Appendix C – Environmental Resources

Mitchell Lake, San Antonio, TX

General Investigations Feasibility Study
Integrated Draft Feasibility Report and Environmental Assessment

December 2019

US Army Corps of Engineers®
Fort Worth District

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1 Introduction

This appendix documents the existing conditions and potential environmental impacts associated with the identified ecosystem restoration plan for the Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study. The appendix documents an assessment of the study area; the formulation of restoration plans; the quantification of existing, future without the project, and future with project habitat quality for each of the plans; and the justification for selecting the Tentatively Selected Plan (TSP).

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. 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, 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 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, a goal they have expressed interest in implementing.

The environmental appendix has been prepared to supplement the Integrated Feasibility Report-Environmental Assessment (EA) pursuant to Section 102 of the National Environmental Policy Act (NEPA) of 1969 as implemented by the regulations promulgated by the Council on Environmental Quality (CEQ) 40 Code for Federal Regulation (CFR) 1500-1508 and Engineering Regulation (ER) 200-2-2. The objectives of NEPA are to ensure consideration of the environmental aspects of the Proposed Action in Federal decision-making processes and to disclose environmental information to the public and collect their input before decisions are made and actions are taken. The Integrated Feasibility Report-Environmental Assessment provides sufficient evidence for determining whether to prepare an Environmental Impact Statement (EIS) or Finding of No Significant Impact (FONSI). This report evaluates the potential environmental impacts associated with eight Plans, including the No Action Plan. The scope of the plans analyzed are limited to the boundaries of the Mitchell Lake study area.

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.

1.1 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 the 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 78221 (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.

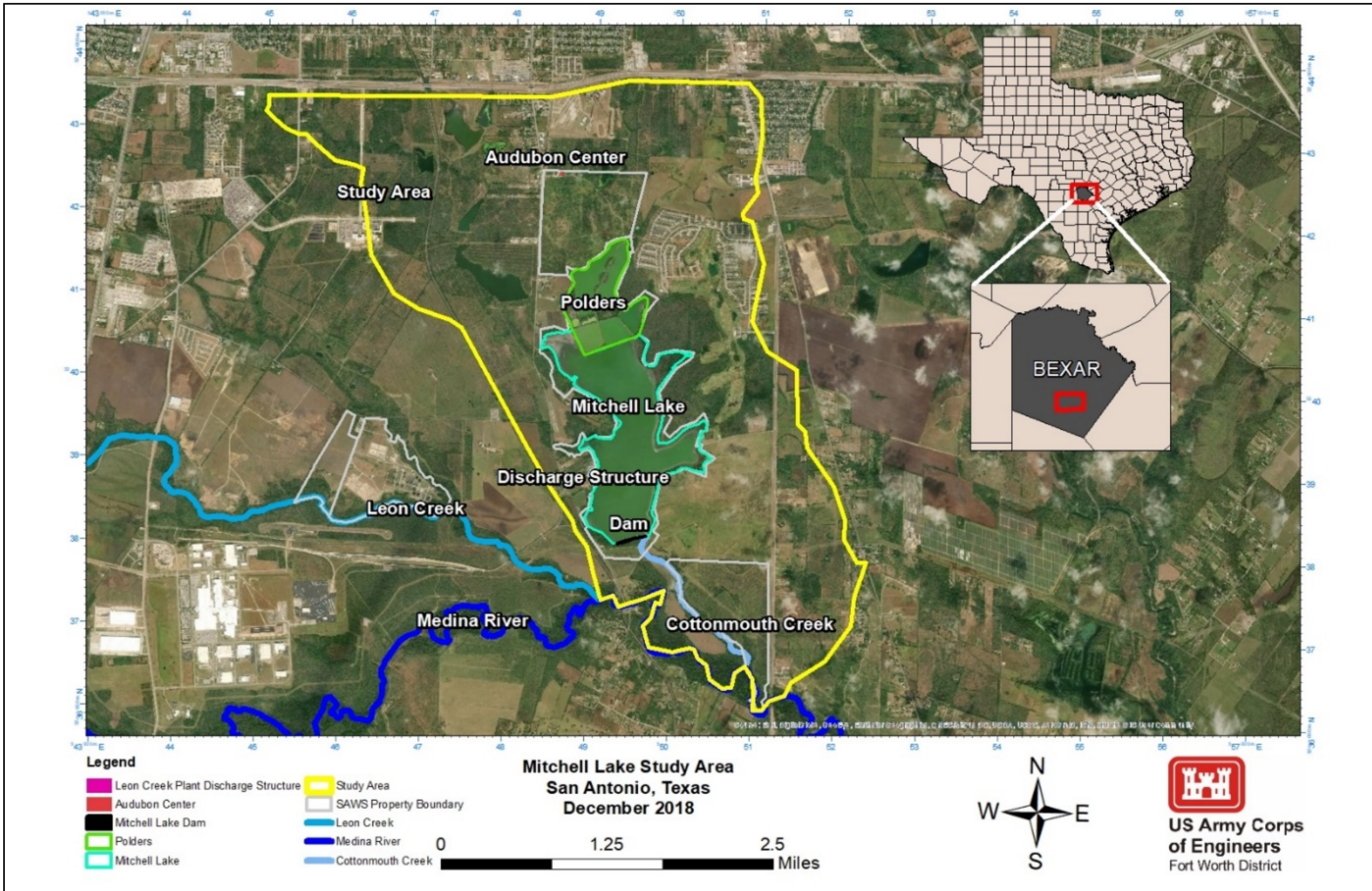


Figure 1-1. Mitchell Lake Study Area

1.2.1 Prior Studies and Reports

WESTSIDE CREEKS

The Westside Creeks (Alazan, Apache, Martinez, and San Pedro Creeks) are located in the city of San Antonio, TX. The creeks ultimately flow to the Mission Reach segment of the San Antonio River. The creeks are components of the existing USACE San Antonio Channel Improvement Project and have been channelized as trapezoidal, grass-lined channels. The proposed restoration plan includes the restoration of the function of the creeks through natural stream design methods and the establishment of woody riparian vegetation within the channels at densities that would not increase the flood risk to the adjacent neighborhoods. The project was authorized on 8 September 2014, but funding has not been appropriated for the detailed design or construction of the project.

OLMOS Creek

Olmos Creek is located in the City of San Antonio, north of the central business district on lands associated with the Olmos Basin Reservoir. The Section 206 aquatic ecosystem restoration study consisted of creating 73 acres of riparian habitat, 17 acres of native prairie, and erosion control measures along 6 miles of Olmos Creek. The project was authorized in 2006 and the final design was completed in August 2016. Restoration areas include lands adjacent to the San Pedro San Antonio golf course, the Olmos Basin Alamo City Golf Trail, Olmos Creek between the intersection of E. Basse Road and Jones Maltsberger Road to Olmos Basin Park, and Olmos Basin Park. Construction funds have not yet been allocated for the project.

1.2.2 Previously Constructed Projects

EAGLELAND, Section 1135 of the Water Resources Development Act of 1986

The Eagleland project is located in San Antonio, TX along the portion of the San Antonio Channel Improvement Project (SACIP) from the Alamo Street dam downstream to the Lone Star Boulevard bridge. Clearing of the floodway and channel re-alignment for the SACIP destroyed the vast majority of the high quality riparian habitat. This project incorporated ecosystem restoration and recreation purposes into the existing Flood Risk Management (FRM) project while maintaining the existing FRM performance. The Eagleland project restored approximately one mile of the San Antonio River, relocating the base flow channel to meander primarily along the outside of the existing bends. Native grasses, trees, and shrubs were planted along channel side slopes, the top of the floodway bank, and within the flood control channel to restore riverine habitat. A riffle-pool complex was created in the base flow channel, and storm water outfall structures were naturalized through the use of native stone and wetland plantings. Construction was completed in 2006 with a total project cost of $2.8 million in 2006 (approximately $3.4 million in October 2012 dollars).

MISSION REACH

San Antonio River, San Antonio, Texas, Channel Improvement Project, General Re-evaluation Report (GRR) (July 2006). The Mission Reach project continued the restoration downstream along the San Antonio River that began with the above mentioned Eagleland project. This project also incorporates ecosystem restoration and recreation while maintaining the existing FRM level of performance. This report concluded “the hydrologic regime of the San Antonio River within the Mission Reach has been severely altered by the construction, operation, and maintenance of the SACIP.” In addition, “while conveying flood flows more quickly downstream, the geomorphic impact is erosion, scour, headcutting, and sediment accumulation. Together with the lack of vegetation, there is insufficient suitable aquatic feeding, breeding, and resting habitat for native fishes.” The National Environmental Restoration (NER) plan recommended in the 2006 report is comprised of a series of pools-riffle-chute complexes, restored river remnants, nine embayments, four tributary mouths, a wetland, and riparian vegetation resulting in 113 acres of restored aquatic habitat, and 320 acres of restored riparian habitat. The recommended plan in the 2006 report also includes the following recreation features: multipurpose trails, shade shelters, picnic tables, water fountains, trash receptacles, benches, lighting, and signage. The total estimated cost of this plan was $93.8 million in September 2004. When updated to October 2012, this cost is $134.8 million. Construction of the Mission Reach project began in 2008 and was completed in the winter of 2014.

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 ecosystem restoration proposed, such as mudflat habitat creation and invasive species management within this study area would greatly benefit these species and may possibly provide suitable core habitat over time.

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 utlilize habitats within the study area (TPWD, 2019a)(Attachment B). 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.

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				
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	*Phrynosoma cornutum*		T	Yes
Texas Indigo Snake	*Drymarchon melanurus erebennus*		T	Yes
Timber Rattlesnake	*Crotalus horridus*		T	Yes
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

[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

Fish and Wildlife Coordination Act of 1958

The Fish and Wildlife Coordination Act 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 Tentatively Selected 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 Tentatively Selected Plan will meet with intent and provisions of the Fish and Wildlife Coordination Act 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 Act 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.

Migratory Bird Treaty Act

The United States 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.

Executive Order 13112

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 Proposed Plan addresses non-native invasive species by implementing goals and objectives that will assist in the management and removal of these species.

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 Tentatively Selected Plan includes restoration of 150.65 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 wetlands, as defined by acreage and function. The Proposed Action for Mitchell Lake will enhance and create 150.65 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 enhancement 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.

Texas Senate Bill 2

In Texas, Senate Bill 2, 77th Legislature of Texas recognizes the San Antonio River basin as a critical fish and wildlife resource. This bill requires the TPWD, The Texas Water Development Board (TWDB), the Texas Commission on Environmental Quality (TCEQ), and other agencies to establish an interagency instream flow program to determine conditions necessary to support a sound ecological environment. TPWD is an agency that has participated in the planning of the Mitchell Lake ecosystem restoration and the Mitchell Lake ecosystem restoration study would restore fish and wildlife resources within the San Antonio River basin.

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, 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.

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. Section 2.1 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 in the following sections.

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)(Table 2-2).

Table 2-2. Bexar County Bird Species (Coffey et al., 2011) on the Audubon Watchlist 2007 (Bucher et al., 2007)

Red-list Species	Yellow-list Species	
Mottled Duck (*Anas fulvigula*)	Scaled Quail (*Callipepla squamata*)	Bay-breasted Warbler (*Setophaga castanea*)
Reddish Egret (*Egretta rufescens*)	Swallow-tailed Kite (*Elaoides forficatus*)	Cerulean Warbler (*Setophaga cerulean*)
Whooping Crane	King Rail (*Rallus elegans*)	Prothonotary Warbler (*Protonotaria citrea*)
Piping Plover	American Golden-Plover (*Pluvialis dominica*)	Kentucky Warbler (*Geothlypis formosa*)
Mountain Plover (*Charadrius montanus*)	Snowy Plover (*Charadrius nivosus*)	Canada Warbler (*Cardellina canadensis*)

Buff-breasted Sandpiper (*Calidris subruficollis*)	Wilson's Plover (*Charadrius semipalmatus*)	Lark Bunting (*Calamospiza melanocorys*)
Least Tern	Long-billed Curlew (*Numenius americanus*)	Le Conte's Sparrow (*Ammodramus leconteii*)
Green Parakeet (*Aratinga holochroa*)	Marbled Godwit (*Limosa fedoa*)	Chestnut-collared Longspur (*Calcarius ornatus*)
Bell's Vireo (*Vireo belli*)	Red Knot	Varied Bunting (*Passerina versicolor*)
Black-capped Vireo (*Vireo atricapilla*)	Sanderling (*Calidris alba*)	Painted Bunting (*Passerina ciris*)
Golden-winged Warbler (*Vermivora chrysoptera*)	Semipalmated Sandpiper (*Calidris pusilla*)	Rusty Blackbird (*Euphagus carolinus*)
Golden-cheeked Warbler	White-rumped Sandpiper (*Calidris fuscicollis*)	Swainson's Hawk (*Buteo swainsoni*)
Baird's Sparrow (*Centronyx bairdii*)	Bridled Tern (*Onychoprion anaethetus*)	Hudsonian Godwit (*Limosa haemastica*)
Henslow's Sparrow (*Centronyx henslowii*)	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*)	

Department of Defense (DoD) Partners in Flight (PIF)

The Department of Defense 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.

Table 2-3. Bexar County Bird Species (Engleman et al., 2019) on the DoD PIF Priority List (DoD, 2015)

Species	
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*)	

Partners in Flight

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;
- Non-governmental Organizations;
- and Private Industry

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 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 declinging but vulerneralbe 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.

Table 2-4. Bexar County Species on PIF Watch List (Engleman et al., 2019)

Species	
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 Sparrow[ND]	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*)
R – Recover(Red Watch List) *ND – Prevent Decline (Yellow Watch List)* *D – Reverse Decline (Yellow Watch List)*	

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 enhance 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, enhance and manage 15.7 million acres of waterfowl priority landscapes in North America. The NAWMP was updated again in 2004 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 Proposed Action for the ecosystem restoration of Mitchell Lake will directly effect 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.

Table 2-5. Bexar County Species (Engleman et. al., 2019) in the North American Waterfowl Management Plan Update (NAWMP, 2018)

Species	
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 the table below. Waterbirds will be benefitted by the measures proposed for the Mitchell Lake Aquatic ER. Increased quality of wetlands, mudflats, and open water habitats will attract waterbirds and supplement their food and cover resources.

Table 2-6. 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 (*Egretta caerulea*)	X	X	X
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	X	X	X

(*Nycticorax nycticorax*)			
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 2-7 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 from the Proposed Action will benefit shorebird populations within Bexar County and will have some effects on shorebirds nationwide.

Table 2-7. 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
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 Fish and Wildlife Conservation Act 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. The table below cross references the BCC and birds identified in Bexar County.

Table 2-8. 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)		
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
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

3 Existing and Future Without Project Conditions

This chapter presents a description of the environmental resources and baseline conditions that could be affected from implementing the proposed plan. Unless stated otherwise, it is assumed the existing conditions will continue to persist and degrade in the Future Without Project (FWOP) scenario, these assumptions are further described in the "No Action Plan" sections of Chapter 5.

In compliance with NEPA, CEQ, and 32 CFR 775 guidelines, the discussion of the affected environment (i.e., existing conditions) focuses on those resource areas that are potentially subject to more-than-trivial impacts. In addition, the level of detail used in describing a resource is commensurate with the anticipated level of potential environmental impact.

For each resource area section, the resource is: (1) generally defined, (2) given an appropriate project area, and (3) described for existing conditions. The project area for each resource is a geographic area within which the Proposed Action may exert some influence. The existing conditions discussion for each resource area presents the condition of the resource within each respective project area.

3.1 Climate

San Antonio has a modified subtropical climate with a relatively continental influence during the winter and maritime influence from the Gulf of Mexico during the summer. The mean annual temperature is 68.7ºF (U.S. Climate Data 2019). Mild weather prevails most of the winter, with freezing temperatures occurring approximately 20 days per year. Summers are usually long and hot with daily maximum temperatures over 90ºF occurring approximately 80% of the time. The mean annual precipitation is 32.91 inches per year.

In Texas, temperatures are expected to increase by 4ºF by 2050 because of rising levels of carbon dioxide and other greenhouse gases in the atmosphere. The intensity of hurricanes and extreme storm events is expected to increase; however, these pulsed periods of high precipitation are expected to be followed by increasingly long periods of drought (U.S. EPA 2013). Although temperatures are expected to increase according to the latest climate models, future changes to precipitation in Texas resulting from climate change are highly variable and continue to have a high level of uncertainty (North et. Al. 2011).

3.2 Geology and Topography

Elevation in the study area ranges from 484’ above mean seal level (amsl) to 604’ amsl with higher elevations in the northern portion of the study area and lower elevations in the southern portion. Water runoff in the northern section of the study area drains south through the center of the study area and into Mitchell Lake before draining to the Medina River.

Geologic formations outcropping in the study area are Paleocene, Eocene, and Pleistocene in age (Bureau of Economic Geology 1987). The formations within the study area include the Wilcox and Midway Groups, Leona Formation, and the Fluviatile Terrace Deposits. The Fluviatile Terrace Deposits surround the study area, while the Wilcox Group outcrops the northern and southern sections of the study area, which also includes the Mitchell Lake dam. The Midway Group lies directly below Mitchell Lake and the Leona Formation sits in the eastern section of the study area.

3.3 Soils, Including Prime Farmlands

The Farmland Protection Policy Act (FPPA) (Public Law 97-98, Title XV, Subtitle I, Section 1539-1549 requires federal actions to minimize unnecessary and irreversible conversion of farmland to nonagricultural uses, specifically prime farmlands. The Act defines prime farmlands as “…land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor, and without intolerable soil erosion…” The act also exempts prime farmlands located within existing urban areas or areas that have been committed to urban development or water storage. The Mitchell Lake study area is located within the city limits of San Antonio, therefore the proposed project is exempt from the FPPA requirements. There are a total of twenty-seven soils types that occur within the study area (Natural Resources Conservation Service [NRCS] 2019), which can be found in Table 3-1 and Figure 3-1.

Table 3-1. Soil Types Located Within the Mitchell Lake Study Area

Symbol	Name	Acres
CfB[3,4]	Miguel Fine Sandy Loam	731.2
CkC2	Miguel fine sandy loam, 2 to5 percent slopes, eroded	144.8
Fr[4]	Loire clay loam, 0 to 2 percent slopes, occasionally flooded	421.5
Gu	Gullied land-Sunev complex, 3 to 20 percent slopes	66.1
HgD	Rock outcrop-Olmos complex, 5 to 25 percent slopes	238.9
HkB[3]	Wilco loamy fine sand, 0 to 3 percent slopes	138.8
HkC[3]	Wilco loamy fine sand, 3 to 5 percent slopes	135.9
HnB[2]	Heiden clay, 1 to 3 percent slopes	127.5
HnC2	Heiden clay, 3 to 5 percent slopes, eroded	308.5
HsA[2]	Houston Black clay, 0 to 1 percent slopes	85.5
HsB[2]	Houston Black clay, 1 to 3 percent slopes	732.1

HtA[2]	Branyon clay, 0 to 1 percent slopes	164.7
HuB[2]	Houston Black gravelly clay, 1 to 3 percent slopes	349.5
HuC[2]	Houston Black gravelly clay, 3 to 5 percent slopes	190.2
Pt	Pits and Quarries, 1 to 90 percent slopes	19.1
SaB[2]	San Antonio clay loam, 1 to 3 percent slopes	244.6
SaC[2]	San Antonio clay loam, 3 to 5 percent slopes	279.2
Tf[4]	Tinn and Frio soils, 0 to 1 percent slopes, frequently flooded	337.9
VcA[1]	Sunev clay loam, 0 to 1 percent slopes	255.6
VcB[1]	Sunev clay loam, 1 to 3 percent slopes	258.9
W	Water	751.1
WbB	Floresville fine sandy loam, 1 to 3 percent slopes	124.9
WeC2	Floresville fine sandy loam, 1 to 5 percent slopes, eroded	360.9
WmA[2]	Willacy loam, 0 to 1 percent slopes	120.7
WmB[2]	Willacy loam, 1 to 3 percent slopes	70.0
Za	Zavala fine sandy loam, 0 to 2 percent slopes, occasionally flooded	19.2
Zg	Zavala and Gowen soils, 0 to 2 percent slopes, frequently flooded	46.4

[1]*Soil of Statewide Importance*

[2]Prime Farmland

[3]Prime Farmland if Irrigated

[4]Hydric Soil

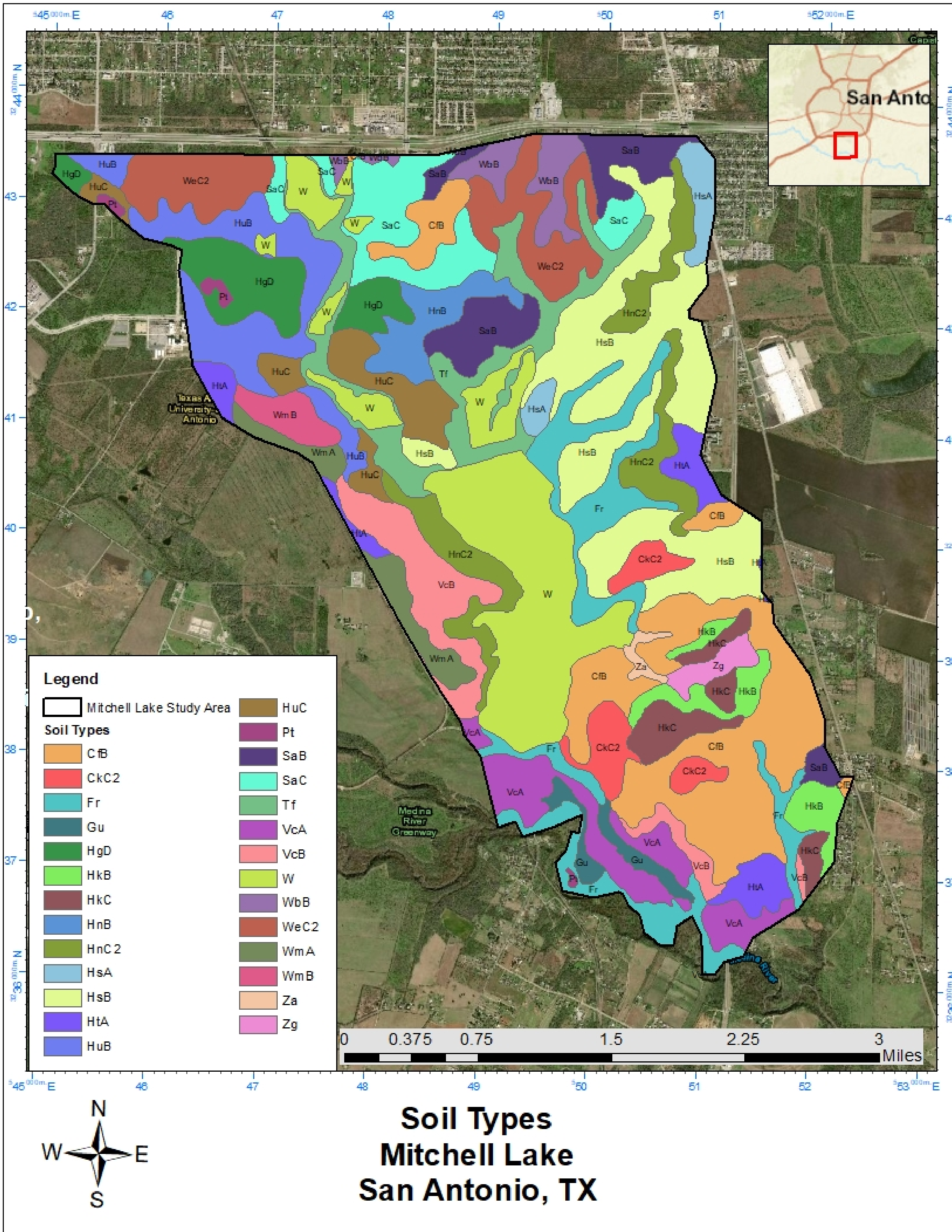


Figure 3-1. Mitchell Lake Soil Types (NRCS 2019)

3.4 Land Use

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.

