet/NatureServe?searchName=truncilla+macrodon. Accessed on 22 October 2019.

NatureServe 2019F.Texas Pimpleback: Ecology & Life History. Available on the internet at: http://explorer.natureserve.org/servlet/NatureServe?searchName=Quadrula+petrina. Accessed on 22 October 2019.

NatureServe 2019G. Comal Springs Dryopid Beetle: Ecology & Life History. Available on the internet at: http://explorer.natureserve.org/servlet/NatureServe?searchName=Stygoparnus+comalensis. Accessed on 22 October 2019.

NatureServe. 2019H. Peck's Cave Amphipod: Ecology & Life History. Available on the internet at: http://explorer.natureserve.org/servlet/NatureServe?searchName=Stygobromus+pecki. Accessed on 22 October 2019.

NatureServe. 2019I. Gray Bracted Twistflower: Ecology & Life History. Available on the internet at:http://explorer.natureserve.org/servlet/NatureServe?searchName=Streptanthus+bracteatus. Accessed on 22 October 2019.

NatureServe. 2019J. Texas Wild Rice: Ecology & Life History. Available on the internet at: http://explorer.natureserve.org/servlet/NatureServe?searchName=Zizania+texana. Accessed on 22 October 2019.

Nelson, J. 1993. Population size, distribution, and life history of Eurycea nana in the San Marcos River. M.S. Thesis, Southwest TSU, San Marcos, Texas.

Newstead, D. J. 2012. Habitat use of North Padre Island and Laguna Madre habitats by piping plover and red knots in the vicinity of current and proposed wind energy development. Interim Report the Endangered Species Program Texas. Texas Parks and Wildlife Department, Austin, Texas, USA.

Newstead, D. J., L. J. Niles, R. R. Porter, A. D. Dey, J. Burger, and O. N. Fitzsimmons. 2013. Geolocation reveals mid-continent migratory routes and Texas

Texas Parks and Wildlife (TPWD). 2019A. Texas Blind Salamander (*Eurycea rathbuni*). Available on the internet at: https://tpwd.texas.gov/huntwild/wild/species/blindsal/. Accessed on 23 October 2019.

TPWD. 2019B. Fountain Darter (*Etheostoma fonticola*). Available on the internet at: https://tpwd.texas.gov/huntwild/wild/species/fdarter/. Accessed on 23 October 2019.

Texas Water Development Board. 2019. Edwards (Balcones Fault Zone) Aquifer. http://www.twdb.texas.gov/groundwater/aquifer/majors/edwards-bfz.asp. Accessed 19 July 2019

Tupa, D., W. Davis. 1976. Population dynamics of the San Marcos salamander, Eurycea nana Bishop. The Texas Journal of Science, 27:179-194.

USFWS. 1985. Determination of endangered and threatened status for piping plover. Federal Register 50:50726-50734.

USFWS. 1996. San Marcos & Comal Springs & Associated Aquatic Ecosystems (Revised) Recovery Plan. Albuquerque, New Mexico.

USFWS. 2008. Bexar County Karst Invertebrates *Draft Recovery Plan.* Southwest Region, U.S. Fish and Wildlife Service, Albuquerque, New Mexico. http://www.edwardsaquifer.net/pdf/karst_invertebrate_recovery_plan.pdf. Accessed on 23 October 2019.

USFWS. 2011. Species assessment and listing priority assignment form – Red knot (*Calidris canutus* ssp. *rufa*). U.S. Fish and Wildlife Service, Northeast Region, Hadley, Massachusetts, USA.

USFWS. 2012. Comprehensive conservation strategy for the piping plover (*Charadrius melodus*) in its coastal migration and wintering range in the continental United States. USFWS, East Lansing, Michigan, USA.

USFWS. 2014. Rufa red knot background information and threats assessment; supplement to endangered and threatened wildlife and plants; Final threatened status for the rufa red knot (*Calidris canutus rufa*) [Docket No. FWS-R5-ES-2013-0097; RIN AY17].

USFWS. 2020. U.S. Fish and Wildlife Service. Information, Planning, and Consultation system, Environmental Conservation Online System. https:ecos.fws.gov. Accessed on 22 September 2020.

ATTACHMENT C

Last Update: 4/18/2019

BEXAR COUNTY

AMPHIBIANS

black-spotted newt *Notophthalmus meridionalis*

May be found in resacas and bodies of water with firm bottoms and little or no vegetation. Can be found in wet or sometimes wet areas, such as arroyos, canals, ditches, or even shallow depressions; the absence of predatory fish is probably important. Aestivates in the ground during dry periods; Gulf Coastal Plain south of the San Antonio River.

Federal Status: State Status: T SGCN: Y

Endemic: N Global Rank: G1 State Rank: S2

Cascade Caverns salamander *Eurycea latitans*

Subaquatic; springs and caves in Medina River, Guadalupe River, and Cibolo Creek watersheds within Edwards Aquifer area

Federal Status: State Status: T SGCN: Y

Endemic: Y Global Rank: G3 State Rank: S2

Comal Blind salamander *Eurycea tridentifera*

Occurs within the aphotic zones of shallow limestone caves with streams fed by phreatic groundwater; semi-troglobitic; found in springs and waters of caves

Federal Status: State Status: T SGCN: Y

Endemic: Y Global Rank: G1 State Rank: S1

Mexican treefrog *Smilisca baudinii*

The subtropical Rio Grande embayment around Brownsville. May do well in association with man and may tolerate relatively dry situations provided moist microclimates available; breeds May-October coinciding with rainfall, eggs laid in temporary rain pools.

Federal Status: State Status: T SGCN: Y

Endemic: N Global Rank: G5 State Rank: S3

Strecker's chorus frog *Pseudacris streckeri*

Wooded floodplains and flats, prairies, cultivated fields and marshes. Likes sandy substrates.

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G5 State Rank: S3

Texas salamander *Eurycea neotenes*

Troglobitic; springs, seeps, cave streams, and creek headwaters; often hides under rocks and leaves in water; restricted to Helotes and Leon Creek drainages

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G1 State Rank: S1S2

BEXAR COUNTY

AMPHIBIANS

Valdina Farms sinkhole salamander *Eurycea troglodytes*

Isolated, intermittent pools of subterranean streams and sinkholes in Nueces, Frio, Guadalupe, and Pedernales watersheds within Edwards Aquifer area.

Federal Status: State Status: SGCN: N

Endemic: Y Global Rank: G3 State Rank: S3S4

Woodhouse's toad *Anaxyrus woodhousii*

Extremely catholic up to 5000 feet, does very well (except for traffic) in association with man.

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G5 State Rank: SU

ARACHNIDS

Braken Bat Cave meshweaver *Cicurina venii*

Small, eyeless, or essentially eyeless spider; karst features in north and northwest Bexar County

Federal Status: LE State Status: SGCN: Y

Endemic: Y Global Rank: G1 State Rank: S1

Cokendolpher Cave harvestman *Texella cokendolpheri*

Small, eyeless harvestman; karst features in north and northwest Bexar County

Federal Status: LE State Status: SGCN: Y

Endemic: Y Global Rank: G1 State Rank: S1

Government Canyon Bat Cave meshweaver *Cicurina vespera*

Small, eyeless, or essentially eyeless spider; karst features in north and northwest Bexar County

Federal Status: LE State Status: SGCN: Y

Endemic: Y Global Rank: G1 State Rank: S1

Government Canyon Bat Cave spider *Neoleptoneta microps*

Small, eyeless, or essentially eyeless spider; karst features in north and northwest Bexar County

Federal Status: LE State Status: SGCN: Y

Endemic: Y Global Rank: G1 State Rank: S1

Madla Cave meshweaver *Cicurina madla*

Small, eyeless, or essentially eyeless spider; karst features in north and northwest Bexar County

Federal Status: LE State Status: SGCN: Y

Endemic: Y Global Rank: G1 State Rank: S1

BEXAR COUNTY

ARACHNIDS

No accepted common name *Speodesmus reddelli*

Habitat description is not available at this time.

Federal Status: State Status: SGCN: Y

Endemic: Global Rank: GNR State Rank: SNR

No accepted common name *Tartarocreagris amblyopa*

Habitat description is not available at this time.

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G1G2 State Rank: S1

No accepted common name *Tartarocreagris reyesi*

Habitat description is not available at this time.

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: GNR State Rank: S1

Robber Baron Cave meshweaver *Cicurina baronia*

Small, eyeless, or essentially eyeless spider; karst features in north and northwest Bexar County

Federal Status: LE State Status: SGCN: Y

Endemic: Y Global Rank: G1 State Rank: S1

ARTHROPODS

No accepted common name *Speodesmus falcatus*

Habitat description is not available at this time.

Federal Status: State Status: SGCN: Y

Endemic: Global Rank: GNR State Rank: SNR

No accepted common name *Speodesmus ivyi*

Habitat description is not available at this time.

Federal Status: State Status: SGCN: Y

Endemic: Global Rank: GNR State Rank: SNR

BIRDS

bald eagle *Haliaeetus leucocephalus*

Found primarily near rivers and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds

Federal Status: State Status: T SGCN: Y

Endemic: N Global Rank: G5 State Rank: S3B,S3N

BEXAR COUNTY

BIRDS

black-capped vireo *Vireo atricapilla*

Oak-juniper woodlands with distinctive patchy, two-layered aspect; shrub and tree layer with open, grassy spaces; requires foliage reaching to ground level for nesting cover; return to same territory, or one nearby, year after year; deciduous and broad-leaved shrubs and trees provide insects for feeding; species composition less important than presence of adequate broad-leaved shrubs, foliage to ground level, and required structure; nesting season March-late summer

Federal Status: State Status: E SGCN: Y

Endemic: N Global Rank: G3 State Rank: S2B

Franklin's gull *Leucophaeus pipixcan*

Habitat description is not available at this time.

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G4G5 State Rank: S2N

golden-cheeked warbler *Setophaga chrysoparia*

Ashe juniper in mixed stands with various oaks (Quercus spp.). Edges of cedar brakes. Dependent on Ashe juniper (also known as cedar) for long fine bark strips, only available from mature trees, used in nest construction; nests are placed in various trees other than Ashe juniper; only a few mature junipers or nearby cedar brakes can provide the necessary nest material; forage for insects in broad-leaved trees and shrubs; nesting late March-early summer.

Federal Status: LE State Status: E SGCN: Y

Endemic: N Global Rank: G2 State Rank: S2B

interior least tern *Sternula antillarum athalassos*

Sand beaches, flats, bays, inlets, lagoons, islands. Subspecies is listed only when inland (more than 50 miles from a coastline); nests along sand and gravel bars within braided streams, rivers; also know to nest on man-made structures (inland beaches, wastewater treatment plants, gravel mines, etc); eats small fish and crustaceans, when breeding forages within a few hundred feet of colony

Federal Status: LE State Status: E SGCN: Y

Endemic: N Global Rank: G4T2Q State Rank: S1B

mountain plover *Charadrius montanus*

Breeding: nests on high plains or shortgrass prairie, on ground in shallow depression; nonbreeding: shortgrass plains and bare, dirt (plowed) fields; primarily insectivorous

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G3 State Rank: S2

piping plover *Charadrius melodus*

BEXAR COUNTY

BIRDS

Beaches, sandflats, and dunes along Gulf Coast beaches and adjacent offshore islands. Also spoil islands in the Intracoastal Waterway. Based on the November 30, 1992 Section 6 Job No. 9.1, Piping Plover and Snowy Plover Winter Habitat Status Survey, algal flats appear to be the highest quality habitat. Some of the most important aspects of algal flats are their relative inaccessibility and their continuous availability throughout all tidal conditions. Sand flats often appear to be preferred over algal flats when both are available, but large portions of sand flats along the Texas coast are available only during low-very low tides and are often completely unavailable during extreme high tides or strong north winds. Beache appear to serve as a secondary habitat to the flats associated with the primary bays, lagoons, and inter-island passes. Beaches are rarely used on the southern Texas coast, where bayside habitat is always available, and are abandoned as bayside habitats become available on the central and northern coast. However, beaches are probably a vital habitat along the central and northern coast (i.e. north of Padre Island) during periods of extreme high tides that cover the flats. Optimal site characteristics appear to be large in area, sparsely vegetated, continuously available or in close proximity to secondary habitat, and with limited human disturbance.

Federal Status: LT State Status: T SGCN: Y

Endemic: N Global Rank: G3 State Rank: S2N

reddish egret *Egretta rufescens*

Resident of the Texas Gulf Coast; brackish marshes and shallow salt ponds and tidal flats; nests on ground or in trees or bushes, on dry coastal islands in brushy thickets of yucca and prickly pear

Federal Status: State Status: T SGCN: Y

Endemic: N Global Rank: G4 State Rank: S3B

tropical parula *Setophaga pitiayumi*

Semi-tropical evergreen woodland along rivers and resacas. Texas ebony, anacua and other trees with epiphytic plants hanging from them. Dense or open woods, undergrowth, brush, and trees along edges of rivers and resacas; breeding April to July.

Federal Status: State Status: T SGCN: Y

Endemic: N Global Rank: G5 State Rank: S3B

western burrowing owl *Athene cunicularia hypugaea*

Open grasslands, especially prairie, plains, and savanna, sometimes in open areas such as vacant lots near human habitation or airports; nests and roosts in abandoned burrows

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G4T4 State Rank: S2

white-faced ibis *Plegadis chihi*

Prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; currently confined to near-coastal rookeries in so-called hog-wallow prairies. Nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats.

Federal Status: State Status: T SGCN: Y

Endemic: N Global Rank: G5 State Rank: S4B

whooping crane *Grus americana*

Small ponds, marshes, and flooded grain fields for both roosting and foraging. Potential migrant via plains throughout most of state to coast; winters in coastal marshes of Aransas, Calhoun, and Refugio counties.

Federal Status: LE State Status: E SGCN: Y

Endemic: N Global Rank: G1 State Rank: S1N

BEXAR COUNTY

BIRDS

wood stork *Mycteria americana*

Prefers to nest in large tracts of baldcypress (Taxodium distichum) or red mangrove (Rhizophora mangle); forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960

Federal Status: State Status: T SGCN: Y

Endemic: N Global Rank: G4 State Rank: SHB,S2N

zone-tailed hawk *Buteo albonotatus*

Arid open country, including open deciduous or pine-oak woodland, mesa or mountain county, often near watercourses, and wooded canyons an tree-lined rivers along middle-slopes of desert mountains; nests in various habitats and sites, ranging from small trees in lower desert, giant cottonwoods in riparian areas, to mature conifers in high mountain regions

Federal Status: State Status: T SGCN: Y

Endemic: N Global Rank: G4 State Rank: S3B

CRUSTACEANS

a cave obligate isopod *Speocirolana hardeni*

Habitat description is not available at this time.

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G2G3 State Rank: S2

Cascade Cave amphipod *Stygobromus dejectus*

Subaquatic crustacean; subterranean obligate; in pools

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G1G2 State Rank: S1

Ezell's Cave amphipod *Stygobromus flagellatus*

Known only from artesian wells

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G2G3 State Rank: S3

No accepted common name *Mexiweckelia hardeni*

Habitat description is not available at this time.

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G2G3 State Rank: S2

FISH

alligator gar *Atractosteus spatula*

Habitat description is not available at this time.

Federal Status: State Status: SGCN: Y

BEXAR COUNTY

FISH

Endemic: N Global Rank: G3G4 State Rank: S4

american eel *Anguilla rostrata*

Coastal waterways below reservoirs to gulf; spawns January to February in ocean, larva move to coastal waters, metamorphose, then females move into freshwater; most aquatic habitats with access to ocean, muddy bottoms, still waters, large streams, lakes; can travel overland in wet areas; males in brackish estuaries; diet varies widely, geographically, and seasonally

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G4 State Rank: S4

chub shiner *Notropis potteri*

Habitat description is not available at this time.

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G4 State Rank: S4

Guadalupe bass *Micropterus treculii*

Endemic to perennial streams of the Edwards Plateau region; introduced in Nueces River system

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G3 State Rank: S3

Guadalupe darter *Percina apristis*

Most common over gravel or gravel and sand raceways of large streams and rivers.

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G4 State Rank: SNR

headwater catfish *Ictalurus lupus*

Originally throughout streams of the Edwards Plateau and the Rio Grande basin, currently limited to Rio Grande drainage, including Pecos River basin; springs, and sandy and rocky riffles, runs, and pools of clear creeks and small rivers

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G3 State Rank: S2

plateau shiner *Cyprinella lepida*

Edwards Plateau portion of Nueces basin, mainstem and tributaries of Nueces, Frio, and Sabinal rivers; clear, cool, spring-fed headwater creeks; usually over gravel

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G1G2 State Rank: S1S2

BEXAR COUNTY

FISH

river darter *Percina shumardi*

As above. More tolerant of turbidity than most darters.

Federal Status: State Status: SGCN: N

Endemic: Global Rank: G5 State Rank: S4

sharpnose shiner *Notropis oxyrhynchus*

Endemic to Brazos River drainage; also, apparently introduced into adjacent Colorado River drainage; large turbid river, with bottom a combination of sand, gravel, and clay-mud

Federal Status: LE State Status: SGCN: Y

Endemic: Y Global Rank: G3 State Rank: S3

silverband shiner *Notropis shumardi*

Habitat description is not available at this time.

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G5 State Rank: S4

smalleye shiner *Notropis buccula*

Endemic to upper Brazos River system and its tributaries (Clear Fork and Bosque); apparently introduced into adjacent Colorado River drainage; medium to large prairie streams with sandy substrate and turbid to clear warm water; presumably eats small aquatic invertebrates

Federal Status: LE State Status: SGCN: Y

Endemic: Y Global Rank: G2 State Rank: S2

Texas shiner *Notropis amabilis*

Habitat description is not available at this time.

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G4 State Rank: S4

toothless blindcat *Trogloglanis pattersoni*

To depths of 600 meters in subterranean waters of the San Antonio Pool of the Edwards Aquifer, troglobitic.

Federal Status: State Status: T SGCN: Y

Endemic: Y Global Rank: G1G2 State Rank: S1

widemouth blindcat *Satan eurystomus*

To depths of 600 meters in subterranean waters of the San Antonio Pool of the Edwards Aquifer, troglobitic.

Federal Status: State Status: T SGCN: Y

Endemic: Y Global Rank: G1G2 State Rank: S1

INSECTS

a cave obligate beetle *Batrisodes shadeae*

BEXAR COUNTY

INSECTS

Habitat description is not available at this time.

Federal Status: | State Status: | SGCN: Y
Endemic: | Global Rank: G1 | State Rank: SNR

a ground beetle *Rhadine exilis*

Small, essentially eyeless ground beetle; karst features in north and northwest Bexar County

Federal Status: LE | State Status: | SGCN: Y
Endemic: Y | Global Rank: G3 | State Rank: S1

a ground beetle *Rhadine infernalis*

Small, essentially eyeless ground beetle; karst features in north and northwest Bexar County

Federal Status: LE | State Status: | SGCN: Y
Endemic: Y | Global Rank: G2G3 | State Rank: S1

American bumblebee *Bombus pensylvanicus*

Habitat description is not available at this time.

Federal Status: | State Status: | SGCN: Y
Endemic: | Global Rank: G3G4 | State Rank: SNR

Helotes mold beetle *Batrisodes venyivi*

Small, eyeless mold beetle; karst features in northwestern Bexar County and northeastern Medina County

Federal Status: LE | State Status: | SGCN: Y
Endemic: Y | Global Rank: G1 | State Rank: S1

Manfreda giant-skipper *Stallingsia maculosus*

Most skippers are small and stout-bodied; name derives from fast, erratic flight; at rest most skippers hold front and hind wings at different angles; skipper larvae are smooth, with the head and neck constricted; skipper larvae usually feed inside a leaf shelter and pupate in a cocoon made of leaves fastened together with silk

Federal Status: | State Status: | SGCN: Y
Endemic: N | Global Rank: G1 | State Rank: S1

No accepted common name *Bombus variabilis*

Habitat description is not available at this time.

Federal Status: | State Status: | SGCN: Y
Endemic: | Global Rank: GU | State Rank: SNR

BEXAR COUNTY

INSECTS

No accepted common name *Cotinis boylei*

Habitat description is not available at this time.

Federal Status: State Status: SGCN: Y

Endemic: Global Rank: GNR State Rank: SNR

No accepted common name *Cotalpa conclamara*

Habitat description is not available at this time.

Federal Status: State Status: SGCN: Y

Endemic: Global Rank: GNR State Rank: SNR

No accepted common name *Dichopetala catinata*

Habitat description is not available at this time.

Federal Status: State Status: SGCN: Y

Endemic: Global Rank: GNR State Rank: SNR

No accepted common name *Dichopetala seeversi*

Habitat description is not available at this time.

Federal Status: State Status: SGCN: Y

Endemic: Global Rank: GNR State Rank: SNR

No accepted common name *Lymantes nadineae*

Habitat description is not available at this time.

Federal Status: State Status: SGCN: Y

Endemic: Global Rank: GNR State Rank: SNR

No accepted common name *Megachile parksi*

Habitat description is not available at this time.

Federal Status: State Status: SGCN: Y

Endemic: Global Rank: GH State Rank: SNR

No accepted common name *Nectopsyche texana*

Habitat description is not available at this time.

Federal Status: State Status: SGCN: Y

Endemic: Global Rank: G1G3 State Rank: S2?

BEXAR COUNTY

INSECTS

No accepted common name *Rhadine bullis*

Habitat description is not available at this time.

Federal Status: State Status: SGCN: Y

Endemic: Global Rank: GNR State Rank: SNR

No accepted common name *Pygarctia lorula*

Habitat description is not available at this time.

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G2G3 State Rank: S2?

MAMMALS

American badger *Taxidea taxus*

Habitat description is not available at this time.

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G5 State Rank: S5

big brown bat *Eptesicus fuscus*

Any wooded areas or woodlands except south Texas. Riparian areas in west Texas.

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G5 State Rank: S5

big free-tailed bat *Nyctinomops macrotis*

Habitat data sparse but records indicate that species prefers to roost in crevices and cracks in high canyon walls, but will use buildings, as well; reproduction data sparse, gives birth to single offspring late June-early July; females gather in nursery colonies; winter habits undetermined, but may hibernate in the Trans-Pecos; opportunistic insectivore

Federal Status: State Status: SGCN: Y

Endemic: Global Rank: G5 State Rank: S3

black bear *Ursus americanus*

In Chisos, prefers higher elevations where pinyon-oaks predominate; also occasionally sighted in desert scrub of Trans-Pecos (Black Gap Wildlife Management Area) and Edwards Plateau in juniper-oak habitat. For ssp. luteolus, bottomland hardwoods, floodplain forests, upland hardwoods with mixed pine; marsh. Bottomland hardwoods and large tracts of inaccessible forested areas.

Federal Status: State Status: T SGCN: Y

Endemic: N Global Rank: G5 State Rank: S3

black-tailed prairie dog *Cynomys ludovicianus*

Dry, flat, short grasslands with low, relatively sparse vegetation, including areas overgrazed by cattle; live in large family groups

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G4 State Rank: S3

BEXAR COUNTY

MAMMALS

cave myotis bat *Myotis velifer*

Colonial and cave-dwelling; also roosts in rock crevices, old buildings, carports, under bridges, and even in abandoned Cliff Swallow (Hirundo pyrrhonota) nests; roosts in clusters of up to thousands of individuals; hibernates in limestone caves of Edwards Plateau and gypsum cave of Panhandle during winter; opportunistic insectivore.

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G4G5 State Rank: S4

eastern red bat *Lasiurus borealis*

Found in a variety of habitats in Texas. Usually associated with wooded areas. Found in towns especially during migration.

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G3G4 State Rank: S4

eastern spotted skunk *Spilogale putorius*

Catholic; open fields prairies, croplands, fence rows, farmyards, forest edges & woodlands. Prefer wooded, brushy areas & tallgrass prairies. S.p. ssp. interrupta found in wooded areas and tallgrass prairies, preferring rocky canyons and outcrops when such sites are available.

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G4 State Rank: S1S3

hoary bat *Lasiurus cinereus*

Known from montane and riparian woodland in Trans-Pecos, forests and woods in east and central Texas.

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G3G4 State Rank: S4

long-tailed weasel *Mustela frenata*

Includes brushlands, fence rows, upland woods and bottomland hardwoods, forest edges & rocky desert scrub. Usually live close to water.

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G5 State Rank: S5

Mexican free-tailed bat *Tadarida brasiliensis*

Roosts in buildings in east Texas. Largest maternity roosts are in limestone caves on the Edwards Plateau. Found in all habitats, forest to desert.

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G5 State Rank: S5

mink *Neovison vison*

Intimately associated with water; coastal swamps & marshes, wooded riparian zones, edges of lakes. Prefer floodplains.

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G5 State Rank: S4

BEXAR COUNTY

MAMMALS

mountain lion *Puma concolor*

Rugged mountains & riparian zones.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S2S3

plains spotted skunk *Spilogale putorius interrupta*

Catholic; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie

Federal Status:	State Status:	SGCN: N
Endemic: N	Global Rank: G4T4	State Rank: S1S3

swamp rabbit *Sylvilagus aquaticus*

Habitat description is not available at this time.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S5

thirteen-lined ground squirrel *Ictidomys tridecemlineatus*

Habitat description is not available at this time.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S5

tricolored bat *Perimyotis subflavus*

Forest, woodland and riparian areas are important. Caves are very important to this species.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G2G3	State Rank: S3S4

western hog-nosed skunk *Conepatus leuconotus*

Habitats include woodlands, grasslands & deserts, to 7200 feet, most common in rugged, rocky canyon country; little is known about the habitat of the ssp. telmalestes

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: S4

western spotted skunk *Spilogale gracilis*

Habitat description is not available at this time.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S5

BEXAR COUNTY

MAMMALS

white-nosed coati *Nasua narica*

Woodlands, riparian corridors and canyons.Most individuals in Texas probably transients from Mexico; diurnal and crepuscular; very sociable; forages on ground and in trees; omnivorous; may be susceptible to hunting, trapping, and pet trade

Federal Status: State Status: T SGCN: Y

Endemic: N Global Rank: G5 State Rank: S1

MOLLUSKS

golden orb *Quadrula aurea*

Sand and gravel in some locations and mud at others; found in lentic and lotic; Guadalupe, San Antonio, Lower San Marcos, and Nueces River basins

Federal Status: C State Status: T SGCN: Y

Endemic: Y Global Rank: G1 State Rank: S2

mimic cavesnail *Phreatodrobia imitata*

Subaquatic; only known from two wells penetrating the Edwards Aquifer

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G1 State Rank: S1

No accepted common name *Cyclonaias necki*

Habitat description is not available at this time.

Federal Status: State Status: SGCN: N

Endemic: Y Global Rank: GNR State Rank: SNR

No accepted common name *Phreatodrobia conica*

Habitat description is not available at this time.

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G1 State Rank: S2

REPTILES

American alligator *Alligator mississippiensis*

Coastal marshes; inland natural rivers, swamps and marshes; manmade impoundments.

Federal Status: State Status: SGCN: N

Endemic: N Global Rank: G5 State Rank: S4

BEXAR COUNTY

REPTILES

Cagle's map turtle *Graptemys caglei*

Guadalupe River System; shallow water with swift to moderate flow and gravel or cobble bottom, connected by deeper pools with a slower flow rate and a silt or mud bottom; gravel bar riffles and transition areas between riffles and pools especially important in providing insect prey items; nests on gently sloping sand banks within ca. 30 feet of waters edge

Federal Status:	State Status: T	SGCN: Y
Endemic: Y	Global Rank: G3	State Rank: S1

common garter snake *Thamnophis sirtalis*

Irrigation canals and riparian-corridor farmlands in west; marshy, flooded pastureland, grassy or brushy borders of permanent bodies of water; coastal salt marshes.

Federal Status:	State Status:	SGCN: N
Endemic:	Global Rank: G5	State Rank: S2

eastern box turtle *Terrapene carolina*

Eastern box turtles inhabit forests, fields, forest-brush, and forest-field ecotones. In some areas they move seasonally from fields in spring to forest in summer. They commonly enters pools of shallow water in summer. For shelter, they burrow into loose soil, debris, mud, old stump holes, or under leaf litter. They can successfully hibernate in sites that may experience subfreezing temperatures. In Maryland bottomland forest, some hibernated in pits or depressions in forest floor (usually about 30 cm deep) usually within summer range; individuals tended to hibernate in same area in different years (Stickel 1989). Also attracted to farms, old fields and cut-over woodlands, as well as creek bottoms and dense woodlands. Egg laying sites often are sandy or loamy soils in open areas; females may move from bottomlands to warmer and drier sites to nest. In Maryland, females used the same nesting area in different years (Stickel 1989).

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S3

keeled earless lizard *Holbrookia propinqua*

Coastal dunes, barrier islands, and other sandy areas; eats insects and likely other small invertebrates; eggs laid underground March-September (most May-August)

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: S3

Mexican blackhead snake *Tantilla atriceps*

Southern Texas and northeastern Mexico; shrubland savanna; nocturnal; lays clutch of probably 1-3 eggs

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: S1

northern spot-tailed earless lizard *Holbrookia lacerata lacerata*

Habitat description is not available at this time.

Federal Status:	State Status:	SGCN: Y
Endemic: Y	Global Rank: G3G4TNR	State Rank: S2

slender glass lizard *Ophisaurus attenuatus*

BEXAR COUNTY

REPTILES

Prefers relatively dry microhabitats, usually associated with grassy areas. Habitats include open grassland, prairie, woodland edge, open woodland, oak savannas, longleaf pine flatwoods, scrubby areas, fallow fields, and areas near streams and ponds, often in habitats with sandy soil. This species often appears on roads in spring. During inactivity, it occurs in underground burrows. In Kansas, slender glass lizards were scarce in heavily grazed pastures, increased as grass increased with removal of grazing, and declined as brush and trees replaced grass (Fitch 1989). Eggs are laid underground, under cover, or under grass clumps (Ashton and Ashton 1985); in cavities beneath flat rocks or in abandoned tunnels of small mammals (Scalopus, Microtus) (Fitch 1989).

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G5 State Rank: S3

southern spot-tailed earless lizard *Holbrookia lacerata subcaudalis*

Habitat description is not available at this time.

Federal Status: State Status: SGCN: Y

Endemic: Global Rank: G3G4TNR State Rank: S2

spot-tailed earless lizard *Holbrookia lacerata*

Central and southern Texas and adjacent Mexico; moderately open prairie-brushland; fairly flat areas free of vegetation or other obstructions, including disturbed areas; eats small invertebrates; eggs laid underground

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G3G4 State Rank: S2

Texas garter snake *Thamnophis sirtalis annectens*

Irrigation canals and riparian-corridor farmlands in west; marshy, flooded pastureland, grassy or brushy borders of permanent bodies of water; coastal salt marshes. Wet or moist microhabitats are conducive to the species occurrence, but is not necessarily restricted to them; hibernates underground or in or under surface cover; breeds March-August.

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G5T4 State Rank: S1

Texas horned lizard *Phrynosoma cornutum*

Occurs to 6000 feet, but largely limited below the pinyon-juniper zone on mountains in the Big Bend area. Open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September.

Federal Status: State Status: T SGCN: Y

Endemic: N Global Rank: G4G5 State Rank: S3

Texas indigo snake *Drymarchon melanurus erebennus*

Thornbush-chaparral woodland of south Texas, in particular dense riparian corridors.Can do well in suburban and irrigated croplands if not molested or indirectly poisoned. Requires moist microhabitats, such as rodent burrows, for shelter; Texas south of the Guadalupe River and Balcones Escarpment.

Federal Status: State Status: T SGCN: Y

Endemic: Global Rank: G5T4 State Rank: S4

Texas tortoise *Gopherus berlandieri*

BEXAR COUNTY

REPTILES

Open brush with a grass understory is preferred; open grass and bare ground are avoided. Seasonally flooded tidal flats are not utilized. When inactive occupies shallow depressions at base of bush or cactus, sometimes in underground burrows or under objects; longevity greater than 50 years; active March-November; breeds April-November

Federal Status:	State Status: T	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: S2

timber (canebrake) rattlesnake *Crotalus horridus*

Swamps, floodplains, upland pine and deciduous woodland, riparian zones, abandoned farmland. Limestone bluffs, sandy soil or black clay. Prefers dense ground cover, i.e. grapevines, palmetto.

Federal Status:	State Status: T	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: S4

western box turtle *Terrapene ornata*

Ornate or western box trutles inhabit prairie grassland, pasture, fields, sandhills, and open woodland. They are essentially terrestrial but sometimes enter slow, shallow streams and creek pools. For shelter, they burrow into soil (e.g., under plants such as yucca) (Converse et al. 2002) or enter burrows made by other species; winter burrow depth was 0.5-1.8 meters in Wisconsin (Doroff and Keith 1990), 7-120 cm (average depth 54 cm) in Nebraska (Converse et al. 2002). Eggs are laid in nests dug in soft well-drained soil in open area (Legler 1960, Converse et al. 2002). Very partial to sandy soil.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S3

western hognose snake *Heterodon nasicus*

Habitat consists of areas with sandy or gravelly soils, including prairies, sandhills, wide valleys, river floodplains, bajadas, semiagricultural areas (but not intensively cultivated land), and margins of irrigation ditches (Degenhardt et al. 1996, Hammerson 1999, Werler and Dixon 2000, Stebbins 2003). Also thornscrub woodlands and chaparral thickets. Seems to prefer sandy and loamy soils, not necessarily flat. Periods of inactivity are spent burrowed in the soil or in existing burrows. Eggs are laid in nests a few inches below the ground surface (Platt 1969).

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S4

western rattlesnake *Crotalus viridis*

Grassland, both desert and prairie; shrub desert rocky hillsides; edges of arid and semi-arid river breaks.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S5

PLANTS

awnless leastdaisy *Chaetopappa imberbis*

Habitat description is not available at this time.

Federal Status:	State Status:	SGCN: Y
Endemic: Y	Global Rank: G3	State Rank: S3

BEXAR COUNTY

PLANTS

big red sage *Salvia pentstemonoides*

Moist to seasonally wet, steep limestone outcrops on seeps within canyons or along creek banks; occasionally on clayey to silty soils of creek banks and terraces, in partial shade to full sun; basal leaves conspicuous for much of the year; flowering June-October

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G1 State Rank: S1

bigflower cornsalad *Valerianella stenocarpa*

Usually along creekbeds or in vernally moist grassy open areas (Carr 2015).

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G3 State Rank: S3

bracted twistflower *Streptanthus bracteatus*

Shallow, well-drained gravelly clays and clay loams over limestone in oak juniper woodlands and associated openings, on steep to moderate slopes and in canyon bottoms; several known soils include Tarrant, Brackett, or Speck over Edwards, Glen Rose, and Walnut geologic formations; populations fluctuate widely from year to year, depending on winter rainfall; flowering mid April-late May, fruit matures and foliage withers by early summer

Federal Status: C State Status: SGCN: Y

Endemic: Y Global Rank: G1 State Rank: S1

bristle nailwort *Paronychia setacea*

Flowering vascular plant endemic to eastern southcentral Texas, occurring in sandy soils

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G3 State Rank: S2

Buckley tridens *Tridens buckleyanus*

Occurs in juniper-oak woodlands on rocky limestone slopes; Perennial; Flowering/Fruiting April-Nov

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G3G4 State Rank: S3S4

Burridge greenthread *Thelesperma burridgeanum*

Sandy open areas; Annual; Flowering March-Nov; Fruiting March-June

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G3 State Rank: S3

Correll's false dragon-head *Physostegia correllii*

Wet, silty clay loams on streamsides, in creek beds, irrigation channels and roadside drainage ditches; or seepy, mucky, sometimes gravelly soils along riverbanks or small islands in the Rio Grande; or underlain by Austin Chalk limestone along gently flowing spring-fed creek in central Texas; flowering May-September

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G2 State Rank: S2

BEXAR COUNTY

PLANTS

Elmendorf's onion *Allium elmendorfii*

Grassland openings in oak woodlands on deep, loose, well-drained sands; in Coastal Bend, on Pleistocene barrier island ridges and Holocene Sand Sheet that support live oak woodlands; to the north it occurs in post oak-black hickory-live oak woodlands over Queen City and similar Eocene formations; one anomalous specimen found on Llano Uplift in wet pockets of granitic loam; Perennial; Flowering March-April, May

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G2 State Rank: S2

Glass Mountains coral-root *Hexalectris nitida*

Apparently rare in mixed woodlands in canyons in the mountains of the Brewster County, but encountered with regularity, albeit in small numbers, under Juniperus ashei in woodlands over limestone on the Edwards Plateau, Callahan Divide and Lampasas Cutplain; Perennial; Flowering June-Sept; Fruiting July-Sept

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G3 State Rank: S3

gravelbar brickellbush *Brickellia dentata*

Essentially restricted to frequently-scoured gravelly alluvial beds in creek and river bottoms; Perennial; Flowering June-Nov; Fruiting June-Oct

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G3G4 State Rank: S3S4

hairy sycamore-leaf snowbell *Styrax platanifolius ssp. stellatus*

Rare throughout range, in habitats similar to those of var. platanifolius - usually in oak-juniper woodlands on steep rocky banks and ledges along intermittent or perennial streams, rarely far from some reliable source of moisture; Perennial; Flowering April-Oct; Fruiting May-Sept

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G3T3 State Rank: S3

Heller's beardtongue *Penstemon triflorus ssp. integrifolius*

Occurs sparingly on rock outcrops and in grasslands associated with juniper-oak woodlands (Carr 2015).

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G3T2 State Rank: S2

Heller's marbleseed *Onosmodium helleri*

Occurs in loamy calcareous soils in oak-juniper woodlands on rocky limestone slopes, often in more mesic portions of canyons; Perennial; Flowering March-May

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G3 State Rank: S3

BEXAR COUNTY

PLANTS

Hill Country wild-mercury *Argythamnia aphoroides*

Mostly in bluestem-grama grasslands associated with plateau live oak woodlands on shallow to moderately deep clays and clay loams over limestone on rolling uplands, also in partial shade of oak-juniper woodlands in gravelly soils on rocky limestone slopes; Perennial; Flowering April-May with fruit persisting until midsummer

Federal Status:	State Status:	SGCN: Y
Endemic: Y	Global Rank: G2G3	State Rank: S2S3

low spurge *Euphorbia peplidion*

Occurs in a variety of vernally-moist situations in a number of natural regions; Annual; Flowering Feb-April; Fruiting March-April

Federal Status:	State Status:	SGCN: Y
Endemic: Y	Global Rank: G3	State Rank: S3

Lundell's whitlow-wort *Paronychia lundellorum*

The Sand Sheet of eastern South Texas, in tight sandy soils over saline clay on microhighs within salty prairie grasslands, and in upper portions of saline flats surrounding short drainages and brackish basins typical of the South Texas Sand Sheet; flowering April through at least October, probably intermittently throughout the year depending on rainfall

Federal Status:	State Status:	SGCN: Y
Endemic: Y	Global Rank: G1Q	State Rank: S1

narrowleaf brickellbush *Brickellia eupatorioides var. gracillima*

Moist to dry gravelly alluvial soils along riverbanks but also on limestone slopes; Perennial; Flowering/Fruiting April-Nov

Federal Status:	State Status:	SGCN: Y
Endemic: Y	Global Rank: G5T3	State Rank: S3

net-leaf bundleflower *Desmanthus reticulatus*

Mostly on clay prairies of the coastal plain of central and south Texas; Perennial; Flowering April-July; Fruiting April-Oct

Federal Status:	State Status:	SGCN: Y
Endemic: Y	Global Rank: G3	State Rank: S3

Osage Plains false foxglove *Agalinis densiflora*

Most records are from grasslands on shallow, gravelly, well drained, calcareous soils; Prairies, dry limestone soils; Annual; Flowering Aug-Oct

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G3	State Rank: S2

Parks' jointweed *Polygonella parksii*

Mostly found on deep, loose, whitish sand blowouts (unstable, deep, xeric, sandhill barrens) in Post Oak Savanna landscapes over the Carrizo and Sparta formations; also occurs in early successional grasslands, along right-of-ways, and on mechanically disturbed areas; flowering June-late October or September-November

Federal Status:	State Status:	SGCN: Y
Endemic: Y	Global Rank: G2	State Rank: S2

BEXAR COUNTY

PLANTS

Plateau loosestrife *Lythrum ovalifolium*

Banks and gravelly beds of perennial (or strong intermittent) streams on the Edwards Plateau, Llano Uplift and Lampasas Cutplain; Perennial; Flowering/Fruiting April-Nov

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G3G4	State Rank: S3S4

plateau milkvine *Matelea edwardsensis*

Occurs in various types of juniper-oak and oak-juniper woodlands; Perennial; Flowering March-Oct; Fruiting May-June

Federal Status:	State Status:	SGCN: Y
Endemic: Y	Global Rank: G3	State Rank: S3

sandhill woolywhite *Hymenopappus carrizoanus*

Disturbed or open areas in grasslands and post oak woodlands on deep sands derived from the Carrizo Sand and similar Eocene formations; flowering April-June

Federal Status:	State Status:	SGCN: Y
Endemic: Y	Global Rank: G2	State Rank: S2

Siler's huaco *Manfreda sileri*

Rare in a variety of grasslands and shrublands on dry sites; Perennial; Flowering April-July; Fruiting June-July

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G3	State Rank: S3

South Texas rushpea *Caesalpinia phyllanthoides*

Tamaulipan thorn shrublands or grasslands on very shallow sandy to clayey soils over calcareous sandstone and caliche; flowering in spring, sometimes later in growing season, perhaps in response to rainfall

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G2?	State Rank: S1

spreading leastdaisy *Chaetopappa effusa*

Limestone cliffs, ledges, bluffs, steep hillsides, sometimes in seepy areas, oak-juniper, oak, or mixed deciduous woods, 300-500 m elevation; Perennial; Flowering (May) July-Oct

Federal Status:	State Status:	SGCN: Y
Endemic: Y	Global Rank: G3G4	State Rank: S3S4

sycamore-leaf snowbell *Styrax platanifolius ssp. platanifolius*

Rare throughout range, usually in oak-juniper woodlands on steep rocky banks and ledges along intermittent or perennial streams, rarely far from some reliable source of moisture; Perennial; Flowering April-May; Fruiting May-Aug.

Federal Status:	State Status:	SGCN: Y
Endemic: Y	Global Rank: G3T3	State Rank: S3

BEXAR COUNTY

PLANTS

Texas almond *Prunus minutiflora*

Wide-ranging but scarce, in a variety of grassland and shrubland situations, mostly on calcareous soils underlain by limestone but occasionally in sandier neutral soils underlain by granite; Perennial; Flowering Feb-May and Oct; Fruiting Feb-Sept

Federal Status: | State Status: | SGCN: Y
Endemic: Y | Global Rank: G3G4 | State Rank: S3S4

Texas amorpha *Amorpha roemeriana*

Juniper-oak woodlands or shrublands on rocky limestone slopes, sometimes on dry shelves above creeks; Perennial; Flowering May-June; Fruiting June-Oct

Federal Status: | State Status: | SGCN: Y
Endemic: N | Global Rank: G3 | State Rank: S3

Texas fescue *Festuca versuta*

Occurs in mesic woodlands on limestone-derived soils on stream terraces and canyon slopes; Perennial; Flowering/Fruiting April-June

Federal Status: | State Status: | SGCN: Y
Endemic: N | Global Rank: G3 | State Rank: S3

Texas peachbush *Prunus texana*

Occurs at scattered sites in various well drained sandy situations; deep sand, plains and sand hills, grasslands, oak woods, 0-200 m elevation; Perennial; Flowering Feb-Mar; Fruiting Apr-Jun

Federal Status: | State Status: | SGCN: Y
Endemic: Y | Global Rank: G3G4 | State Rank: S3S4

Texas seymeria *Seymeria texana*

Found primarily in grassy openings in juniper-oak woodlands on dry rocky slopes but sometimes on rock outcrops in shaded canyons; Annual; Flowering May-Nov; Fruiting July-Nov

Federal Status: | State Status: | SGCN: Y
Endemic: Y | Global Rank: G3 | State Rank: S3

threeflower penstemon *Penstemon triflorus ssp. triflorus*

Occurs sparingly on rock outcrops and in grasslands associated with juniper-oak woodlands (Carr 2015).

Federal Status: | State Status: | SGCN: Y
Endemic: Y | Global Rank: G3T3 | State Rank: S3

tree dodder *Cuscuta exaltata*

Parasitic on various Quercus, Juglans, Rhus, Vitis, Ulmus, and Diospyros species as well as Acacia berlandieri and other woody plants; Annual; Flowering May-Oct; Fruiting July-Oct

Federal Status: | State Status: | SGCN: Y
Endemic: N | Global Rank: G3 | State Rank: S3

BEXAR COUNTY

PLANTS

turnip-root scurfea *Pediomelum cyphocalyx*

Grasslands and openings in juniper-oak woodlands on limestone substrates on the Edwards Plateau and in north-central Texas (Carr 2015).

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G3G4 State Rank: S3S4

woolly butterfly-weed *Gaura villosa ssp. parksii*

Habitat description is not available at this time.

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G5T3 State Rank: S3

Wright's milkvetch *Astragalus wrightii*

Habitat description is not available at this time.

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G3 State Rank: S3

ATTACHMENT D

United States Department of the Interior

FISH AND WILDLIFE SERVICE
10711 Burnet Road, Suite 200
Austin, Texas 78758
512 490-0057

JAN - 3 2020

Arnold (Rob) Newman
Director, Regional Planning and Environmental Center
U.S. Army Corps of Engineers
Room 3A12
819 Taylor Street
Fort Worth, Texas 76102-0300

Dear Director Newman:

This letter transmits the U.S. Fish and Wildlife Service's (Service) final report on the U.S. Army Corps of Engineers' (USACE) Integrated Feasibility Report and Environmental Impact Statement for the Mitchell Lake Ecosystem Restoration in Bexar County, Texas, in accordance Section 2(b) of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). Please see the attached Coordination Act Report.

The Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study is a single-purpose, ecosystem restoration, general investigation feasibility study. The study officially started with the signing of the Feasibility Cost Share Agreement between USACE and the San Antonio Water System (SAWS) on September 5, 2018.

Background

Mitchell Lake is located in southern Bexar County within the City of San Antonio's city limits. Originally called Lake of the Ducks, the area was comprised of a complex of wetlands dominated by a diversity emergent and aquatic vegetation. A dam below the wetlands was constructed in 1901 which resulted in the formation of Mitchell Lake. Historically, the City of San Antonio utilized Mitchell Lake for the disposal of raw sewage, sludge, waste activated sludge, and treated wastewater effluent from the Rilling Road Wastewater Treatment Plant. The northern portion of Mitchell Lake contained a significant amount of sludge, and was subsequently diked and isolated in the early 1970s. Despite these efforts to contain the waste sludge, it eventually began to overflow, requiring the creation of five additional basins. In 1987, sludge disposal in these areas ceased after the Rilling Road Wastewater Treatment Plant was decommissioned. As a result of decades of wastewater discharge and sewage disposal into the lake, the habitat surrounding Mitchell Lake has experienced severe degradation.

Currently, Mitchell Lake is approximately 650 acres of highly eutrophic open water and surrounded by 6,718 acres of degraded wetland and riparian habitat. The Leon Creek Water Recycling Center, southwest of Mitchell Lake, supplements flows into the waterbody; however, due to the degraded water quality no releases occur downstream of the dam with the exception of the flows resulting from large storm event runoff.

Mitchell Lake and surrounding uplands and grasslands are owned by SAWS. Currently, the Mitchell Lake Audubon Society leases these areas for recreation and educational purposes. As the non-Federal sponsor, SAWS requested USACE evaluate Mitchell Lake to assess the feasibility of restoring Mitchell Lake and surrounding habitat. The Service assisted USACE in assessing this project by attending team meetings, conducting site visits, and reviewing baseline habitat assessments.

Summary and Recommendations

Over a century of habitat modifications to Mitchell Lake have caused significant degradation to wetland ecosystem functions, resulting in hypereutrophic waters, reduced habitat quality and quantity, and reductions in wildlife diversity and abundance. Specific planning objectives include (1) maximize and improve fish and wildlife habitat, (2) greater floral and faunal species diversity and richness, and (3) manage and remove invasive species.

After performing analysis on an array of plans, the team recommended the restoration and expansion of a northern section of existing wetland on Mitchell Lake lacking floral diversity known as Bird Pond Wetland. The central wetlands of Mitchell Lake are connected to Bird Pond by a swale of wetlands with intermittent sections of distinct channels. The restoration measures would improve the plant diversity and expand suitable wetland and riparian habitat.

The Service supports the proposed action for the Mitchell Lake Ecosystem Restoration. The proposed ecosystem restoration measures would restore, to the extent practicable, the aquatic, riparian, and wetland functions of the Mitchell Lake ecosystem. Mitchell Lake is located on the Central Flyway bird migration route and is used as a stop-over sight for migratory birds. The proposed action would provide benefits to a resource of national and international significance as functional wetlands and riparian corridors are critical for migratory birds, especially in arid and semiarid climates such as San Antonio, in central Texas.

The Service has determined that there are no federally listed species within the current project area; therefore no adverse affects to listed species are expected to occur with implementation of the proposed action. The Service appreciates the opportunity to assist in the planning of this project. If you have any questions or comments please contact Ashley Jackson at 512-490-0057 (ext. 234).

Sincerely,

Adam Zerrenner
Field Supervisor

Enclosures

cc: Amanda McGuire; U.S. Army Corps of Engineers, Fort Worth, Texas
Harmon Brown; U.S. Army Corps of Engineers, Fort Worth, Texas

Attachment 1:

Coordination Act Report

Mitchell Lake, San Antonio, TX

General Investigations Feasibility Study
Integrated Draft Feasibility Report and Environmental Impact Assessment

December 2019

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Table of Contents

List of Attachments

1 Project Background

Mitchell Lake is located in southern Bexar County within San Antonio city limits. Historically, it was called Lake of the Ducks and was comprised of a complex of emergent wetlands dominated by tall emergent vegetation (Henderson and Lofgren 2008). The construction of the dam below the wetland complex in 1901, resulted in the formation of Mitchell Lake. The lake is approximately 650 acres of open water habitat and has an average depth of three to four feet. Historically, the City of San Antonio utilized Mitchell Lake for the disposal of raw sewage, sludge, waste activated sludge, and treated wastewater effluent from the Rilling Road Wastewater Treatment Plant. The northern portion of the lake withheld a significant amount of sludge. This area was subsequently diked and isolated in the early 1970s, known as the East and West polders or polders. Later, the sludge began to exceed the capacity of the polders requiring the creation of five additional basins, known as Basins 1, 2, 3, 4, and 5. In 1987, sludge disposal in the polders and basins ceased after the Rilling Road Wastewater Treatment Plant was decommissioned. The Leon Creek Water Recycling Center, southwest of Mitchell Lake, supplements flow into the lake to maintain a water elevation of 519 feet. Due to the degraded water quality, there are no releases of water downstream of the dam with the exception of the flows resulting from large storm event runoff.

The non-Federal sponsor, the San Antonio Water Systems (SAWS) requested the U.S. Army Corps of Engineers (USACE) evaluate Mitchell Lake to assess the feasibility of restoring the degraded habitat in Mitchell Lake and the surrounding habitats.

The environment within and around Mitchell Lake has suffered severe habitat degradation due to its historical status as a sewage disposal site and wastewater treatment plant. The Mitchell Lake study area encompasses approximately 6,718 acres. The lake and surrounding uplands and grasslands are leased by the Mitchell Lake Audubon Society, while the property is owned by SAWS. The Audubon Society utilizes the leased areas for recreation and educational purposes.

It has an earth-and-rock embankment dam at the southern end of its boundary, approximately 3,200 feet long and 30 to 60 feet wide. The polders and basins are on the northern shore of the lake. The East Polder is approximately 47 acres and West Polder is approximately 32 acres, both are located to the north of the basins. The basins are located between the lake and the polders and vary in size:

- Basin 1: 11 acres,
- Basin 2: 7 acres,
- Basin 3: 19 acres,
- Basin 4: 21 acres,
- and Basin 5: 22 acres.

1.1 Location

The proposed project is located in the San Antonio River Basin south of San Antonio, TX 78221 (Figure 1). It is located within the city limits of San Antonio and is surrounded by agriculture and other rural uses. However, the land use in the area adjacent to the northeast boundary is transitioning to residential development.

The USACE recognizes that factors outside of the Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study footprint influence the feasibility and sustainability of any actions that might be undertaken. Likewise, any actions taken in cooperation with USACE could have positive or negative impacts on the surrounding area. Therefore, the study area includes the Medina River watershed. This resulting study area boundary consists of an area approximately one and a half miles on either side of Mitchell Lake and terminates along the Medina River.