As described by Menger (1913), 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 2019b). 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.

3.5 Air Quality

The U.S. Environmental Protection Agency (EPA) has the primary responsibility for regulating air quality nationwide. The Clean Air Act (42 U.S.C. 7401 et seq.), as amended, requires the EPA to set National Ambient Air Quality Standards (NAAQS) for wide-spread pollutants from numerous and diverse sources considered harmful to public health and the environment. The Clean Air Act established two types of national air quality standards classified as either “primary” or “secondary.” Primary standards set limits to protect public health, including the health of at-risk populations such as people with pre-existing heart or lung diseases (such as asthma), children, and older adults. Secondary standards set limits to protect public welfare, including protection against visibility impairment, damage to animals, crops, vegetation, and buildings.

EPA has set NAAQS for six principal pollutants, which are called “criteria” pollutants. These criteria pollutants include carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter less than 10 microns (PM_{10}), particulate matter less than 2.5 microns ($PM_{2.5}$), sulfur dioxide (SO_2) and lead (Pb). If the concentration of one or more criteria pollutant in a geographic area is found to exceed the regulated “threshold” level for one or more of the NAAQS, the area may be classified as a non-attainment area. Areas with concentrations of criteria pollutants that are below the levels established by the NAAQS are considered either attainment or unclassifiable areas.

The study area is located in Bexar County, which is currently in marginal nonattainment and has an attainment deadline of September 24, 2021. San Antonio, TX is currently in non-attainment status as well.

3.6 Noise

The study area is located in a relatively rural area of San Antonio and access to the area is controlled by fences around the perimeter. Existing noise sources within the study area are limited to the temporary operation of the pump station at the south end of the polders that is used to maintain water levels in the polders. Noise sources within the study area, but outside of the existing Mitchell Lake property includes traffic on Pleasanton Road, U.S. Highway 281, and Interstate 410. Noise can also be attributed to the driver training course and firing range at the police training academy north of Mitchell Lake. A private airport is located west of Mitchell Lake; however, the airport facilities are in disrepair and it appears that the facility is no longer in use.

3.7 Transportation

Transportation refers to the movement of people, goods, and/or equipment on a surface transportation network that can include many different types of facilities serving a variety of transportation modes, such as vehicular traffic, public transit, and non-motorized travel (e.g., pedestrians and bicycles). The relative importance of various transportation modes is influenced by development patterns and the characteristics of transportation facilities. In general, urban areas tend to encourage greater use of public transit and/or non-motorized modes of transportation, especially if pedestrian, bicycle, and transit facilities provide desired connections and are well operated and well maintained. More dispersed and rural areas tend to encourage greater use of passenger cars and other vehicles, particularly if extensive parking is provided and/or transit systems are unavailable.

Pleasanton Road, a two-lane road, and U.S. 281, a four-lane road, run parallel to Mitchell Lake. Pleasanton Road provides access to the majority of recreation areas on the lake and has minimal traffic. Interstate 410, a four-lane road, is north of the lake.

A small, privately owned airport, Horizon 74R, is approximately 9 miles south of San Antonio, TX and lies within the study area. As stated above, the airport appears to be non-operational.

3.8 Light

The study area is located in a relatively rural area on the edge of the urbanized areas of San Antonio. Fugitive light from the urban areas can be seen from the study area. Existing fugitive light sources within the study area are associated with adjacent traffic, lighting around the Audubon Center and trailhead south of Mitchell Lake, and from neighborhoods, businesses, and industries adjacent to the lake.

3.9 Water Resources

Water resources include both surface water and groundwater resources; associated water quality; and floodplains. Surface water includes all lakes, ponds, rivers, streams, impoundments, and wetlands within a defined area or watershed. Subsurface water, commonly referred to as groundwater, is typically found in certain areas known as aquifers. Aquifers are areas with high porosity rock where water can be stored within pore spaces. Water quality describes the chemical and physical composition of water as affected by natural conditions and human activities.

Mitchell Lake is located within the San Antonio River Basin. According to the San Antonio River Authority (SARA) (2019), there are approximately 4,180 square miles draining into the San Antonio River Basin. Major sub-watersheds located within the San Antonio River Basin are: Cibolo Creek, Leon Creek, Medina River, Salado Creek, and Upper San Antonio River (Figure 3-2).

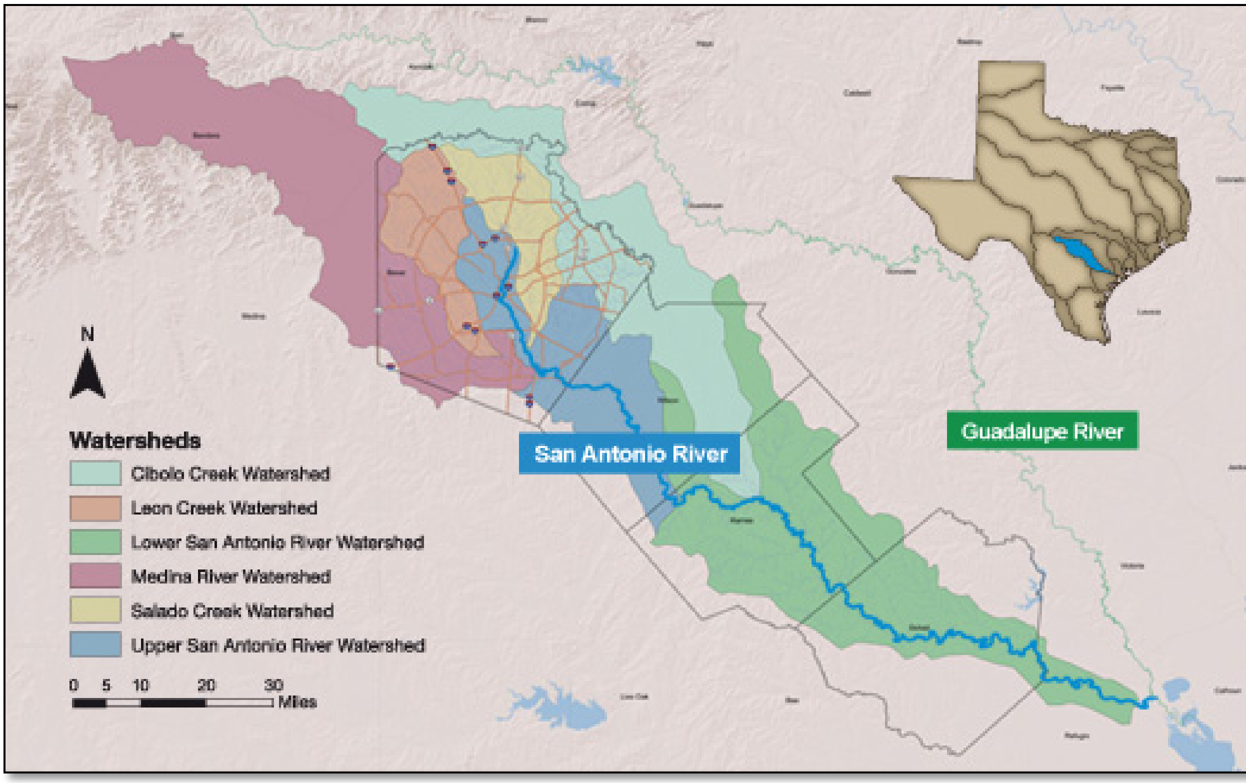


Figure 3-2. San Antonio River Basin and Its Tributaries (SARA 2019)

Mitchell Lake is located within the Medina River Watershed. Approximately 1,112 square miles drain into this watershed (SARA 2019). A majority of the Medina River Watershed is characterized by undeveloped and rural land use, and the hill country terrain of the Edwards Plateau. The immediate Mitchell Lake watershed is drained by Cottonmouth Creek which empties into the Medina River.

3.9.1 Surface Water

Mitchell Lake has approximately 670 acres of surface water at an elevation of 520.4 feet amsl. The water surface elevation is maintained through surface water runoff in the upper basin and inputs from the Leon Creek Wastewater Treatment Plant (WWTP) west of the lake. Inputs from the WWTP are used to offset the evaporation in Mitchell Lake in an effort to maintain a consistent surface water elevation. Due to the impaired water quality of the lake, no releases are allowed out of Mitchell Lake. However, flooding from large storm events results in uncontrolled releases over the water control structure associated with the Mitchell Lake Dam. For the FWOP condition, SAWS intends to lower the normal elevation to 517 or 518 feet above mean sea level in the near future.

Water is pumped from Mitchell Lake into the polders to minimize odors and mobilization of its sediments. The polders are maintained at a relatively consistent water surface elevation and cumulatively provide approximately 50 acres of surface water.

Two ponds are located within the fenced portion of the Mitchell Lake study area: Bird Pond and Edward's Tank, located north of Mitchell Lake and the polders (Figure 3-3). Bird Pond is an 11.8-acre reservoir created by the construction of a levee along an unnamed drainage. Edward's Tank is a 0.75-acre pond located north of the polders. Based on the uniform, rectangular shape of the pond, it is assumed that the pond was excavated to provide water for livestock.

Figure 3-3. Bird Pond and Edward's Tank

Two additional ponds are located outside of the fenced portion of Mitchell Lake west of Pleasanton Road: Canvasback Lake and Ballasetal Lake. These two lakes are located along Cottonmouth Creek and flow into the northwest corner of Mitchell Lake. Cottonmouth Creek continues below the Mitchell Lake Dam until its confluence with the Medina River.

Wetlands are often defined as areas where the frequent and prolonged presence of water at or near the soil surface drives the natural system including the type of soils (i.e. hydric soils) that form, the plants that grow and the fish and/or wildlife that use the habitat.

A desktop survey was performed to determine where the biological wetlands were located within the study area using the USFWS National Wetlands Inventory mapping system (Figure 3-4). Generally, wetlands are concentrated along the drainages north of the polders, along the edge of the polder berms, and below the Mitchell Lake Dam. The wetlands north of the polders primarily consist of freshwater emergent wetlands with small areas of open water interspersed throughout the wetland. The wetlands below the dam consist of forested wetlands with significant areas of open water.

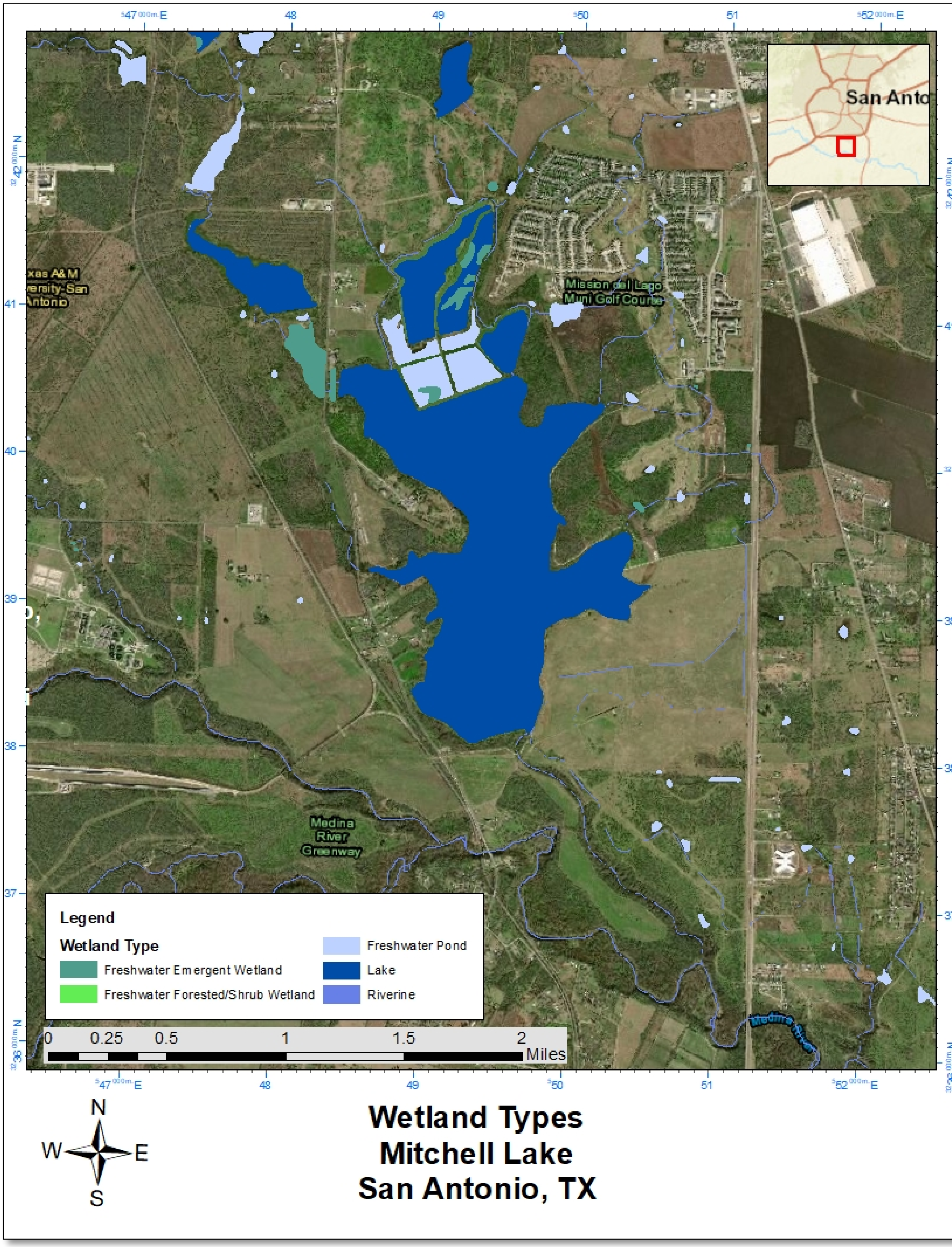


Figure 3-4. National Wetlands Inventory of the Study Area (USFWS 2019)

3.9.2 Groundwater

Groundwater in the study area is provided from the Carrizo-Wilcox Aquifer. The Carrizo-Wilcox Aquifer extends from the Louisiana border to the border of Mexico in a wide band adjacent to the Gulf Coast Aquifer (Figure 3-5). The aquifer is located in the Wilcox Group and the overlying Carrizo Formation of the Clairborne Group. The aquifer is primarily composed of sand locally interbedded with gravel, silt, clay, and lignite. Although the aquifer is approximately 3,000 feet thick, the freshwater saturated thickness of the sands averages 670 feet. Irrigation comprises approximately 50-percent of the water pumped from the aquifer while municipal water supply accounts for 40-percent.

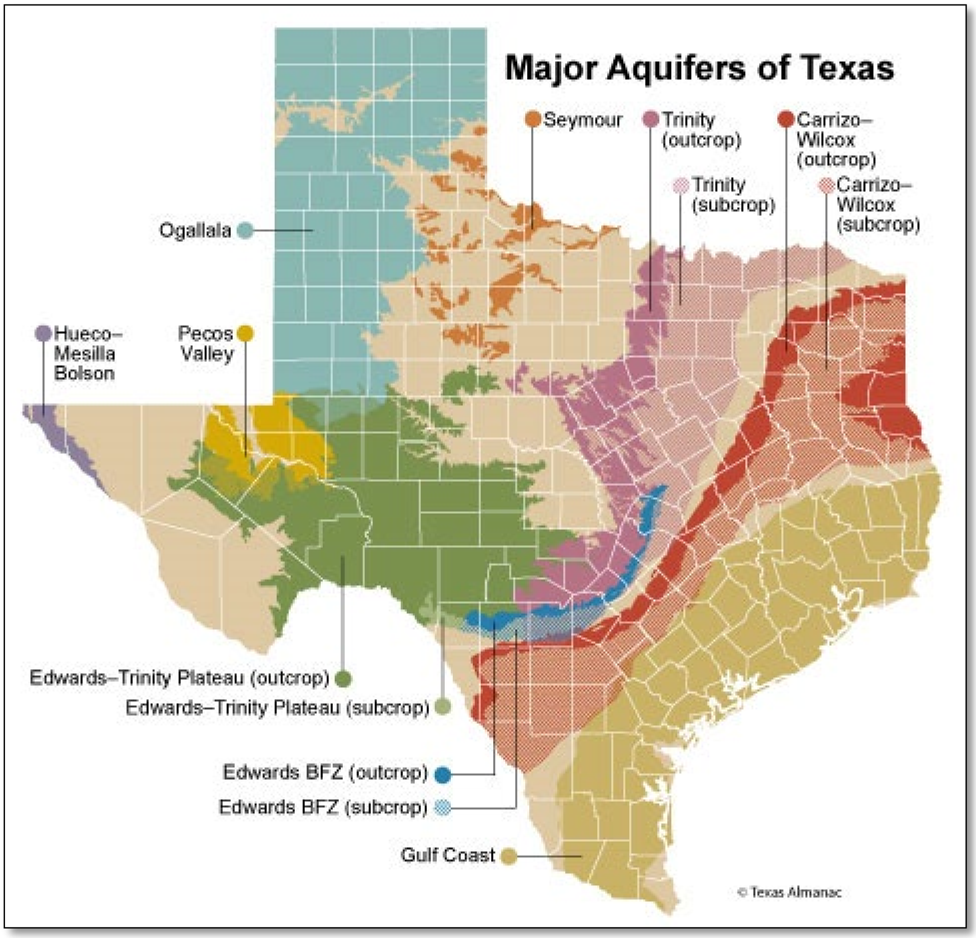


Figure 3-5. Major Aquifers of Texas (Texas Almanac 2019)

3.9.3 Hydrology and Hydraulics

Mitchell Lake has a normal storage capacity of 2,640 acre-feet and a maximum storage capacity of 5,000 acre-feet (ARCADIS U.S. Inc., 2014). The Mitchell Lake dam captures stormwater runoff from the watershed to create the Mitchell Lake reservoir. Attributes of the dam are provided in Table 3-2. TCEQ has classified the dam failure rating as a “low” risk hazard. TCEQ standards require dams with a hazard classification of “Low” be able to pass between 25 and 50 percent of the Probable Maximum Flood (PMF) without overtopping the respective dam. TCEQ, in a letter to SAWS, recommended a 28 percent passage rate for the PMF. The USACE Hydrologic Engineering Center’s Hydrologic Modeling System was used to generate runoff hydrographs for the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year storm events to determine the resulting peak inflows and water surface elevation resulting from the associated storm events (Table 3-3).

Table 3-2. Mitchell Lake and Dam Features (ARCADIS U.S. Inc., 2014)

Attribute	Value
Year Constructed	1901
Approximate Length	3,200 feet
Structural Height	10 feet
Hazard Classification	Low
Drainage Area	9.76 square miles
Normal Water (NWL) Elevation	520.4 feet
NWL Surface Area	670 acres
NWL Storage	2,640 acre-feet
Maximum Storage	5,000 acre-feet
Top of Dam Elevation	528 feet
Primary Service Spillway Crest	520.73 feet
Emergency Spillway Crest	527 feet
Top Width	15 feet

ARCADIS U.S., Inc., 2014

Table 3-3. Peak Water Surface Elevations and Peak Inflows to Mitchell Lake (ARCADIS U.S. Inc., 2014)

Storm Event	Peak Inflows (cubic feet per second)	Peak Water Surface Elevation in Mitchell Lake (feet)
2-year	1,798	522.2
5-year	2,697	522.6
10-year	3,643	523.1
25-year	5,181	524.0

50-year	6,775	525.0
100-year	7,863	525.6
500-year	12,703	527.4
6-hour PMP	35,132	529.2
12-hour PMP	36,021	529.4
24-hour PMP	26,877	529.0
48-hour PMP	16,102	528.4
72-hour PMP	11,606	528.2
28 percent 12-hour PMP	6,673	526.0
40 percent 12-hour PMP	11,620	527.5

The primary concrete spillway, located at the southeastern end of Mitchell Lake is approximately 55 feet wide and has eight 36-inch-diamater gate valves (ARCADIS U.S., Inc. 2014). The valves are positioned at an elevation of 520.73 feet and lead to an outfall comprised of a stone and mortar channel which flows into Cottonmouth Creek. The gate valves are permanently open and are unable to be adjusted, essentially creating a weir structure. The uncontrolled flows over this weir structure for specific surface water elevations are provided in Table 3-4. There is a ninth gate with a 36-inch reinforced concrete pipe that discharges to an irrigation canal that leads away from Cottonmouth Creek. An emergency spillway is located on the western side of the dam and is approximately 1,000 feet in length. Cottonmouth Creek then flows to the Medina River, a tributary of the San Antonio River, approximately 7,000 feet downstream of the spillway. Under the FWOP conditions, SAWS intends to retire the primary concrete spillway, and build a new spillway structure; designs are unknown at this time. SAWS does not allow lake levels to reach a level where the weir structure is activated. The only flows out of Mitchell Lake are those resulting from large storm events. The National Climatic Data Center (NCDC) storm event database reports 176 flash flood events in Bexar County between January 2009 and July 2019 (NOAA 2019).

Table 3-4. Spillway Rating Curve (ARCADIS U.S. Inc., 2014)

Elevation (feet)	Gate Flow (cfs)	Weir Flow (cfs)	Flow Control
520.73	0	0	Gate
521	11	0	Gate
522	100	0	Gate
523	260	0	Gate

524	490	0	Gate
525	690	0	Gate
526	770	0	Gate
526.5	800	80	Gate
527	830	270	Gate
527.5	860	860	Gate/Weir
528	900	2,200	Weir
528.5	923	5,600	Weir
529	954	10,600	Weir

3.9.4 Water Quality

SAWS operates Mitchell Lake as a permitted wastewater treatment unit under TCEQ Texas Pollutant Discharge Elimination System (TPDES) Permit No. WQ0010137004 (Alan Plummer and Associates, Inc. 2016). Under this permit, SAWS is required to monitor and report outflows of the lake, pH, 5 day Biochemical Oxygen Demand (BOD5), Dissolved Oxygen (DO), and Total Suspended Solids (TSS) when discharges occur. The maximum allowable water quality parameters allowed under the TCEQ TPDES permit are provided in Table 3-5. Discharges only occur during substantial rainfall events out of the uncontrolled primary spillway.

Table 3-5. Mitchell Lake TCEQ TPDES Maximum Allowable Water Quality Parameters (Alan Plummer and Associates, Inc. 2016)

Parameter[a]	Existing Permit[b]
BOD_5, mg/L	30
TSS, mg/L	90
Ammonia, mg/L	N/A
DO, mg/L	>4
pH, SU	6 - 9

a. Partial list of permit effluent parameters

b. Daily average

Historical water quality information is somewhat limited in regards to Mitchell Lake. The Simpson Group conducted sampled water to assess water quality in the polders and lake in 1997 (Alan Plummer and Associates, Inc. 2016). The Simpson Group data represents a single point in time and not a seasonal average. Currently, SAWS also monitors water quality in the polders and lake. Table 3-6 provides a summary of the water quality data provided by the Simpson Group and SAWS.

Because water is pumped into Mitchell Lake to offset losses of water due to evaporation and no outflow of water is allowed from Mitchell Lake, nutrients and salts concentrate in the lake. Therefore, under the FWOP conditions, the water quality at Mitchell Lake is expected to degrade. As indicated by the table below, the Total Dissolved Solids, DO, and Nitrogen levels are above average for most waters, contributing the low water quality in Mitchell Lake.

Table 3-6. Mitchell Lake Water Quality, in 1997 (Alan Plummer and Associates, Inc. 2016)

Parameter	Source	
	Simpson Group	SAWS
BOD_5, mg/L	40	25.5 (n=217)
TSS, mg/L	138	114.1 (n=218
Volatile Suspended Solids, mg/L	108	N/A
Total Phosphate, mg/L P	1.1	N/A
Total Nitrogen, mg/L N	15.5	N/A
Total Kjeldahl Nitrogen, mg/L N	15.4	N/A
Organic Nitrogen, mg/L N	15.4	N/A
Ammonia, mg/L N	<0.1	N/A
Nitrate, mg/L N	0.05	N/A
Total Dissolved Solids, mg/L	1,450	N/A
DO, mg/L	0 – 20	7.8 (n=219)
pH, SU	9.4	8.7 (n=219)

3.10 Socioeconomics and Environmental Justice

The socioeconomics of the communities surrounding Mitchell Lake are summarized in this section. Mitchell Lake is located in San Antonio, Bexar County, Texas. This section will describe the socioeconomics and demographics of Bexar County, the city of San Antonio, and the census tract in which the lake lies (Census tract 1519). These three areas will be referred to as the “area of interest” in this section of the report. Demographic information for the state of Texas is provided for comparison. The parameters used to describe the demographics and socioeconomic environment include population trends, private sector employment, and wage earnings. Other social characteristics such as race composition, age distribution, and poverty will be examined in order to recognize any potential environmental justice issues that the improvement project may induce.

<u>POPULATION</u>

Population estimates for the state of Texas and the area of interest are displayed in Table 3-7 below. Bexar County is expected to experience 77% growth between 2017 and 2050, compared to a 73% overall growth rate in Texas.

Table 3-7. Population Estimates and Projections (2000, 2017, and 2050)

Geographical Area	2000 Population Estimate	2010 Population Estimate	2017 Population Estimate	2050 Population Projection
Texas	20,851,820	25,145,561	27,419,612	47,342,105
Bexar County	1,392,931	1,714,773	1,892,004	3,353,060
San Antonio	1,144,646	1,327,407	1,461,623	4,467,980
Census Tract 1519	3,059	5,113	5,888	N/A
Source: U.S. Census Bureau, Population Division (2000, 2010 Estimates); U.S. Census Bureau, 2013-2017 American Community Survey 5-Year Estimates (2017 Estimate); Texas State Data Center, The University of Texas at San Antonio (2050 Projections)				

EMPLOYMENT BY INDUSTRY

The labor force by industry for the state and the area of interest is characterized in Table 3-8. The largest majority of the area of interest is employed in the Educational services, and health care and social assistance sector, followed by the Arts, entertainment, and recreation, and accommodation and food services sector, and then Retail Trade.

Table 3-8. Employment by Sector

Industry	Texas	Bexar County	San Antonio	Census Tract 1519
Agriculture, forestry, fishing and hunting, and mining	3%	1%	1%	5%
Construction	8%	8%	8%	5%
Manufacturing	9%	6%	6%	12%
Wholesale trade	3%	2%	2%	1%
Retail trade	11%	12%	12%	13%
Transportation and Warehousing, and utilities	6%	4%	4%	4%
Information	2%	2%	2%	0%
Finance and insurance, and real estate and rental and leasing:	7%	9%	9%	10%

Professional, scientific, and management, and administrative, and waste management services	11%	11%	11%	9%
Educational services, and health care and social assistance	22%	23%	23%	17%
Arts, entertainment, and recreation, and accommodation and food services	9%	12%	12%	18%
Other services, except public administration	5%	5%	5%	2%
Public administration	4%	5%	4%	4%
Source: U.S. Census Bureau, 2013-2017 American Community Survey 5-Year Estimates (2017 Estimate)				

INCOME AND POVERTY

Median household and per capita incomes for the selected geographies are displayed in Table 3-9. The median household incomes are lower in each of the areas of interest when compared to the state of Texas, with the largest discrepancy between the state and the census tract immediately surrounding the lake. The same trend is observed in per capita income.

Also displayed in the table is the percentage of individuals and families whose incomes were below the poverty level within the last twelve months. The poverty level in Bexar County is comparable to the state of Texas, but is slightly higher in the city of San Antonio and slightly higher still in the census tract surrounding Mitchell Lake.

Table 3-9. Median, Per Capita income and Poverty Data (2017)

Geographical Area	Median Household Income	% of Families with Incomes Below Poverty Level (Last 12 months)	Per Capita Income	% of People with Incomes Below Poverty Level (Last 12 months)
Texas	$57,051	12.4%	$28,985	16.0%
Bexar County	$53,999	12.9%	$26,158	16.4%
San Antonio	$49,711	14.7%	$24,325	18.6%
Census Tract 1519	$41,869	18.7%	$19,164	20.0%
Source: U.S. Census Bureau, 2013-2017 American Community Survey 5-Year Estimates (2017 Estimate)				

LABOR FORCE AND UNEMPLOYMENT

Details on the labor force and unemployment rates for the state and Bexar County are displayed in Table 3-10 below. The 2017 annual average unemployment rate in Texas was 4.3%. The unemployment rates in Bexar County were slightly lower than in the state.

Table 3-10. Labor Force, Employment, and Unemployment Rates (2017 Annual Averages)

Geographic Area	Civilian Labor Force	Number Employed	Number Unemployed	Unemployment Rate
Texas	13,538,385	12,960,595	577,790	4.3%
Bexar County	924,590	892,277	32,313	3.5%
Source: Bureau of Labor Statistics, Current Population Survey (State estimate, 2017), LAUS (County estimates, 2017)				

RACE and ETHNICITY

Table 3-11 displays race and ethnicity for the comparative geographies. Within each of the areas of interest, the Hispanic population is significantly higher when compared to the state of Texas and comprises the majority of the population. In the census tract surrounding the lake, the Hispanic population accounts for 87% of the total population.

Table 3-11. Racial Composition by Geographical Area (2017)

Area	White	Black	Hispanic or Latino	American Indian and Alaska Native alone	Asian alone	Native Hawaiian and Other Pacific Islander alone	Some other race alone	Two or more races
Texas	43%	12%	39%	0%	4%	0%	0%	2%
Bexar County	28%	7%	60%	0%	3%	0%	0%	2%
San Antonio	25%	7%	64%	0%	3%	0%	0%	1%
Census Tract 1519	8%	1%	87%	0%	3%	0%	1%	1%
Source: U.S. Census Bureau, 2013-2017 American Community Survey 5-Year Estimates (2017 Estimate)								

AGE

The distribution of population by age group is displayed in Table 3-12. The age distribution is similar between the San Antonio, Bexar County, and the state of Texas. In terms of percentage of total population, the census tract that encompasses the lake has a slightly larger population ages 0 to 14 when compared to the state of Texas.

Table 3-12. Population by Age Group (2017)

Area	Age Group

	<5	5 to 9	10 to 14	15 to 19	20 to 24	25 to 34	35 to 44	45 to 54	55 to 59	60 to 64	65 to 74	75 to 84	85 and over
Texas	7%	7%	7%	7%	7%	15%	14%	13%	6%	5%	7%	3%	1%
Bexar County	7%	7%	7%	7%	8%	16%	13%	12%	6%	5%	7%	3%	1%
San Antonio	7%	7%	7%	7%	8%	16%	13%	12%	6%	5%	7%	3%	1%
Census Tract 1519	10%	8%	10%	7%	9%	13%	16%	11%	6%	2%	6%	2%	0%
Source: U.S. Census Bureau, 2013-2017 American Community Survey 5-Year Estimates (2017 Estimate)													

3.11 Cultural Resources

The potential cultural resources within the Mitchell Lake study area are expected to be archaeological, consisting primarily of evidence of the presence of prehistoric and historic peoples. Cultural resources are evaluated for eligibility or listing in the National Register of Historic Places (NRHP).

A review of the Texas Historical Commission's (THC) (Atlas) database revealed several prior terrestrial cultural resource investigations within the study area. However, it is important to note that the majority of the study area has not been culturally surveyed to current THC standards. There are 12 previously recorded terrestrial archeological sites, one cemetery, and six historic structures (earthen embankment dam, concrete/metal flood gate, concrete/stone spillway, natural purge pond, earthen irrigation canal system, and metal electric transmission line) within the study area. Eleven of these terrestrial archeological sites were evaluated to determine their eligibility to the National Register of Historic Places (NRHP); two are Eligible and nine are Not Eligible. The remaining terrestrial archaeological site is considered unevaluated for NRHP eligibility. Four of the identified historic structures were recommended as Eligible, while two were recommended as Not Eligible.

3.12 Hazardous, Toxic, and Radioactive Waste

In order to complete a feasibility level Hazardous, Toxic, and Radioactive Waste (HTRW) evaluation for the Mitchell Lake Ecosystem Restoration Project, a records search was conducted following the rules and guidance of ER 1165-2-132: HTRW Guidance for Civil Works Projects, and ASTM E1527-13: Standard Practice for Environmental Site Assessment: Phase 1 Environmental Site Assessment Process. In the records review, files, maps and other documents that provide environmental information about the project area are obtained and reviewed. To complete the records review, USACE reviewed publicly available databases and sources, using the proposed footprint of the project, along with an approximate 1 mile search distance for each of the sources. The records search revealed only 7 potential HTRW sites in lower Bexar County, although none of these sites have the potential to affect the proposed project. See the future without project and plan analyses, and the HTRW appendix for more information about risks from these sites.

Mitchell Lake is hyper eutrophic due to its past use as a wastewater treatment site. The entire lake, along with its polders and basins is reported to be contaminated with wastewater sludge. Basin 3 is reported to be lined with fly ash. Fly ash is a by-product of coal ash (EPA 2019). Coal ash is referred to by the EPA as a coal combustion residual and is produced by the burning of coal in coal-fired power plants. Fly ash is a very fine and powdery material composed of mostly silica that is made from the burning of finely ground coal in a boiler. The EPA has determined that improperly constructed or mismanaged coal ash disposal units have been linked to surface, groundwater, and air quality contamination. It is important to consider this if Basin 3 were to be included in any excavation or construction plans. At this time, however, there are no plans to disturb this Basin and the recommended treatment is to leave the contaminant “as is” or undisturbed.

Mitchell Lake has a few potential HTRW sites in relative proximity (one mile) to the proposed project footprint, including 3 registered petroleum storage tanks, and 4 state and tribal solid waste facilities/landfills which were primarily for disposal of brush. None of the storage tanks are reported as leaking and the landfills are reported as no longer active. This is a relatively low concentration of sites given the large area of land and the number of oil and gas wells in the surrounding area. San Antonio is a highly developed city within close proximity and most potential HTRW sites are located in or around this settlement.

Although not classified as HTRW, pipelines and oil wells may be a significant contributor to the HTRW existing condition in and around Mitchell Lake. Numerous oil and gas wells are located within 1.0 miles of Mitchell Lake and the restoration area. A Railroad Commission of Texas (RRC) database also shows numerous operating oil, gas, and injection wells (Figures 1 & 2 of HTRW Appendix). Pipelines can be found crossing the lake and restoration areas. Most of the project plans have the potential to interact in some way with some type of oil and gas infrastructure, and relocations may be required as part of the proposed project. Refer to the HTRW Appendix for maps of known pipelines and oil wells surrounding the lake. However, all of these instances have an extremely low potential to impact the proposed project.

3.13 Visual Aesthetics

Visual resources are defined as the natural and manufactured features that comprise the aesthetic qualities of an area. These features form the overall impressions that an observer receives of an area or its landscape character. Landforms, water surfaces, vegetation, and manufactured features are considered characteristic of an area if they are inherent to the structure and function of a landscape. Mitchell Lake and surrounding lands are relatively rural with natural visual aesthetic resources consisting of the lake, grasslands, savannah, and forests. Under the FWOP conditions, the SAWS fenced property would remain the same as the existing conditions as the property is managed for wildlife habitat by the Mitchell Lake Audubon Center. However, the visual aesthetics of the areas adjacent to the SAWS property will be obstructed by residential and commercial development as urban sprawl continues for the city of San Antonio.

3.14 Other Social Effects

Recreational swimming, boating, and other similar activities are not permitted at Mitchell Lake. Guests entering the Audubon Society leased areas within the Mitchell Lake study area are required to register with the Audubon Center before entering the property.

Guests utilizing the hiking trails can park at the trailheads described in Section 3.15. The Pleasanton Road trailhead has a working water fountain that can be utilized before entering the trail. The vegetation, which includes hazardous trees, along trails are maintained and/or removed on a regular basis.

Under the FWOP, recreational features and improved wildlife habitat will increase as the Audubon Center continues to develop wildlife habitat around Mitchell Lake and increase ecotourism opportunities in San Antonio.

3.15 Recreation

The study area has several popular recreation sites: the Mitchell Lake Audubon Center, the Mitchell Lake Trailhead, and the Pleasanton Road Trailhead. The Pleasanton Road Trailhead extends 3.4 miles to Mattox Park at the Mission Del Lago Trailhead. This trail runs parallel to the edge of Mitchell Lake, which offers view of vegetation, wetlands, and various species of wildlife. Parking at the Pleasanton Road Trailhead is available and easily accessible at all points of entry (Figure 3-6).

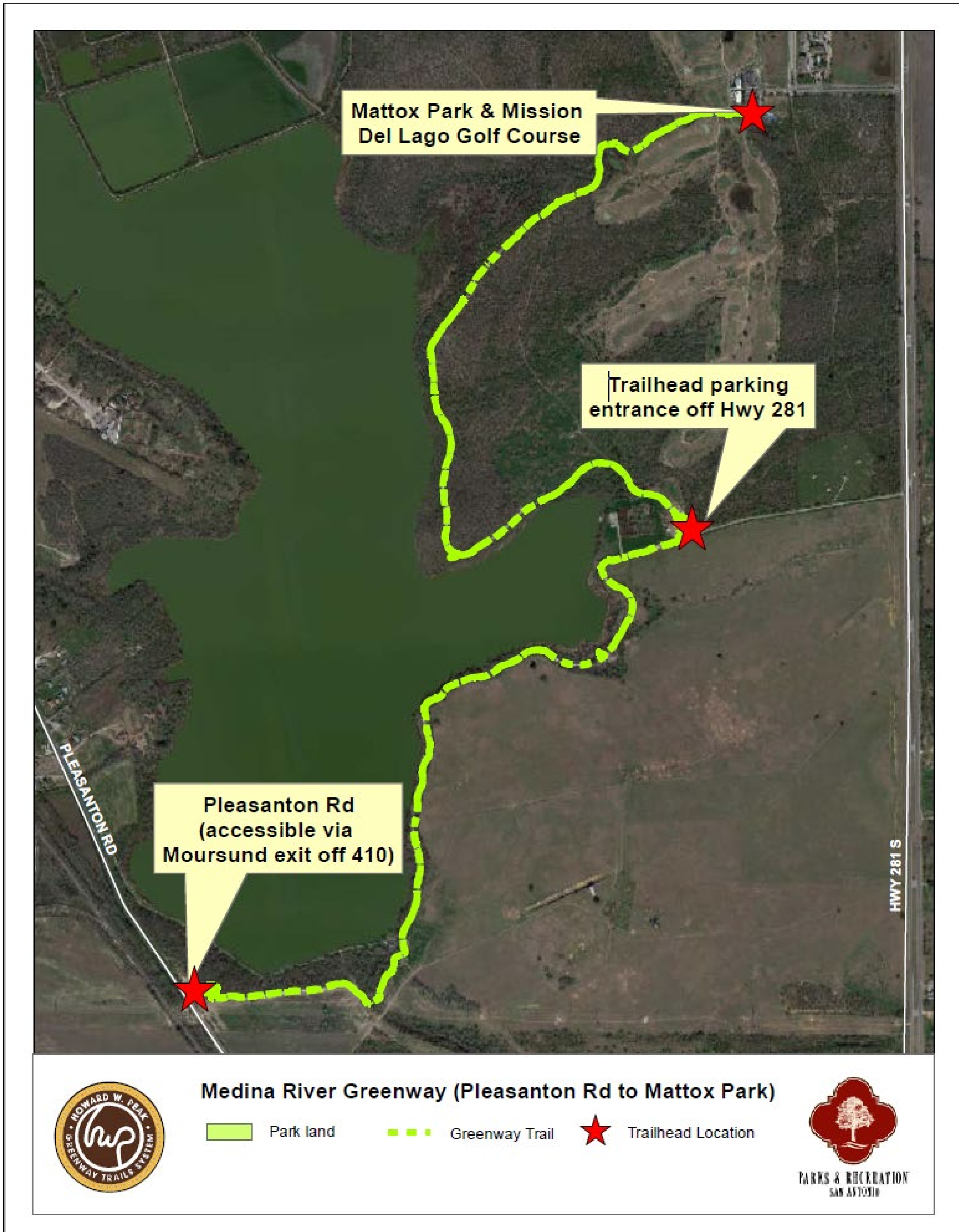


Figure 3-6. Pleasanton Road and Mattox Park Trailheads (City of San Antonio 2019)

The Mitchell Lake Audubon Center, north of the lake, is owned by SAWS and operated by the Audubon Society. Access to the site is controlled by a single gate located near the Mitchell Lake Audubon Center, which is open 7 AM to 2 PM (Audubon 2019). The Audubon Center offers conservation and outdoor science education classes for more than 4,000 students a year. Due to Mitchell Lake's position along the Central Flyway, birding is a popular hobby within the study area and brings ecotourism dollars to the region. Birding tours are held by the Audubon Center every Sunday morning and second Tuesday all year. A drivable birding trail is available for public use around and in between the polders (Figure 3-7). The road provides access to otherwise unobtainable wildlife viewing in the study area.