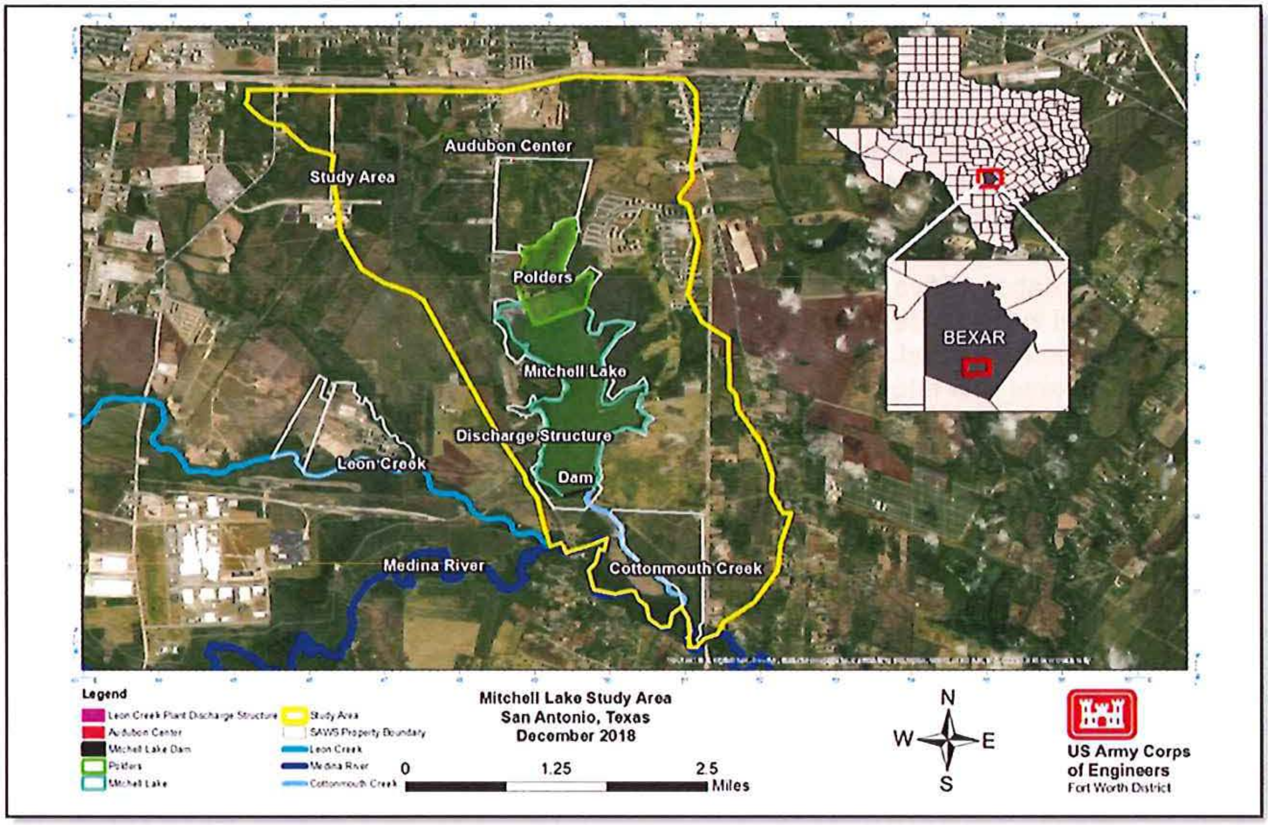

Figure 1. Mitchell Lake Study Area

1.2 General Description

The Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study is a single-purpose, ecosystem restoration, general investigation feasibility study. The study officially started with the signing of the Feasibility Cost Share Agreement between the US Army Corps of Engineers (USACE) and the San Antonio Water System (SAWS) on September 5, 2018.

1.3 Purpose, Need, and Authority for the Action

The purpose of the study is to identify and implement aquatic ecosystem restoration measures to restore the structure and/or function of the historical wetland ecosystem within the study area.

The quantity and quality of wetland habitat no longer supports the historic level of organism diversity at all trophic levels. The degraded aquatic habitat within the study area fails to support the diversity of aquatic plants and macroinvertebrates that form the foundation of wetland biotic ecosystems. An increase in biomass and biotic diversity at the fundamental trophic levels is required to restore sustainable fish, amphibian, reptile, mammal, and avian communities.

1.4 Project Goals

Changes in, and around, Mitchell Lake have caused the historic tule (tall emergent wetland vegetation) wetland system to degrade resulting in hypereutrophic waters, reductions in habitat quality and quantity, and reductions in wildlife diversity.

- There has been a significant loss of fish and wildlife habitat quality and diversity, particularly for migratory birds.
- There is little aquatic connectivity between the upstream and downstream habitats. Salinity and nutrient loading will continue to increase.
- There are invasive species on site that out-compete native flora. These invasive species will continue to spread.
- There is high nutrient loading and extreme daily variation in pH and O_2 levels leading to hypereutrophic conditions.

Opportunities exist to:

- Reconnect the upstream and downstream hydraulic connectivity.
- Improve water quality through ecosystem restoration.
- Provide additional recreation and ecotourism benefits to the community.

Specific planning objectives include:

- Increasing the areal extent and quality of fish and wildlife habitat in the study area for the life of the project.
- Increasing the floral and faunal species diversity and richness in the study area for the life of the project.
- Managing and controlling invasive species in the study area for the life of the project.

2 Fish and Wildlife Resources Within the Study Area

2.1 Vegetation

The Mitchell Lake study area is dominated by non-native invasive species and native nuisance species resulting in habitats with low plant diversity. Woody vegetation in the study area was dominated by sugarberry (*Celtis laevigata*), palo verde (*Parkinsonia texana*), willow baccharis (*Baccharis salicina*), huisache (*Acacia farnesiana*), and mesquite (*Prosopis glandulosa*). Cedar elm (*Ulmus crassifolia*), mulberry (*Morus spp.*), black willow (*Salix nigra*), box elder (*Acer negundo*), and spiny hackberry (*Celtis pallida*) comprised an extremely minor component of the vegetative community and were not observed at all sites. Herbaceous vegetation was dominated by sow thistle (*Sonchus spp.*), hedge parsley (*Torilis arvensis*), western ragweed (*Ambrosia psilostachya*), and bedstraw (*Galium spp.*).

Wetland and aquatic plant species include cattail (*Typha domingensis*), spikerush (*Eleocharis spp.*), duckweed (*Lemna spp.*) and smartweed (*Polygonum spp.*).

Invasive species included johnsongrass (*Sorghum halepense*), bermudagrass (*Cynodon dactylon*), chinaberry (*Melia azedarach*), alligator weed (*Alternanthera philoxeriodes*), and bastard cabbage (*Rapistrum spp.*).

2.2 Wildlife

Wildlife inhabiting the study area include species typical of pastoral, savannah, and woodland habitats. These include eastern fox squirrel (*Sciurus niger*), Virginia opossum (*Didelphis virginiana),* striped skunk (*Mephitus mephitis*), eastern cottontail rabbit (*Sylvilagus floridanus*), and small rodents. Due to its location on the Central Flyway, Mitchell Lake and the surrounding upland habitats provide significant resources for migratory birds. The study area also provides wintering grounds for temperate species and breeding habitat for neotropical species. The polders and lake provide habitat for herons, egrets, cormorants, and migrating shorebirds. Because of the high nutrient load in the polders and lake, the invertebrate biomass of the sediments is substantial and provides significant food resources for migrating shorebirds, waterbirds, and waterfowl. Aquatic wildlife species associated with the polders and lake include Guadalupe spiny softshell turtle (*Apalone spinifera guadlupensis*), water snakes, and red-eared sliders (*Trachemys scripta*).

2.3 Federally Listed Threatened and Endangered Species

Wildlife species may be classified as threatened or endangered under the Endangered Species Act (ESA) of 1973. The ESA protects threatened and endangered species and their habitats by prohibiting the "take of listed animals and the interstate or international trade in listed plants and animals, including their parts and products, except under federal permit." Take is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or to attempt to engage in any such conduct." The term harm is defined as "an act which actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering."

The U.S. Fish and Wildlife Service (USFWS) is responsible for the implementation of the ESA. Federally listed threatened and endangered species for Bexar County are provided in Table 1. No critical habitat is designated within the study area.

Table 1. Federally Listed Threatened and Endangered Species in Bexar County

Name	Scientific Name	Federal Listing	Habitat Present
	Birds		
Golden-cheeked Warbler	*Dendroica chrysoparia*	E	No
Least Tern	*Sterna antillarum*	E	Yes
Piping Plover	*Charadrius melodus*	T	Yes
Red Knot	*Calidris canutus rufa*	T	Yes
Whooping Crane	*Grus Americana*	E	Yes
	Amphibians		
San Marcos Salamander	*Eurycea nana*	T	No
Texas Blind Salamander	*Typhlomolge rathbuni*	E	No
	Fishes		

Fountain Darter	*Etheostoma fonticola*	E	No
Mollusks			
Golden Orb	*Quadrula aurea*	C	No[1]
Texas Fatmucket	*Lampsilis bracteata*	C	No[1]
Texas Pimpleback	*Quadrula petrina*	C	No[1]
Insects			
[no Common Name] Beetle	*Rhadine exilis*	E	No
[no Common Name] Beetle	*Rhadine infernalis*	E	No
Comal Springs Dryopid Beetle	*Stygoparnus comalensis*	E	No
Comal Springs Riffle Beetle	*Heterelmis comalensis*	E	No
Helotes Mold Beetle	*Batrisodes venyivi*	E	No
Arachnids			
Braken Bat Cave Meshweaver	*Cicurina venii*	E	No
Cokendolpher Cave Harvestman	*Texella cokendolpheri*	E	No
Government Canyon Bat Cave Meshweaver	*Cicurina vespera*	E	No
Government Canyon Bat Cave Spider	*Neoleptoneta microps*	E	No
Madla's Cave Meshweaver	*Cicurina madla*	E	No
Robber Baron Cave Meshweaver	*Cicurina baronia*	E	No
Crustaceans			
Peck's Cave Amphipod	*Stygobromus (=Stygonectes) pecki*	E	No

Flowering Plants			
Bracted Twistflower	*Streptanthus bracteatus*	C	No
Texas Wild-rice	*Zizania texana*	E	No

[1]Although the habitat may occur in the study area, the extreme water quality and lack of fish host species precludes the mussels from inhabiting the aquatic habitats of Mitchell Lake and the Polders

2.3.1 All Other Species

Although the species mentioned in Chapter 2.3 have the potential of occurring within the study area, the extreme water quality precludes amphibians, fishes, mollusks, and crustaceans from inhabiting the aquatic habitats of Mitchell Lake and the Polders.

Golden-Cheeked Warbler

Golden-cheeked warbler habitat consists of old-growth and mature growth Ashe juniper-oak woodlands in rocky terrain (NatureServe 2018B). Within the U.S, the species can only be found with the Edwards Plateau Ecoregion during breeding season. It is a migratory species that spends its winters in Honduras and Guatemala. There are numerous occurrences of GCWA the study area, the last sighting was recorded in 2019 (Figure 2; eBird 2019). This occurrence is most likely due to utilizing the area as a resting place during migration than as its permanent residence due to the low quality habitat and lack of Ashe juniper-oak woodlands within the study area.

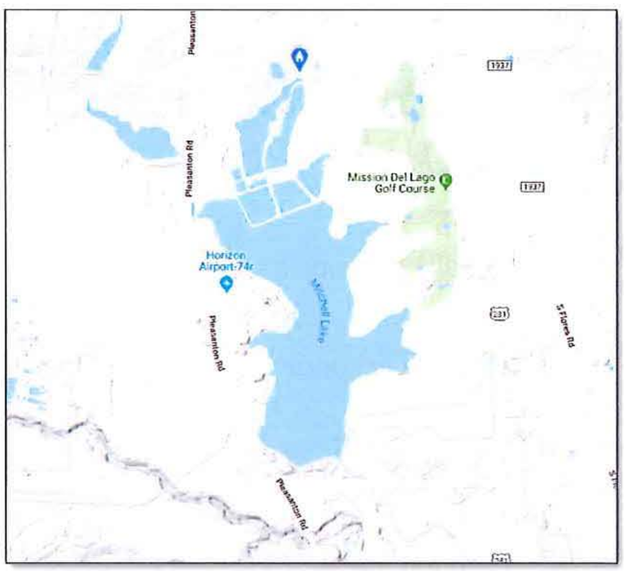

Figure 2. Golden-Cheeked Warbler Sighting (Image provided by eBird (www.ebird.org) and created [17 October 2019])

San Marcos Salamander

The San Marcos salamander occurs in Spring Lake and in rocky areas up to 500 feet downstream of the dam at Spring Lake (USFWS 1996). Moss and algae provide hiding places for the salamanders and habitat for small animals that serve as their food source. Clean, clear, flowing water of constant temperature is required for suitable habitat. The San Marcos salamander eats tiny aquatic crustaceans, aquatic insects, and snails. The total population size was estimated to be 53,200 individuals, with at least 5,200 individuals occurring within the spring systems of Comal County and San Marcos (USFWS 1996).

Habitat consists of algal mats (Tupa and Davis 1976), where rocks are associated with spring openings (Nelson 1993). Sandy substrates devoid of vegetation and muddy silt or detritus laden substrates with or without vegetation are apparently unsuitable habitats for this species. Specimens are occasionally collected from beneath stones in predominantly sand and gravel areas. In view of the abundance of predators (primarily larger fish, but also crayfish, turtles, and aquatic birds) in the immediate vicinity of spring orifices, protective cover such as that afforded by algal mats and rocks is essential to the survival of the salamander. The flowing spring waters in the principal habitat are near neutral (pH 6.7 to 7.2), range from 69.8 to 73.4 degrees Fahrenheit (°F), and are clear with low Dissolved Oxygen (DO) levels (Tupa and Davis 1976; Najvar 2001, Guyton and Associates 1979; Groeger et al. 1997).

Prey items for the San Marcos salamander include amphipods, tendipedid (midge fly) larvae and pupae, other small insect pupae and naiads (an aquatic life stage of mayflies, dragonflies, damselflies, and stone flies), and small aquatic snails (USFWS 1996).

Reduced flow of water from the springs is the greatest threat to the survival of the San Marcos salamander. The growth of cities has led to higher water use by people and increased problems with water pollution and silt accumulation. Introduction of exotic species is also a threat because they may destroy aquatic vegetation, prey on endangered animals, or compete with them for food.

Texas Blind Salamander

Texas blind salamanders are small white, blind, and translucent with red external gills. It lives in dark caves, with clear cool waters within the Edwards Aquifer near San Marcos, Texas. The external gills helps the species gather air from water and its diet consists of small crustaceans and invertebrates (Texas Parks and Wildlife Department [TPWD] 2019A).

Fountain Darter

Fountain darters are a small brown and white fish that can only be found within the San Marcos and Comal River headwaters. Within these areas they can be found in and around dense vegetation, preferably that of algal mats in slow moving waters. Their diet consists of small aquatic invertebrates (TPWD 2019B).

Texas Fatmucket

Texas fatmucket is a small, ovate, brown, freshwater mussel. It occurs in the Colorado and Guadalupe-San Antonio drainage basins and with a possibility of occurring in the Central Brazos river basins. Its habitat consists of shallow (<1m) flowing creeks, rivers, and streams that flow over sand and gravel beds with bedrock underneath. This species is intolerant of impounded waters (NatureServe 2019D).

Texas Pimpleback

The Texas pimpleback is a large freshwater mussel with a moderately thick and inflated shell that generally reaches 2.4 to 3.5 inches in length. With the exception of growth lines, the shell of the Texas pimpleback is generally smooth. The Texas pimpleback typically occurs in moderately sized rivers, usually in mud, sand, gravel, and cobble, and occasionally in gravel-filled cracks in bedrock slab bottoms (Horne and McIntosh 1979; Howells 2002). The species has not been found in water depths greater than 6.6 feet. Texas pimplebacks have not been found in reservoirs, which indicates that this species is intolerant of deep, low-velocity waters created by artificial impoundments (Howells 2002). Texas pimplebacks appear to tolerate faster water more than many other mussel species (Horne and McIntosh 1979).

Karst-Dwelling Species

These species are threatened by the rapid urbanization of the San Antonio area due to the impacts of urban expansion on their habitat. Development can destroy caves and karst features through outright digging or filling or through indirect effects such as storm water run-off and pollutant leaks or spills (USFWS 2008). Due to the lack of cave and karst features within the Mitchell Lake study area, they are not likely to occur within the study area.

- *Rhadine exilis* - small, essentially eyeless ground beetle with a slender body, approximately 7.4 mm in length.
- *Rhadine infernalis* – small, essentially eyeless reddish-brown ground beetle with a narrow neck and a body approximately 8 to 8.6 mm in length.
- Helotes Mold Beetle – tiny, reddish-brown beetle up to 2.4 mm in length.
- Cokendolpher Cave Harvestman – small, eyeless daddy long-leg with a pale orange body.
- Robber Baron Cave Spider – small, essentially eyeless spider that can be found in the Robber Baron Cave in Alamo Heights.
- Braken Bat Cave Meshweaver – small, essentially eyeless spider in Bexar County.
- Madla Cave Meshweaver – small, essentially eyeless spider with reduced pigment that can be found in eight caves in or near Government Canyon, Helotes, and the University of Texas at San Antonio.
- Government Canyon Bat Cave Meshweaver - small, essentially eyeless spider that can be found around the Government Canyon State Natural Area.
- Government Canyon Bat Cave Spider – small, essentially eyeless spider that can be found in approximately two caves in the Government Canyon State Natural Area.

Comal Springs Dryopid Beetle

Small brown aquatic beetle that does not swim. It lives in sub terrestrial habitat within two springs in Central Texas and relies on a steady, natural spring flow for all of its life (USFWS 2008).

Comal Springs Riffle Beetle

A small aquatic beetle growing to a maximum length of approximately 0.2 cm. The entire life cycle of the Comal Springs Riffle Beetle is dependent on the headwaters of the Comal and San Marcos Rivers (USFWS 2008).

Peck's Cave Amphipod

Peck's cave amphipod is a small yellowish semi-translucent eyeless amphipod. Its habitat is located in the subterranean springs of the Comal, Fern Bank and Hueco Springs. The critical habitat designation for this species has high water quality, relatively consistent water flow, a carbonate based water chemistry, and water temperatures ranging from 68ºF to 75ºF (NatureServe 2019H).

Bracted Twistflower

Bracted twistflower is 3-6ft tall annual herb that produces a purple flower. It can be found on slopes and canyon valleys with low density oak-juniper forests on shallow, well drained, gravelly clays and clay loams over limestone bedrock (NatureServe 2019I). Bracted twistflower is not expected to occur in the project areas as it is very limited in abundance and distribution.

Texas Wild-rice

An aquatic perennial grass with a few leaves and flowering stalk that rises above the water's surface up to a height of one meter. It is known to inhabit relatively shallow, clear, flowing waters of spring origin with a constant temperature of 69.8-77 °F. Texas wild-rice is a critically imperiled flowering plant with only one known site of occurrence. It can inhabit a few kilometers of the San Marcos River, where it was abundant until the 1950s. This plant has been heavily impacted by human modification in regards to water levels and quality. Texas wild-rice is also impacted by recreation in the river and by the non-native nutria (*Myocastor coypus*) (NatureServe 2019J).

2.3.2 Red Knot

The red knot is a medium to large shorebird with a weight of 5 ounces, a body length of 9 to 10 inches, and a wingspan of 20 to 22 inches. During the breeding season, it has a rust-colored face, chest, and underside, and dark brown wings. In winter, it has a gray head, chest, and upperparts and a white belly. It has long greenish legs and a pointed black bill. Males and females look similar, and juveniles resemble nonbreeding adults. The red knot was listed as threatened on December 11, 2014 (79 FR 73706). The greatest threat to the red knot population is habitat loss in the U.S., followed by reduction of preferred prey items in nesting areas and along migration routes (USFWS 2014). The red knot breeds in tundra habitat of the central Canadian arctic, between May and mid-July, and winters along the U.S. coastline from North Carolina to Texas and south to Tierra del Fuego in South America between July and May; however, non-breeding red knots are known to remain in Texas year-round. Wintering habitat includes tidal flats, beaches, and oyster reefs, where they primarily feed on small invertebrates, particularly clams (Newstead 2012, Newstead et al. 2013, USFWS 2011). Long-term systematic population surveys are lacking for this species, but current estimates suggest Texas wintering populations may range between 50 and 2,000, with numbers increasing from survey counts in the early 1990s to recent counts in 2012. The increase in numbers does not necessarily reflect an increase in the population, but may be due to an increase or variation in survey effort. Although rigorous population estimates are lacking, preliminary trends indicate prolonged decline followed by stabilization of small populations (USFWS 2014). The last sighting of red knots within the study area was in 1997 (Figure 3; eBird 2019).

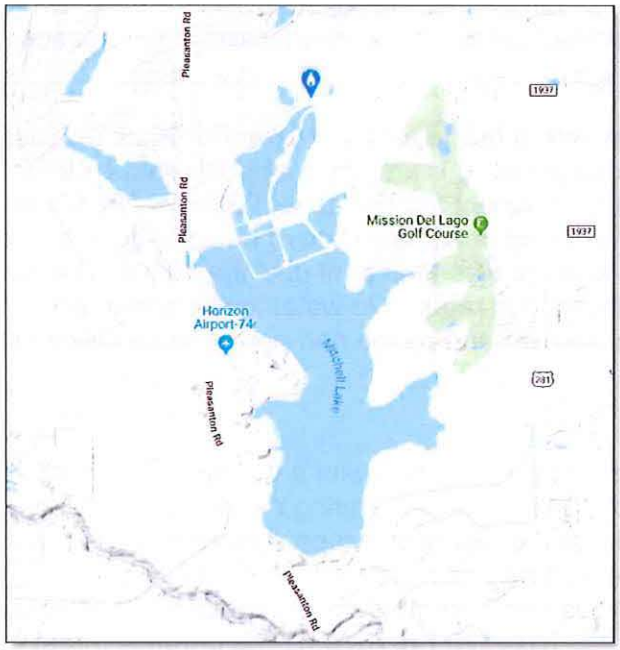

Figure 3. Red Knot Occurrence Location (Image provided by eBird (www.ebird.org) and created [17 October 2019])

2.3.3 *Piping Plover*

The piping plover is a migratory shorebird listed as endangered in the watershed of the Great Lakes and threatened in the remainder of its range (the Northern Great Plains, Atlantic coast, Gulf coast, the Bahamas, and the West Indies) (USFWS 1985). The Northern Great Plains population of piping plover spends up to 10 months a year on its wintering ground along the Gulf coast and arrives on prairie breeding grounds in early May. During migration periods, they use large rivers, reservoir beaches, mudflats, and alkali flats (Haig 1986). Piping plover feed on aquatic and terrestrial invertebrates. The migration and wintering period may last as long as 10 months (mid-July through mid-May). Migration to breeding grounds may occur from mid-February through mid-May, with peak migrations in March. Wintering piping plovers forage on invertebrates located on top of the sand or just below the surface along wrack lines (organic material including seaweed, seashells, driftwood, and other materials deposited on beaches by tidal action). Specific prey items may include polychaete marine worms, crustaceans, fly larvae, beetles, and bivalve mollusks (USFWS 2012).

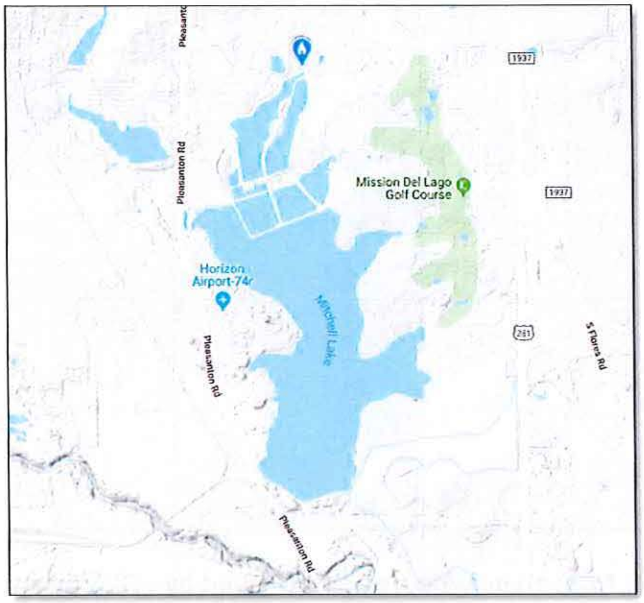

Figure 4. Piping Plover Occurrence Location (Image provided by eBird (www.ebird.org) and created [17 October 2019])

2.3.4 *Interior Least Tern*

The interior least tern is a small, gray, white, and black shorebird that prefers to inhabit wide river channels with barren to sparsely vegetated sandbars. They will also nest on sand and gravel pits, and lake and reservoir shorelines. Their historical breeding range has been mostly eradicated from the Colorado, Arkansas, Ohio, Mississippi, Missouri, and Red river systems; however, they will still breed in these areas as long as there is habitat availability. Interior least terns will winter in marine coastal areas during the non-breeding season, such as; the western and eastern coast of Mexico, Central and South America, and southern Brazil. First year birds may remain in wintering habitat before migrating north during their second year for breeding. Threats to interior least tern populations include: channelization and flood control, hydrological changes, vegetation encroachment, sand and gravel mining, human disturbance, and predation (NatureServe 2019K). There have been documented occurrences of the least tern within the study area in 2019; however, it is unknown whether or not these occurrences were of the interior least tern (Figure 5; eBird 2019).

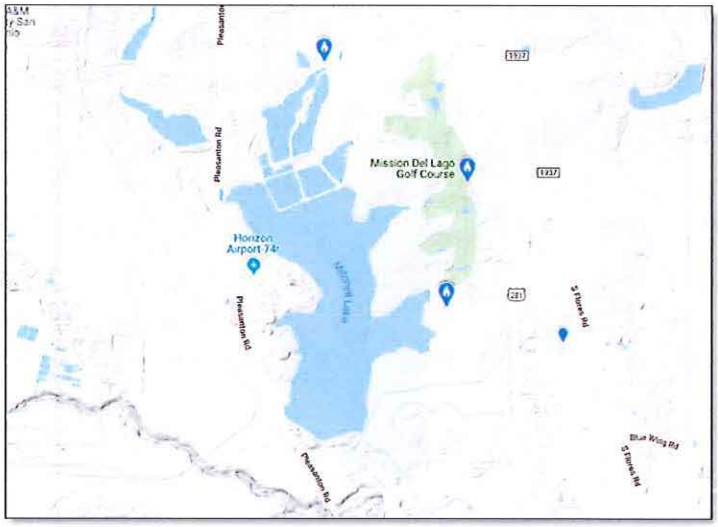

Figure 5. Least Tern Occurrence Location (Image provided by eBird (www.ebird.org) and created [17 October 2019])

2.3.5 Whooping Crane

Whooping cranes are white, tall, have black legs and a reddish black head. Their habitat consists of marshes, shallow lakes, lagoons, salt flats, grain and stubble fields, and barrier islands (AOU 1983, Matthews and Moseley 1990) and (NatureServe 2019A). Autumn migration normally begins in mid-September flying from Wood Buffalo National Park in central Canada, with most birds arriving on the wintering grounds at Aransas National Wildlife Refuge between late October and mid-November. Spring migration occurs during March and April. It has a diverse diet consisting of crabs, snails, fish, frogs, lizards, worms, insects, berries, grains, and acorns. Lakes, ponds, and other open water bodies in Central Texas may be briefly used as stopover habitat by whooping crane.

2.4 Migratory Birds

The past several decades have seen a decline in Neotropical migratory bird numbers. It has been recognized that the loss, fragmentation, and degradation of migratory bird stop-over habitat is potentially the greatest threat to the survival and conservation of Neotropical birds. In arid areas of the United States, stop-over sites are restricted, and the riparian corridors of south central Texas are the primary stop-over resource for migrating birds. As is the trend throughout the nation, naturally functioning aquatic ecosystems in the southwest are decreasing. Due to the historic rarity of these systems in the southwest the impact of their loss or degradation is more acutely felt. Their loss and/or degradation places extreme pressures on the carrying capacity for the few remaining functional systems and places further stress on the South Texas ecoregion when considered in connection with the life requisites of the migratory birds of the Central Flyway.

The Mitchell Lake study area is an ecologically unique system important to a successful migration and breeding of neotropical migrants utilizing the Central Flyway. The location and historical diversity of Mitchell Lake supports stop-over habitat needs for a wide range of migratory bird species.

Table 2. Migratory Birds in the Study Area

Name	Scientific Name	BCC	Breeding

American Golden-plover	*Pluvialis dominica*	Yes	Breeds Elsewhere
Bald Eagle	*Haliaeetus leucocephalus*	No	Breeds Sep 1 to Jul 31
Harris's Sparrow	*Zonotrichia querula*	Yes	Breeds Elsewhere
Lesser Yellowlegs	*Tringa flavipes*	Yes	Breeds Elsewhere
Long-billed Curlew	*Numenius americanus*	Yes	Breeds Elsewhere
Semipalmated Sandpiper	*Calidris pusilla*	Yes	Breeds Elsewhere
Willet	*Tringa semipalmata*	Yes	Breeds Elsewhere

2.5 Invasive Species

Invasive species are non-native species whose populations tend to outcompete native species and decrease the diversity of the native vegetation communities. Invasive species are one of the most pervasive, widespread threats to indigenous biota and often a major driver in the listing of threatened and endangered species. The introduction and establishment of invasive species can have substantial impacts on native species and ecosystems. Invasive species capable of spreading and invading into new areas are typically generalists that can easily adapt to new environments, are highly prolific and superior competitors and/or predators, and lack the natural predators that keep the species in check in the native habitats. Some are very specialized and more efficient and effective than their native competitors at filling a particular niche. They compete for resources, alter community structure, displace native species, and may cause extirpations or extinctions. Invasive species often benefit from altered and declining natural ecosystems by filling niches of more specialized and displaced species with limited adaptability to changing environments.

Habitats in the study area are significantly impacted by exotic plants and animals including: Chinese tallow (*Triadica sebifera*), alligator weed, Johnsongrass, Japanese honeysuckle (*Lonicera japonica*), red imported fire ants, nutria (*Myocastor coypus*), and feral hogs (*Sus scrofa*). While the invasive plant species play a significant role in converting the vegetative community of the ecosystem, nutria and feral hogs alter the environment by creating physical disturbances through rooting, grubbing, grazing, and burrowing that reset the successional stage of the environment.

SAWS and the Audubon Society have implemented a hog trapping program in an attempt to limit the impacts of feral hogs on the ecosystem. Although these efforts would be expected to continue under the Future Without Project (FWOP) condition, the impacts of invasive species on the environment are expected to worsen.

3 Conceptual Ecological Model

A conceptual ecological model (CEM) is a qualitative representation of a system or sub-system that serves as a basis for organization of processes that can be utilized to understand and communicate the function of that process and the identification of factors impairing the optimal performance of the systems. These models, as applied to ecosystems are simple, qualitative models, represented by a diagram which describes general functional relationships among the essential components of an ecosystem.

A resource agency kick-off meeting was held on 7 November 2018 with the USACE, TPWD, USFWS, and the Texas Commission on Environmental Quality (TCEQ) to develop a CEM for the study to depict the condition of the existing environment described in Chapter 3 and identify factors that have resulted in the degradation of the Mitchell Lake habitats. The resulting CEM is presented in Figure 6.

The CEM provides a framework enabling the team to characterize the drivers and effects of impediments to ecosystem functions, potential measures to address these impediments, and methodologies to characterize and quantify ecosystem benefits resulting from any restoration actions. The CEM format utilized here follows a top-down hierarchy of information. The Mitchell Lake CEM does not attempt to explain all possible relationships or include all possible factors influencing the performance measure targets within natural systems in the study area. Rather, the model attempts to simplify ecosystem function by containing only information deemed most relevant to ecosystem restoration and monitoring goals.

The CEM includes the following components:

- **Drivers:** Includes major external driving forces that have large-scale influences on natural systems. Drivers may be natural (e.g. climate change) or anthropogenic (e.g. hydrologic alteration) in nature. Anthropogenic drivers provide opportunities for finding relevant solutions to problems. Natural drivers, however, cannot be influenced directly by human interference. Some drivers are both anthropogenic and natural in nature. The Mitchell Lake CEM introduces six drivers: Urban Development, Adjacent Agriculture and Land Use, the Mitchell Lake Dam, Wastewater Operations, Wildlife and Ecological Function, and Climate Change.
- **Ecological Stressors:** Includes physical or chemical changes that occur within the natural systems, which are produced or affected by drivers and are directly responsible for significant changes in biological components, patterns, and relationships in natural systems.
- **Ecological Effects:** Includes biological, physical, or chemical responses within the natural system that are produced or affected by stressors. CEMs propose linkages between one or more ecological stressors and ecological effects and attributes to explain changes that have occurred in ecosystems.
- **Attributes:** This component is a prudent subset of all potential elements or components of natural systems representative of overall ecological conditions. Attributes may include populations, species, communities, or chemical processes.
- **Performance Measures**: Includes specific features of each attribute to be monitored to determine the degree to which attribute is responding to projects designed to correct adverse effects of stressors (i.e. to determine success of the project).

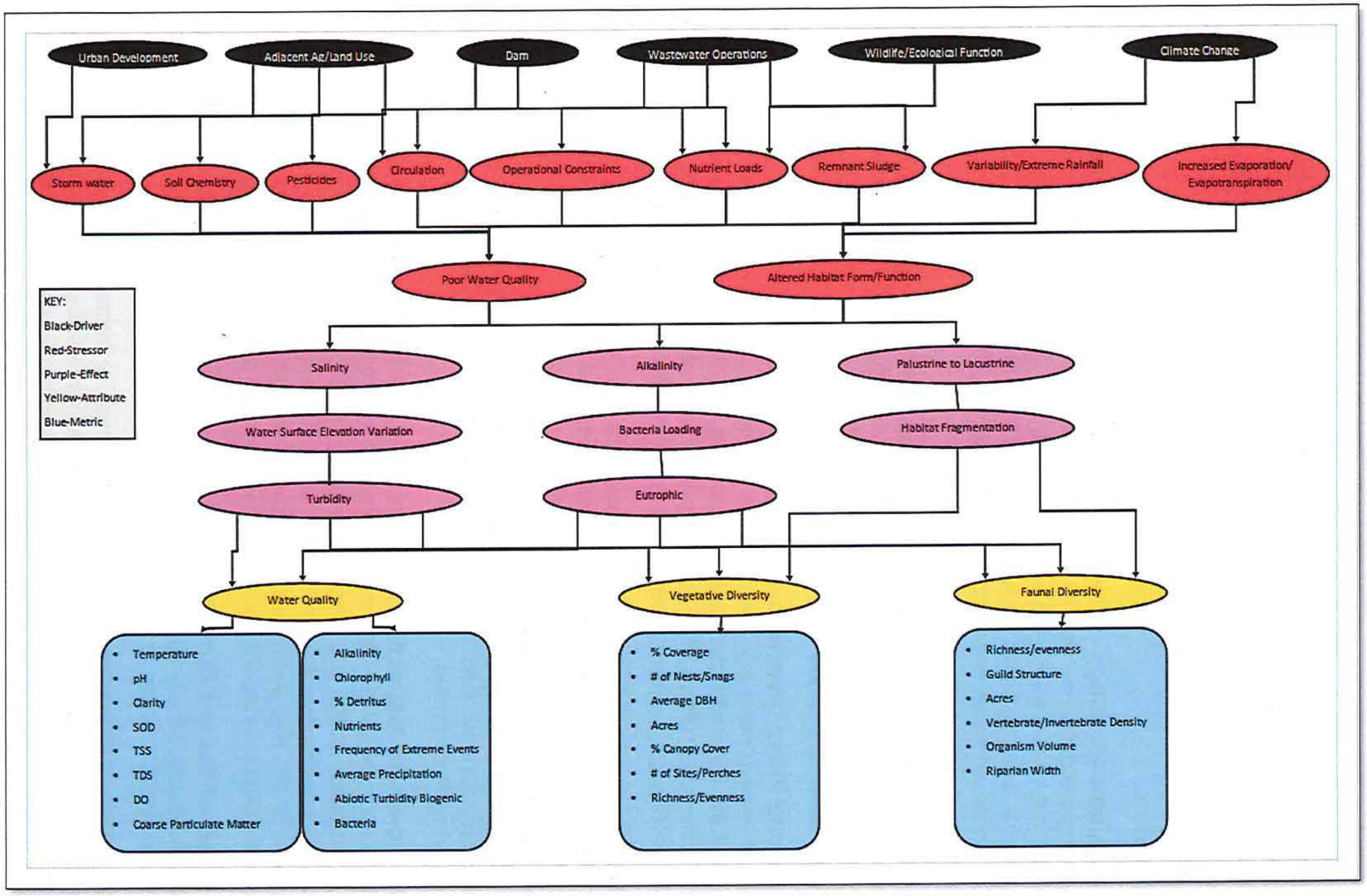

Figure 6. Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study Conceptual Model (CEM)

4 Measures, Areas, and Alternatives

A measure is defined as a means to an end; an act, step, or procedure designed for the accomplishment of an objective. In other words, a measure is a feature (structure), or an activity, that can be implemented at a specific geographic site to address one or more planning objectives. Measures are the building blocks of alternatives and are categorized as structural and non-structural. Equal consideration was given to these two categories of measures during the planning process while conducting this feasibility study.

Structural Measures

- **Native Aquatic Plantings** - Emergent and submergent wetland vegetation typically thrive along the perimeter and shallow areas of lakes. This measure entails the establishment of emergent and submergent aquatic vegetation to provide feeding, reproduction, and protective cover habitats for fish, invertebrate, and bird species. The aquatic plants would be established as planted seedlings or plugs from site-specific, native, diverse wetlands.
- **Native Riparian Plantings** - This measure entails increasing the vegetative structure and species diversity of riparian habitat. It would include planting a diverse community of high quality native tree and shrub species, including mast producers, bald cypress (*Taxodium distichum*), and other species native to the San Antonio area.
- **Pipeline and Pump Installation** - This measure would entail the placement of a pipeline that would enable pumping of water from Mitchell Lake to the wetland areas at the upper portions of the Mitchell Lake watershed and also pumping water between the cells of the polders. The construction of a pipeline to the areas north of the polders would provide a reliable water supply allowing better manipulation and sustainability of the wetlands.
- **Low Quality Vegetation Removal** - In order to increase the diversity of the vegetative communities within the project area, select trees and shrubs would be removed to provide room for the planting of additional site specific native species. Large trees could be treated with herbicides and left standing in order to created habitats for numerous wildlife that utilize standing snag habitats. The creation of standing snags would remove the overstory canopy cover opening up gaps in the canopy for the establishment of seedling shrubs and trees.
- **Habitat Structure Augmentation** - This measure entails habitat improvement through the addition of habitat structures in the project area such as brush piles, fallen logs, root wads, rock piles, snags, etc. These structures could be aquatic or terrestrial in nature and would provide cover habitat for fish and wildlife species. This measure would be dependent on the excavation and low quality vegetation removal measures as these measures would provide the source material for the creation of these features.
- **Installation of Bat and Bird Nest Boxes** - This measure would include the installation of artificial nesting structures for bats, wood ducks, bluebirds, and other cavity nesting species in the study area.
- **Invasive Animal Management** - Non-native invasive animals such as feral hogs and nutria cause significant damage to existing habitats due to grubbing and grazing foraging strategies. The removal and continual management of invasive animal would reduce the impacts these species have on the habitats in the study area and specifically the newly restored areas.

- **Invasive Vegetation Management** - This measure includes the removal and management of invasive plant species to allow a native and diverse vegetative community to become established. Depending on the species, invasive species may be controlled by biological, mechanical, or chemical methods incorporating an integrated pest management approach. Larger non-native invasive trees could be treated with herbicide and left standing to provide standing snag habitat for numerous wildlife species.
- **Berm Construction** - This measure would entail reducing the size of the polders and wetlands to create a more manageable and appropriately sized mudflat and wetland habitats. The utilization of excavated materials from the creation of wetlands or offsite borrow material could be used to create additional mudflat cells. This measure would be dependent on the polder operational measure.
- **Clearing / Excavation** - In order to create the hydrology required for the target restoration habitats, excavation may be required to create suitable conditions to ensure sustainability for the ecosystem restoration. Excavation can include widening and deepening of wetland areas using machinery such as bulldozers, graders, and backhoes.
- **Water Control Structures** - This measure would be utilized to control the depth of water by blocking or opening a water channel within the proposed areas. Stop logs will be used to ensure water inundates the appropriate areas during the appropriate times.

Non-Structural Measures

- **Polder Operations Management** - This measure entails the manipulation of water in the polders and basins to manage the area for migratory shorebirds. By draining the polders on a periodic systematic schedule, mudflats would be exposed during migration providing foraging habitat for shorebirds. The inundation phase of the polder management would ensure that vegetation would not become established within the polders reducing the shorebird foraging habitat quality. When the polders are inundated, habitat for waterfowl would be available. The polder management would require the modification and/or construction of water control structures to facilitate the draining and filling of the polders.
- **Seasonal Water Pulses** - This measure includes managing the flow of water through the Mitchell Lake study area to mirror natural historical flood/drought processes. The seasonal pulses would support wetland habitats through periodic inundation and desiccation required to support a diverse aquatic, wetland, and riparian community. Additionally, the control of water surface levels in the wetlands facilitates the control of cattails within the existing and/or proposed wetland areas in the study area. The seasonal water pulse measure would be dependent on the construction of a pipeline from Mitchell Lake to the upstream portions of the study area. The measure would also include the construction or modification of water control structures to allow manipulation of the flows and inundation of the wetlands.

4.1 Project Areas

Individual restoration sites were identified as feasible for project implementation (Figure 7). The measures were built in combination with one another based upon site conditions. Discreet restoration areas were generally identified as locations where site appropriate measures could be applied; however, specific restoration areas were not delineated until field verification of the proposed restoration boundaries was completed. Measure success is dependent upon site conditions at Mitchell Lake.

- Area 1: Bird Pond Wetlands
- Area 2: Central Wetlands
- Area 3: Skip's Pond
- Area 6: Polders
- Area 7: Fringe Wetlands
- Area 9: Dam Forested Wetlands
- Area 10: Downstream Wetlands

4.2 Array of Alternatives

For each area remaining, the final array of management measures was combined into individual alternatives. Each of these alternatives could be a standalone plan, or combined with other alternatives to form a suite of Plans.

In addition, several scales of most alternatives were developed for each area in order to achieve differing levels of captured and uncaptured benefits.

- Alternative 1A – 3.17 acres of Bird Pond Wetlands restoration
- Alternative 1B – 6.42 acres of Bird Pond Wetlands restoration
- Alternative 2A – 10.46 acres of Central Wetlands restoration
- Alternative 2B – 18.37 acres of Central Wetlands restoration
- Alternative 6 – 49.52 acres of Polder restoration
- Alternative 7A – 53.68 acres of Fringe Wetlands restoration
- Alternative 7B – 11.84 acres of Fringe Wetlands restoration
- Alternative 7C – 6.84 acres of Fringe Wetlands restoration
- Alternative 7D – 65.52 acres of Fringe Wetlands restoration
- Alternative 7E – 60.52 acres of Fringe Wetlands restoration
- Alternative 7F – 18.68 acres of Fringe Wetlands restoration
- Alternative 7G – 72.36 acres of Fringe Wetlands restoration
- Alternative 9A – 2.55 acres of Dam Forested Wetlands restoration
- Alternative 9B – 4.48 acres of Dam Forested Wetlands restoration
- Alternative 10 – 51.32 acres of Downstream Wetlands restoration

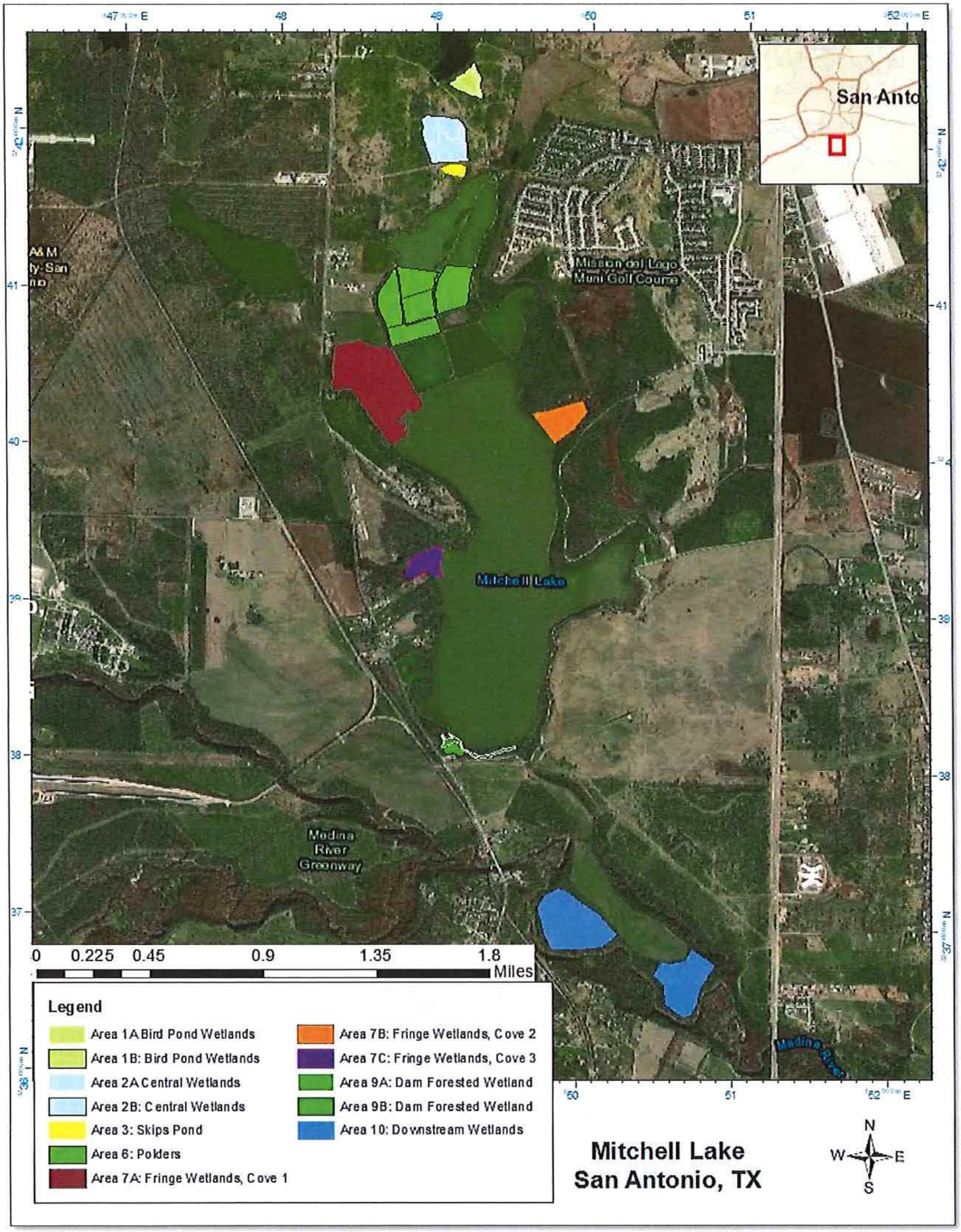

Figure 7. Mitchell Lake Project Areas

5 Modeling

For the purpose of this report, plans mentioned and described will only include those that were used during the Cost Effectiveness and Incremental Benefit Analysis (CE/ICA).

5.1 Habitat Classification

5.1.1 Model Selection

Resource agencies and the USACE Ecosystem Restoration Planning Center of Expertise (ECO-PCX assisted in the selection of ECO-PCX certified species' Habitat Suitability Index (HSI) models that would best represent the Mitchell Lake study area habitats to evaluate existing conditions and habitat response to proposed restoration measures. The models were chosen based on geographic and cover type appropriateness.

The TPWD Ecological Mapping System was utilized and refined using the ArcGIS mapping tool (Figure 8). A large array of habitat types were identified, but were refined into seven categories before conducting field work. These habitat types include: Upland Forest, Shrubland, Grassland, Emergent Wetland, Riparian Forest, Aquatic, and Riverine habitat.

Models initially included during plan formulation and the habitat assessment include:

- Emergent Wetland – Marsh Wren and Bullfrog HSI
- Riparian Forest – Barred Owl, Fox Squirrel, Gray Squirrel, Shelterbelt HSI, and Avian Index of Biological Integrity (IBI)
- Grassland – Meadowlark and Cottontail HSI
- Shrubland – Cottontail and Brown Thrasher HSI
- Riverine – Qualitative Habitat Evaluation Index (QHEI)

The Shorebird Migration Model, described in further detail in Section 5.1.2, was added after the field habitat assessment was complete. This model was utilized to calculate the HSI values for the mudflat habitat located within the polders.

Although all of the models were utilized during the habitat assessment, the Avian IBI, QHEI, Shelterbelt HSI, Meadow Lark HSI, Cottontail HSI, Brown Thrasher HSI, and the Fox Squirrel HSI were not necessaryto determine the existing and future project conditions. Hereafter, these models will not be mentioned in this report. The final models utilized for analysis are shown in Table 3.

Table 3. Final Array of Models Utilized for Feasibility Study

Model	Habitat Type
Barred Owl HSI	Riparian Forest
Gray Squirrel HSI	Riparian Forest
Marsh Wren HSI	Emergent Wetland
Bullfrog HSI	Emergent Wetland
Shorebird Migration	Mudflat

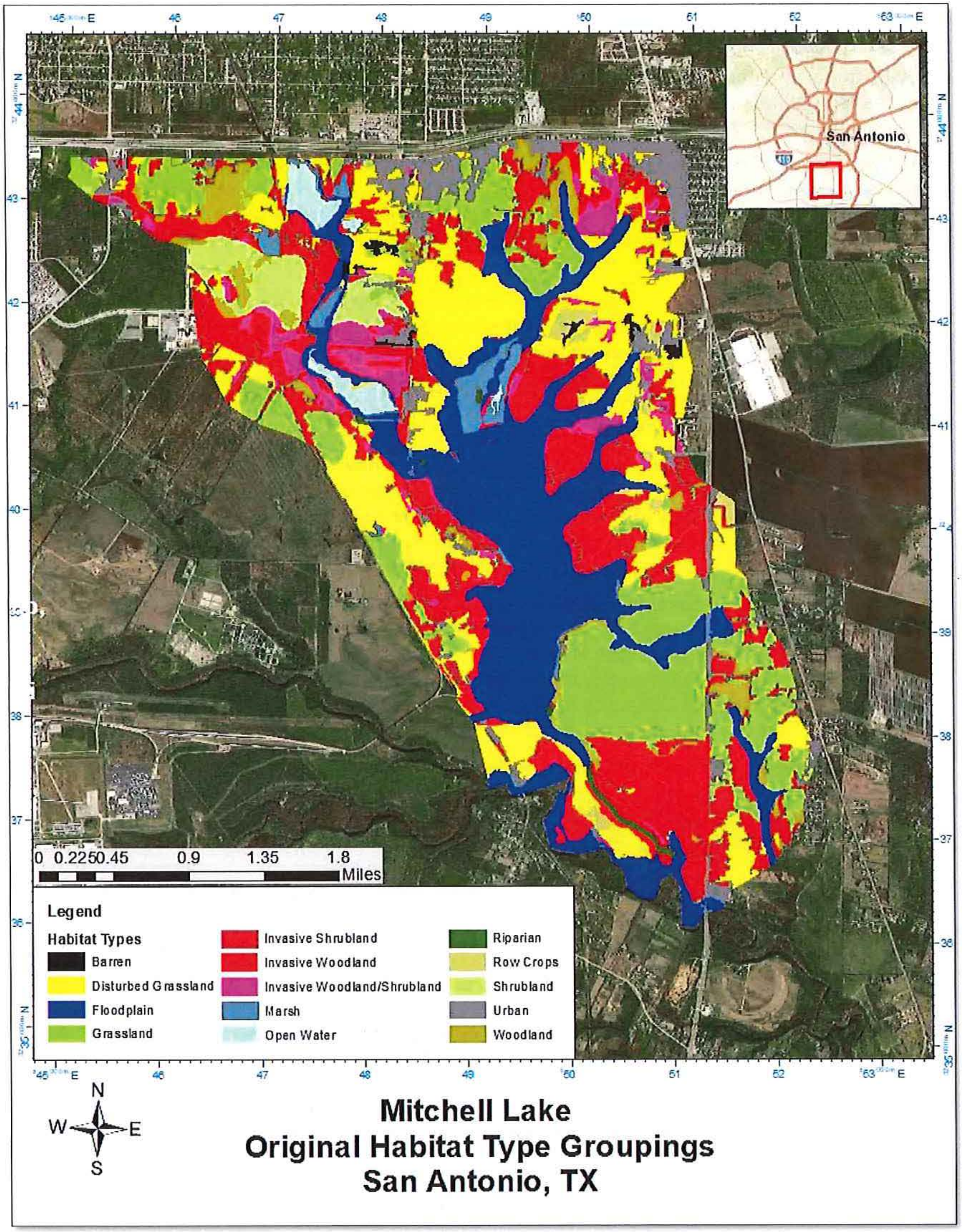

Figure 8. Habitat Type Groupings (TPWD 2019)

5.1.2 Habitat Evaluation Procedure

A baseline assessment using the Habitat Evaluation Procedure (HEP) was required before any habitat impacts to the study area could be identified. HEP involves defining the study area, delineating habitats (i.e. cover types) within the study area, selecting HSI models and/or evaluation species, and characterizing the study area based on the results of the HEP.

HEP was developed by the USFWS in order to quantify the impacts of habitat changes resulting from land or water development projects (USFWS 1980). HEP is based on suitability models that provide a quantitative description of the habitat requirements for a species or group of species. HSI models use measurements of appropriate variables to rate the habitat on a scale from 0.0 (unsuitable) to 1.0 (optimal).

Habitat quality is estimated through the use of species models developed specifically for each habitat type(s). Each model consists of a list of variables that are considered important in characterizing fish and wildlife habitat; a Suitability Index graph for each variable, which defines the assumed relationship between habitat quality and different variable values; and a mathematical formula that combines the Suitability Index for each variable into a single value for habitat quality. The single value is referred to as the HSI.

The Suitability Index graph is a graphic representation of how fish and wildlife habitat quality or "suitability" of a given habitat type is predicted to change as values of the given variable change. It also allows the model user to numerically describe, through the Suitability Index, the habitat quality of an area for any variable value. The Suitability Index ranges from 0.1 to 1.0, with 1.0 representing optimal condition for the variable in question (Tables 4-7).