The Pleasanton Road Trailhead is located at the southern end of Mitchell Lake, while the Mitchell Lake Trailhead is located on the western portion. The two trailheads are connected by a single, approximately 1.7 mile long, concrete trail. The trail passes over Cottonmouth Creek and runs adjacent to the SAWS property boundary. Access to the lake is restricted and controlled by a 10-foot fence. The trail continues to the Mission Del Lago Trailhead, which leads approximately 1.7 miles to the northeast from the Mitchell Lake Trailhead.

Under the FWOP, the trails will connect to the Mission Reach trail on the San Antonio River to the northeast and will be extended to additional trails to the west.

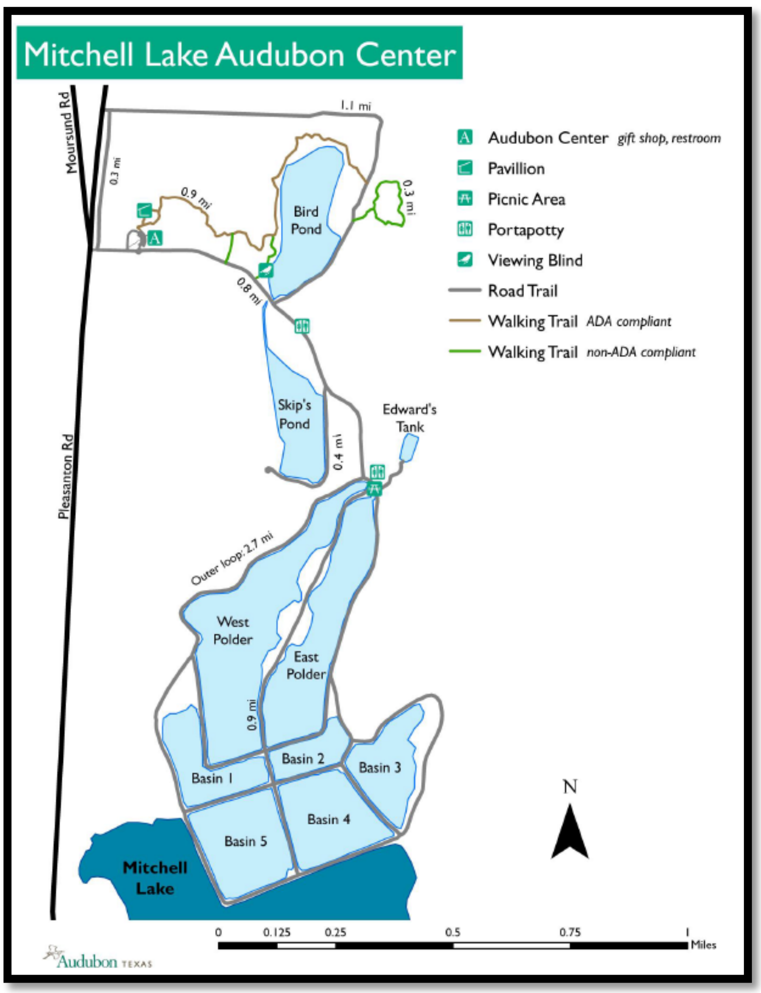


Figure 3-7. Mitchell Lake Audubon Center Trails Map

3.16 Biological Resources

3.16.1 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 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*.).

3.16.2 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 the study areas 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*).

3.16.3 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 USFWS is responsible for the implementation of the ESA. Section 7 of the ESA ensures that federal agencies use their authorities to address the impacts of federal actions on listed species and ensure that those actions would not jeopardize the continued existence of listed species or their critical habitat. Federally listed threatened and endangered species for Bexar County are provided in Attachment A. No critical habitat is designated within the study area. A more thorough discussion of the federally listed threatened and endangered species identified in the USFWS Information for Planning and Consultation report can be found in Attachment C.This assessment evaluates the Threatened and Endangered species, their habitats, and whether the Proposed Action will have any impacts on them.

3.16.4 Texas Listed Threatened and Endangered Species

Chapters 67 and 68 of the TPWD Code and Sections 65.171-65.176 of Title 31 of the Texas Administrative Code gives TPWD the authority to develop a list of state-listed threatened and endangered species and to manage, regulate, and protect listed species in Texas. In addition to the state-listed species, the State of Texas identities “species of greatest conservation need” (SGCN). SGNC are species that are declining or rare and in need of attention to recover or to prevent the need to list under state or federal regulation. TPWD has identified 112 SGCN; a complete list of these species is located in Attachment E of this Appendix.

The Texas Natural Diversity Database (TXNDD) is a GIS-based inventory of known locations of state-listed threatened, endangered, and SGCN species. The TXNDD is limited to elements of occurrence that are located on public lands and private lands where the landowner has given written consent to include in the database. Therefore, the TXNDD data is not a comprehensive representation of the range of the species, but a tool to identify potential listed species in a specific area. A search of the TXNDD for the study area resulted in the identification of two SGCN: the eastern spotted skunk (*Spilogale putorius*) and the western spotted skunk (*Spilogale gracilis*). Habitat for these species is found throughout the grasslands and savannahs in the study area.

3.16.5 Migratory Birds

The Migratory Bird Treaty Act (MBTA)(16 U.S.C. 703-712) prohibits the take, possession, importation, exportation, transportation, selling, purchasing, bartering, or offer to sell, purchase, or barter any migratory bird, or parts, nests, or eggs of such a bird except under terms of a valid Federal permit. The MBTA applies to native birds migrating or residing within the U.S., Mexico, Russia, and Japan. Additional protections for eagles are provided under the Bald and Golden Eagle Protection Act.

The past several decades have seen a decline in Neotropical migratory bird numbers. Recently, it has been recognized that the loss, fragmentation, and degradation of migratory 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.

3.16.6 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 FWOP condition, the impacts of invasive species on the environment are expected to worsen.

4 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 report:

- 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.

The CE/ICA Chapter of the Integrated Feasibility Report-Environmental Assessment will discuss in further detail, the Tentatively Selected Plan and the comparison of the plan's benefits and costs. Chapter 4 is limited to the discussion of the habitat benefits of eachalternative.

4.1 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 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 4-1.

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).

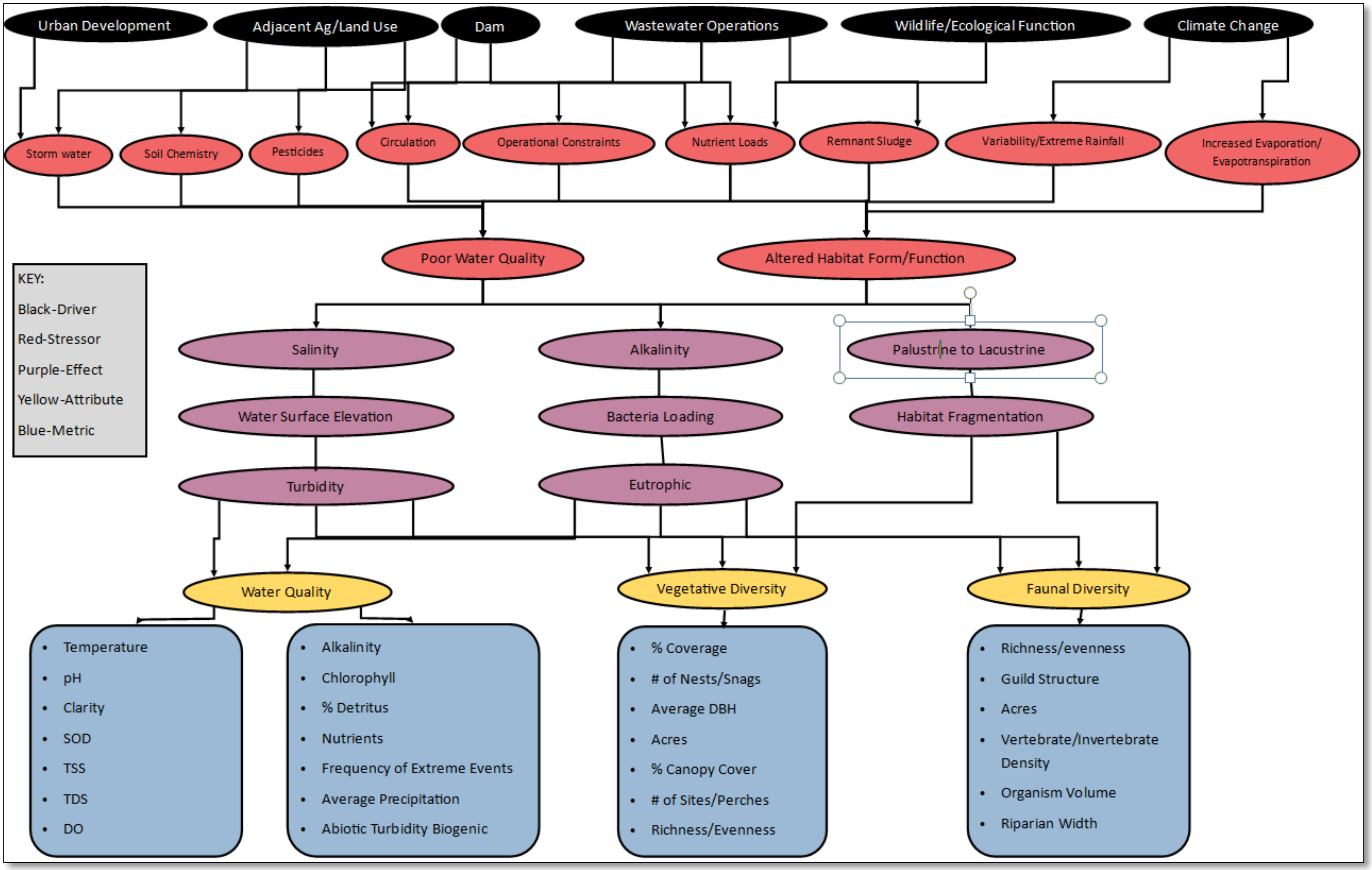


Figure 4-1. Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study Conceptual Ecological Model

4.2 Habitat Classification

4.2.1 Model Selection

Resource agencies and the USACE Ecosystem Restoration Planning Center of Expertise (ECO-PCX) were utilized to assist the USACE in 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. Other factors include economic or ecologic value to the surrounding habitat and/or community.

The TPWD Ecological Mapping System was utilized and refined using the ArcGIS mapping tool (Figure 4-2). A large array of habitat types were listed, but were refined into seven major types for analysis purposes before conducting field work. These habitat types include: Upland, Shrubland, Grassland, Emergent Wetland, Riparian, Aquatic, and Riverine habitat.

Models initially included during plan formulation and the habitat assessment include: the Marsh Wren and Bullfrog HSI to assess emergent wetland habitat; the Barred Owl, Fox Squirrel, Gray Squirrel, and Shelterbelt HSI to assess riparian forest habitat. Upland forest was assessed with the Fox Squirrel and Gray Squirrel HSI; grassland habitat with the Meadowlark and Cottontail HSI; and shrubland with the Cottontail and Brown Thrasher HSI. The Avian Index of Biological Integrity (IBI) was used to assess riparian forest and aquatic habitat during the habitat survey. The Qualitative Habitat Evaluation Index (QHEI) was utilized for riverine habitat. The Shorebird Migration Model, described in Section 4.2.2, was added after the habitat assessment was complete. This model was utilized to project benefits that would directly apply to the polders within the Mitchell Lake study area.

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 needed to determine the Future Without Project and Future With Project conditions. Hereafter, these models will not be mentioned in this report. The models utilized for final analysis of existing and future conditions are shown in Table 4-1.

Table 4-1. 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 Wetland
Bullfrog HSI	Emergent Wetland
Shorebird Migration Model	Mudflat

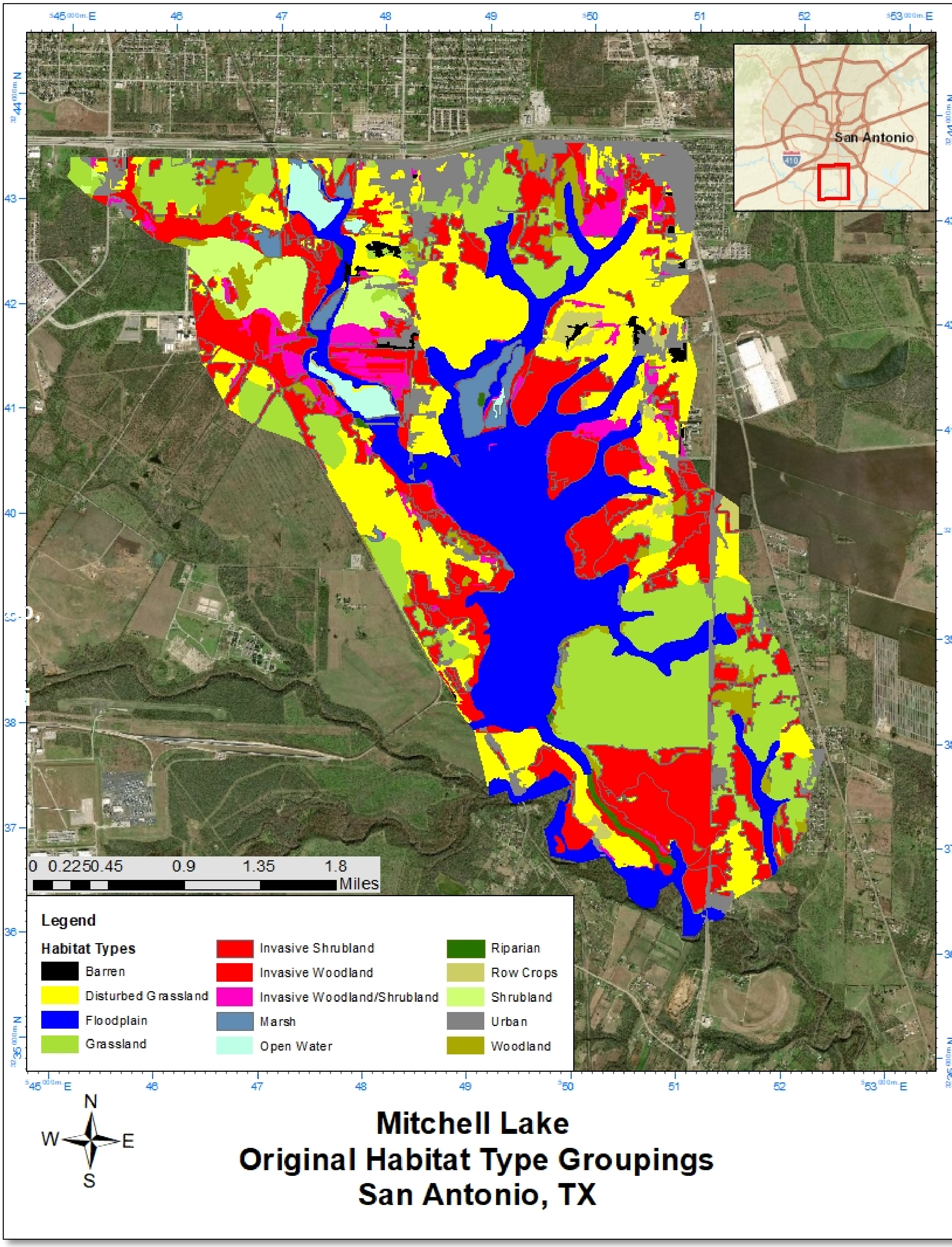


Figure 4-2. Habitat Type Groupings (TPWD 2019b)

4.2.2 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 to 1 (1 representing optimal habitat).

The Shorebird Migration Model and methodology (Table 4-2) 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 4-2. 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

4.2.3 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 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 4-3 to 4-6-19).

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 4-3. 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	

	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)		

Table 4-4. 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 4-5. 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	

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 4-6. 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 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 (ºC) 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)	

4.2.3.1 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.

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

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 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.

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 CE/ICA, which is further described in Appendix B. The IWR Planning Suite II can also perform calculations resulting in the average annual National Ecosystem Restoration (NER) benefits and the average annual equivalent National Economic Development (NED) costs and benefits.

The IWR Planning Suite II was utilized to annualize the HUs of each alternative 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.

4.2.4 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 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 growth of 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.

4.3 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 4-3). 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. The Shorebird Migration model was added after field work and metrics for this model were estimated through a desktop exercise and familiarity with the site conditions. Habitat assessment photos and the field data sheets used during the habitat assessment can be found in Attachments F and G, 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 4-4.

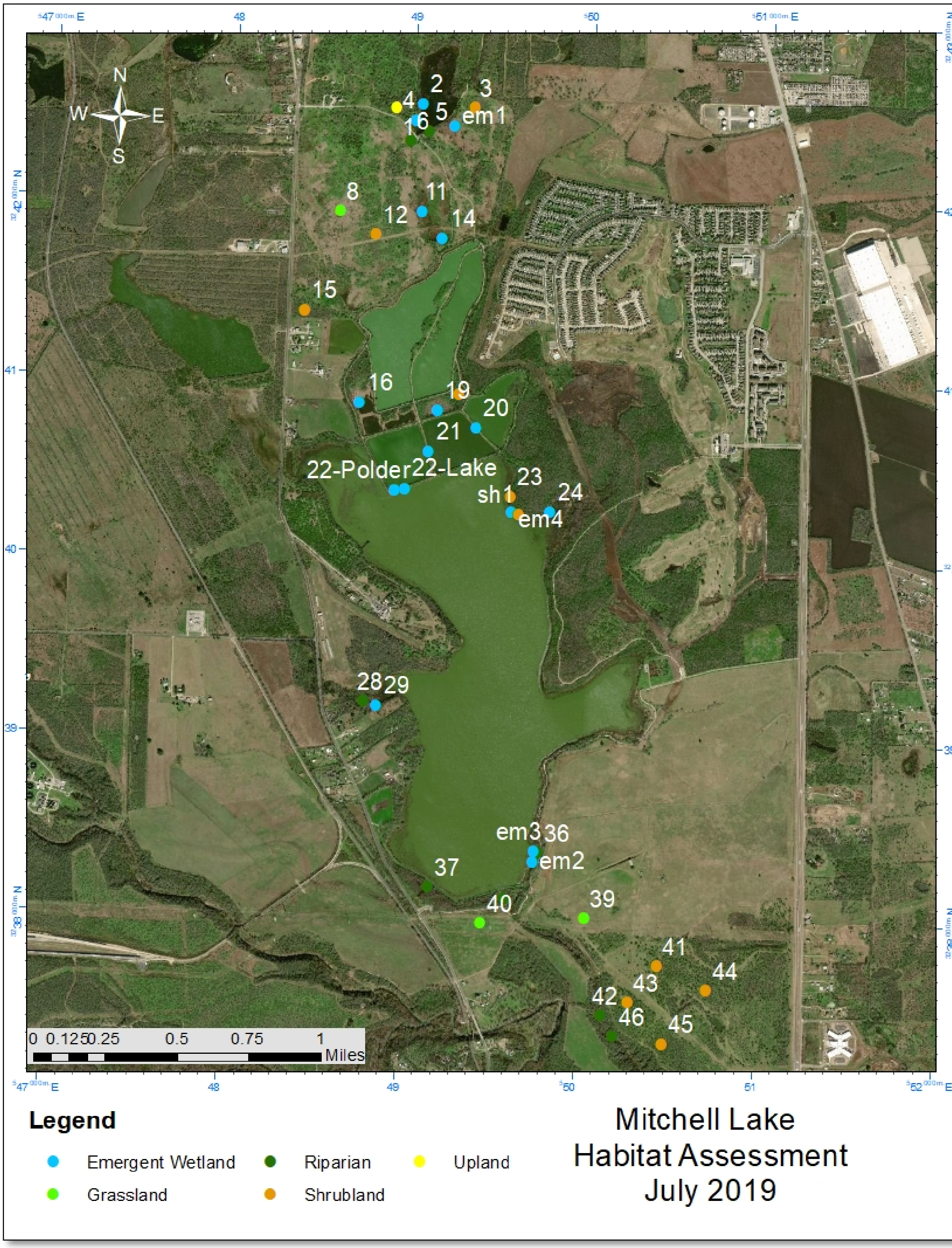


Figure 4-3. Habitat Assessment Survey Points

Figure 4-4. Existing Wetlands Surveyed in June 2019

4.4 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 4.5 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 4.6 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 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 were assisted with this process. Projections can be found in Attachment H.

4.5 Existing and Future Without Project Habitat Conditions

Within the study area, several areas were identified as having potential for restoration efforts. These specific areas, referred to from here on as project areas, are shown in Figure 4-5. The remaining lands within the study area were not considered viable for restoration efforts due to elevation, terrain, and/or little to no aquatic connectivity. The Existing Conditions/FWOP section below describes the general conditions for various resources within the study area. 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.