After a Suitability Index has been developed, a mathematical formula that combines all Suitability Indices into a single HSI value is constructed. Because the Suitability Indices range from 0.1 to 1.0 the HSI also ranges from 0.1 to 1.0, and is a numerical representation of the overall or "composite" habitat quality of the particular habitat being evaluated. The HSI formula defines the aggregation of Suitability Indices in a manner that is unique to each species depending on how the formula is constructed.

Table 4. Life Requisite Suitability Indices for Barred Owl

Species	Life Requisite Suitability Indices (LRSI)	HSI Formula
Barred Owl	Reproduction	Equal to the reproduction suitability index $HSI = SIR = \sqrt[2]{SIV_1 x SIV_2} x SIV_3$
	Life Requisite Suitability Index Formulas & Variables	
	SIV1	The relationship between the number of trees ≥51 cm DBH/0.4 ha and reproductive habitat quality for barred owls.
	SIV2	The relationship between mean DBH of overstory trees and reproductive habitat quality for barred owls
	SIV3	The relationship between percent canopy cover of over-story trees and reproductive habitat quality for barred owls.
	Suitability Index Variable (SIV)	

	Reproduction Suitability Index (SIR)
	Diameter at Breast Height (DBH)

Table 5. Life Requisite Suitability Indices for Gray Squirrel

Species	Life Requisite Suitability Indices (LRSI)	HSI Formula
Gray Squirrel	Winter Food and Cover/Reproduction	Equal to the lowest value calculated for either life requisite $\sum_{i=1}^{n} \frac{HSI_i A_i}{A_i}$ where n = number of stands HSI_i = HSI of stand i A_i = area of stand i
	Life Requisite Suitability Index Formulas & Variables	
	SIV1	Proportion of the total tree canopy cover that is hard mast producing trees ≥25 cm DBH
	SIV2	Number of hard mast tree species
	SIV3	Percent canopy cover of trees
	SIV4	Mean DBH of overstory trees

Table 6. Life Requisite Suitability Indices for Marsh Wren

Species	Life Requisite Suitability Indices (LRSI)	HSI Formula
Marsh Wren	Cover and Reproduction	$HSI = \sqrt[3]{SIV_1 \mathrm{x} SIV_2 \mathrm{x} SIV_3} \mathrm{x} SIV_4$
	Life Requisite Suitability Index Formulas & Variables	
	SIV1	Growth form of emergent hydrophytes
	SIV2	Percent canopy cover of emergent herbaceous vegetation
	SIV3	Mean water depth
	SIV4	Percent canopy cover of woody vegetation

Table 7. Life Requisite Suitability Indices for Bull Frog

Species	Life Requisite Suitability Indices (LRSI)	HSI Formula
Bullfrog	Food, Winter Cover, Reproduction, and Interspersion	$HSI = \sqrt[3]{SIFxSIWCxSIR}xSII$

Life Requisite Suitability Index Formulas & Variables

SIV1	Mean distance from shore to water >1.5 m deep
SIV2	Percent canopy cover of aquatic vegetation in the littoral zone
SIV3	Percent shoreline cover
SIV4	Mean water transparency
SIV5	Maximum water depth greater than maximum ice depth
SIV6	Percent silt in substrate
SIV7	Mean current velocity at mid-depth during summer (cm/s)
SIV8	pH
SIV9	Mean water temperature at mid-depth during summer (°C)
SIV10	Frequency of water level fluctuations >2 m
SIV11	Distance to permanent water (m)

Value for the food component (SIF)

Suitability index for winter cover (SIWC)

Interspersion component value (SII)

5.1.3 Shorebird Migration Model

The Shorebird Migration Model was initially developed in 2002 (USACE 2018). The framework and associated environmental relationships were developed using peer-reviewed and published information from the literature for shorebird habitat in the North American Northern Plains/Prairie Pothole Region. The model was developed to cover all shorebirds found in the region because shorebird community management, rather than single species management, is the primary goal.

The model format combines procedures from Missouri's Wildlife Habitat Appraisal Guide and the USFWS' standards for developing HSI models. The model framework includes the spring and fall migration season and variables and suitability index relationships to represent the three functional habitat groups of migration habitat – food, security, and predictability. The model outcome is an HSI with a value from 0.1 to 1.0 (1 representing optimal habitat).

The Shorebird Migration Model and methodology (Table 8) are consistent with USACE policies and accepted procedures for ecosystem restoration planning. The model does not incorporate, facilitate, or encourage the use of non-ecosystem parameters or values. The model uses established principles of plans evaluation to produce outputs consistent with identification of the National Ecosystem Restoration plan.

Table 8. Shorebird Migration Model

Species	Life Requisite Suitability Indices (LRSI)		HSI Formula
Shorebird Migration Model	Food, Security, Predictability		
	Spring Life Requisite Variables		
	$S1_a$	Water Depths	
	$S1_b$	Availability	
	S_2	Aquatic Invertebrates (in accessible habitat)	
	S_3	Vegetative Cover	
	S_4	Disturbance	
	S_5	Hydrologic Conditions	
	S_6	Management Capabilities	
	Fall Life Requisite Variables		
	$F1_a$	Water Depths and Availability	
	$F1_b$	Timing for Water Depths and Availability	
	F_2	Aquatic Invertebrates (in accessible habitat)	
	F_3	Vegetative Cover	
	F_4	Disturbance	
	F_5	Hydrologic Conditions	
	F_6	Management Capabilities	

5.2 Data Collection

The habitat assessment for the Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study was conducted from 12 March to 14 March 2019 at the Mitchell Lake study area in San Antonio, TX. Although 48 sites were preselected before the field work was conducted, some points were added and/or removed from the assessment (Figure 9). Points added to the assessment were

EM1, 22-Polder, EM2, EM3, EM4, and SH1. However, due to the large study area and time constraints on field visits, some of the points selected before field work were not applicable for this study. Points removed from further evaluation included 7, 9, 10, 17, 25-27, 30-35, and 47-48.

The field points associated with the HSI models that were screened out of further use were not included in the existing conditions assessment. Habitat assessment photos and the field data sheets used during the habitat assessment can be found in Attachments A and B, respectively.

A second field visit was conducted by USACE team members to determine the size and location of any existing wetlands within the study area. The existing wetlands were recorded by GPS and can be found in Figure 10.

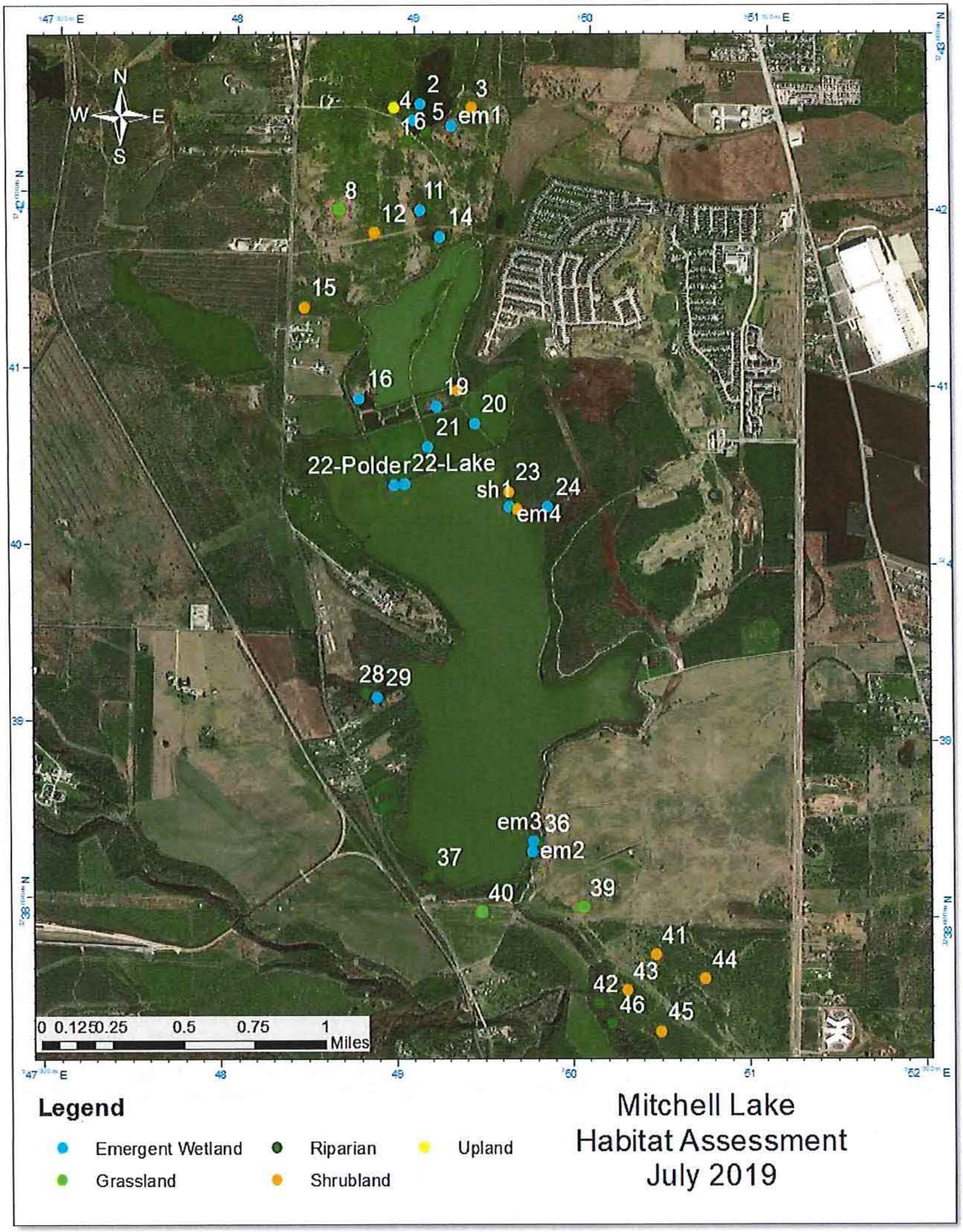

Figure 9. Habitat Assessment Survey Points

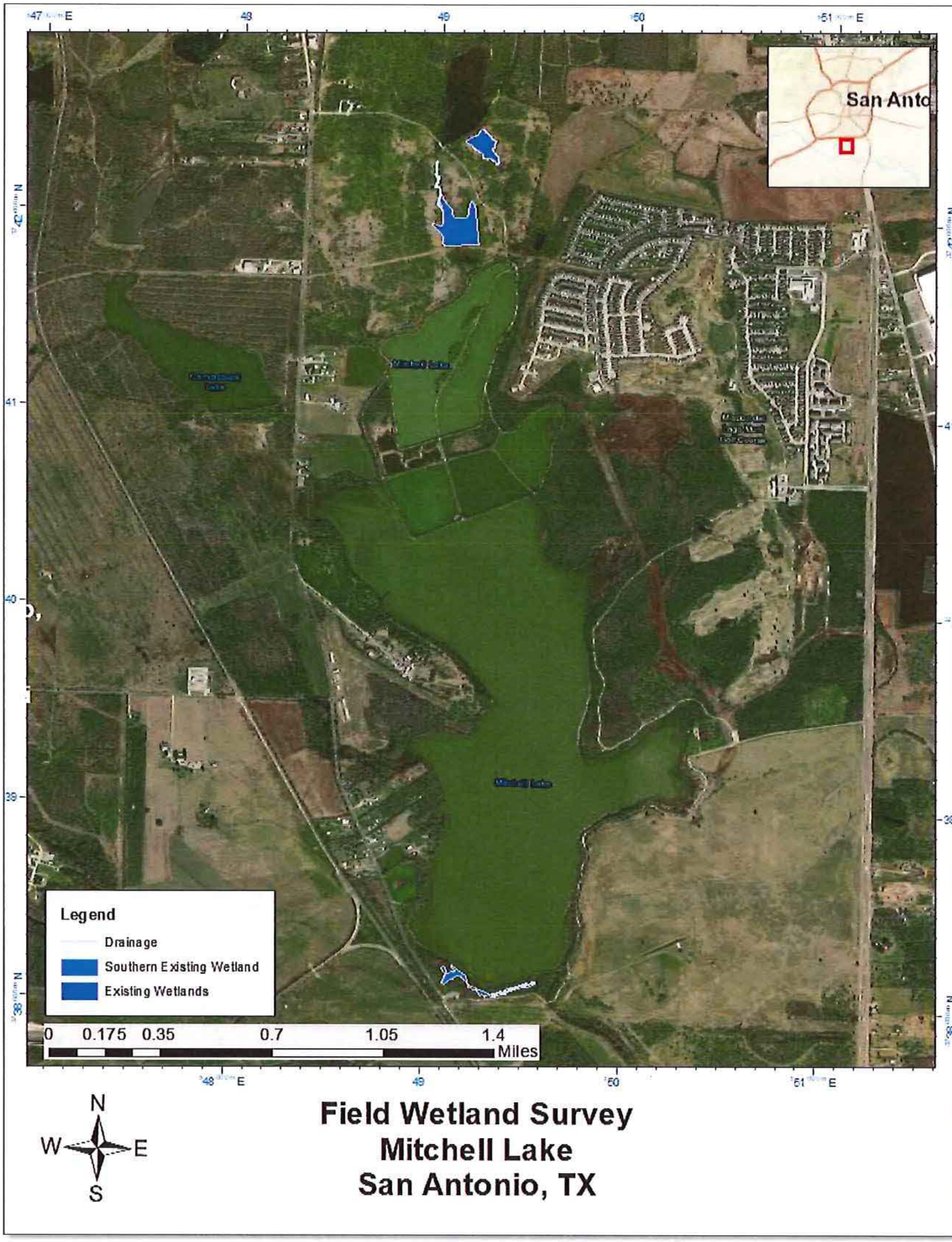

Figure 10. Existing Wetlands Surveyed in June 2019

5.3 Existing, Future Without, and Future With Project Conditions

Under the FWOP condition there would be no ecosystem restoration within the Mitchell Lake study area, however, it is anticipated that normal activities by the public and natural ecological processes would continue to occur in the study area. Section 5.3.3 is a general description of the likely future conditions in the study area over the 50 year life of the project in the future without project. The habitat types analyzed for the FWOP include: riparian forest, emergent wetland, and mudflat habitat. Life requisite values and metric variables will be mentioned throughout this section.

Section 5.3.4 will describe the likely future conditions in the study area over the 50 year life of the future with project. Because this is an ecosystem restoration project, the Future With Project (FWP) is assumed to provide habitat benefits to all areas.

HSI model metric variables for the FWOP and FWP conditions were projected at a meeting with resource agencies on June 22nd and 23rd, 2019. The projections for each of the HSI model metric variables were based on professional judgment and existing conditions. Representatives from the TCEQ, NRCS, USACE, SAWS, and the USFWS assisted with this process.

5.3.1 Target Years

Target Year (TY) 0 habitat conditions are represented by the existing, or baseline, habitat conditions. The field and desktop collected data were used to describe the habitat and quantify habitat units. Target Year 0 conditions serve as a basis of comparison for both FWOP and FWP scenarios. Additional TYs were identified based on when implemented measures would be expected to elicit community responses represented by changes in the projected habitat variables.

Target Year 1 is used as a standard comparison year to identify and capture changes in habitat conditions that occur within one year after measures have been constructed. Amount of wetted area, reduction in invasive species, and water regimes are likely variables that may improve within this time period.

Target Year 5 was selected to allow enough time to review natural plant establishment. Aquatic vegetative abundance and diversity are key variables to assess community response at this target year.

Target Year 10 is used as a point after the initial growth of vegetation and the likely increase in size and benefits plantings have sustained.

Similarly, TY 25 was selected to capture the riparian habitat associated with the restored emergent wetland and riparian habitats. Riparian plant abundance and diversity are also key response variables for this target year.

Target Year 50 is the planning life span of the project and is used as the last projected TY for the study. Restoration measures should produce mature habitat by this target year and represent the habitat types within the study area.

5.3.2 Habitat Units and Annualization of Habitat Quality

The values assessed during the field visits were used to identify the habitat impacts for the proposed ecosystem restoration objective. The HSI scores were multiplied by the net change in acreages of the impacted areas to calculate the net change in Habitat Units (HUs). HUs represent a numerical combination of quality (i.e. HSI) and quantity (acres) existing at any given point in time.

$$\int_0^T HU\,dt \cong (T_2 - T_1)\left[\left(\frac{A_1H_1 + A_2H_2}{3}\right) + \left(\frac{A_2H_1 + A_1H_2}{6}\right)\right]$$

Where:

$$\int_0^T HU\,dt = Cumulative\ HUs\ for\ the\ time\ interval\ of\ T$$

T1= first target year of time interval

T2 = last target year of time interval

A1 = area of available habitat at beginning of time interval

A2= area of available habitat as the end of time interval

H1 = HSI at the beginning of time interval

H2 = HSI at the end of time interval

This formula was developed to precisely calculate cumulative HUs when either HSI or area or both change over a time interval, which is common when dealing with the unevenness found in nature (USFWS 1980). Habitat Unit gains or losses are annualized by summing the cumulative HUs calculated using the above equation across all target years in the period of analysis and dividing the total (cumulative HUs) by the number of years in the planning horizon (i.e. 50 years). This calculation results in the Average Annual Habitat Units (AAHUs).

The impact of a project can be quantified by subtracting the Future With Project (FWP) scenarios benefits/impacts from FWOP benefits/impacts. The difference in AAHUs between the FWOP and the FWP represents the net impact attributable to the project in terms of habitat quantity and quality.

5.3.3 Existing and Future Without Project Habitat Conditions

This section describes the existing conditions for various resources within the study area and the projected conditions of the study area without a project, over the next 50-year period. Habitat modeling efforts focused on the project areas using habitat quality to quantify a baseline of ecological structure and function for analysis of future with project conditions.

SAWS is expected to lower the Mitchell Lake elevation to 517' amsl in the FWOP. Due to this condition, some of the metrics for the FWOP for the Marsh Wren HSI were lowered based on the physical parameters of the life requisite variables.

All project areas, except Area 6: Polders, utilize two HSI models to calculate benefits. The resulting HUs of each Target Year were averaged together. The averages of those HUs were input into the Annualizer tool within the IWR Planning Suite II. To clarify, HUs of the separate models were not added together, but simply averaged to avoid duplicating benefits.

AREA 1: BIRD POND WETLANDS

Area 1: Bird Pond Wetlands is located at the northern extent of the study area adjacent to Bird Pond near the Mitchell Lake Audubon Center (Figure 11). The small existing wetland is located east of the levee/road on the downstream end of Bird Pond. The existing wetland has limited habitat value due to the shallow surface water (<6") and a monoculture of cattails. The lack of water surface level fluctuations has contributed to the dominance of cattails in this wetland.

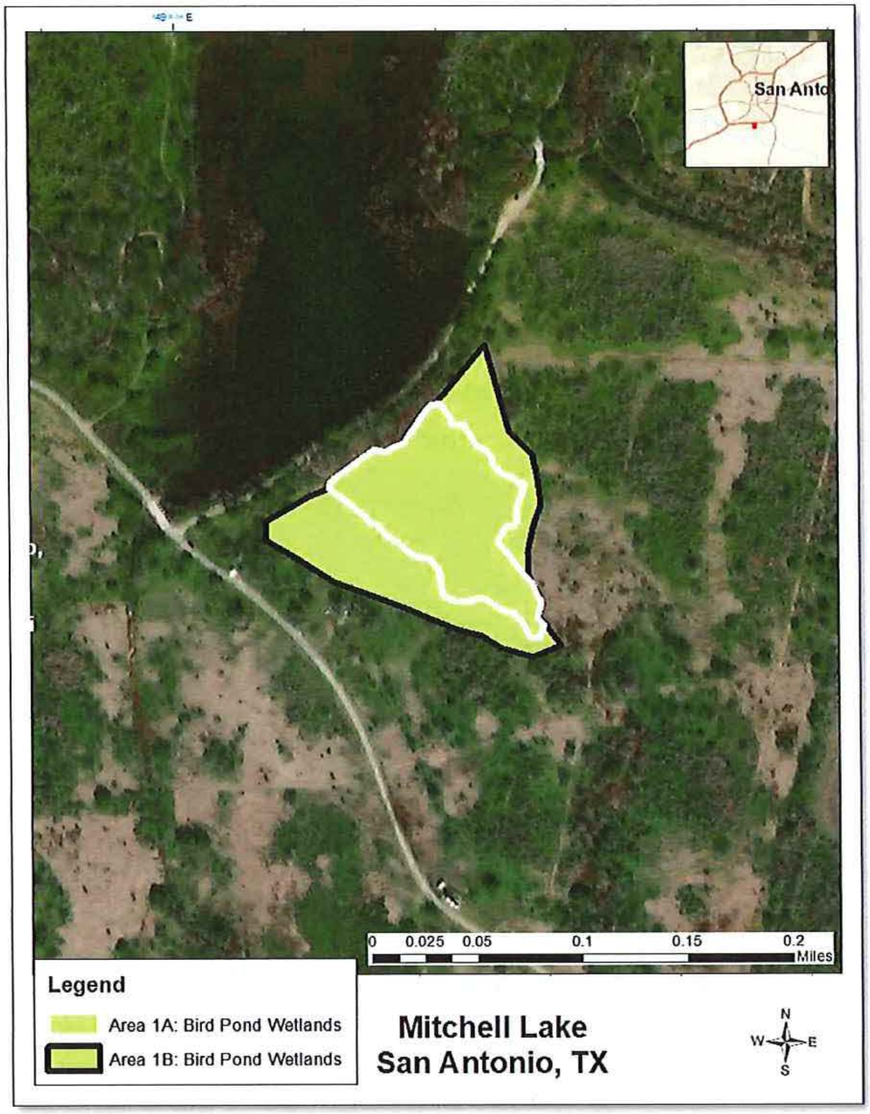

Figure 11. Bird Pond Wetlands Area 1A and 1B

The existing emergent wetland is approximately 3.17 acres. The Marsh Wren HSI scores for the existing wetland were equal to zero at all target years (Table 8). The main contributing factor was the life requisite variable related to growth form of emergent hydrophytes. Because this area lacked vegetative diversity during the habitat assessment the team lowered the value of that metric, resulting in a low HSI value for each target year. Lack of wetland species such as cattails, cordgrasses, and bulrushes contributed to the low scoring for this wetland. This trend was assumed through all target years.

The limiting factors for the baseline of the Bullfrog HSI model were percent shoreline cover and percent silt in substrate. Suitability for winter cover is a heavily weighted life requisite metric for the Bullfrog HSI. A low percent silt in substrate lowered the total HSI score.

The final AAHUs calculated for Marsh Wren and Bullfrog were then averaged together, resulting in a 0.86 AAHUS for the FWOP of Area 1A.

Area 1B is an expansion upon the existing wetlands of Area 1A. The total acreage of the area upon execution of the project would be 6.42 acres.

Although the area selected for expansion is in close proximity to existing wetlands, it is dominated by grassland and shrubland species. The HSI scores for the Marsh Wren and Bullfrog HSI are equal to zero, because the expanded wetlnads do not contain any existing wet areas or wetland vegetation in the FWOP.

It should be noted that the Area 1B acreage in the table below does not reflect the actual acreage for Area 1, but rather the acreage that was used to calculate benefits. To better reflect the site conditions, the additional acreage was subtracted from the total acreage of Area 1A. The benefits of Area 1B were then added to the benefits of Area 1A to combine existing and expanded wetland acreage.

The final AAHUs calculated with the Marsh Wren and Bullfrog HSI were then averaged together; resulting in 0.86 AAHUs in the FWOP for Area 1B.

Table 9. Future Without Project Habitat Conditions for Area 1A and 1B.

Model	Target Year												
		0		1		5		10		25		50	
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU
Marsh Wren HSI Area 1A	3.17	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Bullfrog HSI Area 1A	3.17	0.6	1.85	0.6	1.79	0.6	1.72	0.5	1.71	0.5	1.71	0.5	1.71
Marsh Wren HSI Area 1B	3.25	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Bullfrog HSI Area 1B	3.25	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00

AREA 2: CENTRAL WETLANDS

Area 2: Central Wetlands is directly south of the Bird Pond Wetlands. The Central Wetlands consist of a complex of emergent wetlands connected to each other by swales with higher, upland areas interspersed (Figure 12). It is comprised of a shallow wetland with areas of deeper water (6-12" in depth) and dominated by cattail and willow baccharis.

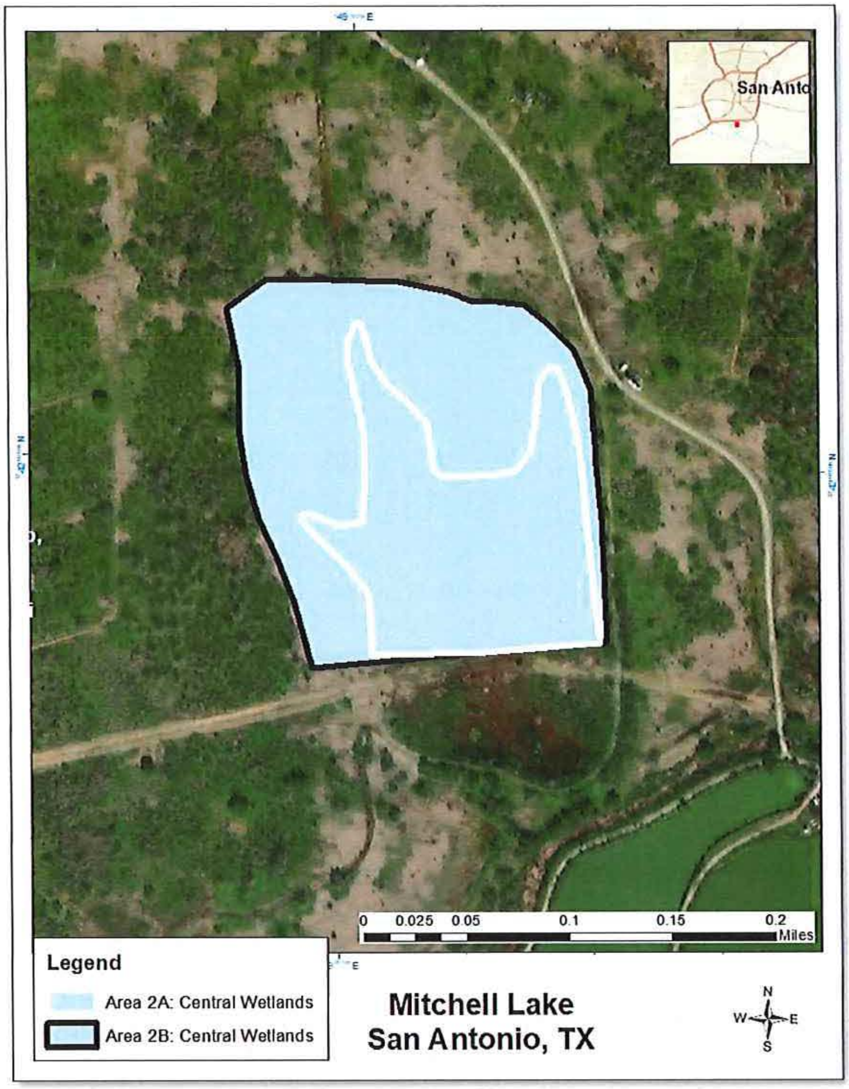

Figure 12. Central Wetlands Area 2A and 2B

The existing wetland is referred to as Area 2A. The current site conditions are low quality. The Marsh Wren HSI metric for growth form of emergent hydrophytes brought down the overall HSI score for Marsh Wren, while the Bullfrog HSI score was decreased by the percent silt in substrate metric (Table 9). The final AAHU score for the existing Central Wetland is 2.85 in the Future Without Project.

Area 2B includes the area of expansion around the existing Central Wetlands. The expansion is mostly shrubland/upland habitat with vegetation like palo verde, spiny hackberry, and bastard cabbage. Because there are already existing wetlands in this area, it is assumed a modification of elevation and contouring would allow for better wetland suitability, increasing the overall size of the wetlands in this area.

Similar to Area 1B, it should be noted that the acreage in the table below does not reflect the total acreage for the plan, but rather the acreage that was used to calculate the benefits of Area 2B.

The final AAHU score for Area 2B is 2.85 at TY 50.

Table 10. Future Without Project Habitat Conditions for Area 2A and 2B.

Model	Target Year												
		0		1		5		10		25		50	
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU
Marsh Wren HSI Area 2A	10.46	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Bullfrog HSI Area 2A	10.46	0.6	6.12	0.6	5.92	0.6	5.70	0.5	5.68	0.5	5.68	0.5	5.68
Marsh Wren HSI Area 2B	7.91	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Bullfrog HSI Area 2B	7.91	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00

AREA 3: SKIP'S POND

Skip's Pond is part of the same wetlands as the Central Wetlands, but is separated by a pipeline right-of-way (Figure 13). This area also supports different vegetation in comparison to the Central Wetlands. Therefore, the areas were annualized separately in regards to restoration efforts.

Skip's Pond is comprised of deeper water emergent wetlands, up to 2' in depth. This area consists of vegetation such as buttercup (*Ranunculus spp.*), alligator weed, and bedstraw. The existing wetland does not hold high quality vegetation, which led to a negative impact on the Marsh Wren HSI score for overall suitability. The Bullfrog HSI scores were relatively average, because of the percent in silt in substrate metric. The total AAHUs for this site was 0.59.

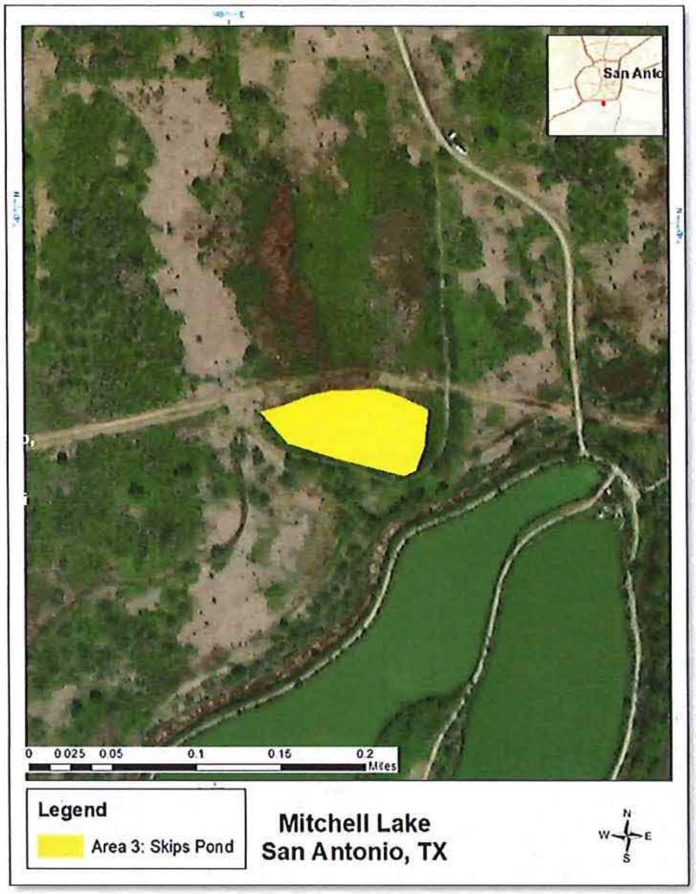

Figure 13. Skip's Pond

Table 11. Future Without Project Habitat Conditions for Area 3.

Model	Target Year												
		0		1		5		10		25		50	
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU
Marsh Wren HSI	2.18	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Bullfrog HSI	2.18	0.6	6.12	0.6	5.92	0.6	5.70	0.5	5.68	0.5	5.68	0.5	5.68

AREA 6: POLDERS

The polders are directly north of Mitchell Lake. This evaluation separates the two large-scale polders and one basin into five separate mudflat habitat cells (Figure 14). The plan for the polders is focused on structural modification and operational management of the water within the polder cells. Common species found along the levees of the polders and basins included: sugarberry, western ragweed, hedge parsley, bedstraw, spiny hackberry, and palo verde. The polders and basin had little to no vegetation or consisted of open water habitat. Vegetative diversity within this area is incredibly low and consists of low quality wildlife habitat.

Figure 14. Polders

Suitability for migrating shorebirds is above average, however a few limiting factors such as water depths and availability and timing for water depths and availability lowered the total HSI score (Table 11). The polders and basins are continually dry or have depths greater than 18 cm with little useable shoreline. The AAHU for FWOP is 30.21 for the polders.

Table 12. Future Without Project Habitat Conditions for Area 6.

Model	Target Year												
		0		1		5		10		25		50	
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU
Shorebird Migration	49.52	0.6	30.21	0.6	30.21	0.6	30.21	0.6	30.21	0.6	30.21	0.6	30.21

AREA 7: FRINGE WETLANDS

Area 7 is characterized by its proximity to the border of the open water habitat of Mitchell Lake. Future management of Mitchell Lake will result in the adjustment of the water surface elevation to 517', lowering the water levels will effectively decrease the amount of emergent and submergent wetland habitat. Plant growth is negatively impacted by the varying dissolved oxygen and pH levels within Mitchell Lake.

The Fringe Wetlands are separated into coves, which can all be implemented as stand-alone alternatives or included in combination with each other (Figure 15). Cove 1 is approximately 53.68 acres on the northwest portion of Mitchell Lake. Cove 2 is approximately 11.84 acres on the northeast portion of Mitchell Lake. Cove 3 is on the southwest section of Mitchell Lake, within close proximity of the dam and is approximately 6.84 acres.

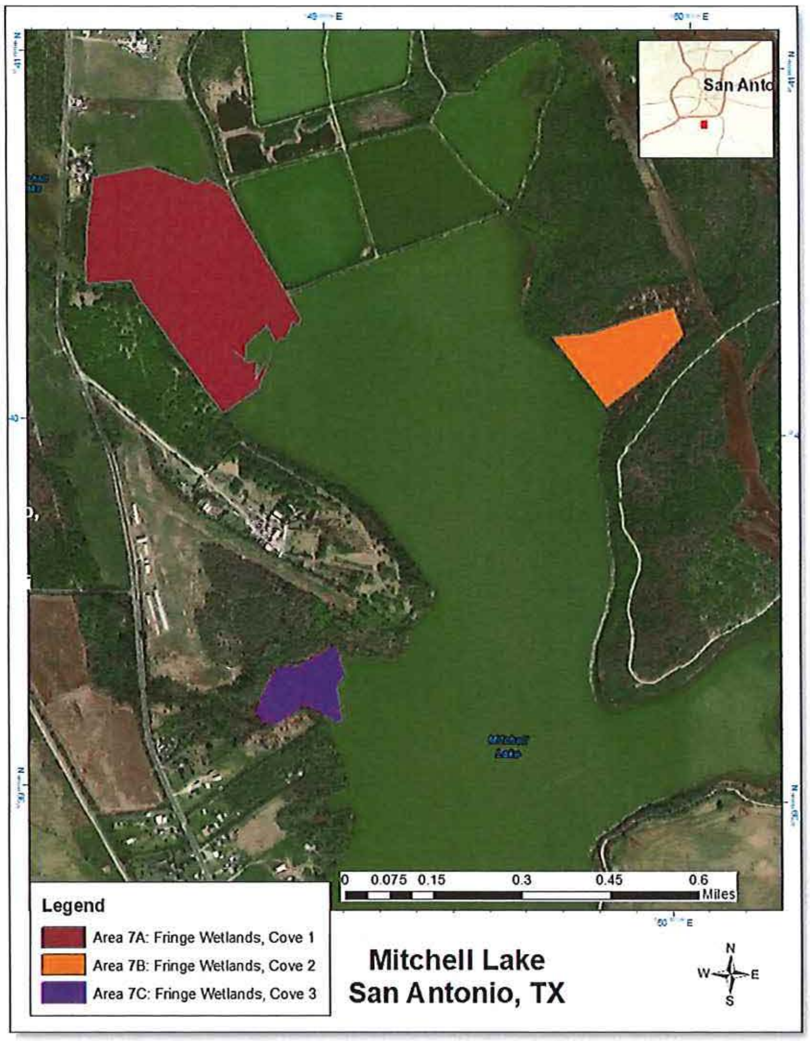

Figure 15. Fringe Wetlands Areas Coves 1, 2, and 3

The borders of the lake have very limited plant diversity, which impacts the overall Marsh Wren HSI score. Other limiting factors for all of the coves include: percent cover of emergent herbaceous vegetation and mean water depth.

The limiting life requisite variables for the Bullfrog HSI model were percent shoreline cover and percent silt in substrate. Percent silt in substrate affected the suitability of the area for winter cover.

The difference in AAHUs for each cove can be accounted for by their difference in size. There are no assumed differences between each of the coves in regards to emergent wetland habitat suitability. Cove 1 FWOP AAHU is 13.43, Cove 2 is 2.96, and Cove 3 is 1.71.

Table 13. Future Without Project Habitat Conditions for Area 7.

Model	Target Year												
		0		1		5		10		25		50	
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU
Marsh Wren HSI Cove 1	53.68	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Bullfrog HSI Cove 1	53.68	0.5	28.12	0.5	25.34	0.5	25.34	0.5	26.16	0.5	26.93	0.5	28.12
Marsh Wren HSI Cove 2	11.84	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Bullfrog HSI Cove 2	11.84	0.5	6.20	0.5	5.59	0.5	5.59	0.5	5.77	0.5	5.94	0.5	6.20
Marsh Wren HSI Cove 3	6.84	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Bullfrog HSI Cove 3	6.84	0.5	3.58	0.5	3.23	0.5	3.23	0.5	3.33	0.5	3.43	0.5	3.58

AREA 9: DAM FORESTED WETLANDS

The Dam Forested Wetlands are maintained by seepage through the dam and are dominated by hackberry woodlands (Figure 16). An existing drainage channel resulting from dam seepage has created low lying wet areas in relative depths, which has resulted in a linear series of in-channel emergent and forested wetlands with several ponded areas along the upstream section of the drainage.

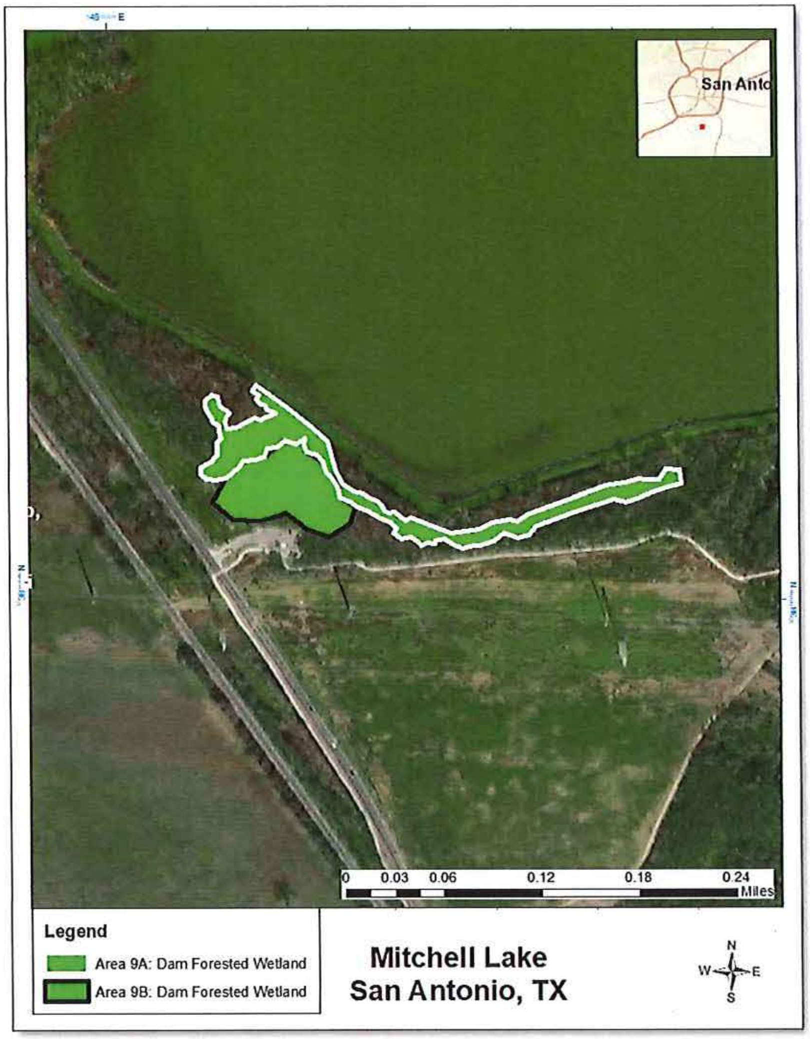

Figure 16. Dam Forested Wetlands Areas 9A and 9B

Area 9A is characterized by the existing low areas below the dam, while Area 9B is the expansion of the existing forested wetlands. The limiting factors for Barred Owl in this area include the number of trees greater than 20 inches per acre and the mean DBH of overstory trees until Target Year 10. Area 9A FWOP AAHUs is 0.71 and 9B is 1.25.

Table 14. Future Without Project Habitat Conditions for Area 9A and 9B.

	Target Year												
Model		0		1		5		10		25		50	
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU

Barred Owl HSI **Area 9A**	2.55	0.2	0.55	0.2	0.55	0.3	0.64	0.3	0.84	0.5	1.19	0.7	1.76
Gray Squirrel HSI **Area 9A**	2.55	0.1	0.25	0.1	0.25	0.1	0.24	0.1	0.25	0.1	0.24	0.1	0.24
Barred Owl HSI **Area 9B**	4.48	0.2	0.97	0.2	0.97	0.3	1.12	0.3	1.48	0.5	2.09	0.7	3.09
Gray Squirrel HSI **Area 9B**	4.48	0.1	0.44	0.1	0.44	0.1	0.43	0.1	0.43	0.1	0.43	0.1	0.43

AREA 10: DOWNSTREAM WETLANDS

The area that will be regarded as the Downstream Wetlands in the Future With Project, currently exist as shrubland/upland habitat. In order to determine the benefits for this plan, the Future Without Project conditions were projected with the current existing conditions, i.e. upland within the respective model metrics for emergent wetland habitat. The habitat within this area is assumed to be upland, due to the surrounding areas. See Figure 17 for the Downstream Wetlands approximate location. Due to its current status as upland habitat, it produced below average scores in the emergent wetland habitat models (Marsh Wren and Bullfrog HSI).

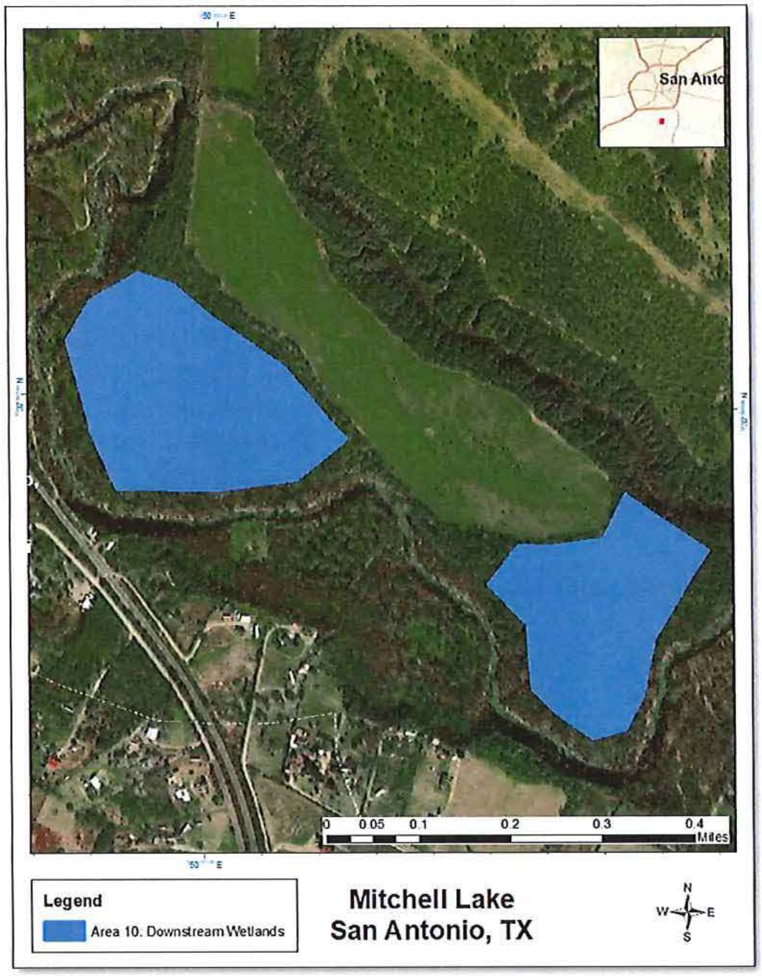

Figure 17. Downstream Wetlands

Table 15. Future Without Project Habitat Conditions for Area 10.

Model	Target Year												
		0		1		5		10		25		50	
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU
Marsh Wren HSI	51.32	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Bullfrog HSI	51.32	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00

5.3.4 Future With Project Habitat Conditions

Various aquatic ecosystem restoration measures were developed for each project area. Measures included efforts, such as invasive species removal and native vegetation plantings. Measures were not considered complete alternatives on their own, as they would not individually restore ecological structure and function to the environment. Combinations of measures were developed for each project area, referred to as alternatives from here on, which would restore aquatic ecosystem habitat as described in the FWP conditions sections below. These alternatives were then used to compare the project area FWOP and FWP habitat modeling results to help inform plan selection.

All areas and acreages are assumed to be the same as the Future Without Project. The ecological benefits for each alternative are dependent on the measures that are assumed to be implemented at the site.

ALTERNATIVES 1A and 1B: BIRD POND WETLANDS

The restoration goal for Alternatives 1A is the enhancement of the existing wetland adjacent to Bird Pond, while Alternative 1B includes the enhancement of the existing area and expansion around it. As mentioned in the previous section, the degraded wetland is shallow, dominated by cattails, and has little or no variation in water depth. The restoration strategy is to increase the depth of the wetland, establish water supply to sustain the wetland, manage the water to inundate the wetland with seasonal pulses, and establish a diverse native wetland vegetation community.

Alternatives 1A and 1B FWP conditions incorporate the following measures:

- Clearing/Excavation,
- Installation of Pipeline,
- Seasonal Pulses,
- Native Wetland Species Plantings,
- Invasive Species Management,
- Low Quality Vegetation Removal,
- Water Control Structures
- Habitat Structure Augmentation, and
- Installation of Bat/Nest Boxes measures.

With the exception of the Bat/Nest Boxes measure, each one of these measures provide hydraulic and ecological components that are critical for the creation of a resilient, sustainable wetland.

The clearing/excavation measure would create the variable water depths required to support a diverse wetland habitat and eliminate the homogenous shallow depths that promote cattail monocultures. The installation of a pipeline would provide a dependable water supply to ensure that the wetland is inundated to a level that supports a diverse vegetative community. Similarly, the water control structures required for the seasonal pulses measure would provide water management to vary the depths of the wetland seasonally to manage for the diverse vegetative community and control of cattails.

The woody material cleared would be stock piled and placed back into the excavated wetland as fallen logs or debris piles to increase to create wildlife habitat structure in the wetland. In addition, excavation of the existing wetlands near large trees could be designed to preserve the tree allowing the conversion of the trees to standing snags by treating the tree with an aquatic labeled herbicide.

Site-specific, native emergent and submergent plant species would be planted to establish a diverse community. In an effort to minimize the establishment of invasive species after the final grading of the wetlands, management, and control of invasive species would be required to ensure establishment of the diverse planted vegetation. An integrated invasive species management plan would be developed and implemented utilizing chemical, mechanical and/or biological controls.

Table 15 below depicts the increase of HSI scores beginning at Year 1. The Marsh Wren HSI scores stay relatively low due to the amount of woody vegetation that is anticipated to cover the area after project implementation. However, enhancement of the area for Alternative 1A and expansion of wetlands for Alternative 1B will result in above average HSI scores for the Bullfrog HSI and increase the Marsh Wren HSI score FWP from 0.0 to 0.4 in Target Year 50.

Table 16. Future With Project Habitat Conditions for Alternatives 1A and 1B.

Model	Target Year												
		0		1		5		10		25		50	
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU
Marsh Wren HSI Alternative 1A	3.17	0.0	0.00	1.0	3.14	0.9	2.85	0.8	2.38	0.4	1.27	0.4	1.27
Bullfrog HSI Alternative 1A	3.17	0.6	1.80	0.9	2.93	1.0	3.04	1.0	3.07	1.0	3.09	1.0	3.09
Marsh Wren HSI Alternative 1B	3.25	0.0	0.00	0.5	1.50	0.9	2.76	0.7	2.31	0.4	1.24	0.4	1.24
Bullfrog HSI Alternative 1B	3.25	0.0	0.00	0.9	2.77	0.9	2.93	1.0	3.08	1.0	3.14	1.0	3.17

ALTERNATIVES 2A AND 2B: CENTRAL WETLANDS

The measures for Alternatives 2A and 2B would be identical to the combination of measures listed for Alternatives 1A and 1B above, thus the Central Wetlands will follow the same trend for HSI scores as the Bird Pond Wetlands. The rise in HUs compared to Alternatives 1A and 1B is due to the difference in acreage.

Alternatives 2A and 2B FWP conditions incorporate the following measures:

- Clearing/Excavation,
- Installation of Pipeline,
- Seasonal Pulses,
- Native Wetland Species Plantings,
- Invasive Species Management,

- Low Quality Vegetation Removal,
- Water Control Structures,
- Habitat Structure Augmentation, and
- Installation of Bat/Nest Boxes measures.

Table 17. Future With Project Habitat Conditions for Alternatives 2A and 2B.

Model	Target Year												
		0		1		5		10		25		50	
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU
Marsh Wren HSI Alternative 2A	10.46	0.0	0.00	1.0	10.36	0.9	9.41	0.8	7.85	0.4	4.18	0.4	4.18
Bullfrog HSI Alternative 2A	10.46	0.6	5.95	0.9	9.66	1.0	10.01	1.0	10.15	1.0	10.19	1.0	10.19
Marsh Wren HSI Alternative 2B	7.91	0.0	0.00	0.5	3.64	0.9	6.72	0.7	5.62	0.4	3.01	0.4	3.01
Bullfrog HSI Alternative 2B	7.91	0.0	0.00	0.9	6.74	0.9	7.12	1.0	7.49	1.0	7.64	1.0	7.71

ALTERNATIVE 3: SKIP'S POND

Alternative 3 would incorporate the same measures and scales as described above for Alternatives 1A, 1B, 2A, and 2B with the exception of the installation of a pipeline due to a petroleum pipeline separating the Central Wetlands from Skip's Pond. Due to the probable increase in woody vegetation, the Marsh Wren HSI score is negatively impacted beginning in Year 25 (Table 17).

Alternative 3 FWP conditions incorporate the following measures:

- Clearing/Excavation,
- Seasonal Pulses,
- Native Wetland Species Plantings,
- Invasive Species Management,
- Low Quality Vegetation Removal,
- Water Control Structure (only needed if Alternative 2A or 2B is implemented),

- Habitat Structure Augmentation, and
- Installation of Bat/Nest Boxes measures.

Table 18. Future With Project Habitat Conditions for Alternative 3.

Model	Target Year												
		0		1		5		10		25		50	
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU
Marsh Wren HSI	2.18	0.0	0.00	1.0	2.16	0.9	1.96	0.8	1.64	0.4	0.87	0.4	0.87
Bullfrog HSI	2.18	0.6	1.24	0.9	2.01	1.0	2.09	1.0	2.11	1.0	2.12	1.0	2.12

ALTERNATIVE 6: POLDERS

Alternative 6 utilizes the existing polders of the old Mitchell Lake wastewater treatment facility. Currently, these polders are maintained as open water habitats to prevent the polder sediments from drying out and becoming airborne. Implementation of the proposed action would manipulate the water levels in the polders to create mudflats for migratory shorebird foraging habitat. The polder cells incorporated in Alternative 6 would be cycled to prevent the complete drying of the sediments and ensuring there is a water supply to inundate the drained polders. The improvement of overall water depths and availability and timing for water depths and availability improved the FWP in comparison to the FWP (Table 18).

Alternative 6 FWP conditions incorporate the following measures:

- Polder Operational Management,
- Installation of Bat/Nest Boxes, and
- Construction of Berms.

Table 19. Future With Project Habitat Conditions for Alternative 6.

Evaluation Method	Target Year												
		0		1		5		10		25		50	
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU
Shorebird Migration Model	49.52	0.6	30.21	1.0	48.53	1.0	48.53	1.0	48.53	1.0	48.53	1.0	48.53

ALTERNATIVES 7A, 7B, 7C, 7D, 7E, 7F, AND 7G: FRINGE WETLANDS

The limited and degraded wetlands found within Mitchell Lake are at risk of being eliminated and converted to upland/riparian habitats due to the proposed lowering the lake level elevation of 517' amsl. The implementation of the Proposed Action would involve invasive species management/removal and the planting of native emergent, submergent, and riparian species. Three coves have been identified as part of the alternatives recommended for restoration within the fringe wetlands. These coves contain a scattered population of large trees adjacent to and within the existing wetland fringe habitats. A select number of these trees could be converted to standing snags for wildlife habitat.

The alternatives for the Fringe Wetlands single out and/or combine the three coves identified for restoration. Each cove has a different benefit associated with its restoration (Table 4-18), based on the amount of acreage associated with the cove.

- 7A: Enhancement of Cove 1
- 7B: Enhancement of Cove 2
- 7C: Enhancement of Cove 3
- 7D: Combination of Coves 1 & 2 Enhancement
- 7E: Combination of Coves 1 & 3 Enhancement
- 7F: Combination of Coves 2 & 3 Enhancement
- 7G: Combination of Coves 1, 2 & 3 Enhancement

Alternative 7A, 7B, 7C, 7D, 7E, 7F, and 7G FWP conditions incorporate the following measures for Coves 1, 2, and 3:

- Native Wetland Species Plantings,
- Invasive Species Management,
- Habitat Structure Augmentation, and
- Installation of Bat/Nest Boxes.