The expected FWOP includes dropping the Mitchell Lake elevation to 517’ amsl. 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, but Area 6: Polders utilize two 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. To clarify, HUs of the separate models were not added together, but simply averaged to avoid duplicating benefits.

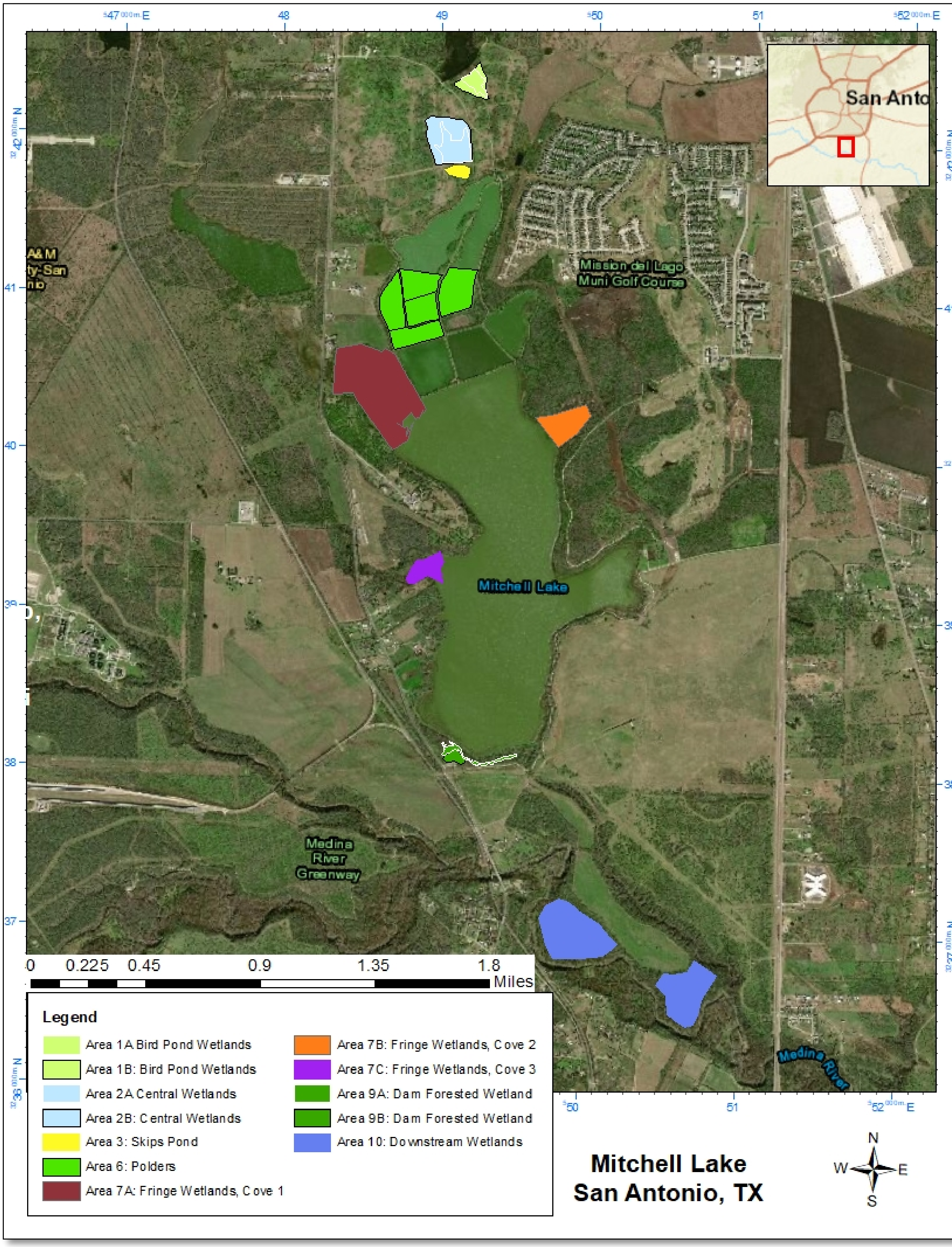


Figure 4-5. Project Areas Considered Within the Study Area

AREA 1: BIRD POND WETLANDS

Area 1 is located at the northern extent of the study area adjacent to Bird Pond near the Mitchell Lake Audubon Center (Figure 4-6). 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.

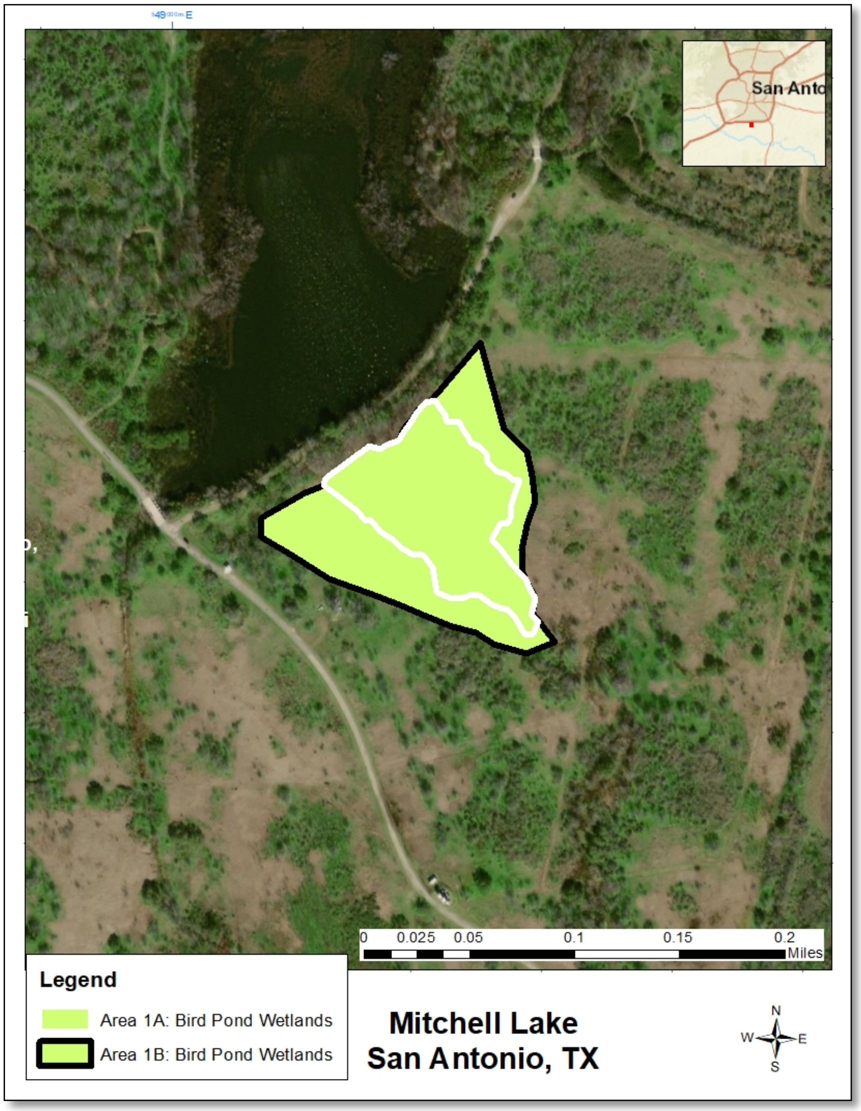


Figure 4-6. Bird Pond Wetlands Area 1A and 1B

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 4-7). 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 target year. Lack of wetland species such as cattails, cordgrasses, and bulrushes 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 is an expansion upon the existing wetlands of Area 1A. The total acreage upon execution of the project would be 6.42 acres.

Although this area 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 Area 1B does not contain any existing wet areas or wetland vegetation.

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 the 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 incorporate the area acreage.

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

Table 4-7. Future Without Project Conditions for Area 1.

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 Area 1A	3.17	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 Area 1A	3.17	0.58	1.85	0.57	1.79	0.55	1.72	0.54	1.71	0.54	1.71	0.54	1.71
Marsh Wren Area 1B	3.25	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 Area 1B	3.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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, upland areas interspersed (Figure 4-7). It is comprised of a shallow wetland with areas of deeper water (6-12" in depth) and dominated by cattail and willow baccharis.

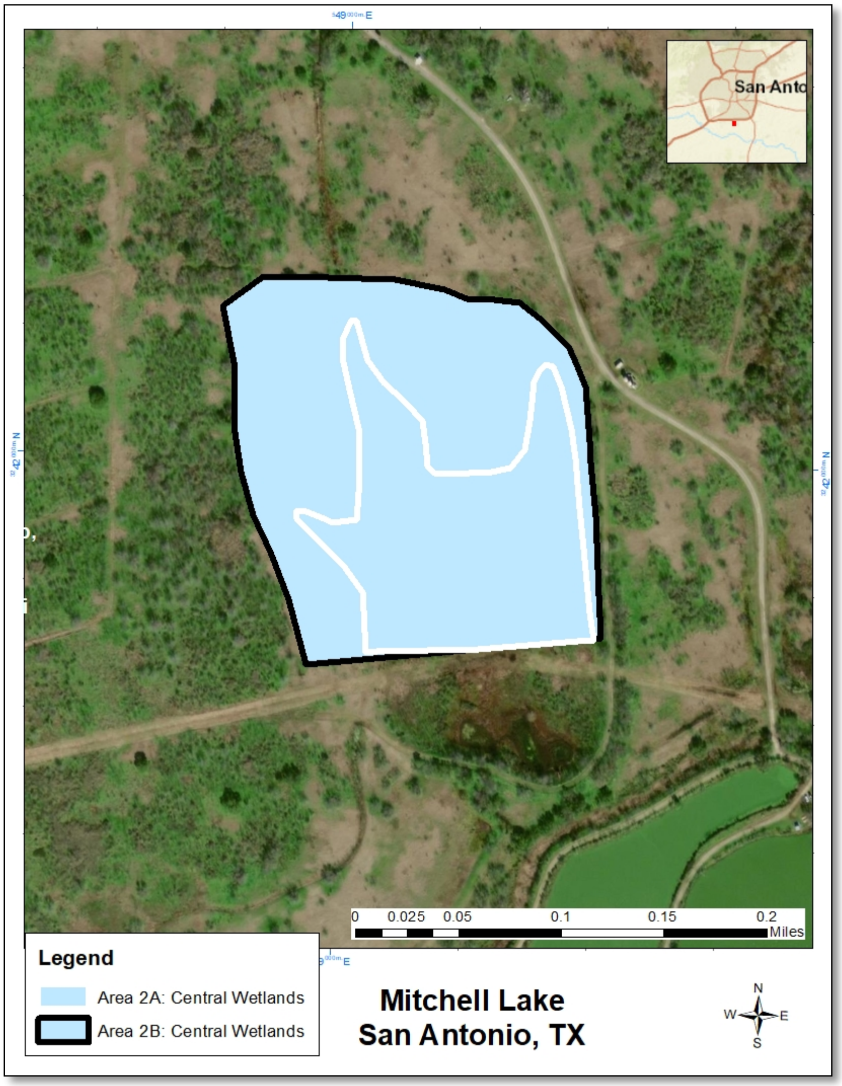


Figure 4-7. Central Wetlands Area 2A and 2B

The existing wetland is referred to as Area 2A. This area has some aspects of suitability in regards to the Marsh Wren and Bullfrog HSI models, but 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 wasdecreased by the percent silt in substrate metric(Table 4-8). The final AAHU score for Area 2A 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 4-8. Future Without Project Conditions for Area 2.

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 Area 2A	10.46	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 Area 2A	10.46	0.58	6.12	0.57	5.92	0.55	5.70	0.54	5.68	0.54	5.68	0.54	5.68
Marsh Wren Area 2B	7.91	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 Area 2B	7.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

AREA 3: SKIP'S POND

Area 3 is part of the same wetlands as Area 2, but they are separated by a pipeline right-of-way (Figure 4-8). This area also supports different vegetation in comparison to Area 2. 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 4-8. Skip's Pond

Table 4-9. Future Without Project Conditions for Area 3.

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	2.18	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	2.18	0.58	6.12	0.57	5.92	0.55	5.70	0.54	5.68	0.54	5.68	0.54	5.68

AREA 6: POLDERS

The polders are directly north of Mitchell Lake. Area 6 is separated into two polders and five basins (Figure 4-9). The plan for this area 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 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.

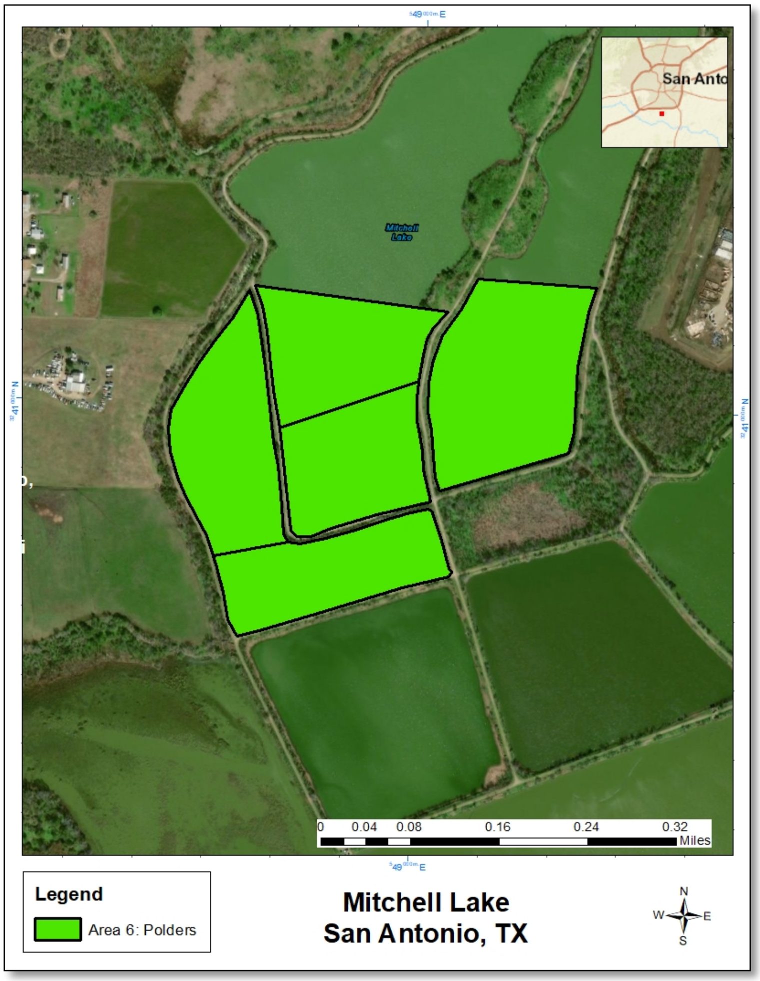


Figure 4-9. Polders

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 4-10). 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 4-10. Future Without Project Conditions for Area 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	0.61	30.21	0.61	30.21	0.61	30.21	0.61	30.21	0.61	30.21	0.61	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 areas or included in combination with each other (Figure 4-10). 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.

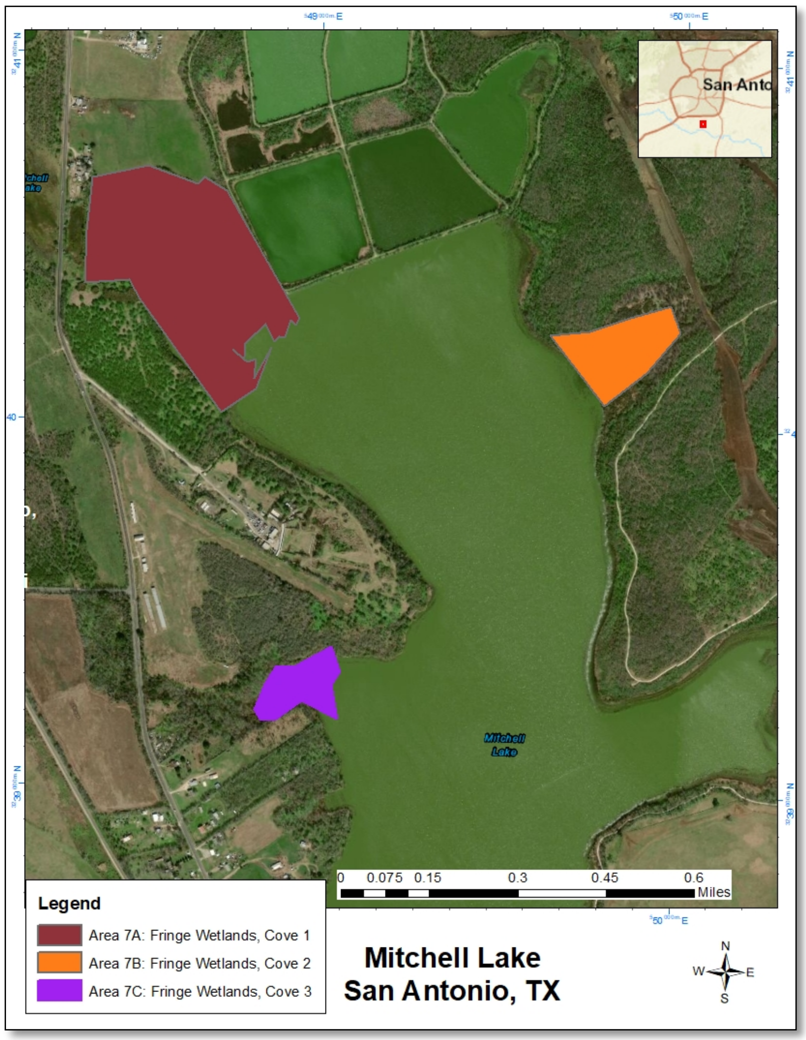


Figure 4-10. Fringe Wetlands Areas Coves 1, 2, and 3

The borders of the lake have very limited plant diversity, lack of diversity impacts the overall Marsh Wren HSI score. 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 suitability. Cove 1 FWOP AAHU is 13.43, Cove 2 is 2.96, and Cove 3 is 1.71.

Table 4-11. Future Without Project Conditions for Area 7.

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 Cove 1	53.68	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 Cove 1	53.68	0.52	28.12	0.47	25.34	0.47	25.34	0.49	26.16	0.50	26.93	0.52	28.12
Marsh Wren Cove 2	11.84	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 Cove 2	11.84	0.52	6.20	0.47	5.59	0.47	5.59	0.49	5.77	0.50	5.94	0.52	6.20
Marsh Wren Cove 3	6.84	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 Cove 3	6.84	0.52	3.58	0.47	3.23	0.47	3.23	0.49	3.33	0.50	3.43	0.52	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 4-11). 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 4-11. Dam Forested Wetlands Areas 9A and 9B

Area 9A is characterized by the existing low areas below the dam, while Area 9B includes the existing forested wetlands and expands upon them. 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 Target Year 10. Area 9A FWOP AAHUs is 0.71 and 9B is 1.25.

Table 4-12. Future Without Project Conditions for Area 9.

Evaluation Method	Target Year												
		0		1		5		10		25		50	
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU

Barred Owl **Area 9A**	2.55	0.22	0.55	0.22	0.55	0.25	0.64	0.33	0.84	0.47	1.19	0.69	1.76
Gray Squirrel **Area 9A**	2.55	0.10	0.25	0.10	0.25	0.10	0.24	0.10	0.25	0.10	0.24	0.10	0.24
Barred Owl **Area 9B**	4.48	0.22	0.97	0.22	0.97	0.25	1.12	0.33	1.48	0.47	2.09	0.69	3.09
Gray Squirrel **Area 9B**	4.48	0.10	0.44	0.10	0.44	0.10	0.43	0.10	0.43	0.10	0.43	0.10	0.43

AREA 10: DOWNSTREAM WETLANDS

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 4-12 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).

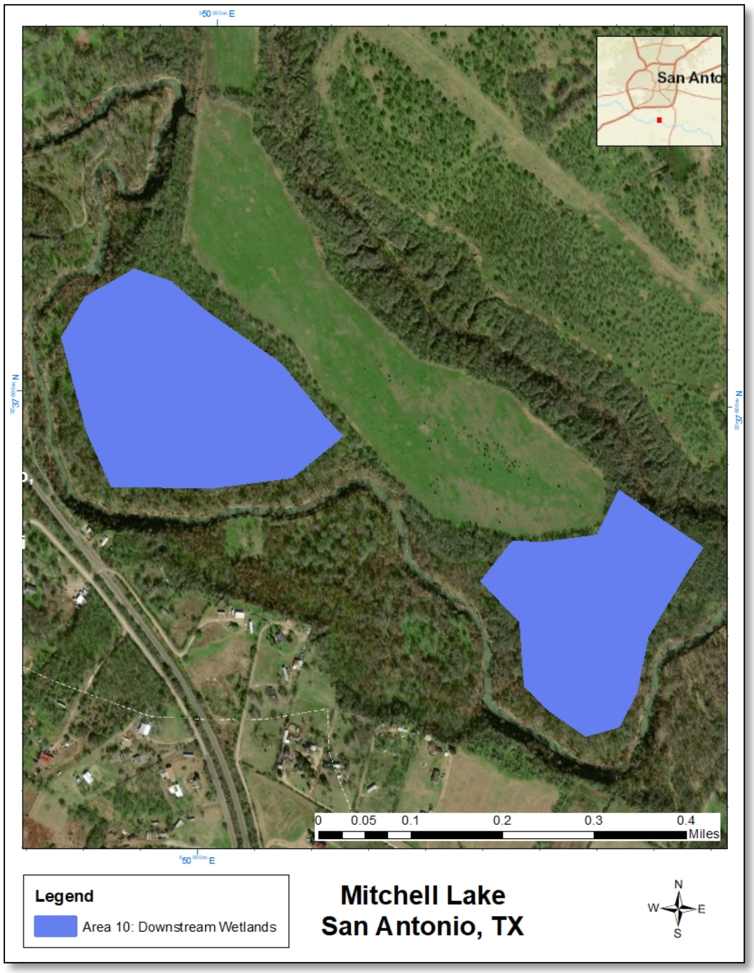


Figure 4-12. Downstream Wetlands Area 10

Table 4-13. Future Without Project Conditions for Area 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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bullfrog	51.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

4.6 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 differences in benefits are dependent on the measures that are assumed to be implemented at the site. The measures for each area are further described in Chapter 4.1.2 of the Integrated Feasibility Report-Environmental Assessment.

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 1B includes the enhancement 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:

- 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 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 control 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 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 4-14 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, 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 to 0.40 in Target Year 50.

Table 4-14. Future With Project Conditions for Alternatives 1A and 1B.

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 Alternative 1A	3.17	0.00	0.00	0.99	3.14	0.90	2.85	0.75	2.38	0.40	1.27	0.40	1.27
Bullfrog Alternative 1A	3.17	0.57	1.80	0.92	2.93	0.96	3.04	0.97	3.07	0.97	3.09	0.97	3.09
Marsh Wren Alternative 1B	3.25	0.00	0.00	0.46	1.50	0.85	2.76	0.71	2.31	0.38	1.24	0.38	1.24
Bullfrog Alternative 1B	3.25	0.00	0.00	0.85	2.77	0.90	2.93	0.95	3.08	0.97	3.14	0.97	3.17

ALTERNATIVES 2A AND 2B: CENTRAL WETLANDS

Alternatives 2A and 2B measures 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 4-15. Future With Project Conditions for Alternatives 2A and 2B.

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 Alternative 2A	10.46	0.00	0.00	0.99	10.36	0.90	9.41	0.75	7.85	0.40	4.18	0.40	4.18
Bullfrog Alternative 2A	10.46	0.57	5.95	0.92	9.66	0.96	10.01	0.97	10.15	0.97	10.19	0.97	10.19
Marsh Wren Alternative 2B	7.91	0.00	0.00	0.46	3.64	0.85	6.72	0.71	5.62	0.38	3.01	0.38	3.01
Bullfrog Alternative 2B	7.91	0.00	0.00	0.85	6.74	0.90	7.12	0.95	7.49	0.97	7.64	0.97	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 4-16).

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 measures are implemented)
- Habitat Structure Augmentation, and
- Installation of Bat/Nest Boxes measures.

Table 4-16. Future With Project Conditions for Alternative 3.

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	2.18	0.00	0.00	0.99	2.16	0.90	1.96	0.75	1.64	0.40	0.87	0.40	0.87
Bullfrog	2.18	0.57	1.24	0.92	2.01	0.96	2.09	0.97	2.11	0.97	2.12	0.97	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 4-17).

Alternative 6 FWP conditions incorporate the following measures:

- Polder Operational Management,
- Installation of Bat/Nest Boxes, and
- Construction of Berms.

Table 4-17. Future With Project 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	0.61	30.21	0.98	48.53	0.98	48.53	0.98	48.53	0.98	48.53	0.98	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, 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 4-18. Future With ProjectConditions for Alternatives 7A, 7B, 7C, 7D, 7E, 7F, 7G.

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 Cove 1	53.68	0.00	0.00	0.00	0.00	0.44	23.62	0.81	43.48	0.76	40.80	0.76	40.80
Bullfrog Cove 1	53.68	0.56	30.24	0.87	46.80	0.90	48.56	0.92	49.58	0.93	49.84	0.93	49.84
Marsh Wren Cove 2	11.84	0.00	0.00	0.00	0.00	0.44	5.21	0.81	9.59	0.76	9.00	0.76	9.00
Bullfrog Cove 2	11.84	0.56	6.67	0.8	10.32	0.90	10.71	0.92	10.93	0.93	10.99	0.93	10.99
Marsh Wren Cove 3	6.84	0.00	0.00	0.00	0.00	0.44	3.01	0.81	5.54	0.76	5.20	0.76	5.20
Bullfrog	6.84	0.56	3.85	0.87	5.96	0.90	6.19	0.92	6.32	0.93	6.35	0.93	6.35

Cove 3													

ALTERNATIVE 9: 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 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 4-19. Future With Project Conditions for Alternatives 9A and 9B.

Evaluation Method	Target Year												
		0		1		5		10		25		50	
	Acres	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU	HSI	HU
Barred Owl Alternative 9A	2.55	0.22	0.55	0.11	0.28	0.16	0.41	0.26	0.65	0.52	1.32	0.58	1.47
Gray Squirrel Alternative 9A	2.55	0.10	0.25	0.32	0.81	0.32	0.81	0.32	0.81	0.55	1.40	0.71	1.80
Barred Owl Alternative 9B	4.48	0.22	0.97	0.11	0.49	0.16	0.73	0.26	1.14	0.52	2.31	0.58	2.59
Gray Squirrel	4.48	0.10	0.44	0.32	1.42	0.32	1.42	0.32	1.42	0.55	2.45	0.71	3.17

Alternative 9B													

ALTERNATIVE 10: DOWNSTREAM WETLANDS

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 would implement 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 4-20. Future With Project 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

4.7 Benefits

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 varying acreage of each alternative. The greatest AAHU benefit based on existing conditions and the Future With Project conditions is in Alternative10: 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 4-21. 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	36.73	36.73	51.32

5 Future With Project and Environmental Consequences

This chapter analyzes the impacts associated with implementation of the final array of plans, including the No Action Plan. The No Action Plan assesses the future impacts to the study area resources that would occur under the FWOP condition. The presentation of the No Action Plan helps the decision maker understand the future conditions in the absence of the Proposed Plan, and how implementation of the plan may alter that future condition. Because the environmental benefits have been calculated over a 50-year period of analysis, the environmental consequences are evaluated over the same timeframe.

For each plan, impacts to the resources resulting from the construction and operation are addressed. However, when impacts are relatively equal between plans, the discussion of the impacts are grouped where appropriate. Because the proposed plan entails improvements to fish and wildlife habitats, no compensatory mitigation is required or proposed for any of the plans.

Detailed information in regards to the Plans for the Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study can be found in Chapter 4.8.4 of the Integrated Feasibility Report-Environmental Assessment.

5.1 Characterization of Potential Impacts

5.1.1 Direct versus Indirect Effects

The terms “effect” and “impact” are synonymous as used in this analysis. Both short- and long-term effects are relevant in considering the significance of an impact. Effects are also expressed in terms of duration. The duration of short-term impacts is considered to be 1 year or less. Long-term impacts are described as lasting beyond 1 year. They can potentially continue in perpetuity, in which case they would also be described as permanent. Effects may be beneficial or adverse and may apply to the full range of natural, aesthetic, historic, cultural, and economic resources of the project area and the surrounding area. Definitions and examples of direct and indirect impacts as used in this document are as follows:

- Direct Impact. A direct impact is one that would be caused directly by implementing one of the two plans and that would occur at the same time and place.
- Indirect Impact. An indirect impact is one that would be caused by implementing a plan that would occur later in time or farther removed in distance, but would still be a reasonably foreseeable outcome of the action. Indirect impacts may include induced changes in the pattern of land use, population density, growth rate, air, water, and other natural resources and social systems.

5.1.2 Significance Criteria and Impact Characterization Scale

In accordance with CEQ regulations and implementation guidance, impacts are evaluated in terms of their significance. The term “significant,” as defined in 40 CFR 1508.27, part of the CEQ regulations for implementing NEPA, requires consideration of both context and intensity. Context means that the significance of an action must be analyzed in several settings, such as society as a whole (human, national); the affected region; the affected interests; and the locality. Significance varies with the setting of the Proposed Action. For instance, in the case of a site-specific action, significance would usually depend on the effects on the locale rather than on the world as a whole.

Intensity refers to the severity of impact with regard to the above ratings (minor through significant). Factors contributing to the evaluation of the intensity of an impact include, but are not limited to, the following:

- The balance of beneficial and adverse impacts, in a situation where an action has both;
- The degree to which the action affects public health or safety;
- The unique characteristics of the geographic area where the action is proposed, such as proximity to parklands, historic or cultural resources, wetlands, prime farmlands, wild and scenic rivers, and ecologically critical areas;
- The degree to which the effects on the quality of the human environment are likely to be controversial;

- The degree to which the effects of the action on the quality of the human environment are likely to be highly uncertain or involve unique or unknown risks;
- The degree to which the action might establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration;
- Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action "temporary" or by breaking it down into small component parts;
- The degree to which the action might adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the NRHP or might cause loss or destruction of significant scientific, cultural, or historic resources;
- The degree to which the action might adversely affect an endangered or threatened species or habitat that has been determined to be critical under the ESA; and;
- Whether the action threatens a violation of Federal, state, or local law or requirements imposed for the protection of the environment.

Impacts are characterized by their relative magnitude. Significant adverse or beneficial impacts are the highest levels of impacts. Conversely, negligible adverse or negligible beneficial effects are the lowest level of impacts. In this document, nine descriptions are used to characterize the level of impacts. In order of degree of increasing impact they are:

- Significant Adverse Impact
- Moderate Adverse Impact
- Minor Adverse Impact
- Negligible Adverse Impact
- No MeasurableImpact
- Negligible Beneficial Impact
- Minor Beneficial Impact
- Moderate Beneficial Impact
- Significant Beneficial Impact

5.2 Proposed Action

A more detailed explanation of the Plans evaluated during the Feasibility Study can be found in Chapter 5 of the Integrated Feasibility Report-Environmental Assessment. The Alternatives described in Chapter 4 were input into the IWR Planning Suite CEICA. The Alternatives were analyzed and compared using the IWR Planning Suite. The output of the analysis conducted by the IWR Planning Suite produced Plans, each plan is briefly described below.

- Plan 1: No Action
- Plan 2: Polders (Alternative 6)

Under the existing condition, the polders are managed for open water and provide essentially no foraging habitat for migrating shorebirds. Due to the larger size of the East and West Polders in comparison to the basins, berms will be installed to create more equal sized cells. This measure will allow better manageability of the water levels within this area, which will assist in waterbird, waterfowl, and shorebird management overall.

- Plan 3: Cove 3 + Plan 2 (Alternatives 6 + 7C)

Plan 3 includes the restoration of shorebird habitat attributed to the polders and adds habitat for waterbirds (another group of birds experiencing significant declines in population sizes) and waterfowl (a nationally managed resource).

- Plan 4: Downstream Wetlands + Plan 3 (Alternatives 6 + 7C + 10)

The addition of the downstream wetlands associated with Plan 4 increases the number of ecological guilds and niches that would benefit from the Mitchell Lake restoration efforts. The creation of mudflat habitat specifically benefits shorebirds, the emergent/submergent wetlands benefit waterfowl and waterbirds, and the emergent wetlands benefit waterbirds and temperate and neotropical migrant songbirds.

- Plan 5: Coves 2 and 3 + Plan 4 (Alternatives 6 + 7G + 10)

Plan 5 would increase the area of emergent/submergent wetlands restored by an order of magnitude. The larger areal extent of Coves 1 and 2 result in exponentially longer habitat edge. The edge habitats provide significant habitat for birds that require shallower habitats for foraging and resting. The result of the larger restored area and longer edge habitat significantly increase waterbird and waterfowl habitat in Mitchell Lake. As previously mentioned, this habitat is highly valuable for nationally significant resources such as waterbirds and waterfowl. Each year, these birds migrate through the area and settle on Mitchell Lake. The addition of two larger coves to the restoration Plan would spread the bird population over a larger area and accommodate more birds that would otherwise have been forced to expend energy in search of additional habitat. The addition of the two larger coves creates "patch" habitat that is utilized by different species of waterfowl and waterbirds. Patch habitats are a component of the island biogeography concept. The island biogeography theory considers the benefits of habitat connectivity in relation to habitat patch sizes and distances between the habitat patches. The restoration of separate patches provides resiliency as natural stresses such as drought or flooding may adversely impact one patch more than another. These stressors are anticipated to increase over time as the effects of climate change manifest.

- Plan 6: Skip's Pond + Plan 5 (Alternatives 3+ 6 + 7G + 10)

Although Skip's Pond adds submergent/emergent wetland habitat to the proposed restoration and increases the total acreage of submergent/emergent for this Plan to 74.54 acres, the Skip's Pond wetlands are significantly different than the cove wetlands. The cove wetlands border the deeper open water habitats of Mitchell Lake with the wetlands gradating from submergent to emergent vegetation towards the shoreline. The deeper wetland areas associated with the cove primarily attract diving ducks such as Canvasbacks (*Aythya valisineria*), Redheads (*A. americana*), and Greater and Lesser Scaup (*A. marila and A. affinis*). The Skip's Pond wetlands provide smaller patches of shallower open water surrounded by more tussocks of emergent vegetation. These smaller wetlands provide high quality habitat for migrating dabbling ducks such as Mallard, Northern Pintail (*Anas acuta*), Gadwall (*Mareca streptera*), and teal (*Spatula discors, Spatula cyanoptera, and Anas crecca*).

- Plan 7: Central Wetlands (2B) + Plan 6 (Alternatives 2B + 3+ 6 + 7G + 10)

Thus far, Plans 2 through 6 have included restoration areas that realize benefits in isolation, albeit with cumulative benefits across the spread of the study area. With the addition of the Central Wetlands, Plan 7 begins linking restoration areas from the previous Plans resulting in synergistic benefits to fish and wildlife habitat. Plan 7 also provides significant ancillary water quality benefits that are not captured or included in the plan formulation of the study.

One of the key components of the Central Wetland restoration is the pipeline from the existing pump station at the southwest corner of the polders to the northern end of the Central wetland complex. This pipeline provides the capability of managing the water levels of the wetlands, extracting low quality water from Mitchell Lake and releasing it into the Central Wetlands. Wetland habitats provide water quality benefits as the wetland vegetation captures nutrients as the water passes through them. The water exiting the wetlands has a lower nutrient load and is of a higher quality than the water entering them. Once the water is filtered through the Central Wetlands, the water flows through Skip's Pond further filtering out the nutrients. Skip's Pond empties into a long linear wetland/drainage feature that borders the polders. This linear wetland continues along the northern and western boundary of the polders until it empties into Cove 1 of Mitchell Lake. Once leaving Skip's Pond, the water is "polished" further as it flows approximately 4,635 feet through the linear wetland and Cove 1 of Mitchell Lake.

- Plan 8: Bird Pond Wetlands (1B) + Plan 7 (Alternatives 1B + 2B + 3+ 6 + 7G + 10)

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.

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.

- Plan 9: Forested Wetlands below the Dam + Plan 8 (Alternatives 1B + 2B + 3+ 6 + 7G + 9B + 10)

Plan 9 would introduce a fourth habitat type into the proposed restoration Plans – forested wetlands. Forested wetlands provide for additional guilds of Neotropical migrant songbirds including the Barred Owl (*Strix varia*), Northern Parula (*Setophaga americana*), Vermilion Flycatcher (*Pyrocephalus rubinus*), Louisiana Waterthrush (*Parkesia motacilla*), and Prothonotary Warbler (*Protonotaria citrea*). The forested wetlands also provide for species of reptiles, amphibians, and mammals that are not found in the grassland and savannah wetlands associated with the previous Plans.

After conducting an "Is It Worth It Analysis" that compares the cost and benefit of each Plan, Plan 8 was chosen as the Proposed Action or Plan (Figure 5-1).

A total of 110.8 AAHUs are provided by Plan 8; the allocation of the AAHUs are provide 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

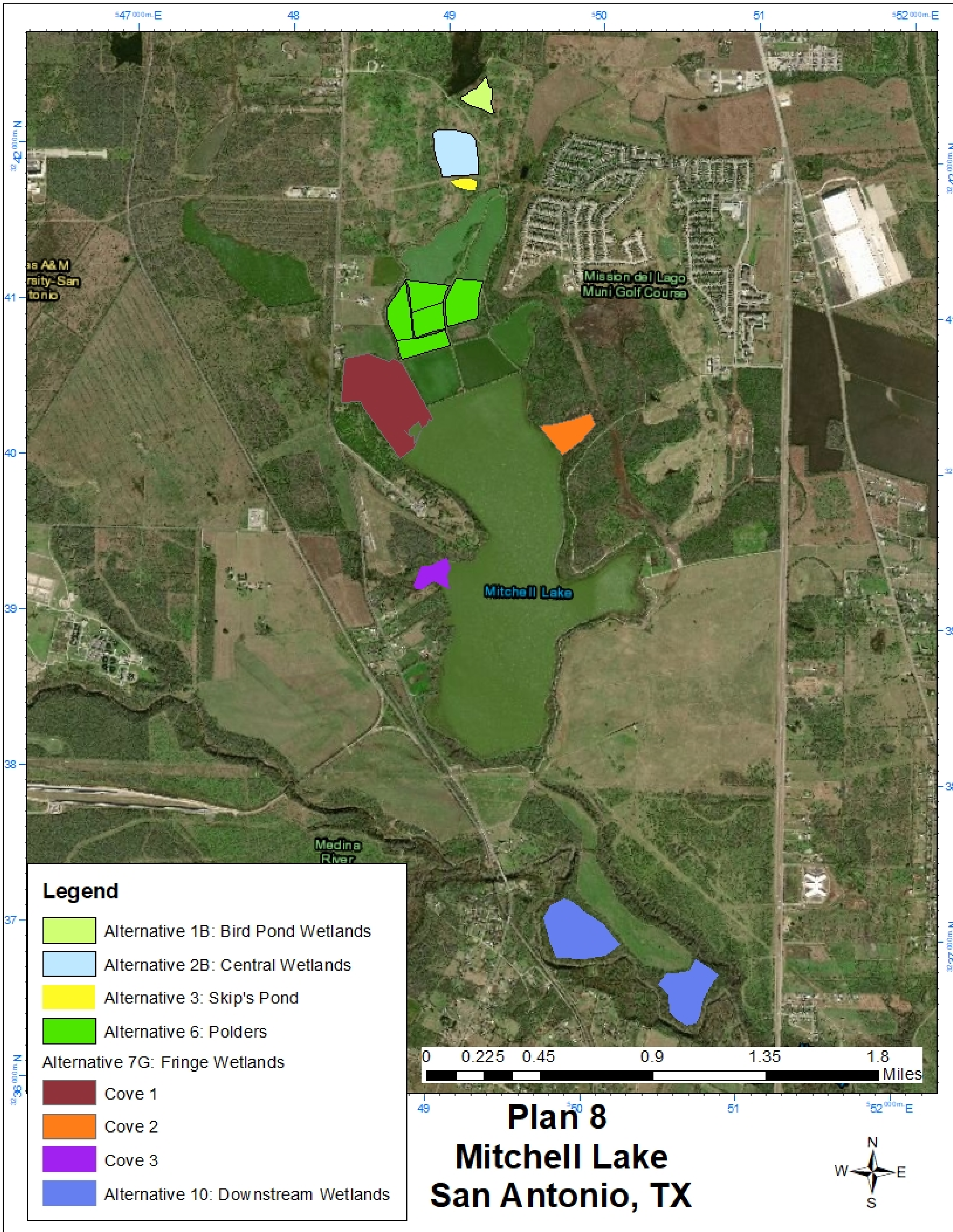


Figure 5-1. Plan 8 Restoration Alternatives

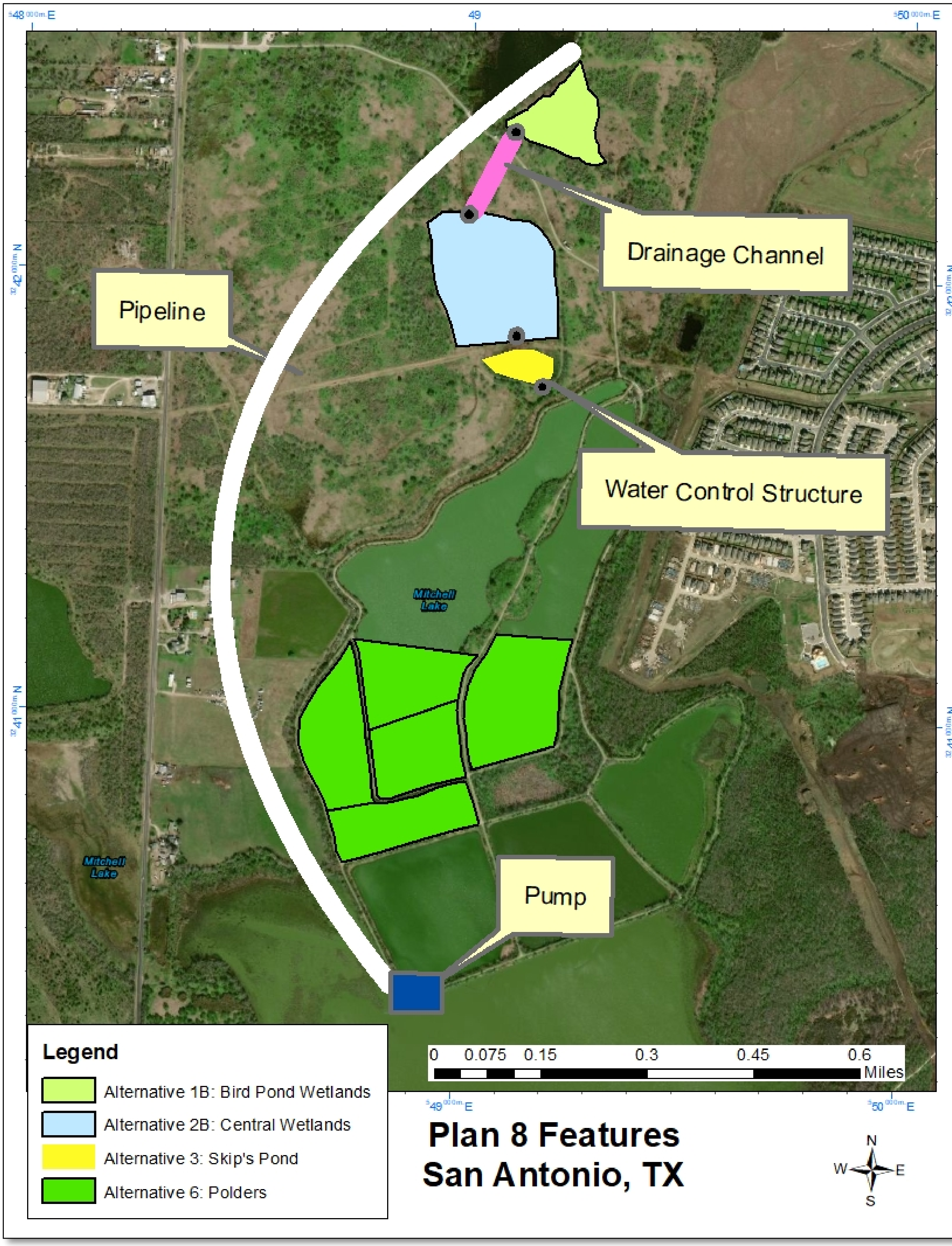


Figure 5-2. Plan 8 Restoration Features

5.3 Climate

The proposed project area encompasses a relatively small area when compared to the global scale. Therefore, any changes to climate change resulting from any of the plans, including the No Action Plan, would be insignificant.