Table 20. Future With Project Habitat Conditions for Alternatives 7A, 7B, 7C, 7D, 7E, and 7G.

Model	Target Year												
		0		1		5		10		25		50	
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU
Marsh Wren HSI Cove 1	53.68	0.0	0.00	0.0	0.00	0.4	23.62	0.8	43.48	0.8	40.80	0.8	40.80
Bullfrog HSI Cove 1	53.68	0.6	30.24	0.9	46.80	0.9	48.56	0.9	49.58	0.9	49.84	0.9	49.84
Marsh Wren HSI Cove 2	11.84	0.0	0.00	0.0	0.00	0.4	5.21	0.8	9.59	0.8	9.00	0.8	9.00
Bullfrog HSI Cove 2	11.84	0.6	6.67	0.9	10.32	0.9	10.71	0.9	10.93	0.9	10.99	0.9	10.99

Marsh Wren HSI Cove 3	6.84	0.0	0.00	0.0	0.00	0.4	3.01	0.8	5.54	0.8	5.20	0.8	5.20
Bullfrog HSI Cove 3	6.84	0.6	3.85	0.9	5.96	0.9	6.19	0.9	6.32	0.9	6.35	0.9	6.35

ALTERNATIVES 9A AND 9B: DAM FORESTED WETLANDS

Measures appropriate for Alternatives 9A and 9B are the same measures identified for Alternatives 1A, 1B, 2A, and 2B above, with a few changes. The existing forested wetlands below the dam are dominated by hackberry which provide limited wildlife habitat. The Future With Project condition would entail the thinning of hackberry trees for use as structural habitat and the creation of standing snags.

Although both of the HSI model scores rise through the years, due to the measures implemented, the impacts are fairly minimal and yield low results in regards to HUs due to the amount of acreage involved with this area.

Alternatives 9A and 9B FWP conditions incorporate the following measures:

- Clearing/Excavation,
- Native Riparian Plantings,
- Seasonal Pulses,
- Native Wetland Species Plantings,
- Invasive Species Management,
- Low Quality Vegetation Removal,
- Water Control Structures,
- Habitat Structure Augmentation, and
- Installation of Bat/Nest Boxes measures.

Table 21. Future With Project Habitat Conditions for Alternatives 9A and 9B.

Model	Target Year												
		0		1		5		10		25		50	
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU
Barred Owl HSI Alternative 9A	2.55	0.2	0.55	0.1	0.28	0.2	0.41	0.3	0.65	0.5	1.32	0.6	1.47
Gray Squirrel HSI	2.55	0.1	0.25	0.3	0.81	0.3	0.81	0.3	0.81	0.6	1.40	0.7	1.80

Alternative 9A													
Barred Owl HSI **Alternative 9B**	4.48	0.2	0.97	0.1	0.49	0.2	0.73	0.3	1.14	0.5	2.31	0.6	2.59
Gray Squirrel HSI **Alternative 9B**	4.48	0.1	0.44	0.3	1.42	0.3	1.42	0.3	1.42	0.6	2.45	0.7	3.17

<u>ALTERNATIVE 10: DOWNSTREAM WETLANDS</u>

Implementation of Alternative 10 would involve the creation of wetlands downstream of the Mitchell Lake dam. Native wetland species plantings, seasonal pulses, and habitat structure augmentation measures have a large impact on this area which have resulted in average to above average HSI scores throughout the Target Years.

The Alternative 10 FWP implements the following measures:

- Clearing/Excavation,
- Native Wetland Species Planting,
- Seasonal Pulses,
- Habitat Structure Augmentation,
- Water Control Structures,
- Installation of Bat/Nest Boxes, and
- Construction of Berms.

Table 22. Future With Project Habitat Conditions for Alternative 10

Evaluation Method	**Target Year**												
		0		**1**		**5**		**10**		**25**		**50**	
	Acres	**HSI**	**HU**	**HSI**	**HU**	**HSI**	**HU**	**HSI**	**HU**	**HSI**	**HU**	**HSI**	**HU**
Marsh Wren	51.32	0.00	0.00	0.46	23.61	0.85	43.62	0.71	36.44	0.38	19.50	0.38	19.50
Bullfrog	51.32	0.00	0.00	0.85	43.71	0.90	46.21	0.95	48.62	0.97	49.55	0.97	50.00

5.4 Comparison of Habitat Units at Year 50 for All Alternatives

Environmental restoration benefits are calculated by subtracting the FWOP AAHU from the FWP AAHU. Although the measures for most of the areas are fairly similar, there are vast differences between the amounts of AAHUs gained for each alternative due to the acreage of each alternative. The greatest AAHU benefit based on existing conditions and the Future With Project conditions is in Alternative 10: Downstream Wetlands. The conversion of this area from shrubland/upland habitat to emergent/submergent wetland habitat has a high probability of improving conditions for wildlife utilizing emergent wetland habitat.

Table 23. Alternative Benefits

Project Area	Alternative	FWOP AAHU	FWP AAHU	Annual Benefits AAHU	FWP Acres
Bird Pond Wetlands	1A: Enhancement of Existing Wetlands	0.86	2.39	1.53	3.17
	1B: Expansion/Enhancement of Existing Wetlands and Enhancement of Additional Wetlands	0.86	4.71	3.85	6.42
Central Wetlands	2A: Enhancement of Existing Wetlands	2.85	7.88	5.03	10.46
	2B: Expansion/Enhancement of Existing Wetlands and Enhancement of Additional Wetlands	2.85	13.54	10.69	18.37
Skip's Pond	3: Enhancement of Existing Wetlands	0.59	1.64	1.05	2.18
Polders	6: Management/Modification of Existing Polders/Basins	30.21	48.35	18.14	49.52
Fringe Wetlands	7A: Enhancement of Cove 1 (Wetland/Riparian Plantings)	13.43	43.33	29.9	53.68
	7B: Enhancement of Cove 2 (Wetland/Riparian Plantings)	2.96	9.56	6.6	11.84
	7C: Enhancement of Cove 3 (Wetland/Riparian Plantings)	1.71	5.52	3.81	6.84
	7D: Combination of Coves 1 & 2	16.39	52.89	36.5	65.52
	7E: Combination of Coves 1 & 3	15.14	48.85	33.71	60.52
	7F: Combination of Coves 2 & 3	4.67	15.08	10.41	18.68
	7G: Combination of Coves 1, 2 & 3	18.1	58.41	40.31	72.36
Dam Forested Wetlands	9A: Enhancement of Existing Wet Riparian Habitat	0.71	1.19	0.47	2.55
	9B: Expansion/Enhancement of Existing Wet Riparian Habitat and Enhancement of Additional Riparian Habitat	1.25	2.08	0.83	4.48
Downstream Wetlands	10: Creation of Wetlands Downstream of Mitchell Lake	0.0	36.73	36.73	51.32

6 Final Array of Plans

6.1 Cost Effectiveness and Incremental Cost Analysis (CE/ICA)

Comparing benefits and costs for ecosystem restoration provides a challenge to planners and decision makers because benefits and costs are not measured in the same units. Environmental restoration benefits can be measured in habitat units or some other physical unit, while costs are measured in dollars. Therefore benefits and costs cannot be directly compared. Two analyses are conducted to help planners and decision makers identify plans for implementation, though the analyses themselves do not identify a single ideal plan. These two techniques are cost effectiveness (CE) and incremental cost analysis (ICA). Use of these techniques are described in the Economic and Environmental Principles and Guidelines for Water and Related Land Resource Implementation Studies (U.S. Water Resources Council 1983).

Cost effectiveness compares the annual costs and benefits of plans under consideration to identify the least cost plan alternative for each possible level of environmental output, and for any level of investment, the maximum level of output is identified.

Incremental cost analysis of the cost effective plans is conducted to reveal changes in costs as output levels are increased. Results from both analyses are presented graphically to help planners and decision makers select plans. For each of the best buy plans identified through incremental cost analysis, an "Is It Worth It?" analysis is conducted for each incremental plan to justify the incremental cost per unit of output to arrive at a recommended plan. Of the 1,728 plans (including various scales), 29 were identified as cost effective plans (including no action) and nine were identified as "Best Buy" plans. Detailed numerical output from the ICA is presented in Figure 18. The best buy plans are:

- Plan 1: No Action
- Plan 2: Polders (Alternative 6)
- Plan 3: Polders + Cove 3 (Alternative 7C)
- Plan 4: Polders + Cove 3 + Downstream Wetlands (Alternative 10)
- Plan 5: Polders + Downstream Wetlands + Coves 1-3 (Alternative 7G)
- Plan 6: Polders + Downstream Wetlands + Coves 1-3 + Skip's Pond (Alternative 3)
- Plan 7: Polders + Downstream Wetlands + Coves 1-3 + Skip's Pond + Central Wetlands (Alternative 2B)
- Plan 8: Polders + Downstream Wetlands + Coves 1-3 + Skip's Pond + Central Wetlands + Bird Pond Wetlands (Alternative 1B)
- Plan 9: Polders + Downstream Wetlands + Coves 1-3 + Skip's Pond + Central Wetlands + Bird Pond Wetlands + Forested Wetlands below the Dam (Alternative 9B)

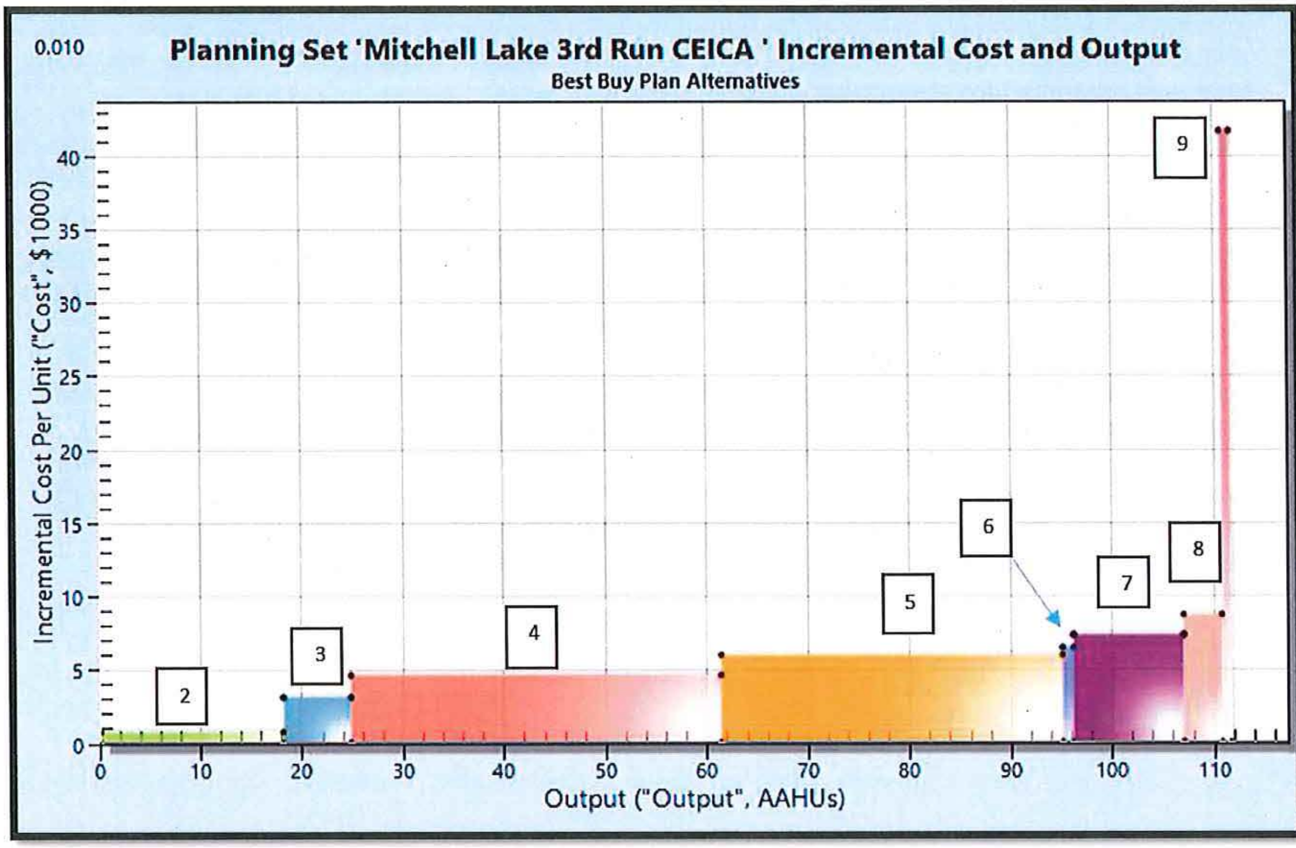

Figure 18. Incremental Cost Analysis Result

6.2 Proposed Action

After performing an "Is It Worth It" Analysis on the Final Array of Plans, Plan 8 was chosen as the Recommended Plan and the National Ecosystem Restoration Plan.

Plan 8 includes the restoration features included in Plan 7 and adds the restoration and expansion of the Bird Pond Wetland from Alternative 1B (Figure 4-8). The Bird Pond Wetland is an existing wetland located east of Bird Pond and upslope of the Central Wetlands. The existing wetlands are dominated by cattails with little herbaceous diversity. An indistinct drainage comprised of a swale of wetlands with intermittent sections of distinct channels connects the Bird Pond and Central Wetlands. Instead of placing the pipeline outfall structure at the north end of the Central Wetlands (Plan 7), the pipeline would be moved to the north end of the Bird Pond Wetland. The restoration measures would improve the plant diversity and expand the wetland complex. The Bird Pond Wetland restoration would add 6.42 acres of emergent wetlands and 3.9 AAHUs to the previous Plan.

A total of 110.8 AAHUs are provided by Plan 8; the allocation of the AAHUs are provided below:

- 49.52 acres and 18.1 AAHUs of mudflat habitat
- 74.54 acres and 41.4 AAHUs of emergent/submergent wetland habitat
- 76.11 acres and 51.3 AAHUs of emergent wetland habitat

The incremental cost per incremental output for Plan 8 is $8,787 with a first cost of $5,115,007, a first cost increase of approximately $472,000 over Plan 7. Plan 8 would restore 97.8% of the total area identified for restoration under this study.

Plan 8 increases the synergistic water quality benefits of the previous Plan by adding the nutrient filtering function of the Bird Pond Wetlands and approximately 591-foot channel to the Central Wetland/Skip's Pond/Linear Wetland/Cove 1 system (Figure 20).

The Bird Pond Wetlands provide the same core target habitat benefits as the Central Wetlands and Downstream Wetlands and provide the same uncaptured benefits as the Central Wetlands associated with the surrounding transitional habitats. However, the Bird Pond Wetlands are located adjacent to the aquatic habitat of Bird Pond and the associated forested habitat that surrounds the pond. The proximity of the forested habitats to the Bird Pond Wetlands provide significant resources for specific neotropical migratory birds that utilize edge habitats along wetland/woodland boundaries such as the Common Yellowthroat (*Geothlypis trichas*), Yellow Warbler (*Setophaga petchia*), Swamp Sparrow (*Melospiza georgiana*), and Song Sparrow (*M. melodia*). The Bird Pond Wetland also provides optional foraging opportunities for pond dependent species utilizing the Bird Pond habitats such as egrets and herons.

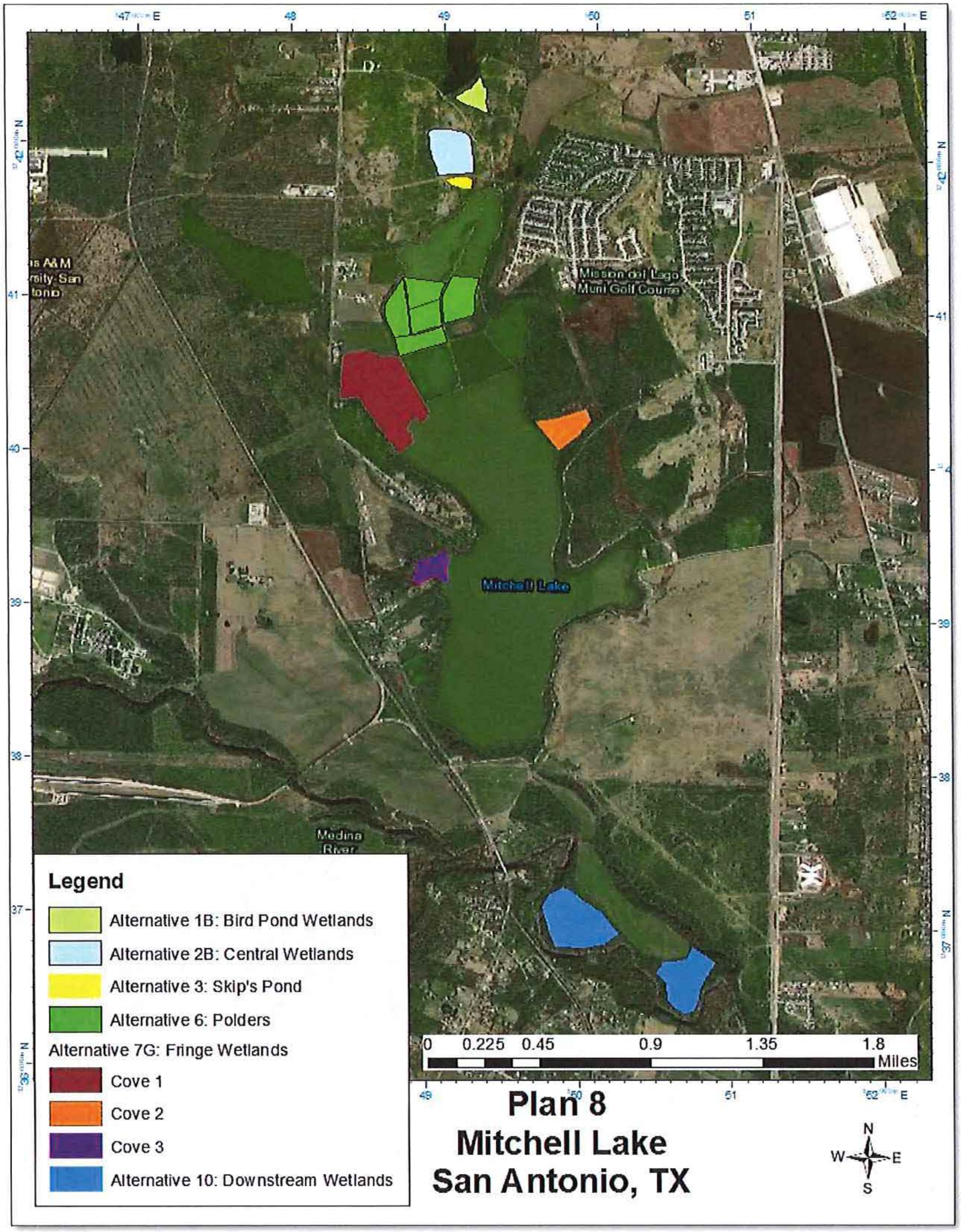

Figure 19. Plan 8 Restoration Areas

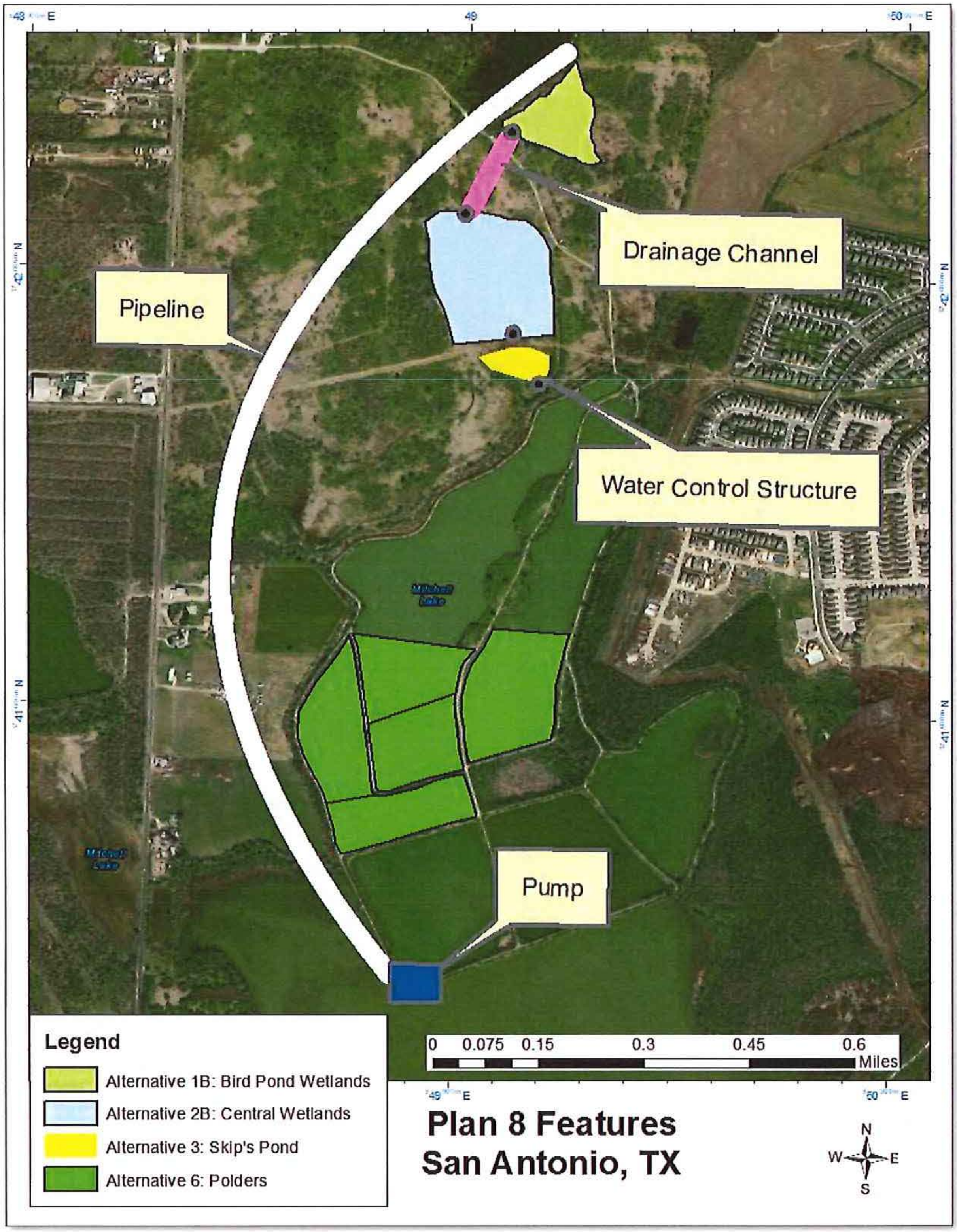

Figure 20. Plan 8 Restoration Features

7 Recommended Fish and Wildlife Conservation Measures

USFWS provides a list of Nationwide Standard Conservation Measures that are utilized with the goal of reducing impacts to birds and their habitat; however, this list can be applied to this project's conservation measures (USFWS 2017). A partial list of effective measures are listed below. See Attachment C of the Coordination Act Report for a full list.

- Educate all employees, contractors, and/or site visitors of relevant rules and regulations that protect wildlife
- Report any incidental take of a migratory bird, to the local Service Office of Law Enforcement.
- Maximize use of disturbed land for all project activities (i.e., siting, lay-down areas, and construction).
- Implement standard soil erosion and dust control measures.
- Schedule all vegetation removal, trimming, and grading of vegetated areas outside of the peak bird breeding season to the maximum extent practicable.
- Prepare a vegetation maintenance plan that outlines vegetation maintenance activities and schedules so that direct bird impacts do not occur.
- Prevent the introduction of invasive plants.
- For temporary and permanent habitat restoration/enhancement, use only native and local (when possible) seed and plant stock.
- Prevent increase in lighting of native habitats during the bird breeding season.
- Avoid contaminating natural aquatic and wetland systems with runoff by limiting all equipment maintenance, staging laydown, and dispensing of fuel, oil, etc., to designated upland areas.

8 Summary of Findings and U.S. Fish and Wildlife Service's Position

The USFWS has provided information and participated throughout the study process. The USFWS supports the recommended Ecosystem Restoration plan.

9 References

American Ornithologists' Union (AOU). 1983. Check-list of North American Birds, 6th edition. Allen Press, Inc., Lawrence, Kansas. 877 pp.

Canadian Wildlife Service and U.S. Fish and Wildlife Service (CWS and USFWS). 2007. International recovery plan for the whooping crane. Ottawa: Recovery of Nationally Endangered Wildlife (RENEW), and U.S. Fish and Wildlife Service, Albuquerque, New Mexico.162 pp.

eBird. 2019. eBird: An online database of bird distribution and abundance [Google Chrome]. eBird, Ithaca, New York. Available: http://www.ebird.org. Accessed on 17 October 2019.

Groeger, A. W., Brown P. F., Tietjen T. E., and Kelsey T. C. 1997. Water quality of the San Marcos River. Texas Journal of Science 49:279-294.

Guyton, W. F. and Associates. 1979. Geohydrology of Comal, San Marcos, and Hueco springs. Texas Department of Water Resources, Report 234 Handbook of Texas Online 2012.

Haig, S. M., C. L. Ferland, F. J. Cuthbert, J. Dingledine, J. P. Goossen, A. Hecht, and N. McPhillips. 2005. A complete species census and evidence for regional declines in piping plovers. Journal of Wildlife Management 69.1:160-173.

Henderson, Dwight, and Ruth Lofgren (2008). Mitchell Lake Wildlife Refuge: An Illustrated History. San Antonio: Mitchell Lake Wetlands Society.

Horne, F. R. and S. McIntosh. 1979. Factors influencing distribution of mussels in the Blanco River of central Texas. The Nautilus 94:119-133.

Howells, R. G. 2002. Freshwater mussels (Unionidae) of the pimpleback complex (Quadrula spp.) in Texas. Texas Parks and Wildlife Management Data Series 197. Austin, Texas.36 pp.

Kuyt, E. 1992. Aerial radio-tracking of whooping cranes migrating between Wood Buffalo National Park and Aransas National Wildlife Refuge, 1981-1984. Occasional Paper Number 74. Canadian Wildlife Service. Ottawa, Canada.

Lofgren, Ruth (1990). Restoring an Ecological Treasure. In "The Bright Scrawl", publication of The Junior League of San Antonio, Winter 1990 edition.

Matthews, J.R. and C.J. Moseley (eds.). 1990. The Official World Wildlife Fund Guide to Endangered Species of North America. Volume 1. Plants, Mammals. xxiii + pp 1-560 + 33 pp. appendix + 6 pp. glossary + 16 pp. index. Volume 2. Birds, Reptiles, Amphibians, Fishes, Mussels, Crustaceans, Snails, Insects, and Arachnids. xiii + pp. 561-1180. Beacham Publications, Inc., Washington, D.C

Najvar, P. A. 2001. The effects of diel water quality fluctuations on reproduction and growth in the San Marcos salamander. M.S. thesis, Southwest Texas State University, San Marcos.

NatureServe. 2019A. Whooping Crane: Ecology Life History. Available on the internet at: http://explorer.natureserve.org/servlet/NatureServe?searchName=Grus+americana. Accessed on 22 October 2019.

NatureServe 2019B. Golden-cheeked Warbler: Ecology & Life History. Available on the internet at:http://explorer.natureserve.org/servlet/NatureServe?searchName=Dendroica+chrysoparia+. Accessed on 22 October 2019.

NatureServe 2019C. Golden Orb: Ecology & Life History. Available on the internet at: http://explorer.natureserve.org/servlet/NatureServe?searchName=Quadrula%20aurea. Accessed on 22 October 2019.

NatureServe 2019D. Texas Fatmucket: Ecology & Life History. Available on the internet at: http://explorer.natureserve.org/servlet/NatureServe?searchName=Lampsilis+bracteata. Accessed on 22 October 2019.

NatureServe 2019E. Texas Fawnsfoot: Ecology & Life History. Available on the internet at: http://explorer.natureserve.org/servlet/NatureServe?searchName=truncilla+macrodon. Accessed on 22 October 2019.

NatureServe 2019F.Texas Pimpleback: Ecology & Life History. Available on the internet at: http://explorer.natureserve.org/servlet/NatureServe?searchName=Quadrula+petrina. Accessed on 22 October 2019.

NatureServe 2019G. Comal Springs Dryopid Beetle: Ecology & Life History. Available on the internet at: http://explorer.natureserve.org/servlet/NatureServe?searchName=Stygoparnus+comalensis. Accessed on 22 October 2019.

NatureServe. 2019H. Peck's Cave Amphipod: Ecology & Life History. Available on the internet at: http://explorer.natureserve.org/servlet/NatureServe?searchName=Stygobromus+pecki. Accessed on 22 October 2019.

NatureServe. 2019I. Gray Bracted Twistflower: Ecology & Life History. Available on the internet at:http://explorer.natureserve.org/servlet/NatureServe?searchName=Streptanthus+bracteatus. Accessed on 22 October 2019.

NatureServe. 2019J. Texas Wild Rice: Ecology & Life History. Available on the internet at: http://explorer.natureserve.org/servlet/NatureServe?searchName=Zizania+texana. Accessed on 22 October 2019.

NatureServe. 2019K. Interior Least Tern: Ecology & Life History. Available on the internet at: http://explorer.natureserve.org/servlet/NatureServe?searchName=Sternula+antillarum+athalassos. Accessed on 22 October 2019.

Nelson, J. 1993. Population size, distribution, and life history of Eurycea nana in the San Marcos River. M.S. Thesis, Southwest TSU, San Marcos, Texas.

Newstead, D. J. 2012. Habitat use of North Padre Island and Laguna Madre habitats by piping plover and red knots in the vicinity of current and proposed wind energy development. Interim Report the Endangered Species Program Texas. Texas Parks and Wildlife Department, Austin, Texas, USA.

Newstead, D. J., L. J. Niles, R. R. Porter, A. D. Dey, J. Burger, and O. N. Fitzsimmons. 2013. Geolocation reveals mid-continent migratory routes and Texas

Texas Parks and Wildlife (TPWD). 2019A. Texas Blind Salamander (Eurycea rathbuni). Available on the internet at: https://tpwd.texas.gov/huntwild/wild/species/blindsal/. Accessed on 23 October 2019.

TPWD. 2019B. Fountain Darter (Etheostoma fonticola). Available on the internet at: https://tpwd.texas.gov/huntwild/wild/species/fdarter/. Accessed on 23 October 2019.

Tupa, D., W. Davis. 1976. Population dynamics of the San Marcos salamander, Eurycea nana Bishop. The Texas Journal of Science, 27:179-194.

U.S. Army Corps of Engineers. 2018. Recommended Regional Use Certification of the Shorebird Migration Model.

U.S. Fish and Wildlife Service (USFWS). 1980. Ecological Services Manual – Habitat as a Basis for Environmental Assessment. 15 September 1980.

USFWS. 1985. Determination of endangered and threatened status for piping plover. Federal Register 50:50726-50734.

USFWS. 1996. San Marcos & Comal Springs & Associated Aquatic Ecosystems (Revised) Recovery Plan. Albuquerque, New Mexico.

USFWS. 2008. Bexar County Karst Invertebrates Draft Recovery Plan. Southwest Region, U.S. Fish and Wildlife Service, Albuquerque, New Mexico. http://www.edwardsaquifer.net/pdf/karst_invertebrate_recovery_plan.pdf. Accessed on 23 October 2019.

USFWS. 2011. Species assessment and listing priority assignment form – Red knot (Calidris canutus ssp. rufa). U.S. Fish and Wildlife Service, Northeast Region, Hadley, Massachusetts, USA.

USFWS. 2012. Comprehensive conservation strategy for the piping plover (Charadrius melodus) in its coastal migration and wintering range in the continental United States. USFWS, East Lansing, Michigan, USA.

USFWS. 2014. Rufa red knot background information and threats assessment; supplement to endangered and threatened wildlife and plants; Final threatened status for the rufa red knot (Calidris canutus rufa) [Docket No. FWS-R5-ES-2013-0097; RIN AY17].

USFWS. 2017. Nationwide Standard Conservation Measures. Available at: https://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf. Accessed on 25 October 2019.

ATTACHMENT C

NATIONWIDE STANDARD CONSERVATION MEASURES

Listed below are effective measures that should be employed at all project development sites nationwide with the goal of reducing impacts to birds and their habitats. These measures are grouped into three categories: General, Habitat Protection, and Stressor Management. These measures may be updated through time. We recommend checking the Conservation Measures website regularly for the most up-to-date list.

1. **General Measures**

a. Educate all employees, contractors, and/or site visitors of relevant rules and regulations that protect wildlife. See the Service webpage on Regulations and Policies for more information on regulations that protect migratory birds.

b. Prior to removal of an inactive nest, ensure that the nest is not protected under the Endangered Species Act (ESA) or the Bald and Golden Eagle Protection Act (BGEPA). Nests protected under ESA or BGEPA cannot be removed without a valid permit. i. See the Service Nest Destruction Policy

c. Do not collect birds (live or dead) or their parts (e.g., feathers) or nests without a valid permit. Please visit the Service permits page for more information on permits and permit applications.

d. Provide enclosed solid waste receptacles at all project areas. Non-hazardous solid waste (trash) would be collected and deposited in the on-site receptacles. Solid waste would be collected and disposed of by a local waste disposal contractor. For more information about solid waste and how to properly dispose of it, see the EPA Non-Hazardous Waste website.

e. Report any incidental take of a migratory bird, to the local Service Office of Law Enforcement.

f. Consult and follow applicable Service industry guidance.

2. **Habitat Protection**

a. Minimize project creep by clearly delineating and maintaining project boundaries (including staging areas).

b. Consult all local, State, and Federal regulations for the development of an appropriate buffer distance between development site and any wetland or waterway. For more information on wetland protection regulations see the Clean Water Act sections 401 and 404.

c. Maximize use of disturbed land for all project activities (i.e., siting, lay-down areas, and construction).

d. Implement standard soil erosion and dust control measures. For example: i. Establish vegetation cover to stabilize soil ii. Use erosion blankets to prevent soil loss iii. Water bare soil to prevent wind erosion and dust issues

3. Stressor Management

Stressor: Vegetation Removal

Conservation Goal: Avoid direct take of adults, chicks, or eggs.

Conservation Measure 1: Schedule all vegetation removal, trimming, and grading of vegetated areas outside of the peak bird breeding season to the maximum extent practicable. Use available resources, such as internet-based tools (e.g., the FWS's Information, Planning and Conservation system and Avian Knowledge Network) to identify peak breeding months for local bird species; or, contact local Service Migratory Bird Program Office for breeding bird information.

Conservation Measure 2: When project activities cannot occur outside the bird nesting season, conduct surveys prior to scheduled activity to determine if active nests are present within the area of impact and buffer any nesting locations found during surveys.

1) Generally, the surveys should be conducted no more than five days prior to scheduled activity.

2) Timing and dimensions of the area to be surveyed vary and will depend on the nature of the project, location, and expected level of vegetation disturbance.

3) If active nests or breeding behavior (e.g., courtship, nest building, territorial defense, etc.) are detected during these surveys, no vegetation removal activities should be conducted until nestlings have fledged or the nest fails or breeding behaviors are no longer observed. If the activity must occur, establish a buffer zone around the nest and no activities will occur within that zone until nestlings have fledged and left the nest area. The dimension of the buffer zone will depend on the proposed activity, habitat type, and species present and should be coordinated with the local or regional Service office.

4) When establishing a buffer zone, construct a barrier (e.g., plastic fencing) to protect the area. If the fence is knocked down or destroyed, work will suspend wholly, or in part, until the fence is satisfactorily repaired.

5) When establishing a buffer zone, a qualified biologist will be present onsite to serve as a biological monitor during vegetation clearing and grading activities to ensure no take of migratory birds occurs. Prior to vegetation clearing, the monitor will ensure that the limits of construction have been properly staked and are readily identifiable. Any associated project activities that are inconsistent with the applicable conservation measures, and activities that may result in the take of migratory birds will be immediately halted and reported to the appropriate Service office within 24 hours.

6) If establishing a buffer zone is not feasible, contact the Service for guidance to minimize impacts to migratory birds associated with the proposed project or removal of an active nest. Active nests may only be removed if you receive a permit from your local Migratory Bird Permit Office. A permit may authorize active nest removal by a qualified biologist with bird handling experience or by a permitted bird rehabilitator.

Conservation Measure 3: Prepare a vegetation maintenance plan that outlines vegetation maintenance activities and schedules so that direct bird impacts do not occur.

Stressor: Invasive Species Introduction

Conservation Goal: Prevent the introduction of invasive plants.

Conservation Measure 1: Prepare a weed abatement plan that outlines the areas where weed abatement is required and the schedule and method of activities to ensure bird impacts are avoided.

Conservation Measure 2: For temporary and permanent habitat restoration/enhancement, use only native and local (when possible) seed and plant stock.

Conservation Measure 3: Consider creating vehicle wash stations prior to entering sensitive habitat areas to prevent accidental introduction of non-native plants.

Conservation Measure 4: Remove invasive/exotic species that pose an attractive nuisance to migratory birds.

Stressor: Artificial Lighting

Conservation Goal: Prevent increase in lighting of native habitats during the bird breeding season.

Conservation Measure 1: To the maximum extent practicable, limit construction activities to the time between dawn and dusk to avoid the illumination of adjacent habitat areas.

Conservation Measure 2: If construction activity time restrictions are not possible, use down shielding or directional lighting to avoid light trespass into bird habitat (i.e., use a 'Cobra' style light rather than an omnidirectional light system to direct light down to the roadbed). To the maximum extent practicable, while allowing for public safety, low intensity energy saving lighting (e.g. low pressure sodium lamps) will be used.

Conservation Measure 3: Minimize illumination of lighting on associated construction or operation structures by using motion sensors or heat sensors.

Conservation Measure 4: Bright white light, such as metal halide, halogen, fluorescent, mercury vapor and incandescent lamps should not be used.

Stressor: Human Disturbance

Conservation Goal: Minimize prolonged human presence near nesting birds during construction and maintenance actions.

Conservation Measure 1: Restrict unauthorized access to natural areas adjacent to the project site by erecting a barrier and/or avoidance buffers (e.g., gate, fence, wall) to minimize foot traffic and off-road vehicle uses.

Stressor: Collision

Conservation Goal: Minimize collision risk with project infrastructure and vehicles.

Conservation Measure 1: Minimize collision risk with project infrastructure (e.g., temporary and permanent) by increasing visibility through appropriate marking and design features (e.g., lighting, wire marking, etc.).

Conservation Measure 2: On bridge crossing areas with adjacent riparian, beach, estuary, or other bird habitat, use fencing or metal bridge poles (Sebastian Poles) that extend to the height of the tallest vehicles that will use the structure.

Conservation Measure 3: Install wildlife friendly culverts so rodents and small mammals can travel under any new roadways instead of over them. This may help reduce raptor deaths associated with being struck while tracking prey or scavenging road kill on the roadway.

Conservation Measure 4: Remove road-kill carcasses regularly to prevent scavenging and bird congregations along roadways.

Conservation Measure 5: Avoid planting "desirable" fruited or preferred nesting vegetation in medians or Rights of Way.

Conservation Measure 6: Eliminate use of steady burning lights on tall structures (e.g., >200 ft).

Stressor: Entrapment

Conservation Goal: Prevent birds from becoming trapped in project structures or perching and nesting in project areas that may endanger them.

Conservation Measure 1: Minimize entrapment and entanglement hazards through project design measures that may include:

1. Installing anti-perching devices on facilities/equipment where birds may commonly nest or perch

2. Covering or enclosing all potential nesting surfaces on the structure with mesh netting, chicken wire fencing, or other suitable exclusion material prior to the nesting season to prevent birds from establishing new nests. The netting, fencing, or other material must have no opening or mesh size greater than 19 mm and must be maintained until the structure is removed.

3. Cap pipes and cover/seal all small dark spaces where birds may enter and become trapped.

Conservation Measure 2: Use the appropriate deterrents to prevent birds from nesting on structures where they cause conflicts, may endanger themselves, or create a human health and safety hazard.

1. During the time that the birds are trying to build or occupy their nests (generally , between April and August, depending on the geographic location), potential nesting 5 surfaces should be monitored at least once every three days for any nesting activity, especially where bird use of structures is likely to cause take. It is permissible to remove non-active nests (without birds or eggs), partially completed nests, or new nests as they are built (prior to occupation). If birds have started to build any nests, the nests shall be removed before they are completed. Water shall not be used to remove the nests if nests are located within 50 feet of any surface waters.

2. If an active nest becomes established (i.e., there are eggs or young in the nest), all work that could result in abandonment or destruction of the nest shall be avoided until the young have fledged or the nest is unoccupied. Construction activities that may displace birds after they have laid their eggs and before the young have fledged should not be permitted. If the project continues into the following spring, this cycle shall be repeated. When work on the structure is complete, all netting shall be removed and properly disposed of.

Stressor: Noise

Conservation Goal: Prevent the increase in noise above ambient levels during the nesting bird breeding season.

Conservation Measure 1: Minimize an increase in noise above ambient levels during project construction by installing temporary structural barriers such as sand bags

Conservation Measure 2: Avoid permanent additions to ambient noise levels from the proposed project by using baffle boxes or sound walls.

Stressor: Chemical Contamination

Conservation Goal: Prevent the introduction of chemicals contaminants into the environment.

Conservation Measure 1: Avoid chemical contamination of the project area by implementing a Hazardous Materials Plan. For more information on hazardous waste and how to properly manage hazardous waste, see the EPA Hazardous Waste website.

Conservation Measure 2: Avoid soil contamination by using drip pans underneath equipment and containment zones at construction sites and when refueling vehicles or equipment.

Conservation Measure 3: Avoid contaminating natural aquatic and wetland systems with runoff by limiting all equipment maintenance, staging laydown, and dispensing of fuel, oil, etc., to designated upland areas.

Conservation Measure 4: Any use of pesticides or rodenticides shall comply with the applicable Federal and State laws.

1. Choose non-chemical alternatives when appropriate

2. Pesticides shall be used only in accordance with their registered uses and in accordance with the manufacturer's instructions to limit access to non-target species.

3. For general measures to reducing wildlife exposure to pesticides, see EPA's Pesticides: Environmental Effects website.

Stressor: Fire

Conservation Goal: Minimize fire potential from project-related activities.

Conservation Measure 1: Reduce fire hazards from vehicles and human activities (e.g., use spark arrestors on power equipment, avoid driving vehicles off road).

Conservation Measure 2: Consider fire potential when developing vegetation management plans by planting temporary impact areas with a palate of low-growing, sparse, fire resistant native species that meet with the approval of the County Fire Department and local FWS Office.

ATTACHMENT E

IPaC **U.S. Fish & Wildlife Service**

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Project information

NAME

Mitchell Lake

LOCATION

Bexar County, Texas

DESCRIPTION

Some(Ecosystem restoration of Mitchell Lake in San Antonio, TX. Project will possibly incorporate aquatic ecosystem restoration methods including invasive species removal, native plantings, wetland creation, dam/spillway and or polder modification, and etc. The feasibility study has begun. Engineering, design, and construction has not been initiated. This project is located south of San Antonio, TX.)

Local office

Austin Ecological Services Field Office

(512) 490-0057
(512) 490-0974

10711 Burnet Road, Suite 200
Austin, TX 78758-4460

http://www.fws.gov/southwest/es/AustinTexas/
http://www.fws.gov/southwest/es/EndangeredSpecies/lists/

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Log in to IPaC.
2. Go to your My Projects list.
3. Click PROJECT HOME for this project.
4. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

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1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Birds

NAME	STATUS

Golden-cheeked Warbler (=wood) Dendroica chrysoparia Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/33	Endangered
Piping Plover Charadrius melodus This species only needs to be considered if the following condition applies: • Wind Energy Projects There is **final** critical habitat for this species. The location of the critical habitat is not available. https://ecos.fws.gov/ecp/species/6039	Threatened
Red Knot Calidris canutus rufa Wherever found This species only needs to be considered if the following condition applies: • Wind Energy Projects There is **proposed** critical habitat for this species. The location of the critical habitat is not available. https://ecos.fws.gov/ecp/species/1864	Threatened
Whooping Crane Grus americana There is **final** critical habitat for this species. The location of the critical habitat is not available. https://ecos.fws.gov/ecp/species/758	Endangered

Amphibians

NAME	STATUS
San Marcos Salamander Eurycea nana Wherever found There is **final** critical habitat for this species. The location of the critical habitat is not available. https://ecos.fws.gov/ecp/species/6374	Threatened
Texas Blind Salamander Eurycea [=Typhlomolge] rathbuni Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5130	Endangered

Fishes

NAME	STATUS

Fountain Darter Etheostoma fonticola Wherever found There is **final** critical habitat for this species. The location of the critical habitat is not available. https://ecos.fws.gov/ecp/species/5858	Endangered

Insects

NAME	STATUS
[no Common Name] Beetle Rhadine exilis Wherever found There is **final** critical habitat for this species. The location of the critical habitat is not available. https://ecos.fws.gov/ecp/species/6942	Endangered
[no Common Name] Beetle Rhadine infernalis Wherever found There is **final** critical habitat for this species. The location of the critical habitat is not available. https://ecos.fws.gov/ecp/species/3804	Endangered
Helotes Mold Beetle Batrisodes venyivi Wherever found There is **final** critical habitat for this species. The location of the critical habitat is not available. https://ecos.fws.gov/ecp/species/1149	Endangered

Arachnids

NAME	STATUS
Braken Bat Cave Meshweaver Cicurina venii Wherever found There is **final** critical habitat for this species. The location of the critical habitat is not available. https://ecos.fws.gov/ecp/species/7900	Endangered
Cokendolpher Cave Harvestman Texella cokendolpheri Wherever found There is **final** critical habitat for this species. The location of the critical habitat is not available. https://ecos.fws.gov/ecp/species/676	Endangered
Government Canyon Bat Cave Meshweaver Cicurina vespera Wherever found There is **final** critical habitat for this species. The location of the critical habitat is not available. https://ecos.fws.gov/ecp/species/7037	Endangered

Government Canyon Bat Cave Spider Neoleptoneta microps | Endangered
Wherever found
There is **final** critical habitat for this species. The location of the critical habitat is not available.
https://ecos.fws.gov/ecp/species/553

Madla Cave Meshweaver Cicurina madla | Endangered
Wherever found
There is **final** critical habitat for this species. The location of the critical habitat is not available.
https://ecos.fws.gov/ecp/species/2467

Robber Baron Cave Meshweaver Cicurina baronia | Endangered
Wherever found
There is **final** critical habitat for this species. The location of the critical habitat is not available.
https://ecos.fws.gov/ecp/species/2361

Flowering Plants

NAME	STATUS
Bracted Twistflower Streptanthus bracteatus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/2856	Candidate
Texas Wild-rice Zizania texana Wherever found There is **final** critical habitat for this species. The location of the critical habitat is not available. https://ecos.fws.gov/ecp/species/805	Endangered

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

THERE ARE NO CRITICAL HABITATS AT THIS LOCATION.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Measures for avoiding and minimizing impacts to birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Nationwide conservation measures for birds http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON (IF A BREEDING SEASON IS INDICATED FOR A BIRD ON YOUR LIST, THE BIRD MAY BREED IN YOUR PROJECT AREA SOMETIME WITHIN THE TIMEFRAME SPECIFIED, WHICH IS A VERY LIBERAL ESTIMATE OF THE DATES INSIDE WHICH THE BIRD BREEDS ACROSS ITS ENTIRE RANGE. "BREEDS ELSEWHERE" INDICATES THAT THE BIRD DOES NOT LIKELY BREED IN YOUR PROJECT AREA.)

American Golden-plover Pluvialis dominica — Breeds elsewhere

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Bald Eagle Haliaeetus leucocephalus — Breeds Sep 1 to Jul 31

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/1626

Lesser Yellowlegs Tringa flavipes — Breeds elsewhere

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9679

Long-billed Curlew Numenius americanus — Breeds elsewhere

This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/5511

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.

3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season ( )
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

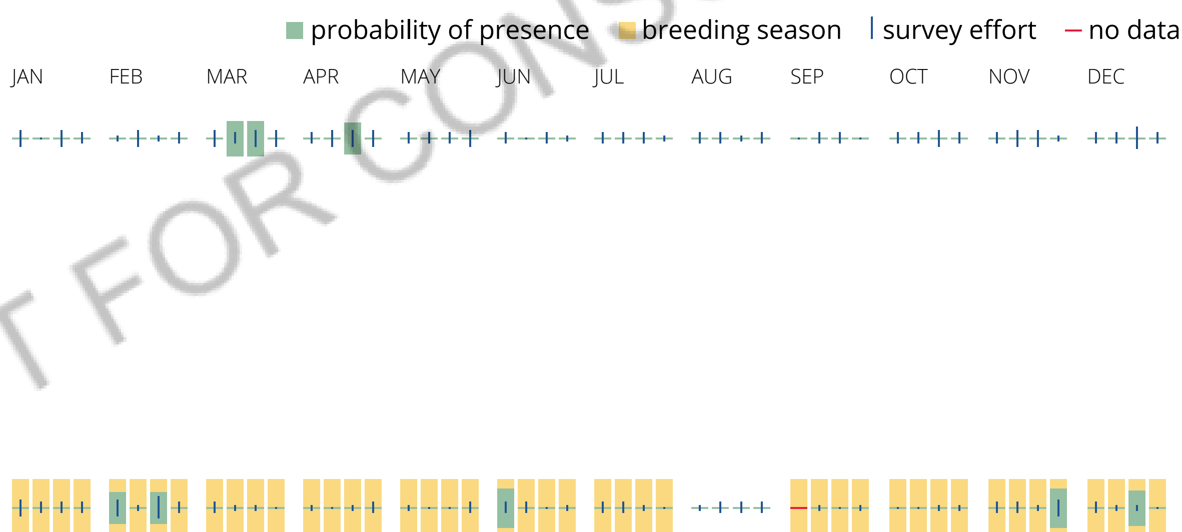
Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

SPECIES

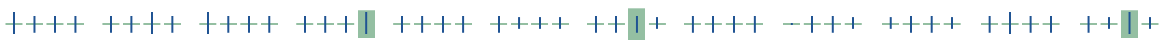


American Golden-plover
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Bald Eagle
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)

Lesser Yellowlegs
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Long-billed Curlew
BCC - BCR (This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA)



Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the AKN Phenology Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets .

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: The Cornell Lab of Ornithology All About Birds Bird Guide, or (if you are unsuccessful in locating the bird of interest there), the Cornell Lab of Ornithology Neotropical Birds guide. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS AT THIS LOCATION.

Fish hatcheries

THERE ARE NO FISH HATCHERIES AT THIS LOCATION.

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

FRESHWATER EMERGENT WETLAND

- PEM1Ch
- PEM1Fh
- PEM1Ah

FRESHWATER FORESTED/SHRUB WETLAND

- PSS1Ah
- PFO1Ah

FRESHWATER POND

- PAB4Fh
- PUBHh
- PUSAh
- PUBFh
- PUSCh
- PUSAx

LAKE

- L1UBHh
- L2UBFh

RIVERINE

- R2UBH
- R4SBC
- R4SBA
- R5UBFx
- R4SBAx
- R5UBH

A full description for each wetland code can be found at the National Wetlands Inventory website

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

ATTACHMENT F

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

March 1, 2021

Ms. Amanda McGuire, Division Chief
Environmental Branch
Regional Planning and Environmental Center
Room 3A12
819 Taylor Street
Fort Worth, Texas 76102

Attention: Ms. Justyss Watson

Re: Mitchell Lake, San Antonio Texas

Dear Ms. McGuire:

This letter is in response to the Mitchell Lake, San Antonio General Investigations Feasibility Study (GIFS) dated December 2020. The U.S. Army Corps of Engineers (Corps) in conjunction with San Antonio Water Systems and the Audubon Society propose to restore the degraded habitat within and surrounding Mitchell Lake. The project is located within Mitchell Lake and the surrounding wetlands, southern Bexar County, San Antonio Texas.

The Texas Commission on Environmental Quality (TCEQ) has reviewed the GIFS and related information. On behalf of the Executive Director and based on our evaluation of the information contained in these documents, the TCEQ certifies that there is reasonable assurance that the project will be conducted in a way that will not violate water quality standards.

The preferred alternative "Plan 6" includes native aquatic plantings, pipeline and pump installation, low quality vegetation removal, habitat structure augmentation, installation of bat and bird nest boxes, invasive vegetation management, berm construction, clearing and excavation, polder operational management, water control structures and seasonal water pulses. These activities will create three distinct habitat types (emergent, emergent/submergent wetlands and mudflats), resilient habitat for migratory birds, and restoration of a complex of wetlands that can be managed for water quality improvement. Approximately 35,000 cubic yards of fill will be discharged into the east and west polders of Mitchell Lake impacting approximately 2 acres. The material will be excavated from Bird Pond Wetlands, Central Wetlands and Skip's Pond. The net benefit of the project is an increase in 50 acres of mudflat habitat, 74 acres of emergent/submergent wetlands, as well as 24 acres of emergent wetland. The project is a restoration project and therefore considered to be self-mitigating.

No review of property rights, location of property lines, nor the distinction between public and private ownership has been made, and this certification may not be used in any way with regard to questions of ownership.

If you require additional information or further assistance, please contact Ms. Brittany M. Lee, Water Quality Assessment Section, Water Quality Division-Matrix, 14250 Judson Road, San Antonio, Texas 78233-4480, at (210) 403-4048 or by email at Brittany.Lee@tceq.texas.gov

Sincerely,

David W Galindo

David W. Galindo, Deputy Director
Water Quality Division
Texas Commission on Environmental Quality

DWG/BL

ccs: Ms. Justyss Watson, Project Manager, Justyss.A.Watson@usace.army.mil

Section 404(b)(1) Analysis

Mitchell Lake, San Antonio, TX

General Investigations Feasibility Study

December 2020

US Army Corps of Engineers®

Fort Worth District

Table of Contents

List of Figures

List of Tables

1 Project Description

Section 404(b)(1) of the Clean Water Act of 1972 requires that any recommended discharge of dredged or fill material into waters of the U.S. must be evaluated using the guidelines developed by the Administrator of the U.S. Environmental Protection Agency (EPA) in conjunction with the Secretary of the Army. These guidelines are in Title 40, Part 230 of the Code of Federal Regulations. The Section 404(b)(1) evaluation in this document analyzes all activities associated with the Recommended Plan that involve the discharge of dredged or fill material into waters of the U.S.

Under the Section 404(b)(1) guidelines, no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the recommended discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences. An alternative is practicable if it is available and capable of action after taking into consideration cost, existing technology, and logistics considering overall project purposes.

Mitchell Lake is in southern Bexar County in San Antonio, TX. Historically, it was called Lake of the Ducks and was comprised of a complex of emergent wetlands dominated by tall emergent vegetation (Henderson and Lofgren 2008). The construction of the dam below the wetland complex in 1901, resulted in the formation of Mitchell Lake. The lake is approximately 650 acres of open water habitat and has an average depth of three to four feet. Historically, the City of San Antonio utilized Mitchell Lake for the disposal of raw sewage, sludge, waste activated sludge, and treated wastewater effluent from the Rilling Road Wastewater Treatment Plant (Robert J. Brandes Consulting 2016). The northern portion of the lake withheld a significant amount of sludge. This area was subsequently diked and isolated in the early 1970s, known as the East and West polders or polders. Later, the sludge began to exceed the capacity of the polders requiring the creation of five additional basins, known as Basins 1, 2, 3, 4, and 5. In 1987, sludge disposal in the polders and basins ceased after the Rilling Road Wastewater Treatment Plant was decommissioned. The Leon Creek Water Recycling Center, southwest of Mitchell Lake, supplements flow into the lake to maintain a water elevation of 519 feet above mean sea level (amsl). Due to the degraded water quality, there are no releases of water downstream of the dam with the exception of flows resulting from large precipitation events.

The non-Federal sponsor (NFS), San Antonio Water Systems (SAWS), requested the U.S. Army Corps of Engineers (USACE) evaluate Mitchell Lake to assess the feasibility of restoring the degraded habitat in Mitchell Lake and the surrounding habitats.

The environment within and around Mitchell Lake has suffered severe habitat degradation due to its historical status as a sewage disposal site and wastewater treatment plant. The Mitchell Lake study area encompasses approximately 6,718 acres. The lake and surrounding uplands and grasslands are leased by the Mitchell Lake Audubon Society, while the property is owned by SAWS. The Audubon Society utilizes the leased areas for recreation and educational purposes.

The earth-and-rock embankment dam at the southern end of its boundary is approximately 3,200 feet long and 30 to 60 feet wide. The polders and basins abut the northern shore of the lake. The East Polder is approximately 47 acres and West Polder is approximately 32 acres, both are located to the north of the basins. The basins are located between the lake and the polders and vary in size:

- Basin 1: 11 acres,
- Basin 2: 7 acres,
- Basin 3: 19 acres,
- Basin 4: 21 acres,
- and Basin 5: 22 acres.

SAWS continues to release water from the Leon Creek Wastewater Treatment Plant which is located approximately 1.2 miles west of the lake. The water released from the plant is carried through a pipeline and discharged from the Leon Creek Wastewater Treatment Plant outfall structure into Mitchell Lake. The water from the plant is used to supplement the water elevation to approximately 519' to 521' amsl, it is normally utilized for irrigation to the Mission Del Lago Golf Course.

1.1 Location

The proposed project is located in the San Antonio River Basin south of San Antonio, TX (Figure 1). It is located within the city limits of San Antonio and is surrounded by agriculture and other rural uses. However, the land use in the area adjacent to the northeast boundary is transitioning to residential development.

The USACE recognizes that factors outside of the Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study footprint influence the feasibility and sustainability of any actions that might be undertaken. Likewise, any actions taken in cooperation with USACE could have positive or negative impacts on the surrounding area. Therefore, the study area includes the Medina River watershed. This resulting study area boundary consists of an area approximately one and a half miles on either side of Mitchell Lake and terminates along the Medina River.

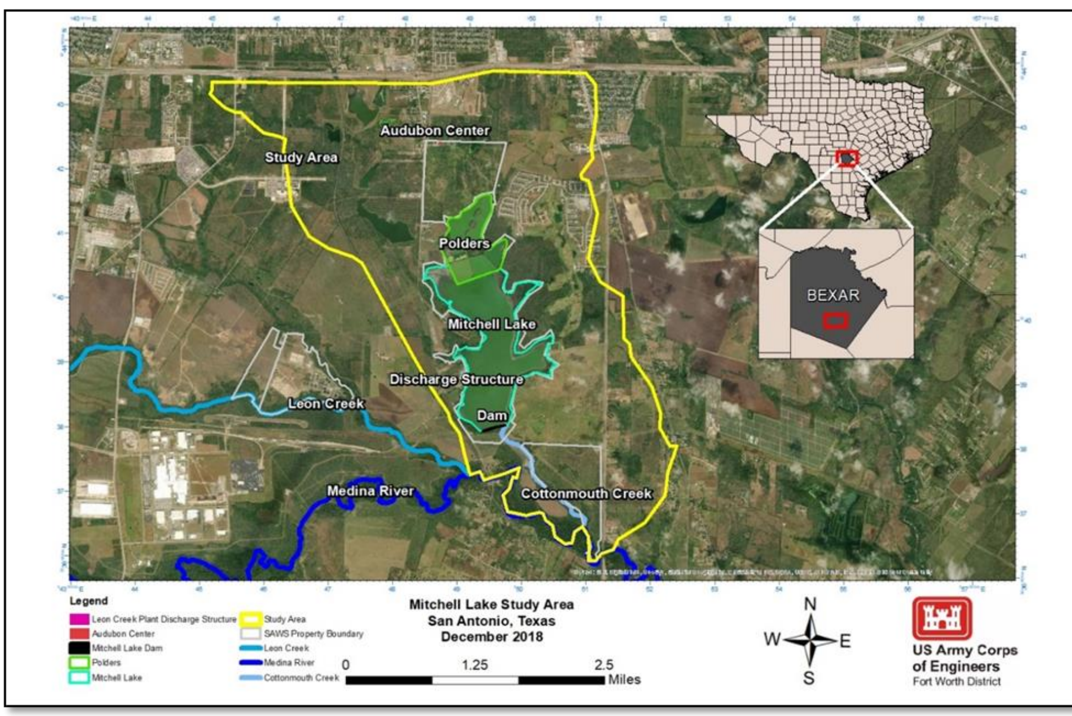


Figure 1. Mitchell Lake Study Area

1.2 General Description

The Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study is a single-purpose, ecosystem restoration, general investigation feasibility study. The study officially began with the signing of the Feasibility Cost Share Agreement between USACE and SAWS on September 5, 2018.

1.3 Purpose, Need, and Authority for the Action

The purpose of the study is to identify and implement aquatic ecosystem restoration measures to restore the structure and/or function of the historical wetland ecosystem within the study area.

The quantity and quality of wetland habitat no longer supports the historic level of organism diversity at all trophic levels. The degraded aquatic habitat within the study area fails to support the diversity of aquatic plants and macroinvertebrates that form the foundation of wetland biotic ecosystems. An increase in biomass and biotic diversity at the fundamental trophic levels is required to restore sustainable fish, amphibian, reptile, mammal, and avian communities.

1.4 Project Goals

Changes in, and around, Mitchell Lake have caused the historic tule (tall emergent wetland vegetation such as cattail [*Typha spp*.], sedge [*Carex spp*.], and smartweed [*Polygonum spp*.]) wetland system to degrade resulting in hypereutrophic waters, reductions in habitat quality and quantity, and reductions in wildlife diversity.

- There has been a significant loss of fish and wildlife habitat quality and diversity, particularly for migratory birds.
- There is little aquatic connectivity between the upstream and downstream habitats. Salinity and nutrient loading will continue to increase.
- There are invasive species on site that out-compete native flora. These invasive species will continue to spread.
- There is high nutrient loading and extreme daily variation in pH and O_2 levels leading to hypereutrophic conditions.

Opportunities exist to:

- Reconnect the upstream and downstream hydraulic connectivity.
- Improve water quality through ecosystem restoration.
- Provide additional recreation and ecotourism benefits to the community.

Specific planning objectives include:

- Increasing the areal extent and quality of fish and wildlife habitat in the study area for the life of the project.
- Increasing the floral and faunal species diversity and richness in the study area for the life of the project.
- Managing and controlling invasive species in the study area for the life of the project.

2 Project Areas Evaluated

2.1 Project Areas

Individual restoration sites were identified as feasible for project implementation (Figure 2). The project measures, as described in the Mitchell Lake Integrated Feasibility Report and Environmental Assessment, were built in combination with one another based upon site conditions. Discreet restoration areas were generally identified as locations where site appropriate measures could be applied; however, specific restoration areas were not delineated until field verification of the proposed restoration boundaries was completed. Measure success is dependent upon site conditions at Mitchell Lake.

- Area 1: Bird Pond Wetlands
- Area 2: Central Wetlands
- Area 3: Skip's Pond
- Area 6: Polders
- Area 7: Fringe Wetlands
- Area 9: Dam Forested Wetlands
- Area 10: Downstream Wetlands

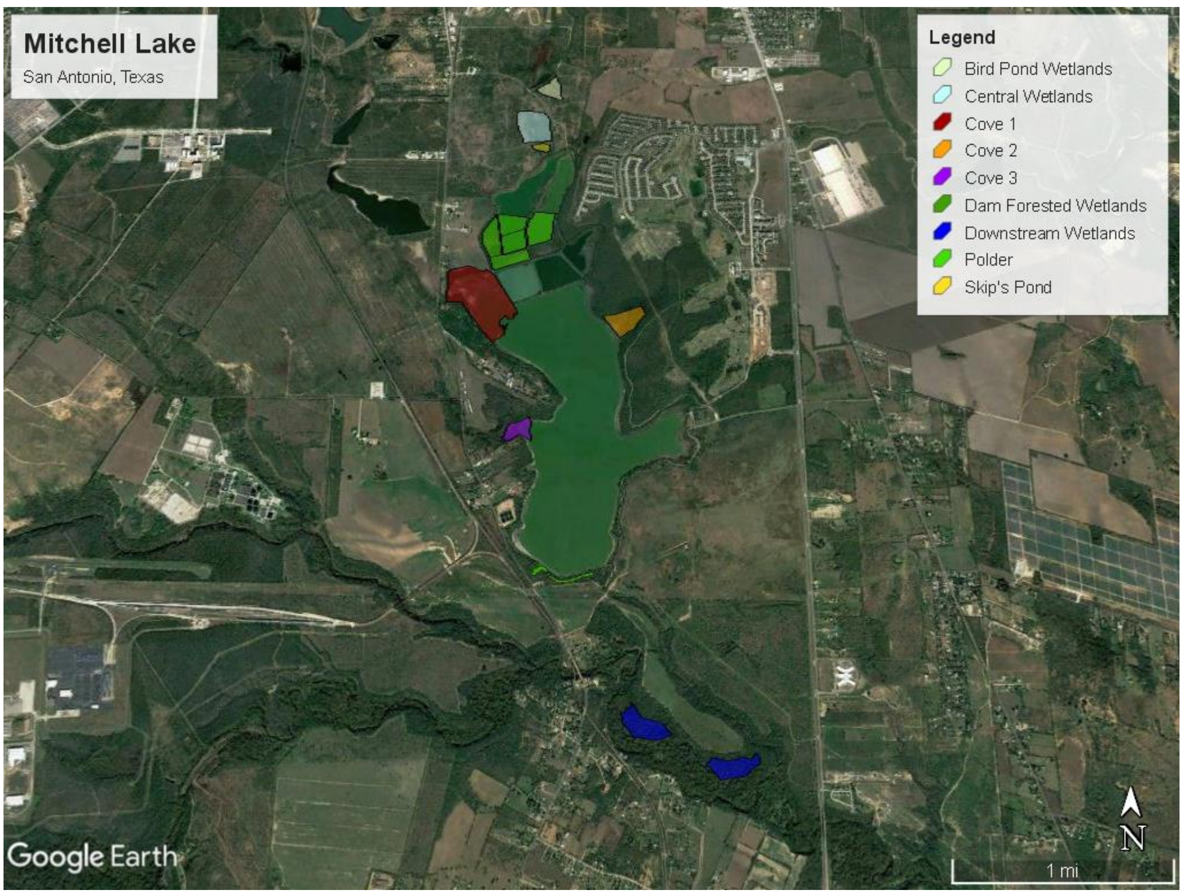


Figure 2. Mitchell Lake Project Areas

2.1.1 *Area 1: Bird Pond Wetlands*

The Bird Pond Wetlands are located at the northern extent of the study area, adjacent to Bird Pond near the Mitchell Lake Audubon Center (Figure 3). This small existing wetland is located east of the levee/road on the downstream end of Bird Pond. Area 1 has limited habitat value due to the shallow surface water (<6") and a monoculture of cattails. As shown in the figure below, the Bird Pond Wetlands are separated into Area 1A and 1B. This "separation" was necessary during plan formulation process to best describe the existing conditions of the project area. Area 1A only includes the existing wetland, while 1B includes the existing wetland along with the surrounding shrubland/upland habitat. Areas 1A and 1B provide two scales of restoration opportunities, which produced different costs and benefits.

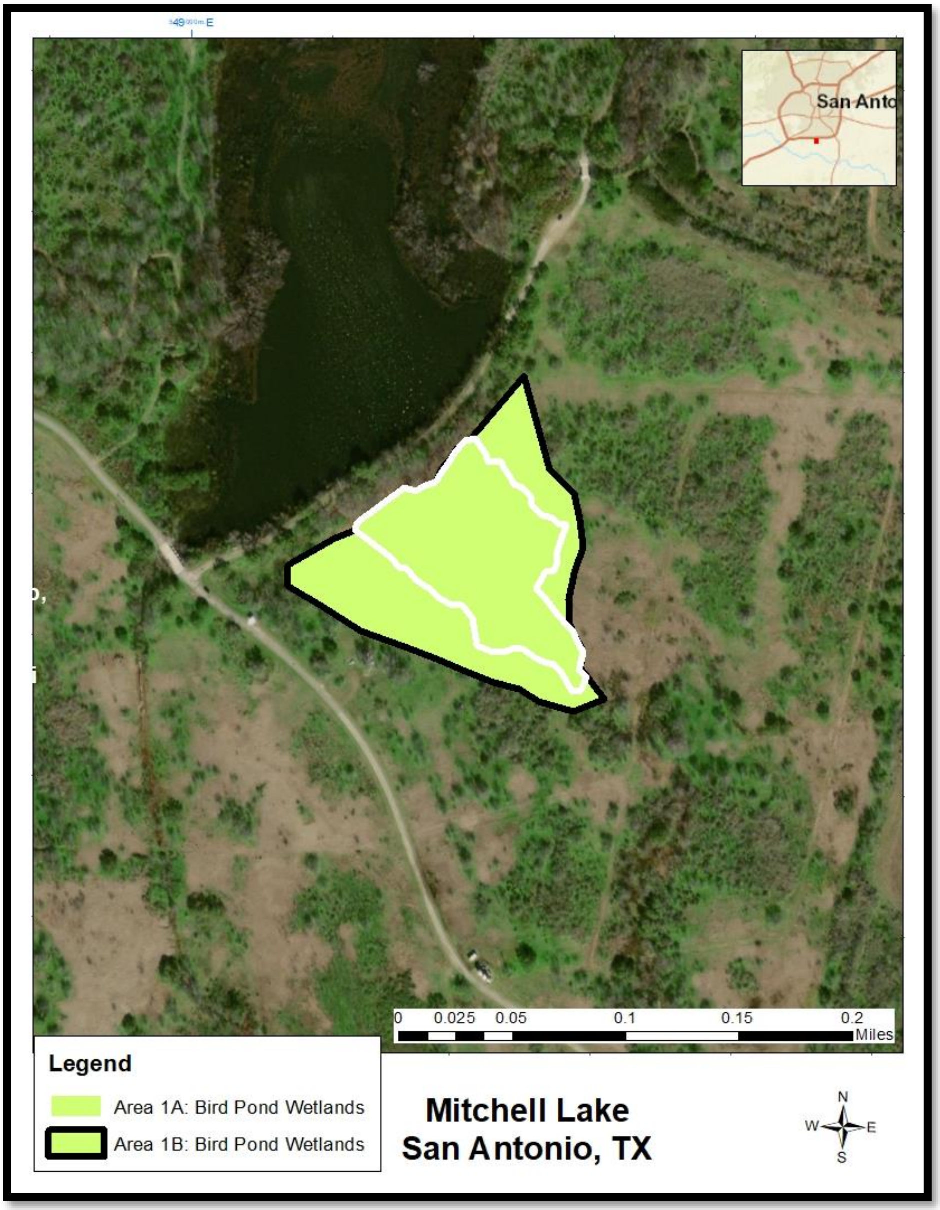


Figure 3. Area 1: Bird Pond Wetlands, Existing Wetlands Outlined in White (1A) and Expanded Wetlands Outlined in Black (1B)

2.1.2 Area 2: Central Wetlands

Area 2: Central Wetlands is south of Area 1: Bird Pond Wetlands (Figure 4). The Bird Pond Wetlands and Central Wetlands are connected to each other by a shallow, nondescript drainage channel. The Central Wetlands consist of a complex of wetlands connected to each other by wetland swales with higher, upland areas interspersed throughout. The Central Wetlands are part of the same wetland complex as Area 3: Skip's Pond, but are separated by a pipeline right-of-way; therefore, the areas are treated as separate. The Central Wetlands are comprised of a shallow wetland with areas of deeper water (6-12" in depth) and dominated by cattails and willow baccharis (*Baccharis salincina*). Area 2A, as shown in Figure 4, is the existing wetland complex as described above. Area 2B includes the wetlands described in Area 2A, but also includes 7.91 acres of shrubland/upland habitat that surrounds the existing wetlands. It was necessary to differentiate these areas during the plan formulation process in order to accurately account for the costs and benefits of the Proposed Action. Areas 2A and 2B provide two scales of restoration opportunities, which produced different costs and benefits.

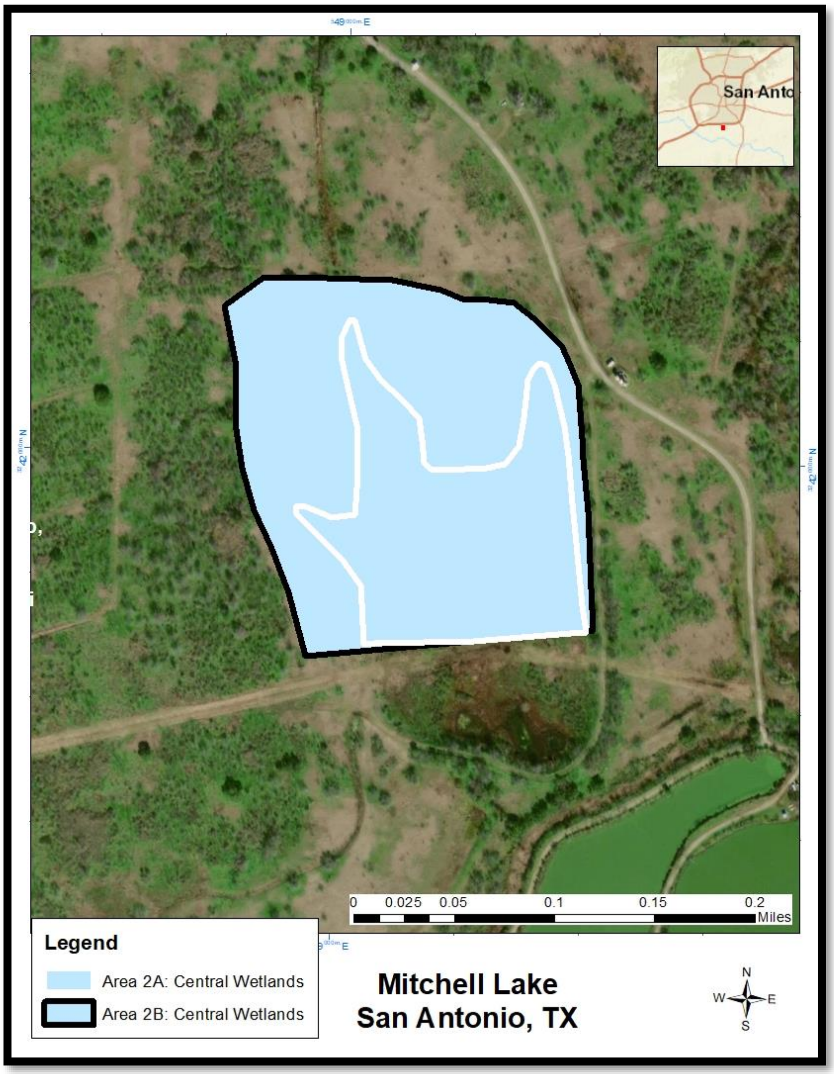


Figure 4. Area 2: Central Wetlands, Existing Wetlands Outlined in White (2A) and Expanded Wetlands Outlined in Black (2B)

2.1.3 Area 3: Skip's Pond

As noted in the Area 2 discussion above, Area 3: Skip's Pond is part of the same wetland complex as the Central Wetlands, but is separated from that area by a pipeline that transects the wetlands (Figure 5). Area 3 is comprised of deeper water wetlands, up to 2' in depth, and supports different vegetation than Area 2. Therefore, Skip's Pond was separated from the Central Wetlands complex.

Figure 5. Area 3: Skip's Pond

2.1.4 Area 6: Polders

The polders are directly north of Mitchell Lake. Area 6: Polders is separated into two polders and five basins (Figure 6). The plan for this area is focused on structural modification and operational management of the water within the polder and basin cells to create mudflat habitat. Common species found along the levees of the polders and basins included: sugarberry (*Celtis laevigata*), western ragweed (*Ambrosia psilostachya*), hedge parsley (*Torilis arvensis*), bedstraw (*Galium aparine*), spiny hackberry (*Celtis tala*), and palo verde (*Parkinsonia spp*.). The areas within the polders and basins have little to no vegetation within them or consist of completely open water habitat. Vegetative diversity within this area is incredibly low and consists of low-quality wildlife habitat.

Figure 6. Area 6: Polders

2.1.5 Area 7: Fringe Wetlands

Area 7 is characterized by its proximity to the border of the open water habitat of Mitchell Lake. Future management of Mitchell Lake will result in the adjustment of the water surface elevation to 518.5' amsl. Lowering the water levels will effectively decrease the amount of emergent and submergent wetland habitat. Plant growth has been negatively impacted by the varying dissolved oxygen and pH levels within Mitchell Lake.

The Fringe Wetlands are separated into coves, which can all be implemented as stand-alone alternatives or included in combination with each other. Cove 1 is approximately 53.68 acres on the northwest portion of Mitchell Lake. Cove 2 is approximately 11.84 acres on the northeast portion of Mitchell Lake. Cove 3 is on the southwest section of Mitchell Lake, within proximity of the dam and is approximately 6.84 acres.

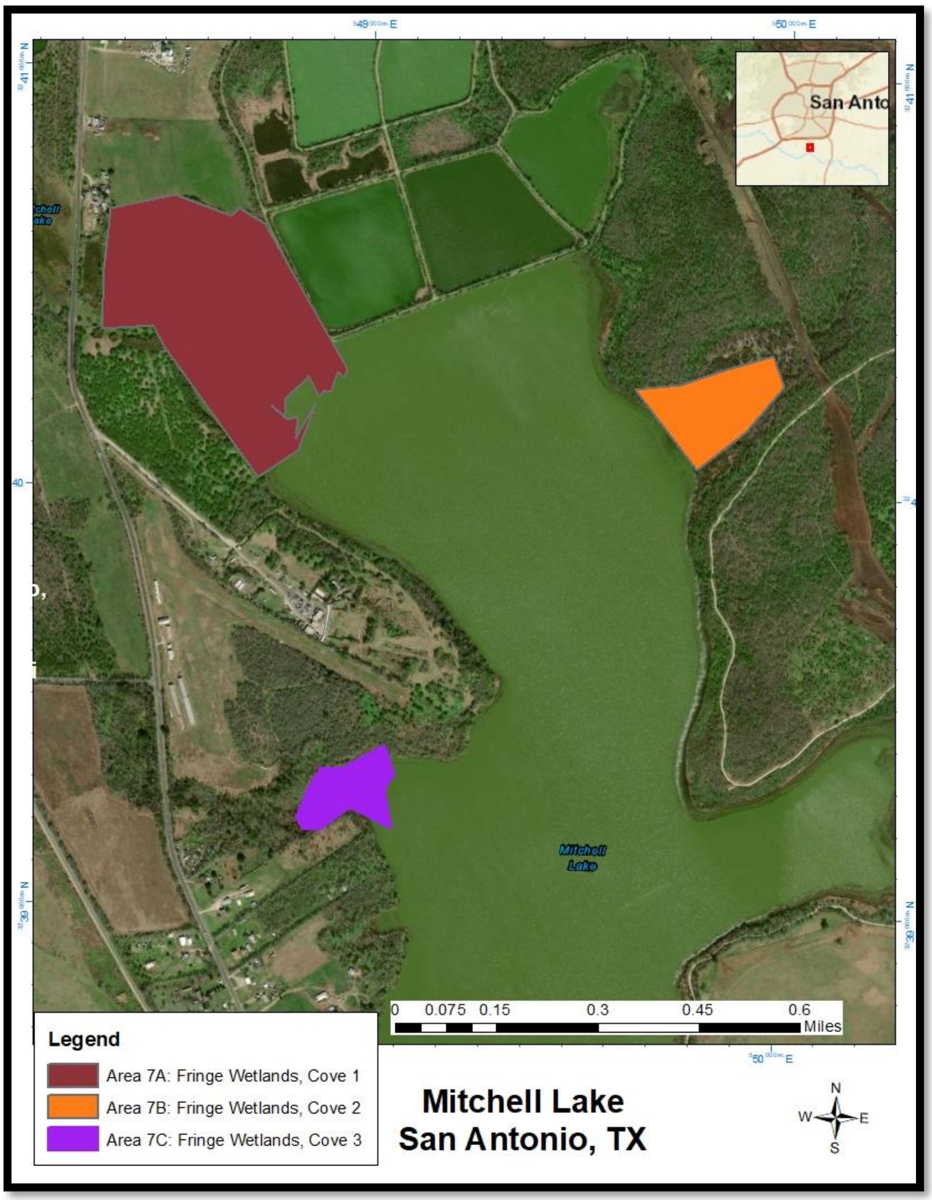


Figure 7. Area 7: Fringe Wetlands, Coves 1, 2, and 3

2.1.6 Area 9: Dam Forested Wetlands

The Dam Forested Wetlands are maintained by seepage through the dam and are dominated by hackberry woodlands (Figure 8). An existing drainage channel resulting from dam seepage has created low lying wet areas in relative depths, which has resulted in a linear series of in-channel emergent and forested wetlands with several ponded areas along the upstream section of the drainage. Figure 8 details Areas 9A and 9B, which were utilized specifically for plan formulation and the benefit calculation process for the feasibility study. The split of this area is not pertinent for the 404(b)(1) process but was necessary to determine the cost and benefit of the Recommended Plan.

Figure 8. Area 9: Dam Forested Wetlands, Existing Wetlands Outlined in White (9A) and Expanded Wetlands Outlined in Black (9B)

2.1.7 Area 10: Downstream Wetlands

Area 10: Downstream Wetlands is currently shrubland/upland habitat with future restoration plans to enhance the area by converting the shrubland/upland habitat to wetland habitat. The enhancement would entail the construction of a wetland complex adjacent to the proposed water quality treatment wetlands that would be constructed by SAWS (Figure 9). The Downstream Wetlands would contribute to the capture of synergistic benefits associated with combining the low habitat quality SAWS treatment wetlands with high habitat quality wetlands, creating an edge transition between the wetlands, and providing an opportunity to further filter and improve the water quality of water from the treatment wetlands.

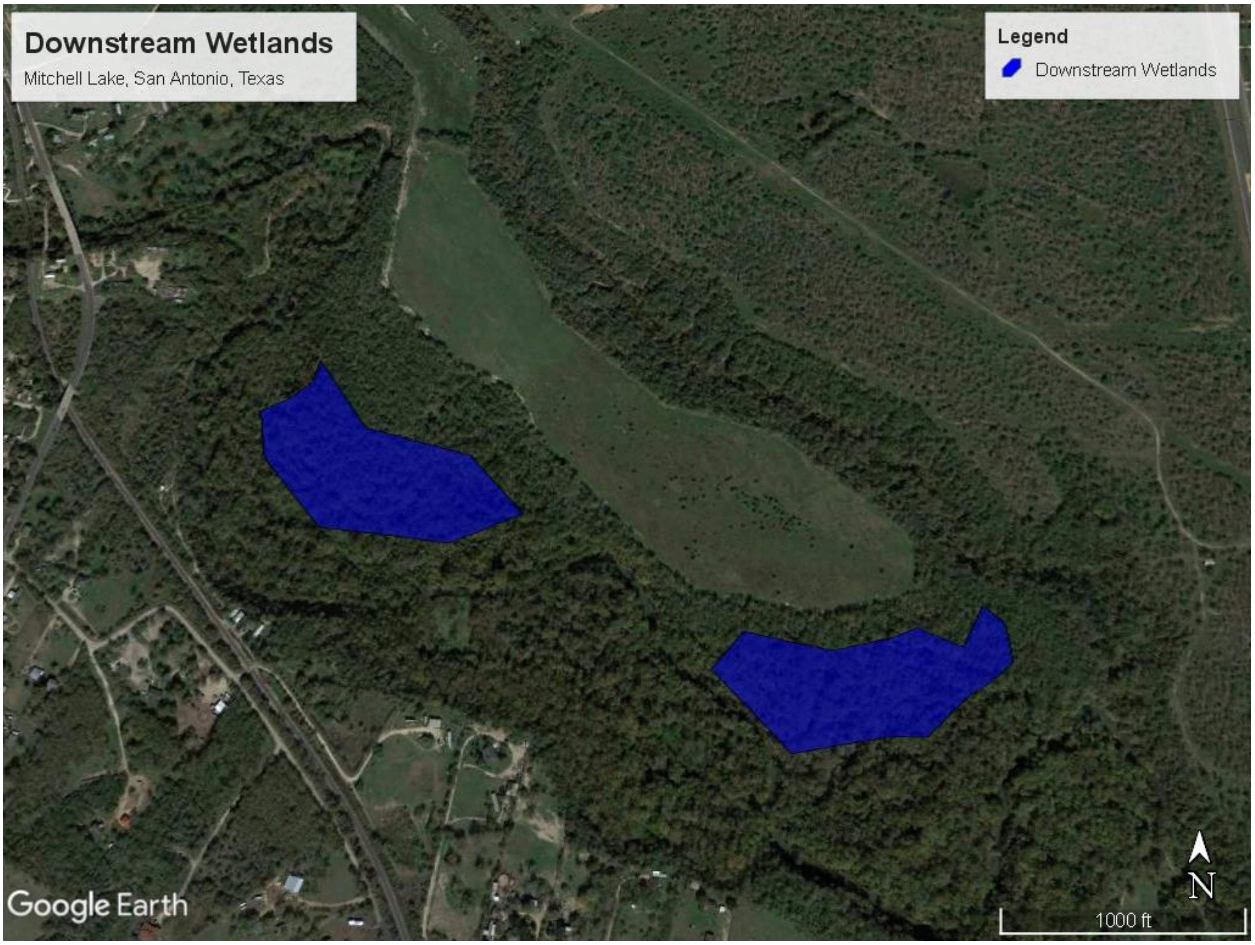


Figure 9. Area 10: Downstream Wetlands

2.2 Recommended Plan

A cost and benefit analysis was performed on the Final Array of Plans consisting of different combinations of project measures and areas. The Recommended Plan (Plan 6) includes measures associated with the Bird Pond Wetlands, Central Wetlands, Skip's Pond, Polders, and the Fringe Wetlands.

The Bird Pond Wetland is an existing wetland located east of Bird Pond and upstream of the Central Wetlands. The existing wetlands are dominated by cattails with little herbaceous diversity. An indistinct drainage comprised of a swale of wetlands with intermittent sections of distinct channels connects the Bird Pond and Central Wetlands. A pipeline with connecting outfall structure would be placed on the northern end of the Bird Pond Wetlands.

Migratory birds are the primary resource of national significance identified within the study area. Based on historical descriptions, the large wetland complex that occupied the study area prior to the impoundment of Mitchell Lake would have acted as extremely valuable stopover habitat for migrating birds. The recreation of the emergent, submergent, and forested wetlands along with the associated mudflat and prairie habitats are critical to improving vital migratory habitat for migratory birds and help stem the systemic decline in population sizes for these species.

Plan 6 is the recommended National Ecosystem Restoration (NER) plan. This Plan provides:

- Three distinct habitat types (emergent wetlands, submergent/emergent wetlands, and mudflats) out of the four targeted habitat types;
- Resilient habitat for migratory birds;
- The restoration of a complex of wetlands that can be managed to improve water quality as an ancillary benefit;
- An approximate total cost of $4.35 million (including Pre-Construction Engineering and Design, Construction Management, and Contingency).

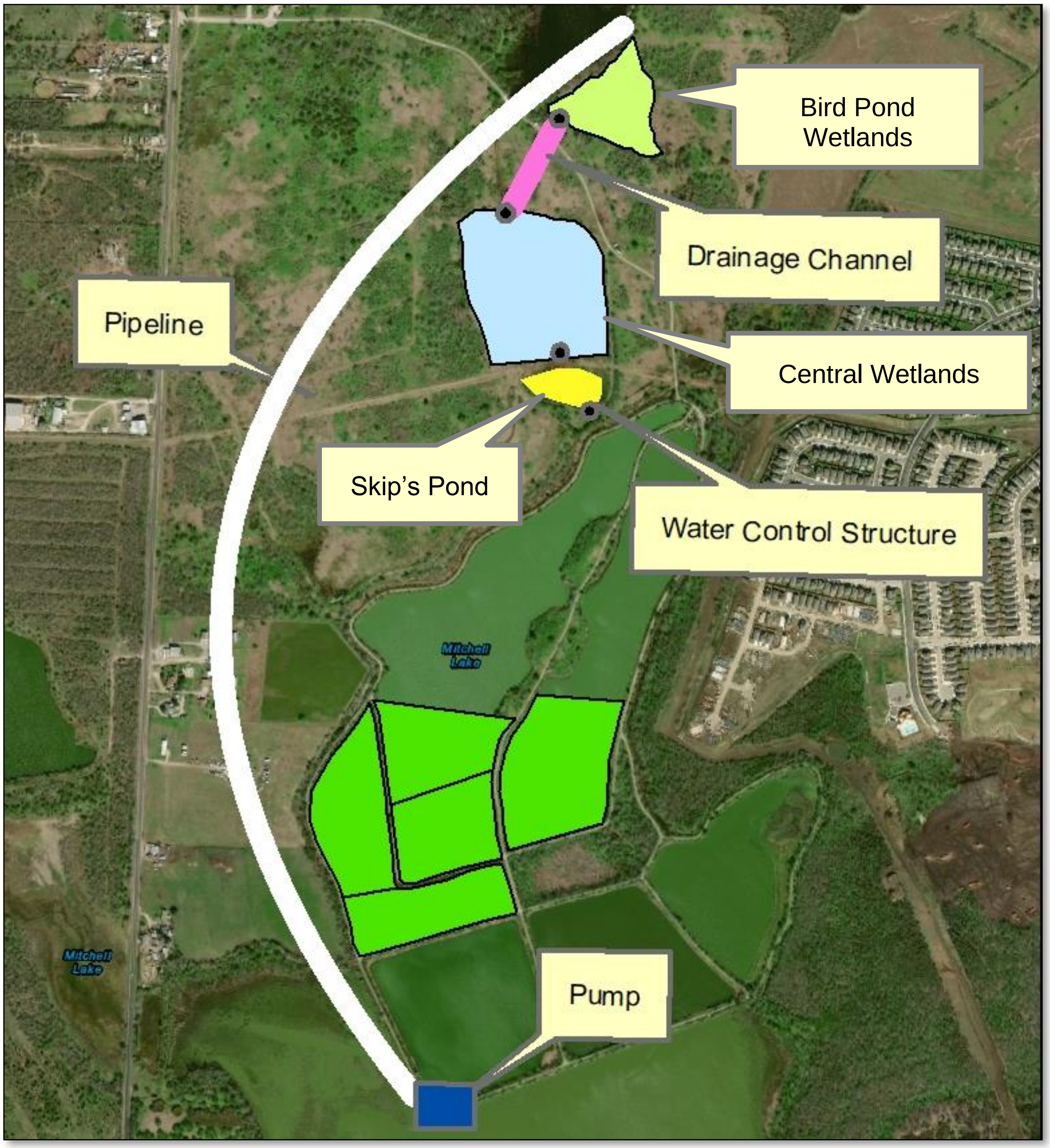


Figure 10. Recommended Plan Northern Restoration Features

2.3 Impacts to Wetlands, Streams, and Open Water

As part of the alternative evaluation process, a semi-quantitative assessment of permanent impacts to wetlands, streams, and open water was conducted for the No Action and seven best buy or cost-effective alternatives to allow for a relative comparison of impacts. Impacts that were considered included berm construction and the clearing/excavation of existing wetland areas. Please see the Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study Integrated

Feasibility Report and Environmental Assessment for a detailed list of the best buy or cost-effective alternatives, as well as a description of the measures.

The specific type and quality of habitat impacts were evaluated, but are not required for this analysis. Habitat types that would be affected by installation of management measures are expected to be primarily degraded uplands, grasslands, wetlands, and open water habitats. The historical impacts to Mitchell Lake and its shifting habitat quality precludes a precise determination. Thus, each aquatic resource was estimated to have the same functional value on an aerial basis. Available U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) online mapping data for wetlands in the Mitchell Lake study area were reviewed and compared with current aerial imagery and field surveys to supplement the analysis (Figures 11 and 12).

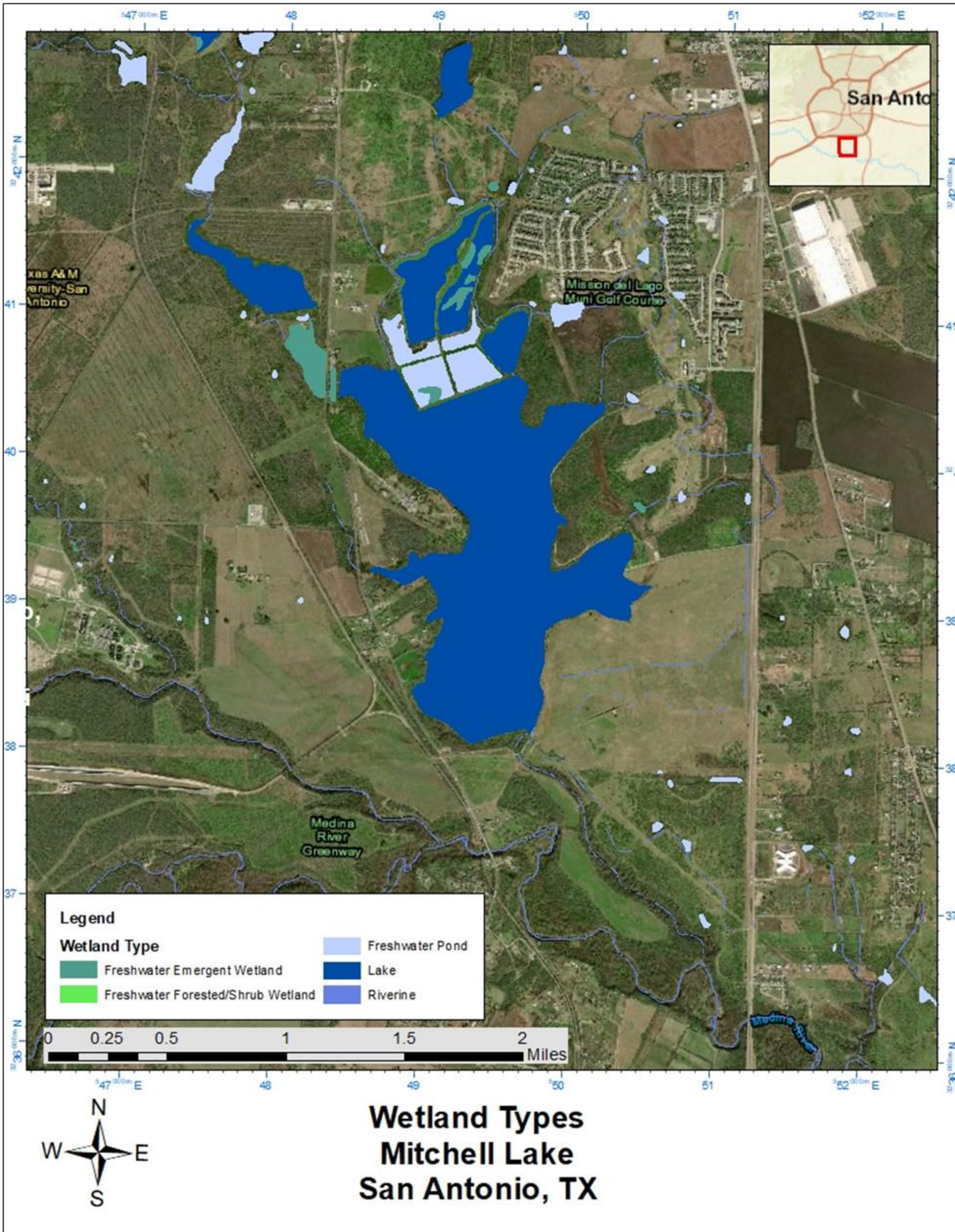


Figure 11. National Wetlands Inventory of Wetland Types within the Study Area (USFWS 2019)

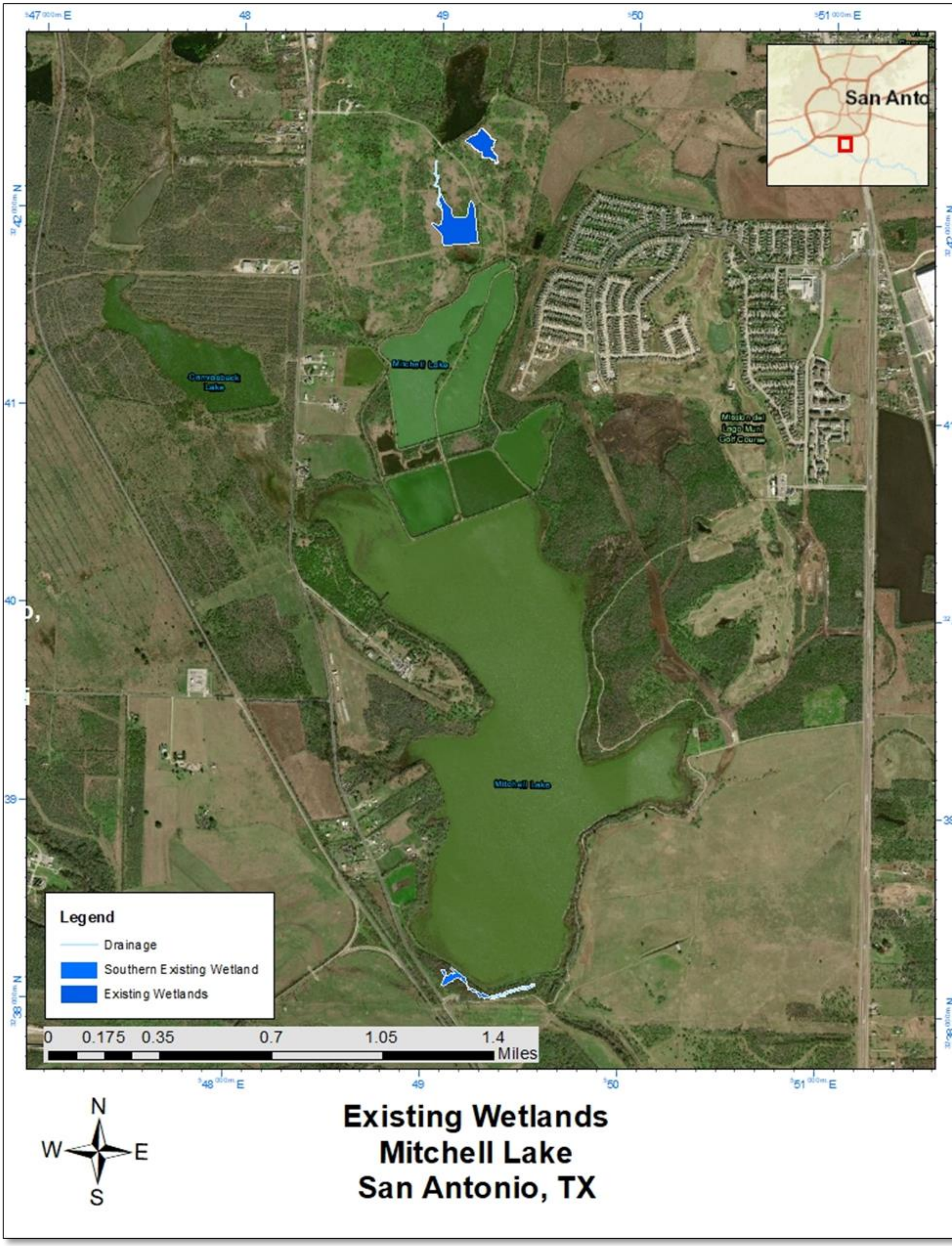


Figure 12. Existing Wetlands within the Study Area Surveyed by the USACE Team

Based on the analysis, the estimated impact to aquatic habitats from the permanent placement of fill materials is 35,600 cubic yards (CYs) for the Recommended Plan.

Table 1. Amount of Material Required for Excavation, Ditches, Trenches, and Fill

Alternatives		Total Area of Alternative (Acres)	Cut (Cubic Yards)	Ditch and Trench Excavation (Cubic Yards)	Fill (Cubic Yards)
Bird Pond Wetlands	1B: Expansion/Enhancement of Existing Wetlands and Enhancement of Additional Wetlands	6.42	17,000	876	12,200
Central Wetlands	2B: Expansion/Enhancement of Existing Wetlands and Enhancement of Additional Wetlands	18.37	26,000	1,046	12,000
Skip's Pond	3: Enhancement of Existing Wetlands	2.18	9,350	177	9,350
Polders	6: Management/Modification of Existing Polders/Basins	49.52	0	0	16,800

2.4 Least Environmentally Damaging Practicable Alternative Analysis

Although there were seven plans that could be considered economically and environmentally justifiable, Plan 6 was determined by the Project Delivery Team (PDT) to represent the least environmentally damaging practicable alternative for restoration, as it would provide restoration of the target habitat types and connectivity throughout the study area. All of the plans would result in an increase in environmental benefits, so the Recommended Plan is the Least Environmentally Damaging Practicable Alternative.

3 Recommended Plan

3.1 Project Description

The Recommended Plan (Plan 6) will incorporate the restoration of the Bird Pond Wetlands, Central Wetlands, Skip's Pond, the Polders, and the Fringe Wetlands. The following measures will be enacted during construction and implementation of the project:

- Native Aquatic Plantings
- Pipeline and Pump Installation
- Low Quality Vegetation Removal

- Habitat Structure Augmentation
- Installation of Bat and Bird Nest Boxes
- Invasive Vegetation Management
- Berm Construction
- Clearing / Excavation
- Polder Operational Management
- Water Control Structures
- Seasonal Water Pulses

The measures that will induce changes to wetlands, streams, and open water include: excavation, berm construction (fill needed), pipeline and pump installation, polder operational management, and seasonal water pulses.

Plans were screened and compared based on how well a Plan 1) accounts for all the required work in order to meet project objectives and projected benefits (Completeness); 2) achieves the planning objectives (Effectiveness); 3) complies with laws, regulation, and public policy (Acceptability); and 4) achieves the planning objectives in relation to costs (Efficiency).

3.1.1 Completeness

The alternatives fully analyzed do not completely restore the project area's ecosystem; however, all of the alternatives in the final array would achieve the benefits described below without other projects being completed. For all alternatives, this included determining the likelihood of natural resources that could be benefitted as part of a project's implementation.

3.1.2 Effectiveness

The Recommended Plan contributes to the achievement of the planning objectives and avoids all constraints. It would

- Reduce the loss of fish and wildlife habitat quality and diversity, particularly for migratory birds;
- Improve aquatic connectivity between the upstream and downstream habitats;
- Decrease nutrient loads in Mitchell Lake and Cottonmouth Creek;
- Remove invasive species within the project footprint for at least 10 years;
- Reduce daily variation in pH and O_2 levels in the water that flows through the upper wetlands and back into Mitchell Lake, in the restored coves, and in Cottonmouth Creek below this project;
- Reconnect the upstream and downstream hydrologies;
- Improve water quality as an incidental benefit; and
- Provide additional recreation and ecotourism benefits to the community.

3.1.3 Acceptability

The Recommended Plan is both workable and viable. It is acceptable to the State and local entities and the public. The Recommended Plan received significant positive feedback, and the National Audubon Society and Texas Parks and Wildlife Department (TPWD) submitted letters of support for the project. It is compatible with all known applicable laws, regulations, and public policies.

3.1.4 Efficiency

The Recommended Plan is the most cost-effective means of achieving the objectives of all of this study’s alternatives, plans, and scales of plans. It would have an approximate total cost of $4,355,847.

3.2 General Description of Dredged or Fill Material

3.2.1 General Characteristics of Material

The subsurface conditions of the project area include bedrock materials and mineral deposits.

Construction material for the site would include earth fill from the Bird Pond Wetlands, Central Wetlands, and Skip’s Pond. These areas have soils that are somewhat limited and/or very limited when conducting construction for embankments, levees, and dikes. They yield materials that can be somewhat hard to pack and are dusty (NRCS 2019). Although an embankment, levee, and/or dike will not be constructed for this project, materials from the Bird Pond Wetlands, Skip’s Pond, and the Central Wetlands will be utilized to create the berms required for the Polders in the Recommended Plan.

3.2.2 Quantity of Material

Based on conceptual designs approximately 16,800 CYs would be placed within the polders to create berms. The Bird Pond Wetlands, Central Wetlands, and Skip’s Pond would require 52,350 CYs of material to be excavated in and around existing wetlands and 2,513 CYs would be excavated for connector ditches and trenches. Approximately 33,500 CYs would be used as fill within the existing wetlands during project implementation.

3.2.3 Source of Material

The source of material for the Polder berms will be obtained from the Bird Pond Wetlands, Central Wetlands, and Skip’s Pond after excavation completion. The materials would be tested by USACE field construction engineers. The materials must meet requirements by the design specifications in the construction contract, prior to the material being used in the construction of berm features. It is anticipated that the materials would be free of any contaminants. If the proposed material is not verified as suitable, then fill material will be acquired from a permitted commercial source. This material would also be verified and tested before placement on-site.

3.3 Description of the Proposed Discharge Site(s)

3.3.1 Location

The discharge site is in the polders of Mitchell Lake. The engineered berms would be placed within the east and west polders and basin 5 (Figure 13). Because there will be more material cut (excavated) from the Bird Pond Wetlands, Central Wetlands, and Skip’s Pond; it is assumed that the net CY loss of material will be greater than the net CY increase of material.

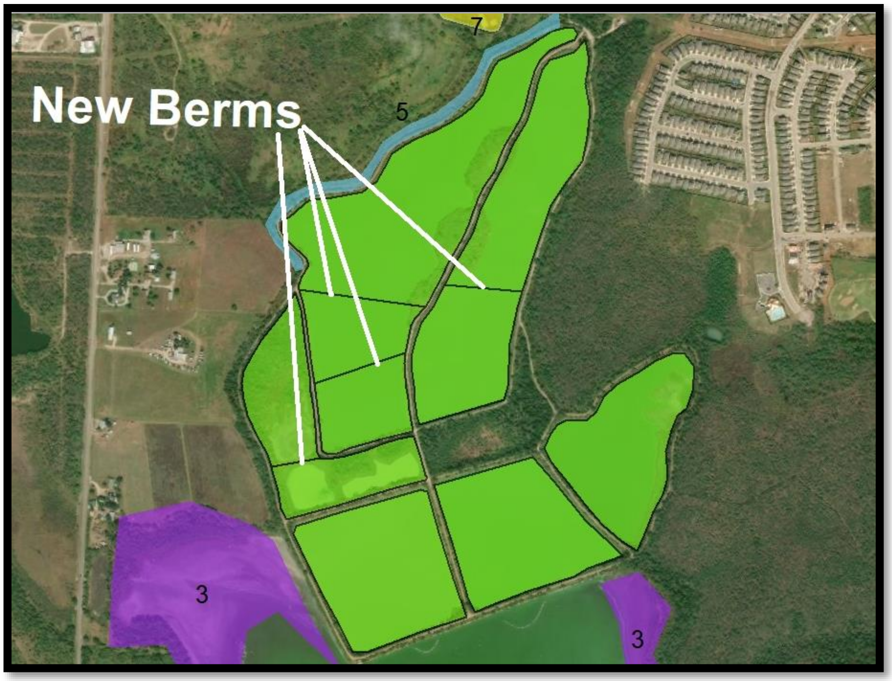


Figure 13. Newly Created Berms within East and West Polders and Basin 5

3.3.2 Size

Approximately 1.6 acres would be permanently affected by fill associated with restoration activities within the polders and Basin 5.

3.3.3 Type(s) of Sites

In the case of the Recommended Plan and associated construction activities, land cover in the project area includes wetland, upland, grassland, and open water habitat.