5.3.1 No Action Plan

As stated above, there would be no significant impacts to climatic conditions.

5.3.2 Proposed Action

Although the small scale of the project area would limit any significant changes to the earth's climate, the restoration of 200.17 acres of habitat would contribute to the collective sequestration of carbon. In particular, wetland habitats sequester significantly more carbon than the associated upland habitats.

5.4 Land Use

The Audubon Society manages the proposed project area for wildlife habitat and SAWS maintains and manages the water in Mitchell Lake and the Polders to ensure water quality impairments downstream of the lake are minimized. This management will continue into the Future With Project conditions.

5.4.1 No Action Plan

There would be no measurable impacts to land use due to the No Action Plan.

5.4.2 Proposed Action

The Proposed Action would have no measurable impactsto land use as described above.

5.5 Geology and Topography

No changes to the proposed project area geology would result from the No Action and Proposed Action.

5.5.1 No Action Plan

Since the No Action Plan would leave the proposed project area in its existing condition, there would be no measurable impacts to the Mitchell lake geology or topography would result.

5.5.2 Proposed Action

Plan 8 Areas 1, 2, 3, 9, and 10 require excavation to increase the extent and/or depth or create (Area 10) wetland habitats. Implementing the Bird Pond Wetlands, Central Wetlands, and Skip's Pond would result in the excavation of 6 inches to six feet of material to create the target wetlands. The Downstream Wetlands would require the excavation of upland material to create a series of wetland cells averaging approximately four feet in depth with small pools extending to 6 feet in depth. The Polders and Fringe Wetlands would not require changes to the topography in the proposed project area, with the exception of the installation of berms to segment off three of the existing polder cells. Any changes to topography resulting from the Proposed Action would result in the increased habitat quality within the proposed project area due to the improvement with vegetative diversity because of the topographical changes. No measurable impacts would occur due to the Proposed Action.

5.6 Soils, Including Prime Farmlands

Because the proposed project area is located within the city limits of San Antonio, prime farmland soils do not occur at the site. Therefore, Section 1541(b) of the FPPA of 1980 and 1995, 7 U.S.C. 4202(b) is not applicable.

5.6.1 No Action Plan

Under the No Action Plan, soils would not be directly impacted by excavation or other ground disturbing activities.

5.6.2 Proposed Action

The potential impacts to soils with the implementation of the Proposed Plans have been documented above in Section 5.5.2. The topsoil from the excavated areas would be stockpiled and used to line the excavated wetland areas to grade. Sedimentation and erosion Best Management Practices (BMPs) will be incorporated to avoid erosion and sedimentation to adjacent waterbodies and wetlands.

5.7 Air Quality

5.7.1 No Action Plan

Under the No Action Plan, there would be no measurable impacts to air quality within the study area.

5.7.2 Proposed Action

The operation of heavy equipment, support vehicles, and other motorized machinery for construction would result in combustion of fossil fuels and the release of volatile organic compounds (VOCs), nitrogen oxides (NOx), carbon monoxide (CO), ozone (O_3), sulfur dioxide (SO_2), and particulates(PM_{10} and $PM_{2.5}$). Additionally, fugitive dust emitted to the atmosphere by heavy equipment and support vehicles moving across unpaved, non-vegetated roadways or staging areas, wind blowing dust from disturbed areas and storage piles into the atmosphere could create a haze over the project area and increase ambient concentrations of particulate matter. Fugitive dust emissions would be greatest during the initial site preparation activities and would vary from day to day depending on the construction phase, level of activity, and prevailing weather conditions. The quantity of uncontrolled fugitive dust emissions from a construction site is proportional to the area of land being worked and the level of construction activity. Emissions would be temporary in nature. The use of BMPs during construction would minimize these emissions, including the use of cleaner burning fuels and energy efficient equipment.

Air quality impacts from implementation of any of the Proposed Plans would be similar in scope, but varying in scale and duration. In general, each area plan would have minor and temporary direct impacts to ambient air quality from construction activities. Air emissions would be mobile in nature, temporary, and localized to the restoration unit(s) being worked at that time. Implementation of the following BMPs would further reduce air quality impacts and should be incorporated when developing contract specifications:

Mobile Source Controls:

- The use of heavy machinery should be fitted with approved muffling devices that reduce emissions;
- Plan construction scheduling to minimize vehicle trips;
- Limit idling of heavy equipment;

- Maintain and tune engines per manufacture's specifications to perform at EPA certification levels, prevent tampering, and conduct inspections to ensure these measures are followed; and
- Consider alternative fuel and energy sources (e.g. natural gas, electricity, etc.) when and where appropriate.

Fugitive Dust Source Controls:

- Stabilize open storage piles and disturbed areas by covering and/or applying water or chemical/organic dust palliative where appropriate at active and inactive sites; and
- Install wind fencing and phase grading operations where appropriate, and operate water trucks for stabilization of surfaces under windy conditions.

5.8 Noise

Pursuant to Chapter 21, Article III of the City Municipal Code, maximum permissible noise levels depend on the land use of the property that contains the noise source (e.g., industrial, commercial, or residential) and the land use of the property receiving that noise. Maximum permissible noise levels range from the 63 A-frequency weighted decibels (dBA) in residential zoning districts

5.8.1 No Action Plan

Under the No Action Plan, there would be periodic noise attributed to mowing equipment and vehicles during routine maintenance and site visits.

5.8.2 Proposed Action

The Proposed Action would require heavy equipment to implement construction efforts, which would cause short-term localized increases in noise levels. These short-term increases are not expected to substantially affect adjacent noise sensitive receptors or wildlife areas. The nearest noise receptors to any of the restoration areas is the Mission del Lago neighborhood east of the polders. As all of the proposed plans include construction activities at the polders, each plan would have a minimal temporary noise impact to the Mission del Lago community.

Noise levels created by construction equipment would vary greatly depending on factors such as the type of equipment, the specific model, the operation being performed, and the condition of the equipment. The equivalent sound level of the construction activity also depends on the fraction of time that equipment is operated over the period of time of the construction. Construction would occur during daylight hours, thus reducing the day-night average sound levels and the chances of causing annoyances. Construction would also be in accordance with migratory bird nesting periods, due to their proximity to the project area. Because much of the construction activities would occur within the existing SAWS property, adjacent properties would be partially buffered from construction noises. The use of BMPs such as keeping equipment in good operating condition, proper training, and providing appropriate health and safety equipment would minimize the potential noise impacts associated with the Proposed Action. Construction would be conducted in accordance with Chapter 21 of the San Antonio City Ordinances.

5.9 Transportation

5.9.1 No Action Plan

Under the No Action Plan, there would be no measurable impacts to transportation.

5.9.2 Proposed Action

For the Proposed Action, short-term, insignificant impacts to traffic volumes would be expected during construction activities. Local roads are well designed and are capable of handling a large volume of vehicles. However, during construction, traffic congestion could occur as construction vehicles enter and exit the project area, or transport construction debris to the disposal site. Road closures or restricted access would not be anticipated; however, temporary detours or traffic control may be needed during working hours. A traffic control plan would be prepared by the construction contractor and submitted for approval to Federal and local officials prior to the start of any construction activities.

Implementation of any of the action plans would have no measurable impact on transportation or transportation corridors. Insignificant indirect impacts to Pleasanton Road could include the additional wear and tear, caused by support vehicles entering the restoration units. The level of indirect impacts would be expected to be minimal and not cause a noticeable increase or hardship on local maintenance programs.

5.10 Light

The Mitchell Lake area is managed for natural resources and exposed to the fugitive light sources from adjacent neighborhoods, roads, and the nearby urban development. Due to increasing urbanization, it is expected that fugitive light will occur more frequently in the study area.

5.10.1 No Action Plan

Light sources will become more frequent in the study area due increased urbanization, however; this is a unavoidable impact that will affect the study area over an extended amount of time.

5.10.2 Proposed Action

No permanent light sources would be added as the result of any of the plans and no construction would occur during nighttime hours. Therefore, there would be no measurable impacts associated with the construction of the proposed restoration features.

5.11 Water Resources

Each of the proposed plans would result in the restoration or improvement of aquatic resources within the study area. Therefore, any temporary adverse impacts to water resources would be offset by the net gain in habitat quantity and quality. Each proposed plan beneficially impacts the water resources of the study area to a different degree and is described below.

5.11.1 No Action Plan

Under the No Action Plan, there would be no measurable impacts to waters. The future water management plan for Mitchell Lake is to decrease the surface water elevation from 519 feet to 517 feet amsl, thereby decreasing the open water surface area of the lake. Urbanization will be a contributing factor to the water quality of the northern wetlands, polders, and Mitchell Lake itself. Although there are not permittable actions that would allow runoff from adjacent properties to enter Mitchell Lake, this may impact water quality of the study area regardless. Water quality would not be improved, although a complex of water quality treatment proposed for construction by SAWS would increase the water quality for the Mitchell Lake outflows. However, the treatment wetlands would not affect the water quality withinMitchell Lake, the polders, or the northern wetlands.

5.11.2 Proposed Action

Each proposed plan would restore the form and function of specific aquatic features within the study area which would result in differing magnitudes of beneficial impacts. All proposed plans would have temporary localized water quality impacts during construction. However, these impacts would be temporary and would be minimized with the implementation of BMPs and a Stormwater Pollution Prevention Plan (SWPPP). The impacts to water resources for each of the proposed plans are provided below.

5.11.2.1 Surface Water

Implementation of Alternative 6 would result in the construction of berms to create two mudflat polders at the south end of the West Polder and one mudflat polder at the south end of the East Polder. The construction of the berms to create these mudflat polders would result in the loss of approximately 3.0 acres of open water habitat. An additional berm would be constructed in Polder 1 to create two similar sized mudflat polders; however, Polder 1 is managed to capture overflows of the adjacent polders during storm events and remains dry most of the time. With the implementation of Plan 2, the water management of the 5 mudflat polder units would result in temporal impacts to the open water habitat, but not a loss of overall open water acreage. At any one time, two mudflat polders would be managed as mudflats while the remaining three would remain as open water habitats. Once constructed, two of the five polders (the two Polder 1 mudflat polders) would be dry, so any loss of open water habitat resulting from the draining of the East and West mudflat polders would be compensated by the creation of open water habitat in the Polder 1 mudflat cells. The loss of open water resulting from the construction of the berms is marginal considering the increased benefits that the mudflats provide for the avian community.

Alternative 10 includes the conversion of 51.32 acres of uplands to emergent wetland habitat. The water supply for these wetlands would be provided by the future constructed treatment wetlands proposed by SAWS. Therefore, the construction of the Downstream Wetlands would have no measurable impacts on surface water resources.

Alternative 7G would increase the surface water habitat by increasing species diversity and habitat structure to Coves 1, 2, and 3. This alternative includes the creation of 72.36 acres of wetland habitat.

Alternative 3 adds the restoration of Skip’s Pond, a 2.18-acre pond supporting emergent and submergent vegetation.

Alternative 2B adds the restoration of 10.46 acres of emergent wetlands (Central Wetlands) and the creation of an additional 7.91 acres of emergent wetland adjacent to the existing Central Wetlands. The restoration of the existing wetlands would have similar temporary impacts as those identified for Skip’s Pond; however, the creation of the additional wetland areas would result from the conversion of upland habitats to wetlands and would not result in measurable impacts to surface water or wetland resources.

The Bird Pond wetlands, Alternative, 1B would restore 3.17 acres of existing emergent wetland habitat and create an additional 3.25 acres adjacent to the existing wetland. The excavation required for the restoration of the existing wetland area would have the same temporary impacts as those identified above.

Although Plan 8 entails the excavation and re-contouring of portions of the pond’s wetlands, the restoration would increase the habitat structure and diversity of the wetland resulting in a net increase in habitat quality by 110.8 AAHUs.

5.11.2.2 Groundwater

The Mitchell Lake study area is located outside of the Edwards and Carrizo Wilcox Aquifer Recharge Zones; therefore, no measurable impacts on groundwater are anticipated from the No Action or Proposed Plan.

5.11.2.3 Hydrology and Hydraulics

Although Plan 8 would change the water management of the polders, the polders are a contained system; therefore, the management of the polders to create mudflat habitats would not have any impact on the watershed hydrology or hydraulics of the surrounding aquatic systems

The implementation of the Downstream Wetlands would not affect the watershed hydrology or hydraulics of Cottonmouth Creek above the impacts that would occur with the water quality treatment wetlands proposed by SAWS. Although the SAWS' wetlands may modify the hydrology and hydraulics of the system by diverting lake water to the wetlands and releasing the outflow back into Cottonmouth Creek or the Medina River, the construction of the Downstream Wetlands will be integrated into the SAWS wetlands with little to no additional changes to the hydrology and hydraulics.

The planting of emergent and submergent vegetation associated with Coves 1, 2, and 3 would not alter the hydrology or hydraulics of the watershed.

The restoration of Skip's Pond entails the excavation of deeper water within the pond to serve as a refugia for fish and wildlife during times of drought and the planting of native emergent and submergent vegetation. The creation of deeper pockets within the pond is not expected to alter the watershed hydrology or affect the hydraulics of the pond inflows and outflows.

From a watershed perspective, wetland habitats essentially function as "sponges". Wetlands slow floodwaters allowing the water to better infiltrate into the ground, decreasing a portion of the runoff from the watershed. Plan 8 increases the wetlands size to 150.65 acres. The increase in wetland size also increases the hydrologic effect on the watershed.

Plan 8 also includes the construction of a water control structure at the downstream end of Skip's Pond and the Bird Pond Wetlands. The water control structure allows for management of the Central Wetland's and Bird Pond Wetland's water levels to mimic seasonal fluctuations in precipitation and maintain a diverse and healthy wetland. The impacts to the hydraulics resulting from the water control structure would also affect Skip's Pond.

The hydraulics of the Bird Pond Wetlands, Central Wetlands, Skip's Pond, and the linear wetlands bordering the northern and western edges of the polders would change as water would be pumped to the upstream portion of the Bird Pond Wetlands to maintain water levels in the wetlands. However, the increased flows that would result from the pumping would occur in a closed system as the water would be pumped from Mitchell Lake and allowed to flow back to the lake relatively close to the pump intake. Therefore, although the internal hydrology and hydraulics of the Bird Pond Wetlands, Central Wetlands, and Skip's Pond may be modified, the impacts outside of that closed system would be negligible.

Plan 8 would include the pumping of Mitchell lake water to the upstream side of the Bird Pond Wetlands. The pumped water would be part of a closed system and outside of that system, impacts to the hydrology and hydraulics would be negligible.

5.11.2.4 Floodplains

Although the Proposed action is located partially within the 100-year floodplain, the primary design consideration of the Proposed Action is to ensure that the combination of all ecosystem restoration measures proposed would maintain hydraulic neutrality, i.e. not result in a decrease in floodplain capacity or an increase in flood risk within the study area. For plans that would require the excavation of materials, appropriate disposal site would be located in an upland areas outside of both the 100- and 500-year floodplains. The Proposed Action would comply with EO 11988 (see Environmental Compliance Section of this Chapter).

5.11.2.5 Water Quality

Implementation of any of the Proposed Action would directly impact surface waters in the study area through construction activities associated with excavation and contouring of wetland cells. During the construction period, these impacts are expected to temporarily degrade water quality as a result of ground disturbing activities. Erosion and sedimentation controls, such as silt fencing and sediment traps, the application of water sprays, and the prompt revegetation of disturbed areas would be required during construction to reduce and control siltation or erosion impacts. In addition, every construction project poses a potential contamination risk from petroleum or chemical spills. The contractor would be required to prepare and follow a site specific Spill Prevention Plan during construction, which would include use of BMPs such as proper storage, handling, and emergency preparedness, reducing the risk of such contamination.

Impacts to surface waters following implementation of the proposed plans could have major beneficial impacts on water quality. The restoration and expansion of 150.65 acres of wetlands associated with the Plan 8 increase the natural nutrient and pollutant filtering functions of the wetlands. This natural function is one of the ancillary benefits provided by the circulation of Mitchell Lake water through the Bird Pond Wetlands, the Central Wetlands, Skip's Pond, the linear wetland adjacent to the polder berms, and Cove 1. Although the scale of these benefits may be relatively small, the proposed plan could be compatible with other water quality treatment methods in an integrated water quality program.

5.12 Socioeconomics and Environmental Justice

5.12.1 No Action Plan

Under the No Action Plan, there would be no measurable impacts to the socioeconomic environment surrounding the Mitchell Lake study area.

5.12.2 Proposed Action

None of the proposed plans would result in the relocation of any residences or businesses. Therefore, there would be no measurable impacts to environmental justice populations and the proposed project would be consistent with EO 12898.

5.13 Cultural Resources

Section 106 (16 U.S.C. 470f) of the National Historic Preservation Act of 1966, as amended, (NHPA) requires that Federal agencies consider their undertakings, or projects, and the potential of those undertakings to impact significant cultural resources through the procedures found in 36 Code of Federal Regulations (CFR) Part 800 (Protection of Historic Properties). To fully consider the effects of a proposed project on cultural resources, USACE must consult with the Texas State Historic Preservation Office (SHPO) and federally recognized Native American tribes who have traditionally or historically used the area affect by the proposed action. USACE initiated consultation with the SHPO and appropriate Native American tribes in 2018.

5.13.1 No Action Plan

Under the No Action Plan, cultural resources would not be impacted by the USACE undertaking. Any significant cultural resources will remain deeply buried and protected. Overall, no known measurable impacts to cultural resources would occur.

5.13.2 Proposed Action

The Proposed Action requires the removal of the top four inches to six feet of existing soil to create appropriate depths for wetland cells. Soils accumulate rapidly in alluvial riverine settings, therefore, cultural bearing deposits would not be expected within that first 18 to 24 inches of top soil. 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 SHPO will ensure compliance with Section 106 of the NHPA. 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 NRHP before ground disturbing activities would be allowed to continue in the vicinity. In this way, no significant impacts for the implementation of the Proposed Action would be expected.

5.14 Hazardous, Toxic, and Radioactive Waste

5.14.1 No Action Plan

Under the No Action Plan, no hazardous, toxic, or radioactive waste would be uncovered as there would be no future dredging of the lake or polders. Although these substances will continue to degrade current water and habitat quality.

5.14.2 Proposed Action

No anticipated measurable impacts are expected by implementation of the Proposed Action. The exposure of any unanticipated hazardous material unearthed during excavation activities would be dealt with in a manner consistent with ER 1165-2-132 Hazardous, Toxic and Radioactive Waste Guidance for Civil Works Projects.

To minimize potential impacts from hazardous and regulated materials during construction, all fuels, waste oils, and solvents would be collected and stored in tanks or drums within a secondary containment system that consists of an impervious floor and bermed sidewalls capable of containing the volume of the largest container stored therein.

The refueling of machinery would be done following accepted guidelines, and all vehicles would have drip pans, when not in use, to contain minor spills and drips. Although it would be unlikely for a major spill to occur, any spill of five gallons or more would be contained immediately within an earthen dike, and the application of an absorbent (e.g., granular, pillow, sock, etc.) would be used to absorb and contain the spill. Any major spill of a hazardous or regulated substance would be reported immediately to SAWS and USACE environmental personnel who would notify appropriate Federal and State agencies.