3.3.4 Type(s) of Habitat

As discussed previously, wetland, open water, grassland, and upland habitats to be affected by restoration activities are degraded. Because of the inconsistent drainage of the polders and lack of hydraulic connectivity, all aquatic habitat types as well as the flora and fauna throughout the study area have been affected. The polders are heavily degraded due to its historic use as a raw sewage discharge site. Lack of hydrologic control has allowed contamination to remain on site with no release of hazardous and toxic waste. Due to its degraded quality, the polders do not support intolerant aquatic species in comparison to normal open water conditions.

3.3.5 Waters and Wetlands

Existing wetland habitats include the Bird Pond Wetlands, Central Wetlands, and Skip's Pond in addition to the polders. However, the polders are severely degraded due to past wastewater treatment uses with minimal aquatic habitat and no possibility of human consumption or need for navigation.

3.3.6 Timing and Duration of Discharge

Construction of each of the restoration measures would be timed to occur during low flow periods to minimize impacts to the wetland system. A more detailed schedule would be developed during design and bid stages of implementation.

3.4 Description of Disposal Method

Heavy construction vehicles and equipment would be needed to construct the project components described above, including excavation, backfilling, and installing berms and pipelines. The vehicles and equipment would operate outside of existing wetlands and drainages to the extent possible.

An assortment of wheeled and tracked equipment necessary to handle large loads of soil, such as backhoes, track hoes, bulldozers, dump trucks, and front end loaders, would be used for construction. All suitable on-site material excavated, would be used as fill material for the construction of the project's restoration features. Unsuitable or excess materials would be hauled off and disposed of properly. Project work would take place during safe and low flow conditions.

The temporary staging and storage of construction materials and vehicles would be situated in areas that are currently disturbed or are recommended to be cleared from the construction of the project components described above. All staging and storage areas would be outside of biological wetlands. Best management practices (BMPs) in staging areas would include erosion control and spill prevention measures.

3.5 Factual Determinations

3.5.1 Physical Substrate Determinations

3.5.1.1 Substrate Elevation and Slope

The existing substrate elevation for Mitchell Lake, the Bird Pond Wetlands, Central Wetlands, Skip's Pond, and the polders is approximately 532' to 553' amsl with an approximate slope of 51H:1D. The elevation and slope of the constructed project areas would be impacted in minor amounts due to contouring and excavation. These impacts are considered beneficial in the long-term because they will enhance the structure and function of the existing wetlands, polders, and basins.

3.5.1.2 Sediment Type

The Bird Pond Wetlands include soil from Tf, Tinn and Frio soils, 0 to 1 percent slopes, frequently flooded (NRCS 2019). The Central Wetlands and Skip's Pond fall into the SaB, San Antonio clay loam, 1 to 3 percent slopes soil type. SaB is dense, blocky clay and slowly permeable. It is moderately productive for crops, but if unprotected can be susceptible to water erosion. The Frio soil series occurs mainly on the flood plains of the Medina River and the San Antonio River. It is limy throughout and a fairly productive soil well suited to native grasses and pecan orchards.

3.5.1.3 Dredge/Fill Material Movement

Because the water levels at each site where fill will be placed will be controlled by stop logs, no movement of fill material is anticipated once construction is complete. Water levels within the polders will be controlled, so major flooding should not affect the project.

3.5.1.4 Physical Effects on Benthos

Under the Recommended Plan, unavoidable impacts to aquatic habitats would be created from the placement of fill material within the polders, acting as berms. Under the Recommended Plan, unavoidable temporary impacts to wetland habitats would be created from contouring existing soils in the Bird Pond Wetlands, Central Wetlands, and Skip's Pond. Once construction is complete, benthos from the surrounding undisturbed sediments would be expected to quickly colonize the sediments around the new berms. During construction, erosion and sedimentation BMPs would be utilized to minimize impacts to benthos within the study area.

Although there will be temporary adverse impacts to aquatic and wetland habitats, the result of the ecosystem restoration would provide long-term benefits to benthos.

3.5.1.5 Other Effects

Temporary adverse impacts to aquatic organisms and fish could occur during construction from the earthmoving activities with the potential for temporary sedimentation and water quality degradation within the polder and basin habitats during construction. However, the severe degradation of aquatic habitats and water quality makes the temporary impacts within Mitchell Lake negligible. In addition, the result of the ecosystem restoration would provide long-term benefits to aquatic organisms and fish.

3.5.1.6 Actions Taken to Minimize Impacts

Actions would be minimized to the extent possible by scheduling construction to coincide with low flow periods. Silt fences and geotextile filters would be placed to minimize sediment transport downstream. Staging and construction access areas would avoid wetlands and aquatic habitats to the extent possible to minimize temporary disturbances and provide distance between aquatic habitats and exposed sediments. BMPs would be detailed as designs for the different elements of the Recommended Plan are prepared. Thus, the existing aquatic organisms and fish found at the construction sites would be temporarily adversely affected during construction and expected to recover and improve post construction due to the efforts of restoration.

3.5.2 Water Circulation, Fluctuation, and Salinity Determinations

3.5.2.1 Salinity

The project would not negatively impact water chemistry of Mitchell Lake.

3.5.2.2 Water Chemistry

The project would not negatively impact water chemistry of Mitchell Lake; however, positive impacts from cycling water from Mitchell Lake through the Bird Pond Wetlands, Central Wetlands, Skip's Pond and Cove 1 (Fringe Wetlands) are expected.

3.5.2.3 Clarity

Temporary disruption to water clarity is expected during construction. After the berms are placed within the polders and are settled, water clarity would return to original conditions.

3.5.2.4 Color

The improvement of water quality within Mitchell Lake and the polders will yield low positive changes in water color over the next 50 years.

3.5.2.5 Odor

The filtering of Mitchell Lake water through Bird Pond Wetlands, Central Wetlands, Skip's Pond, and Cove 1 may yield positive minor changes in odor over time.

3.5.2.6 Taste

The water in Mitchell Lake and the polders are not suitable for human consumption or water for recreation uses. The implementation of the Recommended Plan would not change the water use for the project area.

3.5.2.7 Dissolved Gas Levels

No change in dissolved gas levels would occur following construction.

3.5.2.8 Nutrients

Nutrient levels would decline following construction due to the cycling of Mitchell Lake water through the Bird Pond Wetlands, Central Wetlands, Skip's Pond, and Cove 1. However, the decrease in nutrients resulting from the wetlands would be slight and would require several hundred years to return Mitchell Lake to historical water quality conditions.

3.5.2.9 Eutrophication

Eutrophication is expected to decrease following construction due to the cycling of Mitchell Lake water through the Bird Pond Wetlands, Central Wetlands, Skip's Pond, and Cove 1. However, as mentioned above, discernable improvements could take a substantial amount of time to realize.

3.5.3 Current Patterns and Circulation

3.5.3.1 Current Patterns and Flow

The areas affected are not riverine systems; however, flow will be affected by controlled inflow via pumping from Mitchell Lake and outflow from water control structures at the Bird Pond Wetlands, Central Wetlands, Skip's Pond, and the polders. There is minimal flow between the Bird Pond Wetlands, Central Wetlands, and Skip's Pond, but a small drainage canal currently exists that allows for some water movement between the areas. The polders do not have natural flow and currently exist within a controlled system. There will not be any negative impacts to current patterns or flow due to the Recommended Plan. The constructed wetlands associated with the SAWS treatment wetlands would continue to allow flows to the Medina River.

3.5.3.2 Velocity

Velocity in the Bird Pond Wetlands, Central Wetlands, and Skip's Pond are largely dependent on local rainfall, seepage, and an existing water control structure at Bird Pond. Velocities would be controlled by the water control structures below the Bird Pond and Central Wetlands, although the purpose of these structures is for the management of water levels in the wetlands and not to mediate velocities of the water. There would not be any substantial impacts to velocity due to the Recommended Plan.

3.5.3.3 Stratification

Mitchell Lake is a shallow waterbody, (three to four feet in depth). Stratification does not occur within the project area nor would it occur with implementation of the Recommended Plan.

3.5.3.4 Hydrologic Regime

This area is not known for significant flooding, but would be impacted by copious amounts of local rainfall. Runoff and seepage will continue to contribute to the hydrologic regime within the project areas.

3.5.3.5 Normal Water Level Fluctuations

Fluctuations can occur through stormwater runoff within the watershed; however, the Recommended Plan would control inflows and outflows of the Bird Pond Wetlands, Central Wetlands, and Skip's Pond with stop log structures. The water levels will be controlled in these wetlands to manage the habitats. The polder water level of an individual cell would be managed to create mudflat habitats for migratory shorebirds. However, water levels for the polders not drawn down would be managed the same as the Future With-Project conditions. There will not be substantial negative impacts to normal water levels due to the Recommended Plan

3.5.3.6 Salinity Gradients

The project area waters only contain freshwater components. There would be no impacts to salinity gradients.

3.5.3.7 Actions Taken to Minimize Impacts

Appropriate BMPs would be utilized to minimize erosion and sedimentation during construction. Vegetation would be reestablished to help stabilize the wetlands disturbed by construction activities.

3.5.4 Suspended Particulate and Turbidity Determinations

3.5.4.1 Expected Changes in Suspended Particulates/Turbidity Levels in Vicinity of Disposal Site

Only minor temporary increases in suspended particulates and turbidity levels would likely occur during construction of the Recommended Plan. A Stormwater Pollution Prevention Plan (SWPPP) would be prepared, which would outline site-specific BMPs to minimize the erosion and the potential for sediment to enter receiving waters during construction activities. BMPs, such as silt curtains could be used to reduce impacts. Surplus material that cannot be used for restoration activities would be disposed of appropriately. Over the long-term, reduced nutrient and sediment loading would decrease the associated suspended particles that enter Cottonmouth Creek and the Medina River after large rainfall events due to the cycling and filtering nature of the Recommended Plan.

3.5.4.2 Effects (degree and duration) on Chemical and Physical Properties of the Water Column

Light Penetration: Changes to light penetration would occur during construction associated with minor turbidity increases. Appropriate erosion and sedimentation controls would be implemented to reduce impacts to downstream waters. After project completion and stabilization, the clarity of the polders would return to preconstruction levels.

Dissolved Oxygen: The dissolved oxygen in Mitchell Lake currently experiences dramatic daily swings. Although the construction of the project could lower dissolved oxygen during construction in the immediate area, the change would be temporary.

Toxic Metals and Organics: No water testing was conducted in the immediate proposed project area. The proposed project would not result in the introduction of additional toxicants into the polders and basins of Mitchell Lake or its sediments over those that currently exist in the watershed.

Pathogens: No pathogens would be added to the water column as a result of this project.

Others as Appropriate: No other effects to the water column are anticipated.

3.5.4.3 Effects on Biota

Displacement of local biota would occur during construction as mobile species would emigrate to adjacent habitats. Indirect impacts to biota would occur in the vicinity of the construction areas as emigrating species move into areas already at carrying capacity. This would result in stressors to the existing populations as the emigrating species would compete for food and other resources. Although sessile species would be impacted during construction activities, over time, and upon project completion, it is anticipated that biota would recolonize the project site with a higher diversity and density as currently present under pre-project conditions.

Primary Production, Photosynthesis: There is little to no aquatic vegetation within Mitchell Lake or the polders. As a result, little aquatic vegetation would be lost from the project site during implementation of the Recommended Plan. Vegetation loss would be minimized to the extent possible by using BMPs. While there may be a temporary loss of primary producers as a result of project implementation, the loss is considered less than significant and is anticipated to be improved under post construction conditions.

Suspension/Filter Feeders: The presence of suspension/filter feeders at the construction locations for the Recommended Plan are limited as the severe degradation of water quality in the open water habitat. This degradation has resulted in severely degraded and in some cases almost complete loss of aquatic functions necessary to sustain an open water ecosystem. Therefore, there would be limited impact to suspension/filter feeders as a result of implementation of the recommended project.

Sight Feeders: No net loss of sight feeders is anticipated as the result of the Recommended Plan.

3.5.4.4 Actions Taken to Minimize Impacts

BMPs would be established to control erosion and sedimentation to minimize impacts to biota in Mitchell Lake and the polders during construction.

3.5.5 Contaminant Determinations

The recommended project would not result in the introduction of additional toxicants into the Mitchell Lake polders and basin over those that currently exist. Raw sewage is a contaminant that currently exists within the polders and basin. Introduction of fill material would not increase the amount of contaminants in the project area. Any fill material placed would be tested and verified for contaminants before use.

3.5.6 Aquatic Ecosystem and Organism Determinations

The Recommended Plan was selected after an extensive review of possible environmental restoration alternatives to meet the project's purpose and need, as well as to be the most practicable implementable project. The emphasis on the best buy plans, with the least incremental cost per incremental output or benefit, resulted in alternatives with beneficial effects. Accordingly, long-term impacts associated with the Recommended Plan were determined to have moderately to significantly positive effects on water resources, hydrology, biological resources, land use, and recreation.

3.5.6.1 Effects on Plankton and Nekton

Plankton and nekton that currently occupy the sediments and water columns in the existing sites of the Recommended Plan features would be adversely impacted by fill activities, but it is anticipated that the impact would be temporary and short-term as these species would recolonize the sites once construction is complete.

3.5.6.2 Effects on Benthos

No additional effects other than those previously discussed were identified.

3.5.6.3 Effects on Aquatic Food Web

Temporary disruptions to the food web would occur during construction. However, following construction it is anticipated that species diversity would increase above existing conditions. Therefore, there would be net long term benefits on the food web as the result of the Recommended Plan.

3.5.6.4 Effects on Special Aquatic Sites

Sanctuaries and Refuges: No USFWS sanctuaries or refuges occur within the project area. The Audubon Society operates a birding center on the project area and utilizes the polders as birding opportunities. The use of the polders would not change with the recommended plan. However, the creation of the mudflat habitats would increase the number of species in the polder area and increase the quality of birding on the site.

Wetlands: There will be approximately 88 acres of wetland impacted by the recommended project; however, these impacts will result in net beneficial effects to the wetland systems. An additional 12 acres of wetland will be created around these areas from upland/shrubland habitat. There will not be any negative impacts from the Recommended Plan. Emergent and submergent vegetation will be planted within the Bird Pond Wetlands, Central Wetlands, Skip's Pond, and the Fringe Wetlands to enhance the wetlands within the project area.

Mudflats: The goal of the Recommended Plan is to create mudflat habitat for the benefit of migratory birds and shorebirds within approximately 50 acres of the polders and Basin 5.

Vegetated Shallows: The Recommended Plan will enhance vegetated shallows by removing invasive and nuisance species from the project area. Native emergent/submergent wetland vegetation will be planted in their place.

Coral Reefs: No coral reefs occur within the project area.

Riffle and Pool Complexes: No riffle and pool complexes occur within the project area.

Riverine Sand Bars: No riverine sand bars occur within the project area.

Threatened and Endangered Species: Long-term impacts are expected to be beneficial for migrating red knots (*Calidris canutus*), least terns (*Sternula antillarum*), piping plover (*Charadrius melodus*), and whooping crane (*Grus americana*); however, these species do not utilize this area on a regular basis. Mitchell Lake is utilized during migration as stop-over habitat for Neotropical migrants. There are no potential impacts to other listed species as they do not occur within the study area.

Other Wildlife: Wildlife inhabiting the aquatic and riparian habitats within the project would be temporarily displaced during construction. Mobile species would emigrate to adjacent habitats. Although sessile species would be impacted during construction activities, they would be expected to return to suitable habitat areas following construction.

3.5.6.5 Other Effects

Land Use: Construction of the recommended project would have beneficial impacts to land use within the study area. SAWS owns the real estate required for implementation of the Recommended Plan. The project would enhance these currently underused areas for the benefit of wetland habitat, mudflat habitat, wildlife, and recreation.

Transportation: There would be no effects to transportation networks.

Utilities: There would be no effects to utilities.

Cultural Resources: The Recommended Plan requires the removal of the top four inches to six feet of existing soil to create appropriate depths for wetland cells. Slope shaping and excavation have a slightly higher potential to encounter cultural resources. Significant cultural resources could therefore be adversely affected by these activities.

Continued coordination with the Texas State Historic Preservation Office will ensure compliance with Section 106 of the National Historic Preservation Act. To minimize the impacts to resources that may be encountered during construction, an archeological monitor would be on site to identify cultural resources should they be discovered. The monitor would assess the significance of the resource and mitigate the impacts to sites determined eligible for the National Register of Historic Places before ground disturbing activities would be allowed to continue in the vicinity. In this way, no significant impacts for the Recommended Plan implementation would be expected.

3.5.7 Recommended Disposal Site Determinations

3.5.7.1 Mixing Zone Determination

Fill would occur within the polders and Basin 5 of Mitchell Lake, as well as the Bird Pond Wetlands, Central Wetlands, and Skip's Pond. However, the amount of fill added back into the system of the Bird Pond Wetlands, Central Wetlands, and Skip's Pond will be less than the material removed. The water quality within the polders is severely degraded due to the culmination of raw sewage gathered there. BMPs would be implemented to lower impacts. Disposal of surplus materials would occur at an off-site location that is not within waters of the United States.

3.5.7.2 Determination of Compliance with Applicable Water Quality Standards

Potential impacts on water quality may occur during construction and post-construction operation of the ecosystem measures within the Mitchell Lake system. However, the goal of the measures is to improve wildlife habitat conditions by regulating and operating the polders to an appropriate standard. Sediments would remain in the polders after fill is added. The polders are a closed system that will be operated in and amongst themselves with no discharge to Mitchell Lake or other downstream areas. Water from Mitchell Lake will be pumped to the Bird Pond Wetlands. This water will then flow through the Central Wetlands, Skip's Pond, and Cove 1 before reentering Mitchell Lake. Water that reenters Mitchell Lake will have moved through several cycles that have the possibility of clarifying and capturing nutrients. As a result, there would be minimal, short term adverse impacts on water quality within the project area during construction.

The development and use of the SWPPP for construction and post-construction operation will bring this project into compliance with standards set by the Clean Water Act by identifying the potential stormwater pollution sources, which could include: clearing operations, grading and excavation operations, material storage areas, and staging areas, and reduce the potential of those pollutants entering nearby waterways. Potential pollutants contributed to this project could include: sediments, fuels, trash, and chemicals.

Installation of the recommended ecosystem restoration measures, including additional wetlands in the northern section of the project area would slightly reduce the rate of aquatic degradation within Mitchell Lake. Therefore, the Recommended Plan would result in moderate positive impacts to water quality.

3.5.7.3 Potential Effects on Human Use Characteristics

Municipal and Private Water Supply: Mitchell Lake and its polders are hypereutrophic, as such; they are not suitable for municipal or private water supply. The project will have beneficial impacts on the water quality within Mitchell Lake, but the water will be inappropriate for human consumption.

Recreational and Commercial Fisheries: Due to its hypereutrophic nature, Mitchell Lake and its polders will not be suitable for recreational or commercial fisheries. This project will not have an impact on these characteristics.

Water Related Recreation: Water related recreation is not permitted upon Mitchell Lake or its polders, the project will not impact this characteristic.

Aesthetics: Implementation of the Recommended Plan will have short-term, temporary impacts on aesthetics during construction. While visual and aesthetic preferences are unique to each individual, implementation of the Recommended Plan could have a significant positive effect on the visual aesthetics as the enhanced wetlands and mudflat habitat would attract migratory birds, lending to increases in color and enjoyment by the public.

Parks, National and Historic Monuments, National Seashores, Wilderness Areas, Research Areas, and Similar Preserves: During construction, the Recommended Plan would have minor adverse effects on the Audubon Society's trailheads located around Mitchell Lake; however, minor positive effects would occur over the long-term due to the expanded recreational opportunities such as birding and educational outreach within the study area.

4 Determination of Cumulative Effects of the Aquatic Ecosystem

Wetland habitats in Texas have been lost due to demand for natural resources, agriculture, urbanization, and the introduction of non-native invasive species. The conservation of water resources in Bexar County continues to be a priority and initiatives by the City of San Antonio, San Antonio River Authority, SAWS, Bexar County, TPWD, and non-profit organizations such as the Mitchell Lake Audubon Society are making progress in increasing the extent of restored and protected aquatic habitats including emergent wetland and riverine habitat. Although future restoration and conservation initiatives will undoubtedly continue, the City of San Antonio and Bexar County are one of the top ten growth centers in the U.S. As a result, urban pressures would continue to encroach on the county's suburban and rural aquatic ecosystems. Because of projected future population growth and subsequent urbanization, the sustainability and ecological viability of aquatic habitats for fish and wildlife as well as human uses, highlights one of the greatest ecological needs of the county. The Recommended Plan would effectively provide up to 100 acres of enhanced or created wetland habitat and 50 acres of mudflat habitat with essential connectivity along a critical stop-over corridor for the birds utilizing the Central Flyway (Table 2). Therefore; the cumulative effects of the recommended project will have long-term beneficial impacts.

Table 2. Approximate Increase of Mudflat and Wetland Habitat through Restoration for the Recommended Plan

Recommended Plan	Mudflat Habitat Increase (Acres)	Emergent/Submergent Wetland Habitat (Acres)	Emergent Wetland Habitat (Acres)
Polders + Coves 1-3 + Skip's Pond + Central Wetlands + Bird Pond Wetlands	50	74	24

5 Determination of Secondary Effects on the Aquatic Ecosystem

BMPs to minimize impacts associated with construction activities have been identified and would be refined during design activities, as would construction timing considerations. BMPs are expected to include schedules of activities, prohibitions of practices, maintenance procedures, structural controls, local ordinances, and other management practices to prevent or reduce the discharge of pollutants. BMPs also include treatment requirements, operating procedures, and practices to control construction site runoff, spills or leaks, waste disposal, or drainage from raw material storage areas. Additional erosion control and stabilization practices may include but are not limited to: establishment of temporary or permanent vegetation, mulching, geotextiles, sod stabilization, vegetative buffer strips, protection of existing vegetation, temporary velocity dissipation devices, flow diversion mechanisms, silt fencing, sediment traps, and the prompt revegetation of disturbed areas. These measures would reduce potential impacts to water quality. Implementation of sediment and erosion controls during construction activities would maintain runoff water quality at levels comparable to existing conditions.

An adaptive management plan would be developed to monitor and assess functionality of components of the recommended ecosystem restoration project informing adaptive management strategies to ensure success in meeting goals of the project.

An Operation, Maintenance, Repair, Replacement, Rehabilitation (OMRR&R) plan would be developed to ensure the structural integrity of the berm, pipeline, and pumps are maintained, that vegetation associated with the northern enhanced wetlands survives, and that excess sediment and debris is removed and dislodged from water control structures.

6 Summary of 404(b)(1) Analysis

While implementation of the Recommended Plan would involve the placement of fill material within the project footprint and would impact 2 acres of waters of the U.S., this disposal would not violate established State water quality standards or the Toxic Effluent Standards of Section 307 of the Clean Water Act of 1977, as amended, nor harm any endangered species or their critical habitat. Implementation of the Recommended Plan would not result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreation and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. Appropriate steps to minimize potential adverse impacts of discharge in aquatic systems include use of suitable erosion control technologies together with the implementation of procedures to protect against erosion and sedimentation during and after construction.

Although the USACE does not permit itself, the implementation of the Recommended Plan would meet the conditions of Nationwide Permit (NWP) 27- Aquatic Habitat Restoration, Enhancement, and Establishment Activities and would result in net ecological benefits (148 acres of wetlands and mudflats) for the ecosystem.

7 References

Henderson, Dwight, and Ruth Lofgren (2008). Mitchell Lake Wildlife Refuge: An Illustrated History. San Antonio: Mitchell Lake Wetlands Society.

Natural Resources Conservation Service. 2019. Web Soil Survey. https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx. Accessed 07 October 2019.

Findings Declaration

The preferred alternative “Plan 6” includes native aquatic plantings, pipeline and pump installation, low quality vegetation removal, habitat structure augmentation, installation of bat and bird nest boxes, invasive vegetation management, berm construction, clearing and excavation, polder operational management, water control structures and seasonal water pulses. These activities will create three distinct habitat types (emergent, emergent/submergent wetlands and mudflats), resilient habitat for migratory birds, and restoration of a complex of wetlands that can be managed for water quality improvement. Approximately 35,000 cubic yards of fill will be discharged into the east and west polders of Mitchell Lake impacting approximately 2 acres. The material will be excavated from Bird Pond Wetlands, Central Wetlands and Skip’s Pond. The net benefit of the project is an increase in 50 acres of mudflat habitat, 74 acres of emergent/submergent wetlands, as well as 24 acres of emergent wetland. The project is a restoration project and therefore considered to be self-mitigating.

The proposed placement site for discharge of or fill material complies with Section 404(b)(1) Guidelines.

July 29, 2021	Amanda McGuire
Date	AMANDA MCGUIRE
	Chief, Environmental Branch

ATTACHMENT G

 1-North	 1-East
 1-South	 1-West

 2-North	 2-East
 2-South	 2-West


3-North


3-East


3-South

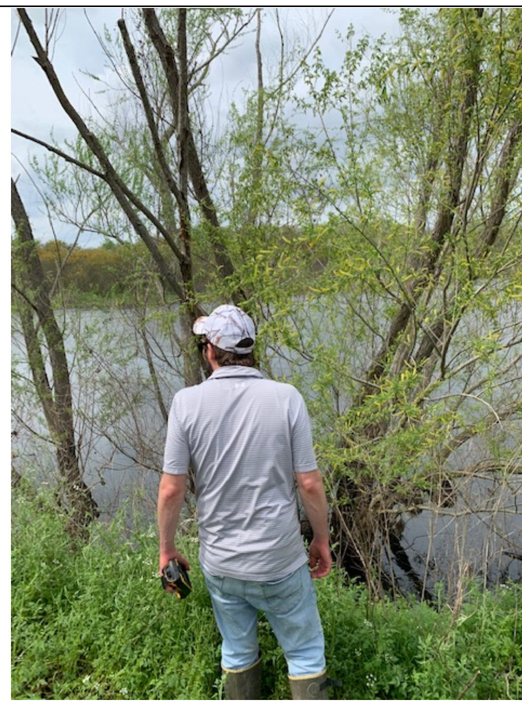

3-West

 4-North	 4-East
 4-South	 4-West

5-North

5-East

5-South



5-West

 6-North	 6-East
 6-South	 6-West

8-North

8-East

8-West


11-North


11-East


11-South


11-West

 12-North	 12-East
 12-South	 12-West

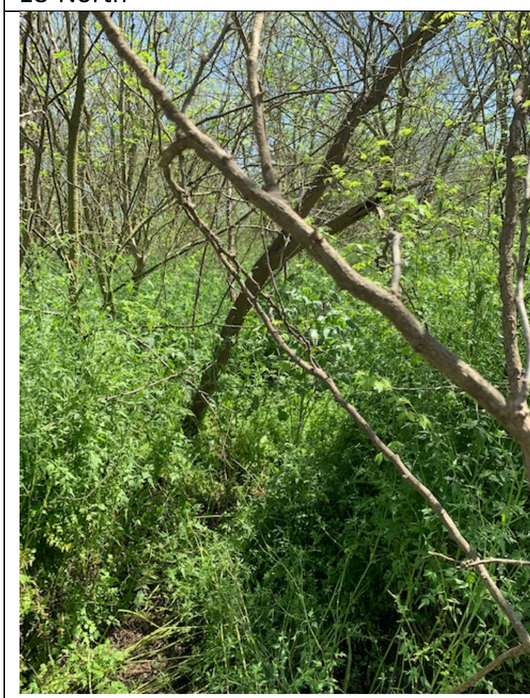
 14-North	 14-East
 14-South	 14-West

 15-North	 15-East
 15-South	 15-West

 16-North	 16-East
 16-South	 16-West

18-North

18-East



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20-West

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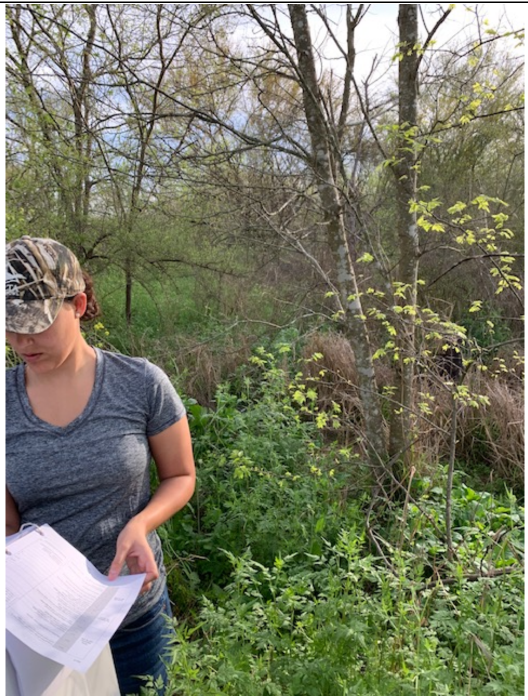
21-South

21-West


23-North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23-West


24-North


24-East


24-South


24-West


28-North


28-East


28-South


28-West

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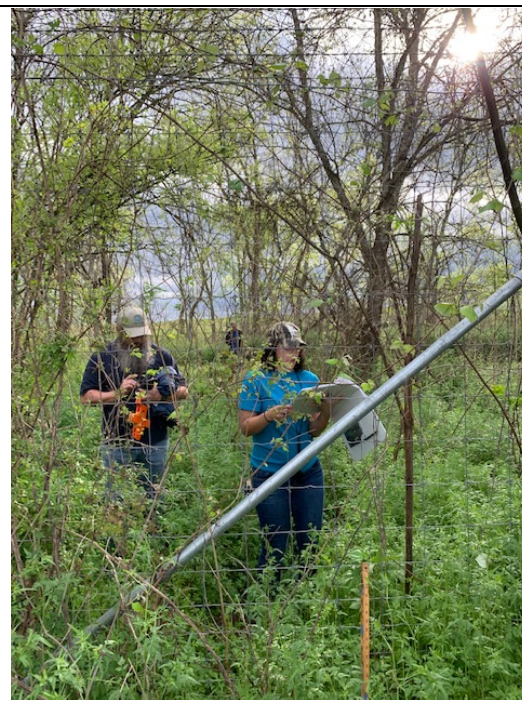
 29-South	 29-West

 36-North	 36-East
 36-South	 36-West

 37-North	 37-East
 37-South	 37-West


38-North


38-East


38-South

 41-North	 41-East
 41-South	 41-West


42-North


42-East

42-South


42-West


43-North


43-East


43-South


43-West


45-North


45-East


45-South


45-West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EM1-North


EM1-East


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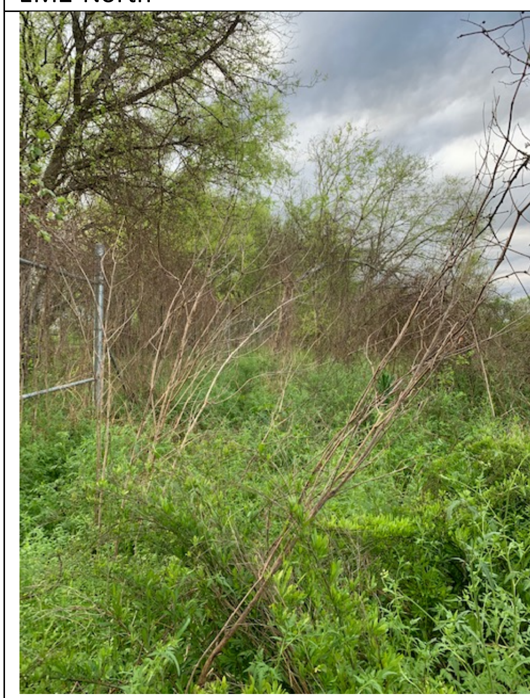
EM2-North


EM2-East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EM3-South


EM3-West

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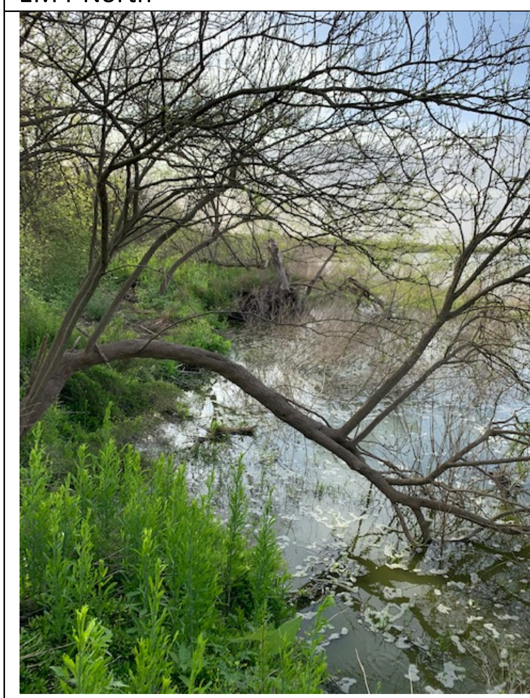
<tr><td>
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EM4-West</td></tr>
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SH1-North


SH1-East


SH1-South


SH1-West

ATTACHMENT H

Name	Vegetation
1	Sugarberry, Spiny Hackberry, Hedge Parsley, Sonchus, Lactuca, Arborensis
2	Black Willow, Duckweed, Hedge Parsley, Bedstraw, Sugarberry, Buttercup, Smartweed, Sesbania, Giant Ragwee
3	Palo Verde, Hedge Parsley, Spiny Hackberry, Elbow Bush, Sonchus, White Brush, Lactuca, Huisache, Sugarberry
4	Palo Verde, Alligator Weed, Buttercup, Esclepius, Switchgrass, Red Root Pigweed
6	Ancua, Sugarberry, Bedstraw, Spiny Hackberry, Giant Ragweed, Hedge Parsley, Huisache, Bastard Cabbage
5	Willow, Spiny Hackberry, Sugarberry, Giant Ragweed, Dakota Mock Vervain, Hedge Parsley, Sonchus, Bedstraw, Yellow Oxalis, Ranunculus, Bermudagrass, Rescuegrass, Ludwigia, Horseweed, Ash, Mulberry, American Germander, Alligator Weed
em1	Slender Spikerush, Cattail, Sonchus, Bermudagrass, Hedge Parsley, Western Ragweed, Sugarberry, Bee Balm
8	Bermudagrass, Sonchus, Palo Verde, Hackberry, Hedge Parsley, White Prickly Poppy, Bedstraw
11	Cattail, Baccharis, Oxalis, Carex, Capparis spp., Rumex
12	Baccharis, Palo Verde, Hedge Parsley, Bastard Cabbage, Sonchus, Spiny Hackberry, White Brush
13	
14	Buttercup, Alligator Weed, Mint spp., Ludwigia, Milkweed, Rumex, Hedge Parsley, Carex spp., Bedstraw
15	Dakota Mock Vervain, Mesquite, White Brush, Cheatgrass, Hedge Parsley, Sonchus, Primrose, Spiny Hackberry, Bedstraw, Prairie Verbena, Wild Geranium, Palo Verde, Oxalis, Texas Wintergrass, Globe Mallow, Croton, Hackberry, Sugarberry, Ball Moss, Yellow Sweet Clover
16	Sesbania, Buttercup, Bermudagrass, Rumex
18	Mulberry, Malva, Hedge Parsley, Sugarberry, Palo Verde, Peppervine, Annual Sunflower, Bedstraw, Bastard Cabbage, Giant Ragweed, Thistle, Spiny Hackberry
19	Western Ragweed, Palo Verde, Bedstraw, Ranunchulus, Annual Sunflower, Sumpweed, Baccharis, Thistle, Hedge Parsley
20	Bastard Cabbage, Hedge Parsley, Cheatgrass, Western Ragweed, Palo Verde, Huisache, Spiny Hackberry, Baccharis, Sonchus, Paspalum, Bermudagrass, Rumex, Sugarberry, Mistletoe
21	Hedge Parsley, Sugarberry, Palo Verde, Baccharis, Bastard Cabbage, Paspalum, Western Ragweed, Bull Thistle, Spiny Hackberry, Cheatgrass
22-Lake	Sugarberry, Palo Verde, Anuncua, Bastard Cabbage, Willow, Baccharis, Paspalum, Cheatgrass, Hedge Parsley, Sonchus, Dakota Mock Vervain, Peppervine
23	Hedge Parsley, Huisache, Spiny Hackberry, Sugarberry, Palo Verde, Bastard Cabbage, Bedstraw, Johnsongrass, Bermudagrass, White Prickly Poppy, Prickly Pear, White Brush, Ball Moss
em4	Sesbania, Mesquite, Black Willow, Rattlebox, Palo Verde, Buttercup, Goldenrod, Hedge Parsley, Bedstraw, Bermudagrass, Ragweed, Spiny Hackberry
sh1	Johnsongrass, Giant Ragweed, Palo Verde, Mesquite, Bedstraw, Hedge Parsley, Sugarberry, Spiny Hackberry, Huisache, Panicum, Sonchus, Hoary Bowlesia
24	Buttercup, Black Willow, Huisache, Duckweed, Giant Ragweed, Rumex, Baccharis
28	Hackberry, Hedge Parsley, Bedstraw, Chinaberrytree, Giant Ragweed, Day Flower, Cheatgrass, Sonchus, Chinaberrytree, Smartweed
29	Baccharis, Sugarberry, Ranunculus, Sumpweed, Alligator Weed, Giant Ragweed, Duckweed, Willow, Cheatgrass, Paspalum, Bedstraw, Ball Moss
36	Chinaberrytree, Red Mulberry, Hackberry, Mustang Grape, Hedge Parsley, Giant Ragweed, Peppervine, Baccharis
37	Sonchus, Palo Verde, Mesquite, Sugarberry, Chinaberrytree, Woody Baccharis, Bedstraw, Metacago, Henbit, Panicum spp., Oxalis, Buttercup
38	Sugarberry, Hedge Parsley, Cheatgrass, Mesquite, Horse Herb, Spiny Hackberry, Giant Ragweed, Panicum spp., Oxalis, White Brush, Bedstraw
40	Metacgo, Bedstraw, Hedge Parsley, Giant Ragwee, Bastard Cabbage, Johnsongrass
39	Silverleaf Nightshade, White Prickly Poppy, Metacago, Bermudagrass, Verigated Thistle, Bastard Cabbage, Shepard's Purse, Jacobina
41	Cheatgrass, White Prickly Poppy, Bedstraw, Prickly Pear, Mesquite, Storksbill, Hedge Parsley, Common Mullein, Shepard's Purse, Ragweed
43	Prickly Pear, Beebalm, Metacago, Hedge Parsley, Texas Vervain, Common Mullein, Bedstraw, Mesquite, White Prickly Poppy, Ground Cherry, Sonchus, Stemless Primrose
44	Shepard's Purse, Ragweed, Prickly Pear, Mesquite, Thistle, Cheatgrass, Sonchus, Metacago, Hedge Parsley, Sugarberry, Texas Vervain, Wild Geranium, Beebalm
42	Cedar Elm, Sugarberry, Gum Bumelia, Bedstraw, Sonchus, Hedge Parsley, Dayflower, Baby Blue Eyes, Giant Ragweed, Wild Onion, Chinaberrytree, Green Briar
46	Cedar Elm, Box Elder, Chinaberrytree, Sugarberry, Lagustrum, Giant Ragweed, Hedge Parsley, Dayflower, Dewberry, Climatus, Latuca, Carix spp., Bamboo, Buttercup, Sonchus, Yucca
45	Hedge Parsley, Mesquite, Bastard Cabbage, Shepard's Purse, Bedstraw, Cheatgrass, Verigated Thistle, Metacago, Giant Ragweed, Frostweed, Sonchus, Prickly Pear
em2	Slender Spikerush, Smartweed, Buttercup, Giant Ragweed, Duckweed, Palo Verde, Carix spp.
em3	Alligator Weed, Jointgrass, Buttercup, Salt Cedar, Giant Cedar, American Germander, Baccharis, Hackberry, Sumpweed, Bedstraw, Hedge Parsley, Rumex
22-Polder	Sugarberry, Palo Verde, Anuncua, Bastard Cabbage, Willow, Baccharis, Paspalum, Cheatgrass, Hedge Parsley, Sonchus, Dakota Mock Vervain, Peppervine

38	Barred Owl	HSI	0.08
			Enter Data
# trees >20"	V1	0.10	0
mean dbh	V2	0.07	6
% canopy	V3	1.00	80

V1	0.333333
V2	8
V3	76.66667

37	Barred Owl	HSI	0.16
			Enter Data
# trees >20"	V1	0.10	0
mean dbh	V2	0.27	9
% canopy	V3	1.00	90

28	Barred Owl	HSI	0.38
			Enter Data
# trees >20"	V1	0.55	1
mean dbh	V2	0.27	9
% canopy	V3	1.00	60

Enter Condition:	38	Enter Year:		
Variable	Description	DATA	HSI	0.00
SIV_1	Proportion of total tree canopy that is hard mast producing >= 25 cm dbh	0.0%	0.10	1.00
SIV_2	Number of hard mast tree species 1 = hard mast species absent 2 = one species present 3 = two species present 4 = three species present 5 = more than 4 species present	1	0.10	0.77
SIV_3	Percent canopy cover of trees for food (%)	80.0%	0.96	0.77
SIV_4	Percent canopy cover of trees for cover/reproduction (%)	80.0%	1.00	8.00
SIV_5	Mean dbh of overstory trees (inches)	6	0.10	
SI_{WF}	Winter Food Index	-	0.10	
SI_{CR}	Cover/Reproduction	-	0.32	
	HSI	-	0.10	

Enter Condition:	37	Enter Year:	
Variable	Description	DATA	HSI
SIV_1	Proportion of total tree canopy that is hard mast producing >= 25 cm dbh	0.0%	0.10
SIV_2	Number of hard mast tree species 1 = hard mast species absent 2 = one species present 3 = two species present 4 = three species present 5 = more than 4 species present	1	0.10
SIV_3	Percent canopy cover of trees for food (%)	90.0%	0.88
SIV_4	Percent canopy cover of trees for cover/reproduction (%)	90.0%	1.00
SIV_5	Mean dbh of overstory trees (inches)	9	0.40
SI_{WF}	Winter Food Index	-	0.09
SI_{CR}	Cover/Reproduction	-	0.63
	HSI	-	0.09

Enter Condition:	28	Enter Year:	
Variable	Description	DATA	HSI
SIV_1	Proportion of total tree canopy that is hard mast producing >= 25 cm dbh	0.0%	0.10
SIV_2	Number of hard mast tree species 1 = hard mast species absent 2 = one species present 3 = two species present 4 = three species present 5 = more than 4 species present	1	0.10
SIV_3	Percent canopy cover of trees for food (%)	60.0%	1.00
SIV_4	Percent canopy cover of trees for cover/reproduction (%)	60.0%	1.00
SIV_5	Mean dbh of overstory trees (inches)	9	0.40
SI_{WF}	Winter Food Index	-	0.10
SI_{CR}	Cover/Reproduction	-	0.63
	HSI	-	0.10

EM1	Marsh Wren		HSI	0.69
			Enter Data	
Growth Form	V1	1.00	cattails, cordgrasses, bulrushes	
% Cover Emergent	V2	1.00		95
Mean water depth	V3	0.33		5
% Cover Woody	V4	1.00		0.5

V1	Other growth forms
V2	75
V3	10.133333
V4	0.5

Emergent Hydrophytes
cattails, cordgrasses, bulrushes
bluejoint reedgrass, reed canarygrass, sedges
buttonbush, mangrove
other growth forms not listed

14	Marsh Wren		HSI	0.00
			Enter Data	
Growth Form	V1	0.00	other growth forms not listed	
% Cover Emergent	V2	0.08		40
Mean water depth	V3	1.00		20.32
% Cover Woody	V4	0.99		1

Emergent Hydrophytes
cattails, cordgrasses, bulrushes
bluejoint reedgrass, reed canarygrass, sedges
buttonbush, mangrove
other growth forms not listed

11	Marsh Wren		HSI	0.70
			Enter Data	
Growth Form	V1	1.00	cattails, cordgrasses, bulrushes	
% Cover Emergent	V2	1.00		90
Mean water depth	V3	0.34		5.08
% Cover Woody	V4	1.00		0

Emergent Hydrophytes
cattails, cordgrasses, bulrushes
bluejoint reedgrass, reed canarygrass, sedges
buttonbush, mangrove
other growth forms not listed

Enter Condition:	Spring	Enter Year:	2019	
EM1				
Variable	Description	DATA	HSI	Comments
V1	Mean distance from shore to water >1.5 m deep	30.0	0.50	
V2	% Canopy cover of aquatic vegetation in the littoral zone	6.0	0.11	
V3	% Shoreline cover	15.0	0.15	
V4	Mean water transparency	5.0	0.53	
V5	Winter water depth (ft)	1.0	1.00	
	Max ice depth (ft)	-		
V6	% Silt in substrate	65.0	0.65	
V7	Mean current velocity at mid-depth during summer (cm/s)	-	1.00	
V8	pH	6.9	1.00	
V9	Mean water temperature at mid-depth during summer (°C)	27.0	1.00	
V10	Frequency of water level flucuations >2 m	1.0	1.00	
V11	Distance to permanent water (m)	-	1.000	
	Food (SIF)		0.32	
	Winter Cover (SIWC)		0.65	
	Reproduction (SIR)		1.00	
	Interspersion (SII)		1.00	
	HSI		0.59	

V1	46.7
V2	28.7
V3	60.0
V4	10.1
V5	1.0
V6 A	-
V6 B	65.0
V7	-
V8	7.5
V9	23.7
V10	1.0
V11	59.7

Enter Condition:	Spring	Enter Year:	2019	
14				
Variable	Description	DATA	HSI	
V1	Mean distance from shore to water >1.5 m deep	80.0	0.50	Comments
V2	% Canopy cover of aquatic vegetation in the littoral zone	-	0.00	
V3	% Shoreline cover	75.0	0.75	
V4	Mean water transparency	20.3	0.60	
V5	Winter water depth (ft)	1.0	1.00	
	Max ice depth (ft)	-		
V6	% Silt in substrate			
V7	Mean current velocity at mid-depth during summer (cm/s)	-	1.00	
V8	pH	8.2	1.00	
V9	Mean water temperature at mid-depth during summer (°C)	23.0	0.87	
V10	Frequency of water level flucuations >2 m	1.0	1.00	
V11	Distance to permanent water (m)	5.0	1.000	
	Food (SIF)		0.46	

	Winter Cover (SIWC)		#VALUE!
	Reproduction (SIR)		0.97
	Interspersion (SII)		1.00
	HSI		#VALUE!

Enter Condition:	Spring	Enter Year:	2019
11			
Variable	Description	DATA	HSI
V1	Mean distance from shore to water >1.5 m deep	30.0	0.50
V2	% Canopy cover of aquatic vegetation in the littoral zone	80.0	1.00
V3	% Shoreline cover	90.0	0.90
V4	Mean water transparency	5.1	0.53
V5	Winter water depth (ft)	1.0	1.00
	Max ice depth (ft)	-	
V6	% Silt in substrate		
V7	Mean current velocity at mid-depth during summer (cm/s)	-	1.00
V8	pH	7.4	1.00
V9	Mean water temperature at mid-depth during summer (°C)	21.0	0.66
V10	Frequency of water level flucuations >2 m	1.0	1.00
V11	Distance to permanent water (m)	174.0	0.995
	Food (SIF)		0.73
	Winter Cover (SIWC)		#VALUE!
	Reproduction (SIR)		0.90
	Interspersion (SII)		1.00
	HSI		#VALUE!

EM2	Marsh Wren	HSI	0.00
			Enter Data
Growth Form	V1	0.00	other growth forms not listed
% Cover Emergent	V2	0.02	10
Mean water depth	V3	0.50	7.5
% Cover Woody	V4	0.80	20

V1	Other growth forms not listed
V2	34
V3	12.996
V4	17.2

Emergent Hydrophytes
cattails, cordgrasses, bulrushes
bluejoint reedgrass, reed canarygrass, sedges
buttonbush, mangrove
other growth forms not listed

EM3	Marsh Wren	HSI	0.00
			Enter Data
Growth Form	V1	0.00	other growth forms not listed
% Cover Emergent	V2	0.40	60
Mean water depth	V3	1.00	22
% Cover Woody	V4	0.99	1

Emergent Hydrophytes
cattails, cordgrasses, bulrushes
bluejoint reedgrass, reed canarygrass, sedges
buttonbush, mangrove
other growth forms not listed

29	Marsh Wren	HSI	0.00
			Enter Data
Growth Form	V1	0.00	other growth forms not listed
% Cover Emergent	V2	1.00	90
Mean water depth	V3	0.33	5
% Cover Woody	V4	1.00	0

Emergent Hydrophytes
cattails, cordgrasses, bulrushes
bluejoint reedgrass, reed canarygrass, sedges
buttonbush, mangrove
other growth forms not listed

EM4	Marsh Wren	HSI	0.00

			Enter Data
Growth Form	V1	0.00	other growth forms not listed
% Cover Emergent	V2	0.01	5
Mean water depth	V3	1.00	15.24
% Cover Woody	V4	0.60	40

Emergent Hydrophytes
cattails, cordgrasses, bulrushes
bluejoint reedgrass, reed canarygrass, sedges
buttonbush, mangrove
other growth forms not listed

24	Marsh Wren	HSI	0.00
			Enter Data
Growth Form	V1	0.00	other growth forms not listed
% Cover Emergent	V2	0.01	5
Mean water depth	V3	1.00	15.24
% Cover Woody	V4	0.75	25

Emergent Hydrophytes
cattails, cordgrasses, bulrushes
bluejoint reedgrass, reed canarygrass, sedges
buttonbush, mangrove
other growth forms not listed

Enter Condition:	Spring	Enter Year:	2019	
EM2				
Variable	Description	DATA	HSI	Comments
V1	Mean distance from shore to water >1.5 m deep	-	0.00	
V2	% Canopy cover of aquatic vegetation in the littoral zone	100.0	0.20	
V3	% Shoreline cover	17.5	0.18	
V4	Mean water transparency	7.5	0.54	
V5	Winter water depth (ft)	1.0	1.00	
	Max ice depth (ft)	-		
V6	% Silt in substrate	65.0	0.65	
V7	Mean current velocity at mid-depth during summer (cm/s)	-	1.00	
V8	pH			
V9	Mean water temperature at mid-depth during summer (°C)			
V10	Frequency of water level flucuations >2 m	1.0	1.00	
V11	Distance to permanent water (m)	-	1.000	
	Food (SIF)		0.23	
	Winter Cover (SIWC)		0.65	
	Reproduction (SIR)		1.00	
	Interspersion (SII)		1.00	
	HSI		0.53	

V1	91.0	
V2	53.0	duckweed, lowering it
V3	55.5	
V4	6.6	
V5	1.0	
V6A	-	
V6B	28.3	
V7	-	
V8	7.2	
V9	21.4	
V10	1.0	
V11	80.0	

Enter Condition:	Spring	Enter Year:	2019	
EM3				
Variable	Description	DATA	HSI	Comments
V1	Mean distance from shore to water >1.5 m deep	30.5	0.50	
V2	% Canopy cover of aquatic vegetation in the littoral zone	60.0	1.00	
V3	% Shoreline cover	90.0	0.90	
V4	Mean water transparency	10.2	0.55	
V5	Winter water depth (ft)	1.0	1.00	
	Max ice depth (ft)	-		
V6	% Silt in substrate	10.0	0.10	
V7	Mean current velocity at mid-depth during summer (cm/s)	-	1.00	
V8	pH			

V9	Mean water temperature at mid-depth during summer (°C)			
V10	Frequency of water level flucuations >2 m	1.0	1.00	
V11	Distance to permanent water (m)	-	1.000	
	Food (SIF)		0.74	
	Winter Cover (SIWC)		0.10	
	Reproduction (SIR)		1.00	
	Interspersion (SII)		1.00	
	HSI		0.42	

Enter Condition: 29	Spring	Enter Year:	2019	
Variable	Description	DATA	HSI	Comments
V1	Mean distance from shore to water >1.5 m deep	200.0	0.50	
V2	% Canopy cover of aquatic vegetation in the littoral zone	90.0	0.60	
V3	% Shoreline cover	20.0	0.20	
V4	Mean water transparency	5.0	0.53	
V5	Winter water depth (ft)	1.0	1.00	
	Max ice depth (ft)	-		
V6	% Silt in substrate	10.0	0.10	
V7	Mean current velocity at mid-depth during summer (cm/s)	-	1.00	
V8	pH	7.1	1.00	
V9	Mean water temperature at mid-depth during summer (°C)	23.0	0.87	
V10	Frequency of water level flucuations >2 m	1.0	1.00	
V11	Distance to permanent water (m)	200.0	0.986	
	Food (SIF)		0.46	
	Winter Cover (SIWC)		0.10	
	Reproduction (SIR)		0.97	
	Interspersion (SII)		0.99	
	HSI		0.35	

Enter Condition: EM4	Spring	Enter Year:	2019	
Variable	Description	DATA	HSI	Comments
V1	Mean distance from shore to water >1.5 m deep	24.4	0.78	

V2	% Canopy cover of aquatic vegetation in the littoral zone	-	0.00	
V3	% Shoreline cover	90.0	0.90	
V4	Mean water transparency	5.1	0.53	
V5	Winter water depth (ft)	1.0	1.00	
	Max ice depth (ft)	-		
V6	% Silt in substrate			
V7	Mean current velocity at mid-depth during summer (cm/s)	-	1.00	
V8	pH	7.3	1.00	
V9	Mean water temperature at mid-depth during summer (°C)	21.2	0.68	
V10	Frequency of water level flucuations >2 m	1.0	1.00	
V11	Distance to permanent water (m)	-	1.000	
	Food (SIF)		0.55	
	Winter Cover (SIWC)		#VALUE!	
	Reproduction (SIR)		0.91	
	Interspersion (SII)		1.00	
	HSI		#VALUE!	

Enter Condition:	Spring	Enter Year:	2019	
24				
Variable	Description	DATA	HSI	Comments
V1	Mean distance from shore to water >1.5 m deep	200.0	0.50	
V2	% Canopy cover of aquatic vegetation in the littoral zone	15.0	0.27	
V3	% Shoreline cover	60.0	0.60	
V4	Mean water transparency	5.1	0.53	
V5	Winter water depth (ft)	1.0	1.00	
	Max ice depth (ft)	-		
V6	% Silt in substrate			
V7	Mean current velocity at mid-depth during summer (cm/s)	-	1.00	
V8	pH	7.1	1.00	
V9	Mean water temperature at mid-depth during summer (°C)	20.0	0.55	
V10	Frequency of water level flucuations >2 m	1.0	1.00	
V11	Distance to permanent water (m)	200.0	0.986	
	Food (SIF)		0.47	
	Winter Cover (SIWC)		#VALUE!	

	Reproduction (SIR)		0.86	
	Interspersion (SII)		0.99	
	HSI		#VALUE!	

ATTACHMENT I

Future Without Project

Bird Pond 1A
3.17 acres

	Target Year	V1	V2	V3	V4
Marsh Wren	0	4.00	75.00	10.00	0.50
Marsh Wren	1	4.00	75.00	10.00	0.50
Marsh Wren	5	4.00	75.00	10.00	0.50
Marsh Wren	10	4.00	75.00	10.00	0.50
Marsh Wren	25	4.00	75.00	10.00	0.50
Marsh Wren	50	4.00	75.00	10.00	0.50

	Target Year	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11
Bullfrog	0	46.70	29.00	60.00	100.00	1/0	30.40	0.00	7.50	31.00	1.00	59.70
Bullfrog	1	49.70	29.00	35.00	100.00	1/0	30.40	0.00	7.50	31.00	1.00	59.70
Bullfrog	5	46.70	29.00	10.00	100.00	1/0	30.40	0.00	7.50	31.00	1.00	59.70
Bullfrog	10	47.70	29.00	7.00	100.00	1/0	30.40	0.00	7.50	31.00	1.00	59.70
Bullfrog	25	47.70	29.00	7.00	100.00	1/0	30.40	0.00	7.50	31.00	1.00	59.70
Bullfrog	50	47.70	29.00	7.00	100.00	1/0	30.40	0.00	7.50	31.00	1.00	59.70

Bird Pond 1B
3.25 acres

	Target Year	V1	V2	V3	V4
Marsh Wren	0	4.00	0.00	0.00	0.50
Marsh Wren	1	4.00	0.00	0.00	0.50
Marsh Wren	5	4.00	0.00	0.00	0.50
Marsh Wren	10	4.00	0.00	0.00	0.50
Marsh Wren	25	4.00	0.00	0.00	0.50
Marsh Wren	50	4.00	0.00	0.00	0.50

	Target Year	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11
Bullfrog	0	0.00	0.00	0.00	0.00	0/1	30.40	100.00	0.00	0.00	1.00	1600.00
Bullfrog	1	0.00	0.00	0.00	0.00	0/1	30.40	100.00	0.00	0.00	1.00	1600.00
Bullfrog	5	0.00	0.00	0.00	0.00	0/1	30.40	100.00	0.00	0.00	1.00	1600.00
Bullfrog	10	0.00	0.00	0.00	0.00	0/1	30.40	100.00	0.00	0.00	1.00	1600.00
Bullfrog	25	0.00	0.00	0.00	0.00	0/1	30.40	100.00	0.00	0.00	1.00	1600.00
Bullfrog	50	0.00	0.00	0.00	0.00	0/1	30.40	100.00	0.00	0.00	1.00	1600.00

Central Wetland 2A
10.46 acres

	Target Year	V1	V2	V3	V4
Marsh Wren	0	4.00	75.00	10.00	0.50
Marsh Wren	1	4.00	75.00	10.00	0.50
Marsh Wren	5	4.00	75.00	10.00	0.50
Marsh Wren	10	4.00	75.00	10.00	0.50
Marsh Wren	25	4.00	75.00	10.00	0.50
Marsh Wren	50	4.00	75.00	10.00	0.50

	Target Year	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11
Bullfrog	0	46.70	29.00	60.00	100.00	1/0	30.40	0.00	7.50	31.00	1.00	59.70
Bullfrog	1	49.70	29.00	35.00	100.00	1/0	30.40	0.00	7.50	31.00	1.00	59.70
Bullfrog	5	46.70	29.00	10.00	100.00	1/0	30.40	0.00	7.50	31.00	1.00	59.70
Bullfrog	10	47.70	29.00	7.00	100.00	1/0	30.40	0.00	7.50	31.00	1.00	59.70
Bullfrog	25	47.70	29.00	7.00	100.00	1/0	30.40	0.00	7.50	31.00	1.00	59.70
Bullfrog	50	47.70	29.00	7.00	100.00	1/0	30.40	0.00	7.50	31.00	1.00	59.70

Central Wetland 2B
7.91 acres

	Target Year	V1	V2	V3	V4
Marsh Wren	0	4.00	0.00	0.00	0.50

Marsh Wren	1	4.00	0.00	0.00	0.50
Marsh Wren	5	4.00	0.00	0.00	0.50
Marsh Wren	10	4.00	0.00	0.00	0.50
Marsh Wren	25	4.00	0.00	0.00	0.50
Marsh Wren	50	4.00	0.00	0.00	0.50

	Target Year	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11
Bullfrog	0	0.00	0.00	0.00	0.00	0/1	30.40	100.00	0.00	0.00	1.00	1600.00
Bullfrog	1	0.00	0.00	0.00	0.00	0/1	30.40	100.00	0.00	0.00	1.00	1600.00
Bullfrog	5	0.00	0.00	0.00	0.00	0/1	30.40	100.00	0.00	0.00	1.00	1600.00
Bullfrog	10	0.00	0.00	0.00	0.00	0/1	30.40	100.00	0.00	0.00	1.00	1600.00
Bullfrog	25	0.00	0.00	0.00	0.00	0/1	30.40	100.00	0.00	0.00	1.00	1600.00
Bullfrog	50	0.00	0.00	0.00	0.00	0/1	30.40	100.00	0.00	0.00	1.00	1600.00

Skip's Pond 3
2.18 acres

	Target Year	V1	V2	V3	V4
Marsh Wren	0	4.00	75.00	10.00	0.50
Marsh Wren	1	4.00	75.00	10.00	0.50
Marsh Wren	5	4.00	75.00	10.00	0.50
Marsh Wren	10	4.00	75.00	10.00	0.50
Marsh Wren	25	4.00	75.00	10.00	0.50
Marsh Wren	50	4.00	75.00	10.00	0.50

	Target Year	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11
Bullfrog	0	46.70	29.00	60.00	100.00	1/0	30.40	0.00	7.50	31.00	1.00	59.70
Bullfrog	1	49.70	29.00	35.00	100.00	1/0	30.40	0.00	7.50	31.00	1.00	59.70
Bullfrog	5	46.70	29.00	10.00	100.00	1/0	30.40	0.00	7.50	31.00	1.00	59.70
Bullfrog	10	47.70	29.00	7.00	100.00	1/0	30.40	0.00	7.50	31.00	1.00	59.70
Bullfrog	25	47.70	29.00	7.00	100.00	1/0	30.40	0.00	7.50	31.00	1.00	59.70
Bullfrog	50	47.70	29.00	7.00	100.00	1/0	30.40	0.00	7.50	31.00	1.00	59.70

Fringe-Cove 1
53.68 acres

	Target Year	V1	V2	V3	V4
Marsh Wren	0	4.00	34.00	30.48	17.20
Marsh Wren	1	4.00	15.00	0.00	0.00
Marsh Wren	5	4.00	34.00	0.00	2.00
Marsh Wren	10	4.00	34.00	0.00	10.00
Marsh Wren	25	4.00	34.00	0.00	15.00
Marsh Wren	50	4.00	34.00	0.00	17.20

	Target Year	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11
Bullfrog	0	91.00	0.00	55.00	100.00	1/0	28.00	0.00	7.20	31.00	1.00	80.00
Bullfrog	1	91.00	0.00	55.00	100.00	1/0	28.00	0.00	7.20	31.00	1.00	80.00
Bullfrog	5	91.00	0.00	55.00	100.00	1/0	28.00	0.00	7.20	31.00	1.00	80.00
Bullfrog	10	91.00	0.00	55.00	100.00	1/0	28.00	0.00	7.20	31.00	1.00	80.00
Bullfrog	25	91.00	0.00	55.00	100.00	1/0	28.00	0.00	7.20	31.00	1.00	80.00
Bullfrog	50	91.00	0.00	55.00	100.00	1/0	28.00	0.00	7.20	31.00	1.00	80.00

Fringe-Cove 2
11.84 acres

	Target Year	V1	V2	V3	V4
Marsh Wren	0	4.00	34.00	30.48	17.20
Marsh Wren	1	4.00	15.00	0.00	0.00
Marsh Wren	5	4.00	34.00	0.00	2.00
Marsh Wren	10	4.00	34.00	0.00	10.00

Marsh Wren	25	4.00	34.00	0.00	15.00
Marsh Wren	50	4.00	34.00	0.00	17.20

	Target Year	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11
Bullfrog	0	91.00	0.00	55.00	100.00	1/0	28.00	0.00	7.20	31.00	1.00	80.00
Bullfrog	1	91.00	0.00	55.00	100.00	1/0	28.00	0.00	7.20	31.00	1.00	80.00
Bullfrog	5	91.00	0.00	55.00	100.00	1/0	28.00	0.00	7.20	31.00	1.00	80.00
Bullfrog	10	91.00	0.00	55.00	100.00	1/0	28.00	0.00	7.20	31.00	1.00	80.00
Bullfrog	25	91.00	0.00	55.00	100.00	1/0	28.00	0.00	7.20	31.00	1.00	80.00
Bullfrog	50	91.00	0.00	55.00	100.00	1/0	28.00	0.00	7.20	31.00	1.00	80.00

Fringe-Cove 3

6.84 acres

	Target Year	V1	V2	V3	V4
Marsh Wren	0	4.00	34.00	30.48	17.20
Marsh Wren	1	4.00	15.00	0.00	0.00
Marsh Wren	5	4.00	34.00	0.00	2.00
Marsh Wren	10	4.00	34.00	0.00	10.00
Marsh Wren	25	4.00	34.00	0.00	15.00
Marsh Wren	50	4.00	34.00	0.00	17.20

	Target Year	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11
Bullfrog	0	91.00	0.00	55.00	100.00	1/0	28.00	0.00	7.20	31.00	1.00	80.00
Bullfrog	1	91.00	0.00	55.00	100.00	1/0	28.00	0.00	7.20	31.00	1.00	80.00
Bullfrog	5	91.00	0.00	55.00	100.00	1/0	28.00	0.00	7.20	31.00	1.00	80.00
Bullfrog	10	91.00	0.00	55.00	100.00	1/0	28.00	0.00	7.20	31.00	1.00	80.00
Bullfrog	25	91.00	0.00	55.00	100.00	1/0	28.00	0.00	7.20	31.00	1.00	80.00
Bullfrog	50	91.00	0.00	55.00	100.00	1/0	28.00	0.00	7.20	31.00	1.00	80.00

Dam Forested Wetlands

2.55 acres

	Target Year	V1	V2	V3
Barred Owl	0	0.30	8.00	76.00
Barred Owl	1	0.30	8.00	76.00
Barred Owl	5	0.30	9.00	79.00
Barred Owl	10	0.30	12.00	80.00
Barred Owl	25	0.50	15.00	80.00
Barred Owl	50	1.00	18.00	80.00

	Target Year	SIV1	SIV2	SIV3	SIV4	SIV5
Gray Squirrel	0	0.00	hard mast trees absent	76.00	76.00	8.00
Gray Squirrel	1	0.00	hard mast trees absent	76.00	76.00	8.00
Gray Squirrel	5	0.00	hard mast trees absent	79.00	79.00	9.00
Gray Squirrel	10	0.00	hard mast trees absent	80.00	80.00	12.00
Gray Squirrel	25	0.00	hard mast trees absent	80.00	80.00	14.00
Gray Squirrel	50	0.00	hard mast trees absent	80.00	80.00	16.00

Dam Forested Wetlands

4.48 acres

	Target Year	V1	V2	V3
Barred Owl	0	0.30	8.00	76.00
Barred Owl	1	0.30	8.00	76.00
Barred Owl	5	0.30	9.00	79.00
Barred Owl	10	0.30	12.00	80.00
Barred Owl	25	0.50	15.00	80.00
Barred Owl	50	1.00	18.00	80.00

	Target Year	SIV1	SIV2	SIV3	SIV4	SIV5

Gray Squirrel	0	0.00	hard mast trees absent	76.00	76.00	8.00
Gray Squirrel	1	0.00	hard mast trees absent	76.00	76.00	8.00
Gray Squirrel	5	0.00	hard mast trees absent	79.00	79.00	9.00
Gray Squirrel	10	0.00	hard mast trees absent	80.00	80.00	12.00
Gray Squirrel	25	0.00	hard mast trees absent	80.00	80.00	14.00
Gray Squirrel	50	0.00	hard mast trees absent	80.00	80.00	16.00

Downstream Wetland

19 acres

	Target Year	V1	V2	V3	V4
Marsh Wren	0	4.00	0.00	0.00	26.25
Marsh Wren	1	4.00	0.00	0.00	28.00
Marsh Wren	5	4.00	0.00	0.00	35.00
Marsh Wren	10	4.00	0.00	0.00	50.00
Marsh Wren	25	4.00	0.00	0.00	60.00
Marsh Wren	50	4.00	0.00	0.00	60.00

	Target Year	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11
Bullfrog	0	0.00	0.00	0.00	0.00	0/1	30.40	100.00	0.00	0.00	1.00	1600.00
Bullfrog	1	0.00	0.00	0.00	0.00	0/1	30.40	100.00	0.00	0.00	1.00	1600.00
Bullfrog	5	0.00	0.00	0.00	0.00	0/1	30.40	100.00	0.00	0.00	1.00	1600.00
Bullfrog	10	0.00	0.00	0.00	0.00	0/1	30.40	100.00	0.00	0.00	1.00	1600.00
Bullfrog	25	0.00	0.00	0.00	0.00	0/1	30.40	100.00	0.00	0.00	1.00	1600.00
Bullfrog	50	0.00	0.00	0.00	0.00	0/1	30.40	100.00	0.00	0.00	1.00	1600.00

Future With Project

Bird Pond 1A

3.17 acres

	Target Year	V1	V2	V3	V4
Marsh Wren	0	4.00	75.00	10.00	0.50
Marsh Wren	1	1.00	80.00	59.00	1.00
Marsh Wren	5	1.00	80.00	59.00	10.00
Marsh Wren	10	1.00	80.00	59.00	25.00
Marsh Wren	25	1.00	80.00	59.00	60.00
Marsh Wren	50	1.00	80.00	59.00	60.00

	Target Year	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11
Bullfrog	0	30.00	29.00	60.00	100.00	1/0	28.00	0.00	7.50	31.00	1.00	0.00
Bullfrog	1	10.00	30.00	60.00	100.00	1/0	100.00	0.00	7.50	31.00	1.00	0.00
Bullfrog	5	10.00	50.00	60.00	100.00	1/0	100.00	0.00	7.50	31.00	1.00	0.00
Bullfrog	10	10.00	60.00	65.00	100.00	1/0	100.00	0.00	7.50	31.00	1.00	0.00
Bullfrog	25	10.00	60.00	70.00	100.00	1/0	100.00	0.00	7.50	31.00	1.00	0.00
Bullfrog	50	10.00	60.00	70.00	100.00	1/0	100.00	0.00	7.50	31.00	1.00	0.00

Bird Pond 1B

3.25 acres

	Target Year	V1	V2	V3	V4
Marsh Wren	0	4.00	0.00	0.00	0.50
Marsh Wren	1	1.00	50.00	59.00	1.00
Marsh Wren	5	1.00	75.00	59.00	10.00
Marsh Wren	10	1.00	75.00	59.00	25.00
Marsh Wren	25	1.00	75.00	59.00	60.00
Marsh Wren	50	1.00	75.00	59.00	60.00

	Target Year	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11
Bullfrog	0	0.00	0.00	0.00	0.00	0/1	30.40	100.00	0.00	0.00	1.00	1600.00
Bullfrog	1	10.00	25.00	1.00	100.00	1/0	100.00	0.00	7.00	31.00	1.00	0.00
Bullfrog	5	10.00	45.00	10.00	100.00	1/0	100.00	0.00	7.00	31.00	1.00	0.00
Bullfrog	10	10.00	55.00	40.00	100.00	1/0	100.00	0.00	7.00	31.00	1.00	0.00
Bullfrog	25	10.00	60.00	60.00	100.00	1/0	100.00	0.00	7.00	31.00	1.00	0.00
Bullfrog	50	10.00	60.00	70.00	100.00	1/0	100.00	0.00	7.00	31.00	1.00	0.00

Central Wetland 2A

10.46 acres

	Target Year	V1	V2	V3	V4
Marsh Wren	0	4.00	75.00	10.00	0.50
Marsh Wren	1	1.00	80.00	59.00	1.00
Marsh Wren	5	1.00	80.00	59.00	10.00
Marsh Wren	10	1.00	80.00	59.00	25.00
Marsh Wren	25	1.00	80.00	59.00	60.00
Marsh Wren	50	1.00	80.00	59.00	60.00

	Target Year	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11
Bullfrog	0	30.00	29.00	60.00	100.00	1/0	28.00	0.00	7.50	31.00	1.00	0.00
Bullfrog	1	10.00	30.00	60.00	100.00	1/0	100.00	0.00	7.50	31.00	1.00	0.00
Bullfrog	5	10.00	50.00	60.00	100.00	1/0	100.00	0.00	7.50	31.00	1.00	0.00
Bullfrog	10	10.00	60.00	65.00	100.00	1/0	100.00	0.00	7.50	31.00	1.00	0.00
Bullfrog	25	10.00	60.00	70.00	100.00	1/0	100.00	0.00	7.50	31.00	1.00	0.00
Bullfrog	50	10.00	60.00	70.00	100.00	1/0	100.00	0.00	7.50	31.00	1.00	0.00

Central Wetland 2B

7.91 acres

	Target Year	V1	V2	V3	V4
Marsh Wren	0	4.00	75.00	10.00	0.50

Marsh Wren	1	1.00	50.00	59.00	1.00
Marsh Wren	5	1.00	75.00	59.00	10.00
Marsh Wren	10	1.00	75.00	59.00	25.00
Marsh Wren	25	1.00	75.00	59.00	60.00
Marsh Wren	50	1.00	75.00	59.00	60.00

	Target Year	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11
Bullfrog	0	0.00	0.00	0.00	0.00	0/1	30.40	100.00	0.00	0.00	1.00	1600.00
Bullfrog	1	10.00	25.00	1.00	100.00	1/0	100.00	0.00	7.00	31.00	1.00	0.00
Bullfrog	5	10.00	45.00	10.00	100.00	1/0	100.00	0.00	7.00	31.00	1.00	0.00
Bullfrog	10	10.00	55.00	40.00	100.00	1/0	100.00	0.00	7.00	31.00	1.00	0.00
Bullfrog	25	10.00	60.00	60.00	100.00	1/0	100.00	0.00	7.00	31.00	1.00	0.00
Bullfrog	50	10.00	60.00	70.00	100.00	1/0	100.00	0.00	7.00	31.00	1.00	0.00

Skip's Pond 3
2.18 acres

	Target Year	V1	V2	V3	V4
Marsh Wren	0	4.00	75.00	10.00	0.50
Marsh Wren	1	1.00	80.00	59.00	1.00
Marsh Wren	5	1.00	80.00	59.00	10.00
Marsh Wren	10	1.00	80.00	59.00	25.00
Marsh Wren	25	1.00	80.00	59.00	60.00
Marsh Wren	50	1.00	80.00	59.00	60.00

	Target Year	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11
Bullfrog	0	30.00	29.00	60.00	100.00	1/0	28.00	0.00	7.50	31.00	1.00	0.00
Bullfrog	1	10.00	30.00	60.00	100.00	1/0	100.00	0.00	7.50	31.00	1.00	0.00
Bullfrog	5	10.00	50.00	60.00	100.00	1/0	100.00	0.00	7.50	31.00	1.00	0.00
Bullfrog	10	10.00	60.00	65.00	100.00	1/0	100.00	0.00	7.50	31.00	1.00	0.00
Bullfrog	25	10.00	60.00	70.00	100.00	1/0	100.00	0.00	7.50	31.00	1.00	0.00
Bullfrog	50	10.00	60.00	70.00	100.00	1/0	100.00	0.00	7.50	31.00	1.00	0.00

Fringe-Cove 1
53.68 acres

	Target Year	V1	V2	V3	V4
Marsh Wren	0	4.00	34.00	30.48	17.20
Marsh Wren	1	4.00	34.00	30.48	1.00
Marsh Wren	5	1.00	50.00	30.48	5.00
Marsh Wren	10	1.00	75.00	30.48	15.00
Marsh Wren	25	1.00	75.00	30.48	20.00
Marsh Wren	50	1.00	75.00	30.48	20.00

	Target Year	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11
Bullfrog	0	10.00	0.00	55.00	100.00	1/0	28.30	0.00	7.20	31.00	1.00	0.00
Bullfrog	1	10.00	35.00	1.00	100.00	1/0	100.00	0.00	7.20	31.00	1.00	0.00
Bullfrog	5	10.00	50.00	5.00	100.00	1/0	100.00	0.00	7.20	31.00	1.00	0.00
Bullfrog	10	10.00	70.00	15.00	100.00	1/0	100.00	0.00	7.20	31.00	1.00	0.00
Bullfrog	25	10.00	70.00	20.00	100.00	1/0	100.00	0.00	7.20	31.00	1.00	0.00
Bullfrog	50	10.00	70.00	20.00	100.00	1/0	100.00	0.00	7.20	31.00	1.00	0.00

Fringe-Cove 2
11.84 acres

	Target Year	V1	V2	V3	V4
Marsh Wren	0	4.00	34.00	30.48	17.20
Marsh Wren	1	4.00	34.00	30.48	1.00
Marsh Wren	5	1.00	50.00	30.48	5.00
Marsh Wren	10	1.00	75.00	30.48	15.00

Marsh Wren	25	1.00	75.00	30.48	20.00
Marsh Wren	50	1.00	75.00	30.48	20.00

	Target Year	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11
Bullfrog	0	10.00	0.00	55.00	100.00	1/0	28.30	0.00	7.20	31.00	1.00	0.00
Bullfrog	1	10.00	35.00	1.00	100.00	1/0	100.00	0.00	7.20	31.00	1.00	0.00
Bullfrog	5	10.00	50.00	5.00	100.00	1/0	100.00	0.00	7.20	31.00	1.00	0.00
Bullfrog	10	10.00	70.00	15.00	100.00	1/0	100.00	0.00	7.20	31.00	1.00	0.00
Bullfrog	25	10.00	70.00	20.00	100.00	1/0	100.00	0.00	7.20	31.00	1.00	0.00
Bullfrog	50	10.00	70.00	20.00	100.00	1/0	100.00	0.00	7.20	31.00	1.00	0.00

Fringe-Cove 3

6.84 acres

	Target Year	V1	V2	V3	V4
Marsh Wren	0	4.00	34.00	30.48	17.20
Marsh Wren	1	4.00	34.00	30.48	1.00
Marsh Wren	5	1.00	50.00	30.48	5.00
Marsh Wren	10	1.00	75.00	30.48	15.00
Marsh Wren	25	1.00	75.00	30.48	20.00
Marsh Wren	50	1.00	75.00	30.48	20.00

	Target Year	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11
Bullfrog	0	10.00	0.00	55.00	100.00	1/0	28.30	0.00	7.20	31.00	1.00	0.00
Bullfrog	1	10.00	35.00	1.00	100.00	1/0	100.00	0.00	7.20	31.00	1.00	0.00
Bullfrog	5	10.00	50.00	5.00	100.00	1/0	100.00	0.00	7.20	31.00	1.00	0.00
Bullfrog	10	10.00	70.00	15.00	100.00	1/0	100.00	0.00	7.20	31.00	1.00	0.00
Bullfrog	25	10.00	70.00	20.00	100.00	1/0	100.00	0.00	7.20	31.00	1.00	0.00
Bullfrog	50	10.00	70.00	20.00	100.00	1/0	100.00	0.00	7.20	31.00	1.00	0.00

Dam Forested Wetlands

2.55 acres

	Target Year	V1	V2	V3
Barred Owl	0	0.30	8.00	76.00
Barred Owl	1	0.30	8.00	40.00
Barred Owl	5	0.30	8.00	50.00
Barred Owl	10	0.50	8.00	60.00
Barred Owl	25	2.00	9.00	70.00
Barred Owl	50	2.00	10.00	75.00

	Target Year	SIV1	SIV2	SIV3	SIV4	SIV5
Gray Squirrel	0	0.00	hard mast trees absent	76.00	76.00	8.00
Gray Squirrel	1	0.00	hard mast trees absent	40.00	40.00	10.00
Gray Squirrel	5	0.00	hard mast trees absent	50.00	50.00	10.50
Gray Squirrel	10	10.00	hard mast trees absent	60.00	60.00	6.00
Gray Squirrel	25	50.00	hard mast trees absent	70.00	70.00	8.00
Gray Squirrel	50	60.00	hard mast trees absent	75.00	75.00	10.00

Dam Forested Wetlands

4.48 acres

	Target Year	V1	V2	V3
Barred Owl	0	0.30	8.00	76.00
Barred Owl	1	0.30	8.00	40.00
Barred Owl	5	0.30	8.00	50.00
Barred Owl	10	0.50	8.00	60.00
Barred Owl	25	2.00	9.00	70.00
Barred Owl	50	2.00	10.00	75.00

	Target Year	SIV1	SIV2	SIV3	SIV4	SIV5

Gray Squirrel	0	0.00	hard mast trees absent	76.00	76.00	8.00
Gray Squirrel	1	0.00	hard mast trees absent	40.00	40.00	10.00
Gray Squirrel	5	0.00	hard mast trees absent	50.00	50.00	10.50
Gray Squirrel	10	10.00	hard mast trees absent	60.00	60.00	6.00
Gray Squirrel	25	50.00	hard mast trees absent	70.00	70.00	8.00
Gray Squirrel	50	60.00	hard mast trees absent	75.00	75.00	10.00

Downstream Wetland

19 acres

	Target Year	V1	V2	V3	V4
Marsh Wren	0	4.00	0.00	0.00	26.25
Marsh Wren	1	1.00	50.00	59.00	1.00
Marsh Wren	5	1.00	75.00	59.00	10.00
Marsh Wren	10	1.00	75.00	59.00	25.00
Marsh Wren	25	1.00	75.00	59.00	60.00
Marsh Wren	50	1.00	75.00	59.00	60.00

	Target Year	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11
Bullfrog	0	0.00	0.00	0.00	0.00	0/1	30.40	100.00	0.00	0.00	1.00	1600.00
Bullfrog	1	10.00	25.00	1.00	100.00	1/0	100.00	0.00	7.00	31.00	1.00	0.00
Bullfrog	5	10.00	45.00	10.00	100.00	1/0	100.00	0.00	7.00	31.00	1.00	0.00
Bullfrog	10	10.00	55.00	40.00	100.00	1/0	100.00	0.00	7.00	31.00	1.00	0.00
Bullfrog	25	10.00	60.00	60.00	100.00	1/0	100.00	0.00	7.00	31.00	1.00	0.00
Bullfrog	50	10.00	60.00	70.00	100.00	1/0	100.00	0.00	7.00	31.00	1.00	0.00

Shorebird Migration Habitat Model - Spring Migration Variables Enter the corresponding letter to the appropriate condition			WO	ENTER PROJECT NAME HERE
			TY:	0-Baseline for FWOP & FWP AND all FWOP
	VARIABLE		Value	COMMENTS
S_{1a}) Water Depths			f	
a	water depth range of 18 cm to recently dewatered to upland - full habitat range	1.0		
b	water depth range of 10 cm to recently dewatered	0.9		
c	water depth range of 3 cm to recently dewatered to upland	0.7		
d	water depth range of recently dewatered to upland (dry)	0.5		
e	wet upland or 10 to 18 cm deep with little useable shoreline	0.3		
f	continually dry or depths greater than 18 cm and little useable shoreline	0.1		
S_{1b}) Availability			f	
a	continually available from April 15 - June 15	1.0		
b	continually available from May 1 - June 1	0.9		
c	continually available from May 15 - June 1	0.7		
d	continually available for > a two-week period between April 15 and June 15	0.5		
e	continually available for a one- to two-week period between April 15 and June 15	0.3		
f	very little or no habitat diversity	0.1		
S_2) Aquatic Invertebrates (in accessible habitat)			a	
a	> 100 individuals/sq m, or decaying vegetation that has been flooded > 3 weeks	1.0		
b	75 - 100 individuals/sq m, or little veg flooded > 3 weeks , or veg flooded 2 to 3 weeks	0.8		
c	50 - 75 individuals/sq m, or little veg flooded 2 to 3 weeks, or veg flooded 1 to 2 weeks	0.5		
d	25 - 50 individuals/sq m, or little veg flooded 1 to 2 weeks, or veg flooded <= 1 week	0.2		
e	0 - 25 individuals/sq m, or little veg flooded <= 1 week, or veg not flooded	0.1		
S_3) Vegetative Cover			a	
a	less than 25% coverage and short	1.0		
b	25% - 50% coverage, or less than 25% coverage and tall, or 50% - 75% coverage and short	0.7		
c	50% - 75% coverage, or 25% - 50% coverage and tall, or greater than 75% coverage and short	0.4		
d	greater than 75% coverage and tall	0.1		
S_4) Disturbance			b	
a	Human activity rare or non-existent	1.0		
b	Human activity infrequent and widespread or common and limited in extent	0.7		
c	Human activity common and widespread or frequent and limited in extent	0.4		
d	Human activity frequent and widespread	0.1		
S_5) Hydrologic Conditions			a	
a	Present annually, predictable	1.0		
b	Present most years (7 out of 10)	0.7		
c	Present some years (4 out of 10)	0.4		
d	Present few years (1 out of 10)	0.1		
S_6) Management Capabilities			d	
a	At least five separate impoundments with full water control capability	1.0		
b	Less than five impoundments or limited water control capability	0.7		
c	less than five impoundments and limited water control capability	0.4		
d	No water control capability	0.1		
	Food		0.30	
	Security		0.18	
	Predictability		0.13	
	Spring HSI		0.31	
	Shorebird Migration Habitat Model - Summer/Fall Migration Variables			
F_{1a}) Water Depths and Availability			f	
a	water depth range of 18 cm to recently dewatered to upland - full habitat range	1.0		
b	water depth range of 10 cm to recently dewatered	0.9		
c	water depth range of 3 cm to recently dewatered to upland	0.7		
d	water depth range of recently dewatered to upland (dry)	0.5		
e	wet upland or 10 to 18 cm deep with little useable shoreline	0.3		
f	continually dry or depths greater than 18 cm and little useable shoreline	0.1		
F_{1b}) Timing for water depths and availability			f	
a	continually available from July 1 - October 15	1.0		
b	continually available from July 15 - October 15	0.9		
c	available for 12-9 weeks between July 1 and October 15	0.7		
d	available for 8-5 weeks between July 1 and October 15	0.5		
e	available for 4-2 weeks between July 1 and October 15	0.3		
f	very little or no habitat diversity	0.1		
F_2) Aquatic Invertebrates (in accessible habitat)			a	
a	> 100 individuals/sq m, or decaying vegetation that has been flooded > 3 weeks	1.0		
b	75 - 100 individuals/sq m, or little veg flooded > 3 weeks , or veg flooded 2 to 3 weeks	0.8		
c	50 - 75 individuals/sq m, or little veg flooded 2 to 3 weeks, or veg flooded 1 to 2 weeks	0.5		
d	25 - 50 individuals/sq m, or little veg flooded 1 to 2 weeks, or veg flooded <= 1 week	0.2		
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c	Human activity common and widespread or frequent and limited in extent	0.4		
d	Human activity frequent and widespread	0.1		
F_5) Hydrologic Conditions			a	
a	Present annually, predictable	1.0		
b	Present most years (7 out of 10)	0.7		
c	Present some years (4 out of 10)	0.4		
d	Present few years (1 out of 10)	0.1		
F_6) Management Capabilities			d	
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b	Less than five impoundments or limited water control capability	0.7		
c	less than five impoundments and limited water control capability	0.4		
d	No water control capability	0.1		
	Food		0.30	
	Security		0.18	
	Predictability		0.13	
	Fall HSI		0.31	
	Overall Baseline Annual (Spring and Fall Combined) HSI		0.61	

Shorebird Migration Habitat Model - Spring Migration Variables Enter the corresponding letter to the appropriate condition			WP
			TY:
	VARIABLE		Value
S_{1a}) Water Depths			a
a	water depth range of 18 cm to recently dewatered to upland - full habitat range	1.0	
b	water depth range of 10 cm to recently dewatered	0.9	
c	water depth range of 3 cm to recently dewatered to upland	0.7	
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S_{1b}) Availability			a
a	continually available from April 15 - June 15	1.0	
b	continually available from May 1 - June 1	0.9	
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d	continually available for > a two-week period between April 15 and June 15	0.5	
e	continually available for a one- to two-week period between April 15 and June 15	0.3	
f	very little or no habitat diversity	0.1	
S_2) Aquatic Invertebrates (in accessible habitat)			a
a	> 100 individuals/sq m, or decaying vegetation that has been flooded > 3 weeks	1.0	
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S_3) Vegetative Cover			a
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a	At least five separate impoundments with full water control capability	1.0	
b	Less than five impoundments or limited water control capability	0.7	
c	less than five impoundments and limited water control capability	0.4	
d	No water control capability	0.1	
	Food		0.60
	Security		0.18
	Predictability		0.20
	Spring HSI		0.49
	Shorebird Migration Habitat Model - Summer/Fall Migration Variables		
F_{1a}) Water Depths and Availability			a
a	water depth range of 18 cm to recently dewatered to upland - full habitat range	1.0	
b	water depth range of 10 cm to recently dewatered	0.9	
c	water depth range of 3 cm to recently dewatered to upland	0.7	
d	water depth range of recently dewatered to upland (dry)	0.5	
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a	Present annually, predictable	1.0	
b	Present most years (7 out of 10)	0.7	
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b	Less than five impoundments or limited water control capability	0.7	
c	less than five impoundments and limited water control capability	0.4	
d	No water control capability	0.1	
	Food		0.60
	Security		0.18
	Predictability		0.20
	Fall HSI		0.49
	Overall Baseline Annual (Spring and Fall Combined) HSI		0.98

ENTER PROJECT NAME HERE
1-All FWP
COMMENTS

ATTACHMENT J

From: Steven Southers (Aviation)
To: Watson, Justyss A CIV USARMY CESWD (USA); Harley Puett (Aviation)
Cc: Allen, Daniel L CIV USARMY CESWF (USA); John MacFarlane (john.macfarlane@faa.gov)
Subject: [Non-DoD Source] RE: USACE Mitchell Lake Project Information
Date: Tuesday, October 22, 2019 3:54:35 PM

Justyss:
We have decided to not send you a letter because the project is more than five miles away from Stinson Airport.
Thank you for your assistance.

Steven K. Southers
Environmental Manager
San Antonio International Airport
Desk: (210) 207-3402
Noise Hotline: (210) 207-3471

-----Original Message-----
From: Watson, Justyss A CIV USARMY CESWD (USA) [mailto:Justyss.A.Watson@usace.army.mil]
Sent: Wednesday, October 02, 2019 3:19 PM
To: Harley Puett (Aviation); Steven Southers (Aviation)
Cc: Allen, Daniel L CIV USARMY CESWF (USA)
Subject: [EXTERNAL] USACE Mitchell Lake Project Information

Good Afternoon,

I just wanted to check back in with you two to make sure you didn't need any additional information for your letter? Please let me know if you have any questions or concerns.

Respectfully,

Justyss Watson
Biologist, Compliance Section
Environmental Branch
Regional Planning and Environmental Center U.S. Army Corps of Engineers justyss.a.watson@usace.army.mil
Office: 817-886-1828
Mobile: 817-504-9037

ATTACHMENT K

Monitoring and Adaptive Management Plan

Mitchell Lake, San Antonio, TX

General Investigations Feasibility Study

May 2021

US Army Corps of Engineers®
Fort Worth District

Table of Contents

List of Figures

List of Tables

1 Introduction

This Monitoring and Adaptive Management Plan (MAMP) outlines the feasibility level monitoring and adaptive management plan for the Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study. This plan identifies and describes the monitoring and adaptive management activities proposed for the project and estimates their cost and duration. As more design detail is provided during the Preconstruction, Engineering, and Design (PED) phase of the project, a more detailed MAMP will be developed. Any changes to the approved MAMP will be coordinated with U.S. Army Corps of Engineers Headquarters as required by policy guidance (Section 1161, Water Resources Development Act [WRDA] 2016).

The Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study MAMP will describe and justify whether adaptive management is needed in relation to the alternatives identified in the Feasibility Study. The plan will outline when the monitored environmental conditions (triggers) would require adaptive management measures to ensure the successful establishment of the restoration features of the project.

The primary intent of this MAMP is to develop monitoring and adaptive management actions appropriate for the project's restoration goals and objectives. The presently identified management actions permit estimation of the adaptive management program costs and duration for the Mitchell Lake Aquatic Ecosystem Restoration Project. This plan is based on currently available data and information developed during plan formulation as part of the feasibility study.

1.1 Authority and Purpose

Ecosystem restoration feasibility studies are required to include a plan for monitoring the success of the restoration (Section 1161, WRDA 2016). "Monitoring includes the systematic collection and analysis of data that provides information useful for assessing project performance, determining whether ecological success has been achieved, or whether adaptive management may be needed to attain project benefits."

Section 1161 of WRDA 2016, as amended, directs the Secretary to ensure that, when conducting a feasibility study for a project (or component of a project for ecosystem restoration, the recommended project includes a plan for monitoring the success of the ecosystem restoration. The MAMP plan shall include a description of:

1. Types and number of restoration activities to be implemented with the Recommended Plan
2. Physical actions to be undertaken to achieve project objectives;
3. Desired outcome resulting from the Recommended Plan;
4. Monitoring design and rationale;
5. Decision criteria for ecosystem restoration success, including adaptive management triggers;
6. Estimated cost and duration of the monitoring; and
7. Adaptive management measures for taking corrective actions in cases in which the monitoring demonstrates that restoration measures are not achieving ecological success in accordance with criteria described in the monitoring plan.

In accordance with the Water Resources Development Act of 2016 Section 1161 (CECW-P Memorandum dated October 19, 2017), MAMP are required for both National Ecosystem Restoration (NER) project components and for any Mitigation Plan required for the National Economic Development (NED) component.

This MAMP includes all elements required by the WRDA 2016 implementation guidance for section 1161.

1.2 Project Goals and Objectives

During the initial stages of project development, the Project Delivery Team (PDT) developed restoration goals and objectives to be achieved by the restoration measures. The goal of the Mitchell Lake Aquatic Ecosystem Restoration is to restore structure and function of the aquatic and wetland habitat within the Mitchell Lake study area. The resulting objective focuses on the importance of emergent wetland, mudflat, and riparian habitat in the study area for migratory birds. The ecosystem restoration objective for Mitchell Lake is to increase the areal extent and quality of wetlands, thereby increasing floral and faunal species diversity and richness. Additional information regarding the Recommended Plan for the Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study can be found in the Integrated Feasibility Report and Environmental Assessment (IFR-EA)

The PDT performed thorough plan formulation to identify potential management measures and restoration actions that address the project objective. The PDT subsequently identified a Recommended Plan. The Recommended Plan included the following nonstructural ecosystem restoration measures:

- Restore and improve submergent/emergent wetland habitat by removing low quality and non-native invasive species and replanting the areas with native submergent and emergent wetland and riparian (Mitchell Lake coves only) species.
    - 6.42 acres in the Bird Pond Wetlands
    - 18.37 acres for the Central Wetlands
    - 2.18 acres for Skip's Pond
    - 72.36 acres for the Mitchell Lake coves

1.3 Introduction to Monitoring and Adaptive Management

Monitoring and adaptive management provides a directed iterative approach to achieve restoration project goals and objectives by focusing on strategies promoting flexible decision making that can be adjusted in the face of uncertainties as outcomes from restoration management actions and other events become better understood. Initiating a formal MAMP early in the study process enables the study team to identify and resolve key uncertainties and other potential issues that can positively or negatively influence project outcomes during every stage of the planning and project implementation process. Hence, early implementation of monitoring and adaptive management will result in a project that can better succeed under a wide range of uncertain conditions and can be adjusted as necessary. Furthermore, careful monitoring of project outcomes both advances scientific understanding and helps adjust policies and/or operations as part of an iterative learning process.

Learning from the management experience is not a new idea; but the purposeful and systematic pursuit of knowledge to address identified uncertainties has rarely been practiced. Adaptive management acknowledges the uncertainty about how ecological systems function and how they may respond to management actions. Nevertheless, adaptive management is not a random trial-and-error process; it is not ad-hoc or simply reactionary. An essential element of adaptive management is the development and execution of a monitoring and assessment program to analyze and understand responses of the system to implementation of the project as restoration progresses. The MAMP was developed and will be used to:

- Allow scientists and managers to collaboratively design plans for managing complex and incompletely understood ecological systems.
- Reduce uncertainty over time.

- Implement systematic monitoring of outcomes and impacts.
- Incorporate an iterative approach to decision-making.
- Provide a basis for identifying options for improvements in the design, construction and operation of restoration through adaptive management.
- Ensure interagency collaboration and productive stakeholder participation as they are key elements to success.

1.3.1 Monitoring and Adaptive Management Process

The developed monitoring and adaptive management program and process is complimentary to the USACE Project Life Cycle (planning, design, construction, and operation and maintenance). The process is not elaborate or duplicative and enhances activities that already take place. The basic process was adapted from a technical note published by the Engineering Research and Development Center (ERDC). Elements of the program include an iterative process involving: planning a program or project; designing the project; building the project; operating and maintaining the project; monitoring and assessing project performance; and continuing, adjusting, or terminating a project if the goals and objectives are not being achieved (Figure 1).

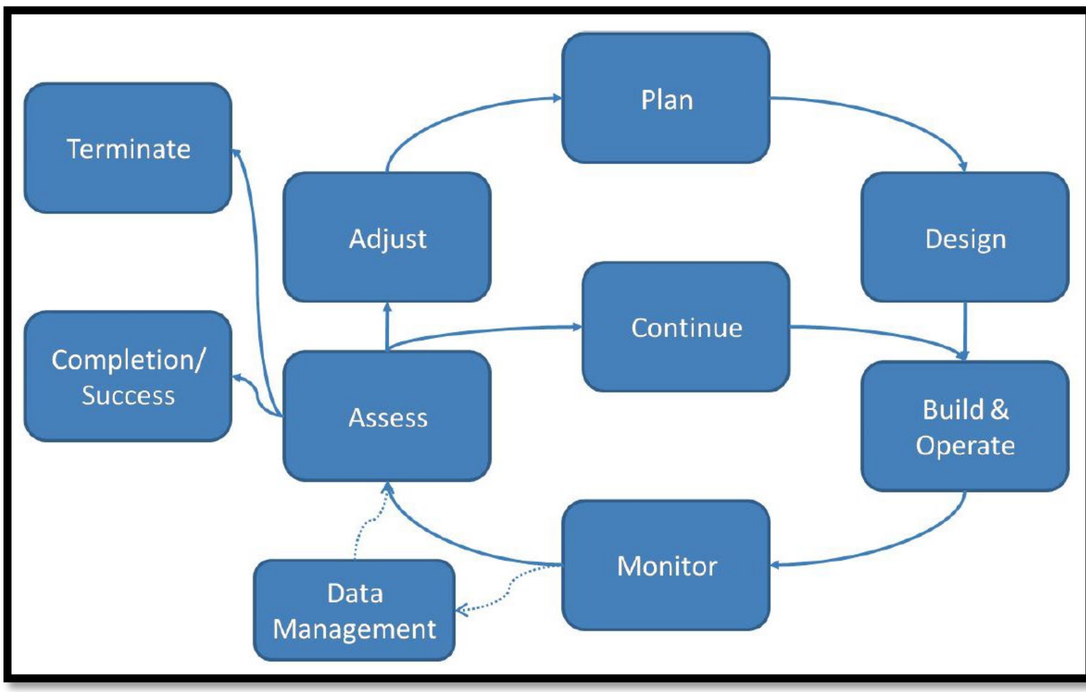

Figure 1. Monitoring and Adaptive Management Process for USACE Civil Works

1.3.2 Adaptive Management Team

As part of the monitoring and adaptive management process, a team is set up to implement the process. The MAMP provides the framework and guidance for a Monitoring and Adaptive Management Team (MAMT) to review and assess monitoring results and consider and recommend adaptive management actions when ecological success is not achieved and decision criteria are triggered. The MAMT members shall work together to make recommendations relevant to implementing the MAMP. The MAMT is composed of USACE staff, the non-Federal sponsor (NFS), contracted personnel (if needed) and interested resource agencies and/or other stakeholders. Although the USACE has coordinated with the entities that will comprise the MAMT in development of the IFR-EA, the MAMT will be officially established during Pre-Construction Engineering and Design (PED).

The MAMT focuses on the ecological function of the habitats through related management actions to maintain and provide functional wetland and riparian habitat within the project area. The MAMT shall review the monitoring results and advise on and recommend actions that are consistent with the project goals and reflect the current and future needs of the habitat and the species they support within the project area. The USACE shall have final determination on all adaptive management actions recommended.

The USACE is responsible for ensuring that monitoring data and assessments are properly used in the adaptive management decision-making process. If the USACE determines that adaptive management actions are needed, it will coordinate with the MAMT on implementation of those actions. The USACE is also responsible for project documentation, reporting, and external communication.

The MAMT shall meet at a minimum of once per year, as scheduled by the USACE during the monitoring period, to review the results of monitoring and assess whether project objectives are being met. If objectives are not being met, the MAMT may recommend that adaptive management actions be taken in response to monitoring results as compared to decision-making triggers.

The MAMT may also consider other related projects in the hydrologic basin in determining the appropriate adaptive management actions, and may consult with other recognized experts or stakeholders as appropriate, to achieve project goals.

Recommendations for adaptive management should be based on:

- Monitoring data from previous years,
- Consideration of current habitat conditions,
- Consideration of current and potential threats to habitat establishment success, and
- Past and predicted response by target species and habitats.

1.3.2.1 __Team Structure__

The MAMT shall include representatives from USACE and the NFS responsible for cost-sharing construction and future operations and maintenance.

The USACE may be represented by the Project Biologist(s), as well as the Project Hydrology and Hydraulics (H&H) representative and the Project Geotechnical representative as needed. Other USACE attendees may include the Project Manager, Project Real Estate Specialists, and/or Operations and Maintenance designees, as needed.

For the feasibility study, NFS is San Antonio Water Systems (SAWS). The NFS would ultimately be responsible for all Operations, Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) activities once the USACE notifies the NFS of project completion. Prior to final project completion, the USACE would transfer responsibility of functional elements of the project to the NFS as they are completed. The NFS may be represented by its designees which may include Project Managers, Planners, Design Engineers, Environmental Specialists, or other designees.

The MAMT should also include representatives from resource agencies who would serve in an advisory capacity, to assist in evaluation of monitoring data and assessment of adaptive management needs. The agencies may include, but is not limited to, and upon their acceptance:

- U.S. Fish and Wildlife Service (USFWS), Austin Ecological Services Office
- Texas Parks and Wildlife Department (TPWD)
- Mitchell Lake Audubon Society

1.4 Sources of Uncertainty and Associated Risks

A fundamental tenet underlying the adaptive management process is achieving desired project outcomes in the face of uncertainties. Scientific uncertainties and technological challenges are inherent with any large-scale restoration project with the principal source of uncertainty typically including:

1. Incomplete description and understanding of relevant ecosystem structure and function,
2. Imprecise relationships between project management actions and corresponding outcomes,
3. Engineering challenges in implementing project alternatives, and
4. Ambiguous management and decision-making processes.

It is important to determine the type of risk each uncertainty comprises and to discern what constitutes sufficient knowledge to proceed considering those risks. There is significant institutional knowledge regarding the construction of the restoration measures; therefore, there is minimal uncertainty from a construction standpoint. Uncertainties relating to measure design and performance are mainly centered on site specific, design-level details (e.g. exact water quantities, invasive species removal needs, construction staging area locations, timing and duration of construction, engineering challenges, etc.), which would be addressed during PED. Identified uncertainties with the Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study Recommended Plan include:

- Natural variability in ecological and physical processes;
- Soil dynamics, including chemical rates;
- Wetland and riparian restoration requirements such as water and nutrient requirements including magnitude and duration of inundation, and type and quantity of nutrients to achieve desired productivity;
- Invasive and nuisance Species; and
- Project feature implementation timing, including schedule and timeline, availability of construction funds.

Issues such as natural variability and soil dynamics are significant scientific uncertainties for this restoration project. These uncertainties were incorporated in the plan formulation process and will be monitored by gathering data on water and soil chemical levels. ERDC will test native species gathered from within the ecoregion with water and soil from Mitchell Lake to determine suitability and success rates before implementing planting measures.

2 Monitoring

An effective monitoring program will be required to determine if the project outcomes are consistent with original project goals and objectives. The power of a monitoring program developed to support adaptive management lies in the establishment of feedback between continued project monitoring and corresponding project management. A carefully designed monitoring program is the central component of the project adaptive management program as it supplies the information to assess whether the project is functioning as planned.

Monitoring must be closely integrated with the adaptive management components because it is the key to the evaluation of adaptive management needs. Objectives must be considered to determine appropriate indicators to monitor. In order to be effective, monitoring must be able to distinguish between ecosystem responses that result from project implement (i.e. management actions) and natural ecosystem variability.

2.1 Monitoring Plan

According to the USACE implementation guidance memo for WRDA Section 1161, "Monitoring includes the systematic collection and analysis of data that provides information necessary to determine if the project is meeting its performance standards, and to determine when ecological success has been achieved or whether adaptive management measures are necessary to ensure that the project will attain project benefits. Development of a monitoring plan will be initiated during the plan formulation process for an ecosystem restoration project, or component of a project, and should focus on key indicators of project performance."

The following discussion outlines a monitoring plan that will support the Mitchell Lake Ecosystem Restoration adaptive management program. The plan identifies performance measures along with desired outcomes and monitoring design in relation to specific objectives. A performance measure includes specific feature(s) to be monitored to determine project performance. Additional monitoring is identified as supporting information needs that will help further understand interrelationships of restoration features and external environmental variability and to corroborate project effects.

Such criteria, or decision-making triggers, are related to each performance measure and desired outcome and identify the need to discuss potential implementation of adaptive management actions with the MAMT. These criteria/triggers are identified in Section 3.3.

Baseline vegetation metrics were compiled during the initial site assessments throughout the study area. Vegetation metrics included, species composition, percent canopy cover for each species, percent overstory canopy cover, and percent wetland vegetation canopy cover. These measurements allow the MAMT to assess the performance standards.

Overall, monitoring results will be used to evaluate the progress of habitat restoration toward meeting project objectives and to inform the need for adaptive management actions to ensure successful restoration is achieved.

2.2 Monitoring Period

Pre-construction/baseline data, during construction, and post-construction monitoring will be utilized to determine restoration success. Baseline monitoring will begin during PED, prior to project construction and continue during construction when possible. Monitoring will continue until the trajectory of ecological change and/or other measures of project success are determined as defined by project-specific objectives. Section 1161 of WRDA 2016 allows ecological success monitoring to be cost-shared for up to ten years post-construction. Once ecological success has been achieved, which may occur in less than ten years post-construction, no further monitoring would be performed. If ecological success cannot be determined within the ten-year post construction period of monitoring, any additional required monitoring would be the responsibility of the NFS.

2.3 Monitoring Elements

Defining and assessing progress towards project objectives are crucial components of the MAMP. The following section outlines the proposed performance measure metrics, desired outcomes and monitoring design needed to measure restoration progress, determine ecological success and support the adaptive management program should changes need to be made to improve project performance. The elements described in this section are based on the available project information and will be updated and refined during PED.

Performance Measure 1: Restore and improve submergent/emergent wetland habitat

> *Desired Outcome:* Success will be measured by an increase of wetland acreage by ~100 acres by year 3.
>
> *Monitoring Design and Rationale:* To determine the increase in acreage, satellite and aerial imagery will be used to identify change pre- and post-construction in year 1, year 2, and year 3. Vegetated habitats should be classified using digital aerial imagery and field observation.

Performance Measure 2: Average cover of 75% of desired vegetation on restoration sites at year 3 compared to pre-construction.

> *Desired Outcome:* One year following completion of final construction activities achieve a minimum average cover of 25%, comprised of native herbaceous species. Three years following construction, achieve a minimum average cover of 75% native wetland and riparian species. Three years following construction, achieve a minimum average cover of 50% herbaceous species.
>
> *Monitoring Design and Rationale:* Vegetation will be sampled annually, at the seven restoration sites. Permanent vegetation monitoring stations will be established for assessing the vegetation community at each site. Sites will be sampled for a two year period pre-construction to assess pre-project conditions and sampled annually post-construction until success is determined.

Performance Measure 3: Establish species diversity.

> *Desired Outcome:* One year following completion of final construction activities achieve a minimum 25% species diversity, comprised of native species. Three years following construction, achieve a minimum of 75% species diversity, comprised of native species.
>
> *Monitoring Design and Rationale:* Vegetation will be sampled annually, at the seven restoration sites. Permanent vegetation monitoring stations will be established for assessing the vegetation community at each site. Sites will be sampled for a two year

period pre-construction to assess pre-project conditions and sampled annually post-construction until success is determined.

<u>Performance Measure 4:</u> Reduce non-native invasive vegetation within restoration sites.

<u>*Desired Outcome:*</u> One year following completion of final construction activities achieve less than 25% average cover of non-native invasive species. Three years following completion of final construction activities achieve average cover of less than 10% non-native species with no area greater than 0.25 acres in size with greater than 25% non-native species

<u>*Monitoring Design and Rationale:*</u> Vegetation will be sampled annually, at the seven restoration sites. Permanent vegetation monitoring stations will be established for assessing the vegetation community at each site. Sites will be sampled for a two year period pre-construction to assess pre-project conditions and sampled annually post-construction until success is determined.

<u>Area Change</u>: To determine changes of areas vegetated with wetland and/or riparian species within the project area, near-vertical color-infrared digital aerial imagery will be acquired during pre-construction and used as a pre-construction standard for future changes in wetland vegetation and size. Three additional satellite and aerial photographic acquisitions will be conducted at year 1, 2, and 3. These data will be collected in conjunction with LiDAR missions and under separate acquisition in non-LiDAR years, if needed. The photography will be geo-referenced, classified, and analyzed using standard operating procedures developed during PED.

<u>Vegetation</u>: Vegetation sampling will occur annually at eight sites within all restoration units (1 site per wetland restoration unit with an additional site occurring within the Downstream Wetlands restoration area) and at 2 reference sites for the duration of the monitoring period. Sampling will occur during spring months, at the peak of the growing season. Permanent 1/10th-acre, field monitoring plots will be located randomly within each wetland restoration plot. The distance between plots will be dependent on the project site area and variability. Monitoring will measure percent cover of native and non-native plant species, structural diversity, and percent cover. Photographs stations are also important for documenting vegetation conditions. All plots and photograph stations will be documented via Global Positioning System (GPS) coordinates to reoccupy in each year of sampling.

General observations, such as fitness and health of plantings, native plant species recruitment, and signs of drought stress should be noted during the surveys. Additionally, potential soil erosion, flood damage, vandalism and intrusion, trampling, and pest problems would be qualitatively identified.

A general inventory of all wildlife species observed and detected using the project area would be documented. Nesting sites, roosting sites, animal burrows, and other signs of wildlife use of the newly created habitat would be recorded. The notes would be important for early identification of species colonization patterns.

2.4 Use of Monitoring Results and Analysis

Results of monitoring will be assessed in comparison to project objectives and decision-making triggers to evaluate whether the project is functioning as planned and whether adaptive management actions are needed to achieve project objectives. The results of the monitoring will be provided to the MAMT who will evaluate and compare data to project objectives and decision making triggers. The MAMT will use the monitoring results to assess habitat responses to management, evaluate overall project performance, and make recommendations for adaptive management actions as appropriate. If monitoring results, as compared to desired outcomes and decision making triggers show that project objectives are not being met, the MAMT will evaluate causes of failure and recommend adaptive management actions to remedy the underlying problems.

As data is gathered through monitoring, more information will also be available to address uncertainties and fill information gap. Uncertainties such as effective operational regimes, restoration design needs, benefits generated by restored features, and accuracy of models can be evaluated to inform adaptive management actions and future restoration needs.

2.5 Costs of Monitoring

Section 1161 of the WRDA 2016 allows monitoring to be cost-shared for up to ten years post-construction. Although, for the purpose of the preliminary MAMP, cost estimating purposes for up to 3 years was assumed for all features (Table 1).

Although the monitoring cost estimates presented in this document display activities during the proposed the first three years of cost-shared monitoring after construction, monitoring may continue beyond the initial ten years, funded by the NFS, if the criteria for ecosystem success have not yet been met.

Table 1. Cost Estimates for monitoring phases provided by USACE's ERDC. All costs assumed to impact a minimum of 15 acres for constructed wetlands and 75 acres for lake/cove wetlands.

	Restoration Site	Year 1 ($)	Year 2 ($)	Year 3 ($)	Total ($)
Monitoring (Monitoring workgroup, drafting detailed monitoring plan, working with PDT on performance measures, vegetation and perimeter assessments)	Constructed Wetlands	0	10,000	12,500	22,500
	Lake/Cove Wetlands	0	37,500	75,000	112,500

3 Adaptive Management

Scientific, technological, socio-economic, engineering, and institutional uncertainties are challenges inherent with any large-scale ecosystem restoration project. A structured monitoring plan will be implemented to provide the feedback necessary to inform decisions about future project adjustments.

Adaptive management is distinguished from more traditional monitoring in part through implementation of an organized, coherent, and documented decision process. For the Mitchell Lake Ecosystem Restoration adaptive management program, the decision process includes

1. Anticipation of the kinds of management decisions that are possible within the original project design;
2. Specification of values of performance measures that will be used as decision-criteria;
3. Establishment of a consensus approach to decision making; and
4. A mechanism to document, report, and archive decisions made during the timeframe of the adaptive management program.

3.1 Rationale for Adaptive Management

The primary incentive for implementing an adaptive management program is to increase the likelihood of achieving desired project outcomes given project uncertainties. All ecosystem restoration projects face uncertainty due to incomplete understanding of relevant ecosystem structure and function, resulting in imprecise relationships between project actions and corresponding outcomes. Given these uncertainties, adaptive management provides an organized and coherent process that suggests management actions in relation to measured project performance compared to desired project outcomes. Adaptive management establishes the critical feedback among project monitoring, and informed project management, and learning through reduced uncertainty.

Many factors such as ecosystem dynamics, engineering applications, institutional requirements, and many other key uncertainties can change and/or evolve over a project's life. The MAMP will be regularly updated to reflect monitoring-acquired and other new information as well as resolution and progress on resolving existing key uncertainties or identification of any new uncertainties that may emerge. Specifically, the MAMP will be revised and updated and project measure specific plans developed during the feasibility level of design phase and further in PED phase as more detailed project designs are developed and uncertainties are better understood. The MAMP would then be used during and after project construction to adjust the project, as necessary to better achieve goals, objectives, and restoration/management outputs/results.

3.2 Assessment

The assessment phase of the adaptive management framework describes the process by which the results of the monitoring efforts will be compared to the project performance measures, which reflect the objectives of the restoration actions.

The results of the monitoring program will be assessed annually through the MAMT. Monitoring results will be compared to the desired project outcomes and decision-making triggers as set forth by the project performance measures. This assessment process will measure the progress of the project in relation to the stated project objectives, evaluate project effectiveness and consider if adaptive management actions are needed. Assessments will also inform the MAMT if other factors are influencing the response that may warrant further research.

USACE will document and report the monitoring results, assessments, and the results of the MAMT deliberations to the managers and decision-makers designated for the Mitchell Lake Ecosystem Restoration. USACE, with assistance from the monitoring team, will also produce annual reports that show progress towards meeting project objectives as characterized by the performance measures. Results of the assessments will be used to evaluate adaptive management needs and inform decision-making.

3.2.1 Database Management

Database management is an important component of the monitoring plan and the overall adaptive management program. Data collected as part of the monitoring and adaptive management plans will be archived as prescribed in the refined monitoring and adaptive management plan developed during PED. The database manager will be responsible for storing final monitoring reports and other study documentation (decisions, agendas, reports) and making them available when requested. Monitoring reports will be searchable by topic and principle author.

Data standards, quality assurance and quality control procedures and metadata standards will also be prescribed in the refined monitoring and adaptive management plan. The database will be designed to store and archive the monitoring and adaptive management data. The format of each data set will vary as appropriate to the type of monitoring. Therefore, data are expected to be archived separately, rather than collated in one master database. Each dataset will include: data and metadata transfer and input policies and standards; data validation procedures; and mechanisms to ensure data security and integrity.

3.3 Decision-Making

Decisions on the implementation of adaptive management actions are informed by the assessment of monitoring results. The information generated by the monitoring plan will be used by USACE and the NFS in consultation with other MAMT members to guide decisions on adaptive management that may be needed to ensure that the ecosystem restoration project achieves success. Final decisions on implementation of adaptive management actions are made by USACE.

If monitoring determines that a management trigger has been “activated” then there are three possible response pathways:

1. Determine that more data is required and continue (or modify) monitoring;
2. Identify and implement a remedial action;
3. Modify project goals and objectives (this option would only be considered as a last resort and upon careful consideration by and consensus of the PDT and MAMT).

3.3.1 Decision Criteria

Decision criteria, also referred to as adaptive management triggers, are used to determine if and when adaptive management opportunities should be implemented. They can be qualitative or quantitative based on the nature of the performance measure and the level of information necessary to make a decision. Desired outcomes can be based on reference sites, predicted values, or comparison to historic conditions. Several potential decision criteria are identified below, based on the project objectives and performance measures. More specific decision criteria, possibly based on other parameters such as hydrology, geomorphology, and vegetation dynamics, may be developed during PED.

If assessments show that any of these triggers are met, USACE would consult with the MAMT to discuss whether an adaptive management action is warranted, and if so, what that action should be. Investigations may be required to determine the cause of failure in order to inform the type of adaptive management actions that should be implemented, if needed. Additionally, prior to enacting any adaptive management measures, USACE would assess whether supplemental environmental analyses are required.

Performance Measure 1: Restore and improve submergent/emergent wetland habitat

> *Desired Outcome:* Success will be measured by an increase of wetland acreage by ~100 acres by year 3
>
> *Monitoring Design and Rationale:* To determine the increase in acreage, satellite and aerial imagery will be used to identify change pre- and post-construction in years 1, 2, and 3. Vegetated habitats should be classified using digital aerial imagery.
>
> *Trigger*: By year 1, the ratio of shrubland/upland habitat cover is greater than emergent/submergent wetland habitat within the restoration site.
>
> *Possible Causes for Not Meeting Desired Outcome*: Immediately post-construction, the target area should be achieved through excavation/grading, low quality vegetation removal, and native species plantings; however, if after 3 years the ratio is not maintained, planting failure and influx of non-native invasive species will be the most likely causes.
>
> *Potential Adaptive Management Measures*: Investigations should be completed to identify why wetland vegetation loss is occurring. To reduce the amount of woody vegetation, areas should be wetted to overwhelm inappropriate vegetation or replanted with native wetland vegetation.

Performance Measure 2: Average cover of 75% of desired vegetation on restoration sites at year 3 compared to pre-construction.

> *Desired Outcome:* One year following completion of final construction activities achieve a minimum average cover of 25%, comprised of native herbaceous species. Three years following construction, achieve a minimum average cover of 75% native wetland and riparian species. Three years following construction, achieve a minimum average cover of 50% herbaceous species.
>
> *Monitoring Design and Rationale:* Vegetation will be sampled annually, at the seven restoration sites. Permanent vegetation monitoring stations will be established for assessing the vegetation community at each site. Sites will be sampled for a two year period pre-construction to assess pre-project conditions and sampled annually post-construction until success is determined.
>
> *Trigger:* The desired minimum average cover of desirable species within each restoration unit is not achieved within the prescribed timeframe.

Possible Causes for Not Meeting Desired Outcome: Wetland vegetation may not achieve the target percent cover or structural conditions due to improper geomorphic or hydrologic conditions (e.g. erosion, nutrient overloading, poor water quality, etc.), or natural events (e.g. loss during storm events or drought, herbivory or trampling).

Potential Adaptive Management Measures: Replanting may be needed if triggers for vegetative cover are not met. Monitoring results should be used to assess the underlying cause of inadequate cover, which may require that additional adaptive management actions be implemented to support successful replanting. For example, water quality and higher average nutrient levels may prevent successful establishment of vegetative communities. Actions would be required to address the factor's influence in the area to improve water quality to promote desirable conditions desirable for native species.

Plant protection may also be required if monitoring indicates that failure is due to herbivory or trampling by wildlife or recreationists. Actions could include installing plant cages or protective fencing.

Performance Measure 3: Establish species diversity.

Desired Outcome: Three years following construction, achieve a minimum of 75% species diversity, comprised of native species.

Monitoring Design and Rationale: Vegetation will be sampled annually, at the seven restoration sites. Permanent vegetation monitoring stations will be established for assessing the vegetation community at each site. Sites will be sampled for prior to construction to assess pre-project conditions and sampled annually post-construction until success is determined.

Trigger: The desired minimum average percentage of species diversity within each wetland restoration unit is not achieved within the prescribed timeframe.

Possible Causes for Not Meeting Desired Outcome: Wetland and riparian vegetation may not achieve the target species diversity due to failure of plantings and invasive species management.

Potential Adaptive Management Measures: Replanting may be needed if triggers for species diversity are not met. Monitoring results should be used to assess the underlying cause of inadequate species diversity, which may require that additional adaptive management actions be implemented to support successful replanting and invasive species management.

Performance Measure 4: Reduce non-native invasive vegetation within restoration sites.

Desired Outcome: One year following completion of final construction activities achieve less than 25% average cover of non-native invasive species. Three years following completion of final construction activities achieve average cover of less than 10% non-native species with no area greater than 0.25 acres in size and greater than 25% non-native species.

Monitoring Design and Rationale: Vegetation will be sampled annually, at the seven restoration sites. Permanent vegetation monitoring stations will be established for assessing the vegetation community at each site. Sites will be sampled prior to construction to assess pre-project conditions and sampled annually post-construction until success is determined.

Trigger: Non-native invasive species percent cover exceeds 10% after 3 years.

Possible Causes for Not Meeting Desired Outcome: Invasive infestation may occur due to introduction of seed sources from outside the restoration unit and desirable growth conditions including lack of native vegetation.

Potential Adaptive Management Measures: Changes in invasive species management may be needed if triggers for invasive species percent cover are met. Monitoring results should be used to determine if existing invasive species control is ineffective or if the project area has been infested with a new invasive plant species. Adaptive management actions could include: modifying the herbicide and/or surfactant type, application method, or application rate; pursuing mechanical control; or introducing biological control agents, if available.

3.4 Reporting

Evaluation of the success of the Mitchell Lake Ecosystem Restoration will be assessed annually at a maximum until all performance standards are met. Site assessments will be conducted annually by the MAMT to determine success of performance standards and an annual report will be submitted to the USFWS, TPWD, and other interested parties by January 30 following each monitoring year.

Permanent locations for photographic documentation will be established to provide a visual record of habitat development over time. The locations of photo points will be identified in the pre-construction monitoring report. Photographs taken at each photo point will be included in monitoring reports.

3.5 Adaptive Management Costs

The MAMP establishes a feedback mechanism whereby monitored conditions will be used to adjust or refine construction or maintenance actions to better achieve project goals and objectives. Monitoring and adaptive management are not be used as a substitute for OMRR&R. Per WRDA 2016, the NFS would be responsible for all OMRR&R. This includes operations and maintenance (O&M) that provides day-to-day activities necessary to properly operate a component of a system and routine maintenance activities to keep the system operating as designed. This also include non-routine or beyond the scope of typical O&M activities of repair or fixing damage caused by an event; rehabilitation or fixing long-term wear and tear; and replacement of components when the useful life is exceeded.

In contrast, periodic monitoring of performance indicators which contain trigger values informs the iterative process of implementing specified adaptive management measures to help achieve ecological success. However, the project area is susceptible to several uncertainties that could significantly impact the ecological success of constructed restoration features.

Costs for the adaptive management program were based on estimated level of effort and potential frequency of need, and include participation in the MAMT and reporting. Only those actions which are most likely to be needed have associated costs. Measures included in the TSP have been successfully implemented with very similar designs within Bexar County;

therefore, the desired outcomes are expected and reasonable based on experience. The likelihood that extreme measures, such as complete replacement of all native vegetation, is very low. Other adaptive management measures that could help achieve ecological success may require significantly more modeling, design, and feasibility analysis than permits with adaptive management.

The current total estimate for implementing the adaptive management program is $187,500 (Table 2).

Table 2. Cost Estimates for PED, Construction, Monitoring, Adaptive Management, and Reporting phases provided by the U.S. Army Corps of Engineers Engineering, Research, and Design Center. All costs assumed to impact a minimum of 15 acres for constructed wetlands and 75 acres for lake/cove wetlands.

	Restoration Site	Year 1 ($)	Year 2 ($)	Year 3 ($)	Total ($)
Adaptive Management (Vegetation, Detailed Adaptive Management Plan and Program Establishment and Management. Contingency for watering & replanting, additional field work, etc.)	Constructed Wetlands	0	10,000	12,500	22,500
	Lake/Cove Wetlands	0	37,500	75,000	112,500
Reporting	Constructed Wetlands & Lake/Cove Wetlands	7,500	20,000	25,000	52,500

4 Project Close-Out

Once ecological success has been documented by the District Engineer in consultation with the Federal and State resource agencies, and a determination has been made by the Division Commander that ecological success has been achieved, no further monitoring or adaptive management will be required and the project can be closed-out. Ecological success will be documented through an evaluation of the predicted outcomes as measured against the actual results. Success would be considered to have been achieved when project objectives have been met or when it is clear they will be met based upon the trend of site conditions and processes.

ATTACHMENT L

February 19, 2020

Ms. Amanda McGuire
Chief, Environmental Branch
Regional Planning and Environment Center
U.S. Army Corps of Engineers
819 Taylor Street
P.O. Box 17300, Room 3A12
Fort Worth, TX 76102-0300

RE: Texas Parks and Wildlife Department Support of Mitchell Lake Aquatic Ecosystem Restoration Project, San Antonio, Bexar County, Texas

Dear Ms. McGuire:

Please accept this letter as Texas Parks and Wildlife Department's (TPWD) support of the proposed Mitchell Lake Aquatic Ecosystem Restoration Project in San Antonio, Bexar County, Texas.

In addition to the "no action" alternative, seventeen build alternatives were developed for the proposed project. These alternatives include enhancing and expanding existing wetlands through native species planting, invasive species management, and incorporating seasonal water pulses. One alternative proposes to create shorebird, waterbird, and waterfowl habitat within Mitchell Lake polders through the use of berms and temporary pumps to provide control over management of water levels within the polders. Another alternative would create new wetland habitat from shrubland downstream of Mitchell Lake. Project developers anticipate that implementation of the proposed project would provide three distinct habitat types (emergent wetlands, submergent/emergent wetlands, mudflats), provide resilient migratory bird habitat, and improve water quality as an ancillary benefit of managing water in the complex of enhanced wetlands.

As proposed, the alternatives developed for the project support many of TPWD's goals outlined in the Texas Conservation Action Plan (TCAP), the state's natural resource conservation guidance document. Goals outlined in the TCAP include conserving and improving habitat for Species of Greatest Conservation Need, removing and controlling invasive species, and providing opportunities for outdoor recreation.

We look forward to continued collaboration on this project and invite the San Antonio Water Systems, the project's non-Federal sponsor, to coordinate with Mr. David Butler, Migratory Game Bird Specialist, to obtain technical guidance pertaining to the management of the wetlands to maximize their use for wildlife. Mr. Butler can be reached by email at david.butler@tpwd.texas.gov at by phone at

(979) 233-9548. For further assistance with this project, please contact Mr. Russell Hooten by email at russell.hooten@tpwd.texas.gov or by phone at (361) 825-3240.

Sincerely,

Clayton Wolf
Wildlife Division Director

CW:RH:dj

cc: Mr. John Davis
Ms. Laura Zebehazy
Mr. Russell Hooten
Mr. David Butler

January 9, 2020

Justyss Watson
Compliance Section, Environmental Branch
Regional Planning and Environment Center
U.S. Army Corps of Engineers
819 Taylor Street
P.O. Box 17300, Room 3A12
Fort Worth, TX 76102-0300

RE: Draft Integrated Feasibility Report and Environmental Assessment for the Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study, San Antonio, Bexar County, Texas

Dear Ms. Watson:

This letter is in response to your request for review of the proposed project referenced above. Texas Parks and Wildlife Department (TPWD) has reviewed the information provided and offers the following comments and recommendations.

Project Description

The U.S. Army Corps of Engineers (USACE) has prepared a draft Integrated Feasibility Report and Environmental Assessment (EA) to identify, evaluate, and disclose all impacts that would potentially result from the implementation of the proposed plans to address ecosystem restoration efforts at Mitchell Lake. Eight alternatives, including the "No Action" alternative, were developed. To varying degrees, the seven "Build" alternatives would achieve benefits to the ecosystem. Benefits would include a quantitative and qualitative increase in fish and wildlife habitat, an increase in species diversity and richness, and controlling invasive, non-native species.

> **Comment:** Based on the description and evaluation of the proposed alternatives in the EA, the Wildlife Habitat Assessment Program anticipates that the proposed project activities would provide long term benefits to fish and wildlife and their habitats within the project area.

General Comments

Several acronyms were used in the EA that were not defined in Section 12. These include PDT, NFS, and P&G.

Throughout Section 4.9.3.## and Section 4.10.6 the tables and figures referenced in the text of the EA are incorrect (*e.g.*, Page 117, Table 20 should be Table 35, Page 146, Figure 4 should be Figure 58).

Recommendation: TPWD recommends inconsistencies in table and figure references be corrected in the Final EA.

I appreciate the opportunity to review and comment on this project. Please contact me at (361) 825-3240 or **russell.hooten@tpwd.texas.gov** if we may be of further assistance.

Sincerely,

Russell Hooten

Russell Hooten
Wildlife Habitat Assessment Program
Wildlife Division

/rh 42874

Audubon | Mitchell Lake Audubon Center

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San Antonio, TX 78221

210.628.1639
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December 5, 2019

Amanda McGuire
Chief, Environmental Branch
Regional Planning and Environmental Center
819 Taylor Street
P.O. Box 17300, Room 3A12
Fort Worth, TX 76102-0300

Ms. McGuire:

The National Audubon Society is a science-based conservation organization dedicated to protecting birds and the places they need, now and in the future. Located in the United States and incorporated in 1905, Audubon is one of the oldest environmental organizations in the world and uses science, education, and grassroots advocacy to advance its conservation mission.

Mitchell Lake is located prominently along the Central Flyway of the Americas. More than 340 migrating bird species are documented at the site, including species federally listed as threatened under the Endangered Species Act. Mitchell Lake provides critical habitat within the San Antonio community and within the Central Flyway. In 1973, the City of San Antonio designated Mitchell Lake as a Refuge for Shore Birds and Waterfowl. Since 2004 the Mitchell Lake Audubon Center, located at Mitchell Lake, has welcomed visitors and invited them to participiple in nature education programs. The Mitchell Lake Audubon Center is dedicated to connecting people to nature through conservation and community education, focused on birds and the habitats they need. A leader in outdoor STEM education, Mitchell Lake Audubon Center educates over 4,000 students each year through their award-winning Nature of Learning school program.

The Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study project is a long-awaited opportunity to redress the balance of the site's history storing treated effluent. The wetlands restoration ties in well with the Mitchell Lake Audubon Center master site plan and conservation planning. The Mitchell Lake Wetland Restoration project will have a positive impact on existing ecological resources; diversifying and expanding wetland habitat for water birds, shorebirds, and waterfowl. According to the recent study from the National Audubon Society, Survival by Degrees: 389 Species on the Brink, 78% of waterbird species are increasingly vulnerable as the climate continues to change. By increasing the habitat birds need, it greatly contributes to our mission to protect birds and the places they need. Twenty-two of the sixty-three Audubon priority bird species are documented at the Mitchell Lake, with an additional three species documented in the surrounding areas. As needed development continues on the south side, this added habitat is essential as natural available habitat slowly disappears. To the benefit of the surrounding area, this project will mitigate flooding due to increased development and intense weather events.

This project aligns with the San Antonio Climate Action and Adaptation Plan by preserving natural space and planting native wetland plants, which will contribute to the offset of greenhouse gases. Grassland restoration is already taking place at the site, with a controlled burn on December 11, 2019 as the first step. Along with localized conservation priorities, the Audubon strategic plan outlines five major priorities: Water, Bird-Friendly Communities, Working Lands, Coasts, and Climate. Mitchell Lake Audubon Center would be a lead center in our water initiatives with this project. It is located in strategic stopover site along the central flyway, the main path 98% of Neotropical migratory bird species use to migrate from North to South, and back.

There are numerous benefits to adjacent areas and regional projects including, but not limited to:

- Increased water quality at the confluence of the Medina and San Antonio Rivers, where the water from the wetlands will discharge.
- The Howard Peak Greenway System benefits by adding additional wildlife viewing between the Mitchell Lake trailhead and Pleasanton Road trailhead.
- The wetlands are adjacent to a federal Qualified Opportunity Zone (Far South), and will add to the increasing economic impact of ecotourism on the south side of San Antonio, a priority of the South San Antonio Chamber of Commerce.

In conclusion, Mitchell Lake Audubon Center supports the Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study.

Sincerely,

Sara Beesley
Center Director, Mitchell Lake Audubon Center

United States Department of the Interior

FISH AND WILDLIFE SERVICE
10711 Burnet Road, Suite 200
Austin, Texas 78758
512 490-0057

JAN - 3 2020

Arnold (Rob) Newman
Director, Regional Planning and Environmental Center
U.S. Army Corps of Engineers
Room 3A12
819 Taylor Street
Fort Worth, Texas 76102-0300

Dear Director Newman:

This letter transmits the U.S. Fish and Wildlife Service's (Service) final report on the U.S. Army Corps of Engineers' (USACE) Integrated Feasibility Report and Environmental Impact Statement for the Mitchell Lake Ecosystem Restoration in Bexar County, Texas, in accordance Section 2(b) of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). Please see the attached Coordination Act Report.

The Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study is a single-purpose, ecosystem restoration, general investigation feasibility study. The study officially started with the signing of the Feasibility Cost Share Agreement between USACE and the San Antonio Water System (SAWS) on September 5, 2018.

Background

Mitchell Lake is located in southern Bexar County within the City of San Antonio's city limits. Originally called Lake of the Ducks, the area was comprised of a complex of wetlands dominated by a diversity emergent and aquatic vegetation. A dam below the wetlands was constructed in 1901 which resulted in the formation of Mitchell Lake. Historically, the City of San Antonio utilized Mitchell Lake for the disposal of raw sewage, sludge, waste activated sludge, and treated wastewater effluent from the Rilling Road Wastewater Treatment Plant. The northern portion of Mitchell Lake contained a significant amount of sludge, and was subsequently diked and isolated in the early 1970s. Despite these efforts to contain the waste sludge, it eventually began to overflow, requiring the creation of five additional basins. In 1987, sludge disposal in these areas ceased after the Rilling Road Wastewater Treatment Plant was decommissioned. As a result of decades of wastewater discharge and sewage disposal into the lake, the habitat surrounding Mitchell Lake has experienced severe degradation.

Currently, Mitchell Lake is approximately 650 acres of highly eutrophic open water and surrounded by 6,718 acres of degraded wetland and riparian habitat. The Leon Creek Water Recycling Center, southwest of Mitchell Lake, supplements flows into the waterbody; however, due to the degraded water quality no releases occur downstream of the dam with the exception of the flows resulting from large storm event runoff.

Mitchell Lake and surrounding uplands and grasslands are owned by SAWS. Currently, the Mitchell Lake Audubon Society leases these areas for recreation and educational purposes. As the non-Federal sponsor, SAWS requested USACE evaluate Mitchell Lake to assess the feasibility of restoring Mitchell Lake and surrounding habitat. The Service assisted USACE in assessing this project by attending team meetings, conducting site visits, and reviewing baseline habitat assessments.

Summary and Recommendations

Over a century of habitat modifications to Mitchell Lake have caused significant degradation to wetland ecosystem functions, resulting in hypereutrophic waters, reduced habitat quality and quantity, and reductions in wildlife diversity and abundance. Specific planning objectives include (1) maximize and improve fish and wildlife habitat, (2) greater floral and faunal species diversity and richness, and (3) manage and remove invasive species.

After performing analysis on an array of plans, the team recommended the restoration and expansion of a northern section of existing wetland on Mitchell Lake lacking floral diversity known as Bird Pond Wetland. The central wetlands of Mitchell Lake are connected to Bird Pond by a swale of wetlands with intermittent sections of distinct channels. The restoration measures would improve the plant diversity and expand suitable wetland and riparian habitat.

The Service supports the proposed action for the Mitchell Lake Ecosystem Restoration. The proposed ecosystem restoration measures would restore, to the extent practicable, the aquatic, riparian, and wetland functions of the Mitchell Lake ecosystem. Mitchell Lake is located on the Central Flyway bird migration route and is used as a stop-over sight for migratory birds. The proposed action would provide benefits to a resource of national and international significance as functional wetlands and riparian corridors are critical for migratory birds, especially in arid and semiarid climates such as San Antonio, in central Texas.

The Service has determined that there are no federally listed species within the current project area; therefore no adverse affects to listed species are expected to occur with implementation of the proposed action. The Service appreciates the opportunity to assist in the planning of this project. If you have any questions or comments please contact Ashley Jackson at 512-490-0057 (ext. 234).

Sincerely,

Adam Zerrenner
Field Supervisor

TEXAS HISTORICAL COMMISSION
real places telling real stories

received
19 August 2019
amL

August 14, 2019

Angela M. Lane
Acting Chief, Environmental Compliance Branch
Regional Planning and Environmental Center
U.S. Army Corps of Engineers Fort Worth District
P.O. Box 17300
Fort Worth, Texas 76102-0300

Re: Agency comment on *Mitchell Lake Aquatic Ecosystem Restoration Study, Bexar County, Texas*

Dear Ms. Lane,

Thank you for submitting the referenced document. This letter serves as comment on the alternatives associated with the proposed three-year study of the historical tule wetland complex at Mitchell Lake from the State Historic Preservation Officer, the Executive Director of the Texas Historical Commission (THC).

The review staff, led by Emily Dylla, has examined the submitted alternatives. We recommend choosing an alternative containing minimal acreage. Most of the area surrounding Mitchell Lake has not yet undergone archeological investigation, and the THC will require an archeological survey be conducted for this project.

Thank you for your efforts to preserve the irreplaceable heritage of Texas. **If you have questions concerning our recommendations or if we can be of further assistance, please contact Emily Dylla at (512) 463-5915 or** emily.dylla@thc.texas.gov.

Sincerely,

William A. Martin

for
Mark Wolfe, State Historic Preservation Officer

MW/ed

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, FORT WORTH DISTRICT
P.O. BOX 17300
FORT WORTH, TX 76102-0300

January 17, 2019

Adam Zerrenner
Field Supervisor
U.S. Fish and Wildlife Service
10711 Burnet Rd., Suite 200
Austin, Texas 78758

Dear Mr. Zerrenner:

The Fort Worth District, U.S. Army Corps of Engineers, has initiated the Mitchell Lake Aquatic Ecosystem Restoration (ER) Feasibility Study in partnership with the non-Federal sponsor, San Antonio Water System. The ER study will develop alternatives to restore a novel ecosystem that provides the structure and function of the historical tule wetland complex. The initial goal is to increase areal extent and quality of wetlands, thereby increasing floral and faunal species diversity and richness.

Mitchell Lake is north of the confluence of the Medina River and Leon Creek, tributaries of the San Antonio River (see enclosure). Historically, the area was described as a large tule wetland. In 1901, a dam was constructed creating the now 600 acre, three mile long Mitchell Lake. The site is a critical migratory bird stopover location due to the aquatic and wetland habitats of the area.

Extensive use of Mitchell Lake as a 20th century wastewater treatment facility, beginning with the construction of the dam in 1901, has created conditions that no longer support the diversity of aquatic species and wildlife. The habitat degradation from the wastewater treatment function is still evident, although the lake is no longer used for that purpose. The waters of Mitchell Lake are highly eutrophic causing unstable oxygen and pH levels. Therefore the current conditions no longer support the biodiversity of the historic wetland vegetation community or other aquatic life.

Despite degraded conditions and ecological losses, ecosystem restoration opportunity exists as the area supports over 338 migratory bird species. Thirty of those species are on the Audubon Watch List and 129 species are considered to be directly threatened by habitat loss and climate change.

Pursuant to Section 102 of the National Environmental Policy Act (NEPA) as implemented by the regulations promulgated by the Council on Environmental Quality (40 Code of Federal Regulations Parts 1500-1508 and USACE Engineering Regulation 200-2-2), an Environmental Assessment will be prepared to describe environmental restoration alternatives and the affected environment, as well as analyze the potential direct, indirect, and cumulative environmental effects.

In accordance with Section 1005 of the Water Resources Reform and Development Act of 2014 and other applicable laws and regulations, the USACE held a Resource Agency Kickoff meeting at SAWS headquarters on 7 November 2018 to introduce the Mitchell Lake ER Feasibility Study along with the general study processes and schedule. Our office would like to solicit any input you may have with respect to the Mitchell Lake area in accordance with the Fish and Wildlife Coordination Act and other applicable laws and regulations to assist us as we progress through the NEPA process. We would also like to invite you to serve as a cooperating agency for this project. It would be most helpful if your participation was confirmed by 16 April 2019, however, we will accept new information throughout the process. Please contact Justyss Watson, Biologist, Environmental Compliance Branch, Regional Planning and Environmental Center, by mail at U.S. Army Corps of Engineers, 819 Taylor Street, P.O. Box 17300, Room 3A12, Fort Worth, TX 76102-0300, by telephone at (817) 886-1828, or by email at Justyss.A.Watson@usace.army.mil with comments, questions, or the need for further information.

Sincerely,

Amanda M. McGuire

Amanda M. McGuire
Acting Chief, Environmental Branch
Regional Planning and Environmental Center

Enclosure

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, FORT WORTH DISTRICT
P.O. BOX 17300
FORT WORTH, TX 76102-0300

January 17, 2019

Laura Zebehazy
Program Leader
Texas Parks and Wildlife Department
Wildlife Division
Wildlife Habitat Assessment Program
4200 Smith School Road
Austin, TX 78744

Dear Ms. Zebehazy:

The Fort Worth District, U.S. Army Corps of Engineers, has initiated the Mitchell Lake Aquatic Ecosystem Restoration (ER) Feasibility Study in partnership with the non-Federal sponsor, San Antonio Water System. The ER study will develop alternatives to restore a novel ecosystem that provides the structure and function of the historical tule wetland complex. The initial goal is to increase areal extent and quality of wetlands, thereby increasing floral and faunal species diversity and richness.

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Sincerely,

Amanda M. McGuire

Amanda M. McGuire
Acting Chief, Environmental Branch
Regional Planning and Environmental Center

Enclosure

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, FORT WORTH DISTRICT
P.O. BOX 17300
FORT WORTH, TX 76102-0300

January 17, 2019

Cheryl Seager
Director
Compliance Assurance and Enforcement Division
U.S. EPA Region 6
Fountain Place 12th Floor, Suite 1200
1445 Ross Avenue
Dallas, Texas 75202-2733

Dear Ms. Seager:

The Fort Worth District, U.S. Army Corps of Engineers, has initiated the Mitchell Lake Aquatic Ecosystem Restoration (ER) Feasibility Study in partnership with the non-Federal sponsor, San Antonio Water System (SAWS). The ER study will develop alternatives to restore a novel ecosystem that provides the structure and function of the historical tule wetland complex. The initial goal is to increase areal extent and quality of wetlands, thereby increasing floral and faunal species diversity and richness.

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Sincerely,

Amanda M. McGuire

Amanda M. McGuire
Acting Chief, Environmental Branch
Regional Planning and Environmental Center

Enclosure

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, FORT WORTH DISTRICT
P.O. BOX 17300
FORT WORTH, TX 76102-0300

January 17, 2019

Dan Keesee
State Wetlands Specialist
Natural Resources Conservation Service
101 South Main Street
Temple, Texas 76501

Dear Mr. Keesee:

The Fort Worth District, U.S. Army Corps of Engineers, has initiated the Mitchell Lake Aquatic Ecosystem Restoration (ER) Feasibility Study in partnership with the non-Federal sponsor, San Antonio Water System (SAWS). The ER study will develop alternatives to restore a novel ecosystem that provides the structure and function of the historical tule wetland complex. The initial goal is to increase areal extent and quality of wetlands, thereby increasing floral and faunal species diversity and richness.

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Sincerely,

Amanda M. McGuire

Amanda M. McGuire
Acting Chief, Environmental Branch
Regional Planning and Environmental Center

Enclosure

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, FORT WORTH DISTRICT
P.O. BOX 17300
FORT WORTH, TX 76102-0300

January 17, 2019

John MacFarlane
Department of Transportation
Federal Aviation Administration
10101 Hillwood Parkway
Fort Worth, Texas 76177

Dear Mr. MacFarlane:

The Fort Worth District, U.S. Army Corps of Engineers, has initiated the Mitchell Lake Aquatic Ecosystem Restoration (ER) Feasibility Study in partnership with the non-Federal sponsor, San Antonio Water System (SAWS). The ER study will develop alternatives to restore a novel ecosystem that provides the structure and function of the historical tule wetland complex. The initial goal is to increase areal extent and quality of wetlands, thereby increasing floral and faunal species diversity and richness.

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Sincerely,

Amanda M. McGuire

Amanda M. McGuire
Acting Chief, Environmental Branch
Regional Planning and Environmental Center

Enclosure

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, FORT WORTH DISTRICT
P.O. BOX 17300
FORT WORTH, TX 76102-0300

January 17, 2019

Peter Schaefer, MC 150
TCEQ
P.O. Box 13087
Austin, Texas 78711-3087

Dear Mr. Schaefer,

The Fort Worth District, U.S. Army Corps of Engineers, has initiated the Mitchell Lake Aquatic Ecosystem Restoration (ER) Feasibility Study in partnership with the non-Federal sponsor, San Antonio Water System (SAWS). The ER study will develop alternatives to restore a novel ecosystem that provides the structure and function of the historical tule wetland complex. The initial goal is to increase areal extent and quality of wetlands, thereby increasing floral and faunal species diversity and richness.

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Sincerely,

Amanda M. McGuire

Amanda M. McGuire
Acting Chief, Environmental Branch
Regional Planning and Environmental Center

Enclosure

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, FORT WORTH DISTRICT
P.O. BOX 17300
FORT WORTH, TX 76102-0300

January 17, 2019

Public Notice

Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study Initiation

The Fort Worth District, U.S. Army Corps of Engineers, has initiated the Mitchell Lake Aquatic Ecosystem Restoration (ER) Feasibility Study in partnership with the non-Federal sponsor, San Antonio Water System. The ER study will develop alternatives to restore a novel ecosystem that provides the structure and function of the historical tule wetland complex. The initial goal is to increase areal extent and quality of wetlands, thereby increasing floral and faunal species diversity and richness.

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Our office would like to solicit any input you may have with respect to the Mitchell Lake area to assist us as we progress through the NEPA process. We look forward to receiving your comments. Please contact Justyss Watson, Biologist, Environmental Compliance Branch, Regional Planning and Environmental Center, by mail at U.S. Army Corps of Engineers, 819 Taylor Street, P.O. Box 17300, Room 3A12, Fort Worth, TX 76102-0300, by email at Justyss.A.Watson@usace.army.mil, or by telephone at (817) 886-1828 with comments, questions, or the need for further information.

Sincerely,

Amanda M. McGuire

Amanda M. McGuire
Acting Chief, Environmental Branch
Regional Planning and Environmental Center

Enclosure

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, FORT WORTH DISTRICT
P.O. BOX 17300
FORT WORTH, TX 76102-0300

January 17, 2019

Representative letter for National Environmental Policy Act and the National Historic Preservation Act.

Carolyn M. White, MSW, LICSW
Regulatory Affairs Division Director and
Acting Tribal Historic Preservation Officer
Poarch Band of Creek Indians
5811 Jack Springs Road, Building 500
Atmore, Alabama 36502

Dear Ms. White:

The Fort Worth District, U.S. Army Corps of Engineers, has initiated the Mitchell Lake Aquatic Ecosystem Restoration (ER) Feasibility Study in partnership with the non-Federal sponsor, San Antonio Water System. The ER study will develop alternatives to restore a novel ecosystem that provides the structure and function of the historical tule wetland complex. The initial goal is to increase areal extent and quality of wetlands, thereby increasing floral and faunal species diversity and richness.

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Pursuant to Section 102 of the National Environmental Policy Act (NEPA) and Section 106 of the National Historic Preservation Act (NHPA), an Environmental Assessment will be prepared to describe risk reduction alternatives and the affected environment as well as analyze potential impacts to historic properties.

Our office would like to solicit any input you may have with respect to the Mitchell Lake Feasibility Study area in accordance with the NHPA and other applicable laws and regulations to assist us in the identification of historic properties. We look forward to receiving your comments. Please contact Seth Sampson, Archaeologist, Regional Planning and Environmental Center, by mail at U.S. Army Corps of Engineers, P.O. Box 867, Room 7500, Little Rock, AR 72203, by telephone at (501) 340-1049, or by email at Seth.Sampson@usace.army.mil with comments, questions, or the need for further information.

Sincerely,

Amanda M. McGuire

Amanda M. McGuire
Acting Chief, Environmental Branch
Regional Planning and Environmental Center

Enclosure

Representative letter and enclosure sent to multiple recipients in regards to the National Environmental Policy Act and the National Historic Preservation Act.

Casey Hanson
Terrestrial Archeologist
Texas Historical Commission
Archeology Division
P.O. Box 12276
Austin, Texas 78722-2276

Dr. Linda Langley
Tribal Historic Preservation Officer
Coushatta Tribe of Louisiana
P.O. Box 10
Elton, Louisana 70532

Kellie Lewis
Tribal Historic Preservation Officer
Kiowa Indian Tribe of Oklahoma
P.O. Box 369
Carnegie, Oklahoma 73015

Devin Oldman
Tribal Historic Preservation Officer
Northern Arapaho Tribe
P.O. Box 67
St. Stevens, Wyoming 82524

Lauren Brown
NAGPRA Coordinator, Consultant & Cultural Clerk
Tonkawa Tribe of Oklahoma
1 Rush Buffalo Road
Tonkawa, Oklahoma 74653

Derek Hill
Cultural Preservation Department
Caddo Nation of Oklahoma
P.O. Box 487
Binger, Oklahoma 73009

Pam Wesley
Administrative Assistant
Kickapoo Tribe of Oklahoma
P.O. Box 70
McLoud, Oklahoma 74851

Theodore Isham
Historic Preservation Officer
Seminole Nation of Oklahoma
P.O. Box 1498
Wewoka, Oklahoma 74884

Earl J. Barbry, Jr.
Tribal Historic Preservation Officer
Tunica-Biloxi Indian Tribe of Louisiana
P.O. Box 1589
Marksville, Louisiana 71351

Kim Penrod
Director, Cultural Resources/106
Delaware Nation
Archives, Library and Museum
31064 State Highway 281
P.O. Box 825
Anadarko, Oklahoma 73005

Janice Lowe
Cultural Preservation Assistant
Alabama-Quassarte Tribal Town
Cultural Preservation Department
P.O. Box 187
Wetumka, Oklahoma 74883

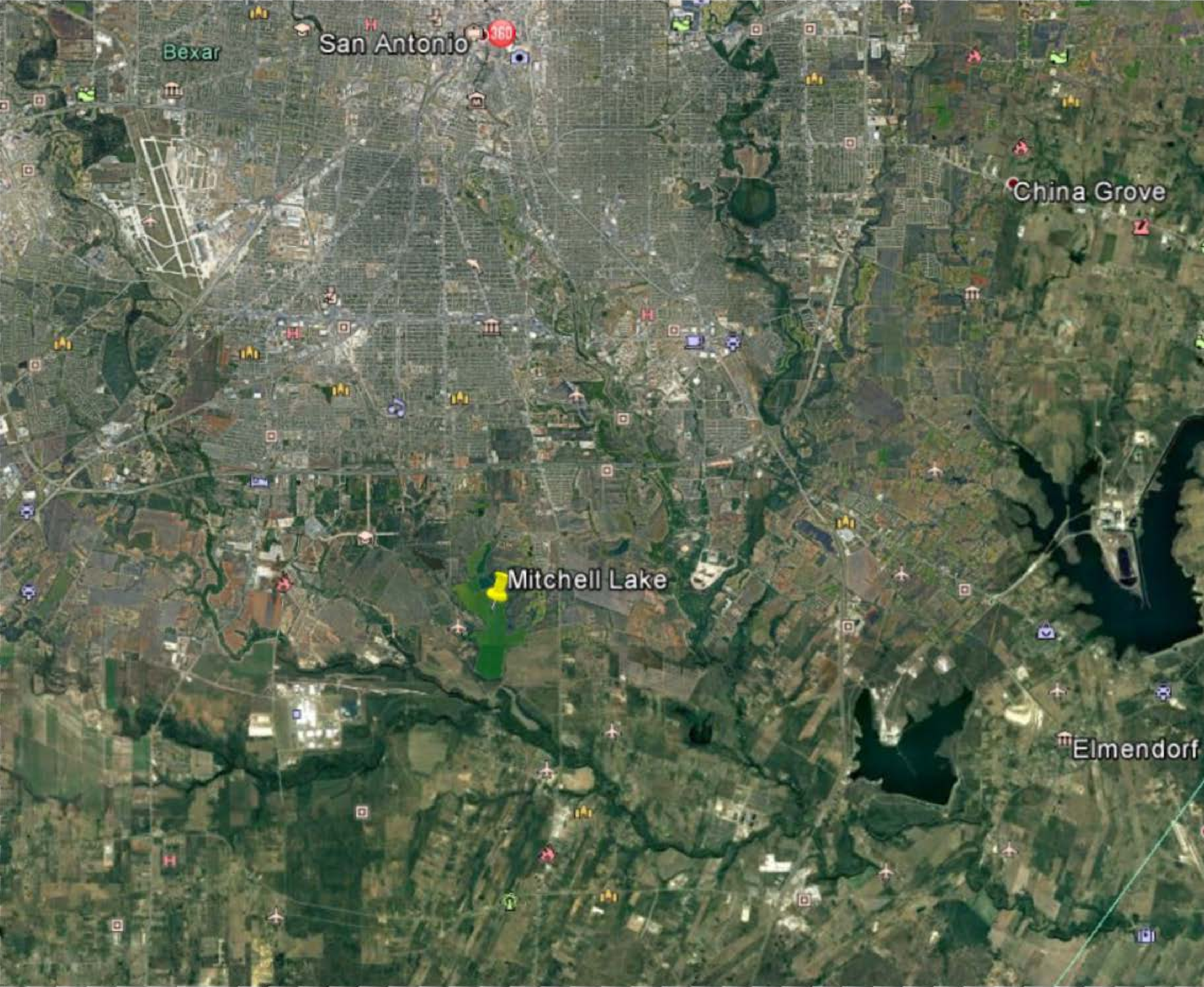
Bryant Celestine
Tribal Historic Preservation Officer
Alabama-Coushatta Tribe of Texas
571 State Park Road 56
Livingston, Texas 77351

Carolyn M. White, MSW, LICSW
Regulatory Affairs Division Director and
Acting Tribal Historic Preservation Officer
Poarch Band of Creek Indians
5811 Jack Springs Road, Building 500
Atmore, Alabama 36502

Martina Callahan
Tribal Historic Preservation Officer
Comanche Nation
P.O. Box 908
Lawton, Oklahoma 73502

Holly Houghten
Tribal Historic Preservation Officer
Mescalero Apache Tribe
P.O. Box 227
Mescalero, New Mexico 88340

Sheila Bird
Tribal Historic Preservation Officer
United Keetoowah Band of Cherokee Indians
P.O. Box 746
Tahlequah, Oklahoma 74465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Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study Public Meeting

FORT WORTH DISTRICT

Published March 8, 2019

PRINT | E-MAIL

FORT WORTH, Texas --*FORT WORTH*, Texas – The Fort Worth District, U.S. Army Corps of Engineer, hereby informs the public of the public scoping meeting to be held for the Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study, San Antonio, Texas. The public meeting will be conducted in an open house format.

The ER feasibility study will develop and analyze ecosystem restoration alternatives, including the No Action Alternative, to restore degraded ecological functions and wetland habitats at Mitchell Lake to increase habitat quality for migratory birds and other wildlife species.

A public meeting will be held at 6 p.m. on March 13, 2019 at the Mitchell Lake Audubon Center, 10750 Pleasanton Road, San Antonio, Texas 78221. General information about the ER feasibility study and its process will be available for review. There will be an opportunity to view maps, ask questions, and provide written comments about the project. USACE staff will be on site to answer any questions and/or address concerns about the project.

A 30-day public comment period begins March 13 and ends April 11, 2019. Comments may be submitted at the public meeting, mailed to Justyss Watson, Biologist, Environmental Branch, Regional Planning and Environmental Center, U.S. Army Corps of Engineers, 819 Taylor Street, P.O. Box 17300, Room 3A12, Fort Worth, TX 76102-0300, or emailed to MitchellLakeER@usace.army .mil.

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About the Fort Worth District: The Fort Worth District, U.S. Army Corps of Engineers was established in 1950. The District is responsible for water resources development in two-thirds of Texas, and design and construction at military installations in Texas and parts of Louisiana and New Mexico. Visit the Fort Worth District Web site at: www.swf.usace.army.mil and SWF Facebook at: https://www.facebook.com/usacefortworth/.

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, FORT WORTH DISTRICT
P.O. BOX 17300
FORT WORTH, TX 76102-0300

December 9, 2019

NOTICE OF AVAILABILITY

DRAFT INTEGRATED FEASIBILITY REPORT AND ENVIRONMENTAL ASSESSMENT FOR THE MITCHELL LAKE AQUATIC ECOSYSTEM RESTORATION FEASIBILITY STUDY SAN ANTONIO, BEXAR COUNTY, TEXAS

The public is hereby notified of the availability of the Draft Integrated Feasibility Report and Environmental Assessment (EA) and Draft Finding of No Significant Impact (FONSI) for the Mitchell Lake Aquatic Ecosystem Restoration (ER) Feasibility Study in San Antonio, Texas. The U.S. Army Corps of Engineers, Fort Worth District prepared the Draft Integrated Feasibility Report and EA to identify, evaluate, and disclose all impacts that would result from the implementation of the proposed plans to address ecosystem restoration.

The ER feasibility study has developed and analyzed ecosystem restoration alternatives, including the "No Action" alternative, to restore degraded ecological functions and wetland habitats at Mitchell Lake to increase habitat quality for migratory birds, shorebirds, and other wildlife species. Alternatives evaluated in the feasibility study include native species plantings, invasive species management, wetland enhancement and creation, and mud flat habitat creation. The Draft Integrated Feasibility Report and EA, Draft FONSI, and comment form will be posted at the link below starting Monday, December 9, 2019.

https://www.swf.usace.army.mil/Missions/Water-Sustainment/Mitchell-Lake/

A printed copy of the Draft Integrated Feasibility Report and EA and Draft FONSI will be available for review at the Mitchell Lake Audubon Center, 10750 Pleasanton Road, San Antonio, Texas 78221.

A 30-day public comment period begins on Monday, December 9, 2019 and ends Thursday, January 9, 2020. Please address any comments by mail to Ms. Justyss Watson, Compliance Section, Environmental Branch, Regional Planning and Environmental Center, U.S. Army Corps of Engineers, 819 Taylor Street, P.O. Box 17300, Room 3A12, Fort Worth, Texas 76102-0300, or by email at M2MitchellLakeER@usace.army.mil.

Sincerely,

Amanda McGuire

Amanda M. McGuire
Chief, Environmental Branch
Regional Planning and Environmental Center

Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study

The U.S. Army Corps of Engineers, Fort Worth District has conducted an environmental analysis in accordance with the National Environmental Policy Act of 1969, as amended. The Draft Integrated Feasibility Report and Environmental Assessment (IFR/EA) dated 9 December 2019, for the Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study addresses aquatic ecosystem restoration opportunities and feasibility in the San Antonio, Bexar County, Texas area.

Mitchell Lake - Comment Form

Mitchell Lake - Integrated Feasibility Report and Environmental Assessment

- Appendix A - Hydrology and Hydraulics
- Appendix B - Cost Effectiveness / Incremental Cost Analysis
- Appendix C - Environmental Resources
- Appendix D - Cultural
- Appendix E - Hazardous, Toxic and Radioactive Waste Program
- Appendix F - Real Estate
- Appendix G - Civil Engineering
- Appendix H - Cost Estimate and Cost Analysis
- Appendix I - Geotechnical Engineering

Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study EA and Draft FONSI announced

SWF USACE

Published Dec. 10, 2019 / **Updated: Dec. 10, 2019**

PRINT | E-MAIL

San Antonio, TX --*FORT WORTH*, Texas – U.S. Army Corps of Engineers officials from the Fort Worth District announced earlier this week the availability of the Draft Integrated Feasibility Report and Environmental Assessment and Draft Finding of No Significant Impact for the Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study in San Antonio, Texas.

The Fort Worth District prepared the Draft Integrated Feasibility Report and EA to identify, evaluate, and disclose all impacts that would result from the implementation of the proposed plans to address ecosystem restoration.

The ER feasibility study has developed and analyzed ecosystem restoration alternatives, including the "No Action" alternative, to restore degraded ecological functions and wetland habitats at Mitchell Lake to increase habitat quality for migratory birds, shorebirds, and other wildlife species. Alternatives evaluated in the feasibility study include native species plantings, invasive species management, wetland enhancement and creation, and mud flat habitat creation. The Draft Integrated Feasibility Report and EA, Draft FONSI and comment form are available at https://www.swf.usace.army.mil/Missions/Water-Sustainment/Mitchell-Lake/.

A printed copy of the Draft Integrated Feasibility Report and EA and Draft FONSI will be available for review at the Mitchell Lake Audubon Center, 10750 Pleasanton Road, San Antonio, Texas 78221.

A 30-day public comment period began December 9 and ends January 9, 2020. Please address any comments by mail to Ms. Justyss Watson, Compliance Section, Environmental Branch, Regional Planning and Environmental Center, U.S. Army Corps of Engineers, 819 Taylor Street, P.O. Box 17300, Room 3A12, Fort Worth, Texas 76102-0300 or by email at M2MitchellLakeER@usace.army.mil.

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Contact
Clay Church