Additionally, all construction personnel would be briefed as to the correct procedures for preventing and responding to a spill. All waste oil and solvents would be recycled if practicable. All non-recyclable hazardous and regulated wastes would be collected, characterized, labeled, stored, transported, and disposed of in accordance with all Federal, State, and local regulations, including proper waste manifesting procedures. A Spill Prevention Plan would be in place prior to the start of construction, and all personnel shall be briefed on the implementation and responsibilities of this plan. Adoption and full implementation of the construction measures described above would reduce adverse hazardous/regulated substances impacts to insignificant levels.

5.15 Visual Aesthetics

5.15.1 No Action Plan

Under the No Action Plan, there would be no changes to the visual landscape beyond those implemented by SAWS or the Audubon Society in the management of natural and water resources in the study area.

5.15.2 Proposed Action

Short-term impacts may occur where construction-related equipment, activities, and dust could be visible to observers. Impacts would be anticipated in years in which construction is implemented. Plans that do not include construction of structures, would realize only temporary aesthetic degradation until the disturbed area blends in with the surrounding environment, at which time, it would be anticipated that the aesthetic value of the area would be improved over the existing condition.

Construction activities can introduce differing elements of form, line, color, and texture into the landscape through construction or placement of constructed features such as roads, structures, equipment, or manipulation of vegetation. Effects can also result when actions change scenic integrity or result in conditions that produce unattractive landscapes.

Impacts associated with the proposed plans regarding aesthetics include visibility of construction disturbances, constructed structures, and temporary roads. Vegetation clearing and/or placement of excavated material on upland sites before relocation would present an obvious contrast in color with the surrounding vegetation.

Temporary placement of staging areas, access roads and floating docks would be visually obvious until use of these is discontinued and the area naturally restores or the structure is removed. Natural restoration would be expected to occur over a period of 1-5 years. Aesthetic degradation would decrease as the disturbed surface begins to blend in color, form, and texture. In general, restoration measures would have minor beneficial impacts to the aesthetic value of the area and pleasing to recreationists.

5.16 Recreation

5.16.1 No Action Plan

Under the No Action Plan, recreation within the study area will continue to improve. The Audubon Society management plan includes plans to improve upland wildlife habitats and improve trail access within the study area.

5.16.2 Proposed Action

Although the proposed plans may have a temporary adverse impact during construction by restricting pedestrian access to active construction sites, the overall recreation experience after construction would be improved as the improved habitat will support increased diversity and population sizes of birds and other wildlife. The enhancement of 49.52 acres of mudflat habitat will attract shorebirds and other migratory birds. This will attract more birders to the area as well, increasing overall recreation use of the project areas.

5.17 Biological Resources

Under NEPA, the significance of project impacts is a function of context and intensity. For biological resources, context refers to the importance (ecological, commercial, scientific, recreational, etc.) or regulatory (i.e., legally protected) status of the resource, and intensity refers to the magnitude – scale and duration – of the impact. Both beneficial and adverse impacts are recognized; either can be significant. In the project area, the habitats of greatest importance are emergent wetlands and riparian habitat. Substantial long-term net changes in the acreage and/or value of these habitats would likely result in significant impacts.

Losses or gains of population and habitat for special status species may also be significant, depending on the magnitude of the impact relative to the population size and distribution of the species in the region.

Finally, an impact that led to new introductions or the expansion of invasive species in the study area would also be considered significant in terms of potential far-reaching effects on the ecosystem as a whole.

5.17.1 No Action Plan

Under the No Action Plan, there will be no added benefits to vegetative or wildlife habitat diversity. The spread of invasive species within the foreseeable future will most likely occur without proper management and will cause significant adverse impacts to the study area. The marginal existing native vegetation will continue to provide very poor wildlife habitat quality. SAWS and the Audubon Society are trying to manage the spread of invasive species and the Audubon Society is conducting grassland restoration on portions of the study area, but there are limited plans to improve aquatic habitats.

5.17.2 Proposed Action

5.17.2.1 Vegetation

The appropriate use of BMPs such as erosion control practices and tree protection devices at construction sites would protect existing high quality trees and large blocks of high quality vegetation/habitat adjacent to the construction areas. Temporary construction impacts to vegetation within staging areas are not anticipated, since staging areas would be stationed in areas with very little vegetation and vegetative diversity. In which case, any vegetation permanently impacted by construction efforts will be for the purpose of wildlife habitat improvement. Installation of appropriate vegetation within the project area would provide connectivity for riparian forest and emergent wetland habitats, more closely mimicking historical conditions.

Approximately 150.65 acres of emergent and emergent/submergent wetlands will be planted within the project area (Table 5-1). Low quality and invasive species will be managed for removal as well. Efforts to restore native riparian and emergent wetland species through seeding, planting, prescribed burns, and invasive species management will bring the environment closer to original conditions, in which case the vegetation structure and diversity is expected to increase in quality with the Proposed Action. The Proposed Action will have a long-term major beneficial impact on vegetation within the study area.

Table 5-1. Recommended Emergent and Submergent Native Vegetation for Proposed Action

Name	Scientific Name	Growth Form
Squarestem spikerush	*E. quadrangulata*	Emergent
Tall burhead	*Echinodorus berteroi*	Emergent

Creeping burhead	*Echinodorus subcordatum*	Emergent
Slender spikerush	*Eleocharis acicularis*	Emergent
Flatstem spikerush	*Eleocharis macrostachya*	Emergent
Squarestem spikerush	*Eleocharis quadrangulata*	Emergent
Illinois pondweed	*Potamogeton illinoensis*	Submersed
American pondweed	*Potamogeton nodosus*	Submersed
Water stargrass	*Heteranthera dubia*	Submersed

5.17.2.2 Wildlife

Where construction or disposal is proposed, there would be an increased level of human disturbance, such as noise, vehicular traffic, and construction equipment, which could lead to temporary localized displacement of affected existing fish and wildlife populations. Mortality of fish or wildlife individuals is possible during the construction phase, but would be rare, as most species would avoid the areas of disturbance.

There would be major long-term major beneficial impacts on fish and wildlife populations from the implementation of the Proposed Action through geographic expansion and improved quality of their respective habitats. By restoring the Mitchell Lake project areas to more natural conditions, native fish populations could repopulate areas that have not been favorable for their existence or survival. Water quality improvements (resulting from planting 150.65 acres of wetland plantings) would improve habitat conditions for intolerant native species, and would restore balance to the native tolerant/native intolerant species over time.

The overall increase of 110.8 AAHUs due to the restoration of riparian and emergent wetland vegetative structure and mudflat habitat would provide additional wildlife habitat (food, shelter, and reproductive resources) for small mammals, amphibians, reptiles, and birds.

5.17.2.3 Threatened and Endangered Species

The migratory birds, Golden-cheeked warbler, least tern, piping plover, red knot, and whooping crane, have the possibility of occurring in in the Project Area before and after project implementation. However, these occurrences will most likely be limited to stopover use during migration. Quality stopover habitat is essential for migratory birds. The quality and quantity of natural stopover habitat within growing urban areas is decreasing due to the destruction of habitat for development and the spread of invasive species. Stopover habitat is essential for birds during migration, because these areas can provide food and shelter for the birds to refuel and rest. Close coordination among the USACE, USFWS, and TPWD would continue as part of overall management of the Project Area and normal operations and maintenance activities for Mitchell Lake. The Proposed Action could cause short-term minor adverse impacts within the construction area. However, every effort will be made to avoid all contact with threatened and endangered species. After completion of construction and establishment of wetland and riparian plantings, the area will return to normal. The effects of effectively managing 200.17 acres of wetland and mudflat habitat will cause major long-term beneficial impacts for species by returning original habitat conditions, as best as possible, and regulating habitat for shorebirds.

The Proposed Action would cause minor beneficial impactsto threatened or endangered species within the study area. Although core habitat for the threatened and endangered birds listed above is not available within the study area, the Proposed Action has the potential to create the habitat conditions necessary for bird species on the list. Should federally listed species change in the future, associated requirements will be reflected in construction efforts in coordination with the USFWS.

5.17.2.4 Texas State Listed Species

Impacts to state-listed and rare species would be the same as described in Section 5.17.2.3 for both habitat and individuals. In general, all species identified as occurring or potentially occurring in the focused study area are highly mobile and would be able to avoid construction related impacts.

The eastern and western spotted skunks are the two species mentioned in the TXNDD and on the Texas State listed species list. Although there would be temporary disturbances to foraging areas for the eastern and western spotted skunk, the long-term habitat benefits of the project would significantly outweigh these impacts. Under the Proposed Action, foraging habitat for species migrating through the study area would be improved due to the enhancement and creation of up to 200.17 acres of mudflat and wetland habitat.

5.17.2.5 Migratory Birds

Many important habitats in the focused study area provide migratory bird shelter, nesting, feeding, and roosting habitat. All adverse impacts to migratory birds would occur during construction and cease post-construction. Significant beneficial impacts to migratory birds would be expected from ecosystem restoration measures. Restoration of wetlands, riparian, and mudflat areas would result in an overall net increase in functional value and ultimately support larger populations of species and potentially increase species diversity.

During construction, there is a potential for harm and/or harassment of nesting migratory birds. Attempts would be made to conduct all restoration activities outside of the nesting season; however, this may not be possible, due to the extended length of the nesting season for some species. Prior to construction commencing, if during the nesting season, nest surveys should be completed. Coordination with USFWS should be completed prior to construction if nesting has been identified and USFWS guidelines should be followed to avoid adverse impacts to these species. By implementing these conservation measures, there should be no adverse effects to migratory birds. There will be major beneficial impacts to migratory birds as a result of the Proposed Action. The Proposed Action will provide crucial stopover habitat for migratory birds during migration. By enhancing the quality and quantity of habitat within the Central Flyway, the Proposed Action incorporates measures that ensure the success of migration by providing food to sustain the birds during their migration and safe places to rest.

Implementation of the Proposed Action would be in compliance with the Migratory Bird Treaty Act and EO 13186, Responsibility of Federal Agencies to Protect Migratory Birds.

5.17.2.6 Invasive Species

As with any ground-disturbance activity, the probability of introducing, spreading, and/or establishing new populations of invasive, non-native species, particularly plant species, exists. Contractors would be required to clean all equipment prior to entering the construction area to avoid the spread of invasive species into the project area.

Areas that are expected to have high rates of erosion, are susceptible to invasive species establishment, or where recruitment of a monoculture is anticipated, would be vegetated with native species. Post-construction and plantings, if needed, each restoration unit would be monitored for invasive species and action taken to prevent establishment of any species.

EO 13112, Invasive Species, dated February 3, 1999, directs federal agencies to expand and coordinate their efforts to combat the introduction and spread of invasive species (i.e., noxious plants and animals not native to the U.S.). Implementation of BMPs such as cleaning equipment prior to entering restoration units and monitoring post construction for invasive species would prevent further spread of invasive species. Implementation of any of the action plans would be in compliance with EO 13112.

5.18 Cumulative Impacts

CEQ regulations define a cumulative impact as an effect which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions (40 CFR Section 1508.7). Relatively minor individual impacts may collectively result in significant cumulative impacts. Project-related direct and indirect impacts must be analyzed in the context of non-project-related impacts that may affect the same resources. Cumulative impacts are the incremental impacts that the project's direct or indirect impacts have on a resource in the context of other past, present and future impacts on that resource from related or unrelated activities.

Unlike direct impacts, quantifying cumulative impacts may be difficult since a large part of the analysis requires forecasting future trends of resources in the study area and future projects that may impact these resources.

The initial step of the cumulative impacts analysis uses information from the evaluation of direct and indirect impacts in the selection of environmental resources that should be evaluated for cumulative impacts. The proposed action would not contribute to a cumulative impact if it would not have a direct or indirect effect on the resource. Similarly, CEQ guidance recommends narrowing the focus of cumulative impacts analysis to important issues of national, regional, or local significance. Therefore, the cumulative impact analysis for Mitchell Lake was focused on those resources that were substantially directly or indirectly impacted by the study and resources that were at risk or in declining health even if the direct/indirect impacts were insignificant.

The resources considered for cumulative impacts assessment include Visual Aesthetics, Recreation, Water Resources, and Biological Resources. These resources would be substantially directly and/or indirectly impacted by the Mitchell Lake Aquatic Ecosystem Restoration project.

5.18.1 Visual Aesthetics

Areas under construction, or areas which are being considered for restoration activity are ecologically impoverished and perceived as aesthetically displeasing. Restoration activities which improve the heterogeneity and complexity of the natural environment would have beneficial impacts to the aesthetics of the Mitchell Lake study area. Any impacts caused by the grading and clearing necessary for wetland creation could have minor adverse impacts to aesthetics within the area, but will be temporary.

The cumulative impacts to aesthetics of past, present, or reasonably foreseeable projects when considered with the impacts of the Proposed Action would be moderately beneficial.

5.18.2 Recreation

Recreation is a vital component to the sustainability of any urban restoration project. Almost all of the areas have the potential for passive recreation features, meaning that while perhaps remotely accessible, persons could have the opportunity to view and interact with the natural resources of the area. Potential impact to the trails parallel to Mitchell Lake and birding opportunities around the Polders, uplands, and grasslands during construction could have minor adverse impacts to recreational resources within the area. However, the plethora of recreation opportunities within the City of San Antonio leads to negligible effects during this short timeframe. The cumulative impacts to recreation after completion of construction to recreation of past, present, or reasonably foreseeable projects when considered with the impacts of the Proposed Action would be moderately beneficial.

5.18.3 Water Resources

Past impacts to Mitchell Lake habitats are documented in Chapter 3, Water Resources. 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, SARA, 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 proposed action would effectively provide up to 151.15 acres of enhanced or created wetland habitat and 49.52 acres of mudflat habitat with essential connectivity along a critical stop-over corridor for the birds utilizing the Central Flyway (see Table 5-2).

Table 5-2. Increase of Mudflat and Wetland Habitat by Enhancement and Creation for Each Plan

Plan	Mudflat Habitat Increase (Acres)	Emergent/Submergent Wetland Habitat (Acres)	Emergent Wetland Habitat (Acres)	Forested Wetland Habitat (Acres)
1: No Action	0.00	0.00	0.00	0.00
2. Polders	49.52	0.00	0.00	0.00
3. Polders + Cove 3	49.52	6.84	0.00	0.00
4. Polders + Cove 3 +Downstream Wetlands	49.52	6.84	51.32	0.00
5. Polders + Coves 1-3 + Downstream Wetlands	49.52	72.36	51.32	0.00
6. Polders + Coves 1-3 + Downstream Wetlands + Skip's Pond	49.52	74.54	51.32	0.00

7. Polders + Coves 1-3 + Downstream Wetlands + Skip’s Pond + Central Wetlands(2B)	49.52	74.54	69.69	0.00
8. Polders + Coves 1-3 + Downstream Wetlands + Skip’s Pond + Central Wetlands(2B) + Bird Pond Wetlands (1B)	49.52	74.54	76.11	0.00
9. Polders + Coves 1-3 + Central Wetlands(2B) + Bird Pond Wetlands (1B) + Dam Forested Wetlands (9B)	49.52	74.54	76.11	4.48

Planting native emergent and submergent wetland vegetation has the ancillary benefit of augmenting water quality at Mitchell Lake. Although these benefits will be focused in Mitchell Lake, the occasional large storm event allows water to flow out of the uncontrolled spillway east of the dam. The water that flows from Mitchell Lake enters Cottonmouth Creek, which has a confluence with the Medina River. The Medina River then meets the San Antonio River and eventually feeds into the Guadalupe River approximately 10 miles from San Antonio Bay on the Gulf of Mexico.

The cumulative impacts to aesthetics of past, present, or reasonably foreseeable projects when considered with the impacts of the Proposed Action would be moderately beneficial.

5.18.4 Biological Resources

Fish and wildlife inhabiting Mitchell Lake and the surrounding areas prior to its utilization as a raw sewage disposal site would have consisted of a diverse community of native invertebrate, fish, amphibian, reptile, mammal, and bird species. As the habitat within the study area degraded, wildlife species intolerant of such impacts such as the Texas tortoise, indigo snakes, bobcat, and black bear migrated out of the area over time and tolerant species such as raccoons, opossums, and great-tailed grackles now thrive. The aquatic habitat that supported a diverse community of amphibians and aquatic invertebrates disappeared, further reducing wildlife diversity in this area of San Antonio. Finally, the introduction of non-native wildlife species such as feral hogs and nutria rats, and vegetative species such as Johnsongrass, bermudagrass, and giant cane that have reduced habitat values, placed increased demands on scarce wildlife resources, and resulted in the non-native species out-competing native species.

In the earlier discussion of direct impacts of the proposed actions, significant beneficial effects were recognized that improve habitat not only for migratory birds and other upper tier trophic species, but more importantly for lower trophic level organisms that support the more visible and mobile species.

As further discussed, these beneficial impacts are not limited to the Mitchell Lake study area, but expand further into the San Antonio River Basin. For migratory birds, the benefits of the proposed Mitchell Lake habitats might be realized several thousand miles away after the successful breeding and fledging of young on the arctic tundra.

The Proposed Action alone cannot ensure the continued survival and existence of migratory birds and other organisms depending on wetland and mudflat resources in the southwest. However, the Proposed Action can contribute to the cumulative conservation, preservation, and restoration efforts underway both locally, regionally, nationally, and internationally. Locally, previous, and ongoing restoration efforts on the San Antonio River at Eagleland, Mission Reach, and Westside Creeks will improve migratory bird habitats in the San Antonio area. Additional conservation efforts in the region, including the implementation of the Southern Edwards Plateau Habitat Conservation Plan, conservation easements initiated by non-governmental conservation organizations, and international initiatives such as the Partners in Flight and Joint Ventures will continue to provide pieces of the migratory bird habitat puzzle that will ensure migratory birds have the resources to complete migration and successfully breed and fledge young.

The cumulative habitat incorporated into these migratory bird conservation efforts are predicated on the establishment of the lower trophic levels by ensuring that aquatic and riparian habitats properly function ecologically.

5.19 Irreversible and Irretrievable Commitment of Resources

NEPA 40 CFR 1502.16 requires that environmental analysis include identification of “any irreversible and irretrievable commitments of resources which would be involved in the Tentatively Selected Plan (Proposed Action) should it be implemented.” Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that the use of these resources have on future generations. Irreversible effects primarily result from use or destruction of a specific resource (e.g. energy and minerals) that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (e.g. extinction of a threatened or endangered species or the disturbance of a cultural site).

The Proposed Action would result in the direct and indirect commitment of resources. These would be related mainly to construction components. Energy typically associated with construction activities would be expended and irretrievably lost under the Proposed Action. Fuels used during the construction and operation of dredging equipment, barges, placement equipment (e.g. bulldozers, backhoes, marsh buggies, etc.) and support vehicles would constitute an irretrievable commitment of fuel resources. Capital and labor resources, as well as, stone material would also be considered an irretrievable and irreversible commitment of resources. The use of such resources would not adversely impact the availability of such resources for other projects both now and in the future.

For the Proposed Action, most resource commitments are neither irreversible nor irretrievable. Benthic communities would be removed and lost along with sediment during excavation and placement operations. Benthic communities would also take several years to recover. Slow moving or non-motile fish, wildlife, invertebrates, and plant (aquatic and terrestrial) species would be entrained in the materials during excavation or smothered during placement of excavated materials. These losses would be irretrievable as well. However, most impacts to the species’ population as a whole would be insignificant. These impacts would only occur during construction.

No other impacts, such as water resources, existing land uses, or visual resources, have been identified which could result in irreversible or irretrievable commitments of resources which would preclude implementation of the Proposed Action.

5.20 Indirect Effects

Indirect effects, as defined by CEQ’s regulations, are “caused by the proposed action and occur later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems” (40 Code of Federal Regulations [CFR] 1508.8). Indirect effects differ from direct impacts associated with the construction and operation of the proposed project and are caused by an action or actions that have an established relationship or connection to the proposed project. However, indirect effects can be linked to direct effects in a causal chain, which can be extended as indirect effects that produce further consequences.

As previously discussed, implementation of the proposed action would directly result in a net beneficial impact to Mitchell Lake and the associated vegetation and wildlife. In addition, the proposed Mitchell Lake ecosystem restoration measures would result in benefits that extend further outside the study area for several notable environmental resources. These benefits would increase over time as the Mitchell Lake habitats develop and mature.

The indirect effects were examined for the study area as identified in Figure 1-1. As discussed below, even though portions of the indirect effects study area are located outside the proposed Mitchell Lake restoration limits, these areas would receive ecological benefits resulting from restoration activities.

The establishment of native plant species in the study area and the removal and control of nonnative, invasive species provides significant indirect benefits. The seed production of the vegetation in the study area can be transported downstream, during high water events, and deposited in the Medina River banks. Under the No Action Alternative, these seeds would generally be comprised of non-native invasive species resulting in the further spread of these species. With implementation of the recommended plan, the seed source would generally be comprised of native species adapted to the conditions of the surrounding landscape. The improved aquatic habitats of Mitchell Lake would improve water quality downstream as the wetland vegetation would filter pollutants and sediments.

5.21 Environmental Compliance

This section demonstrates how the Proposed Action would comply with applicable environmental laws and regulations.

5.21.1 Migratory Bird Treaty Act

As described in Chapter 2.1, The Migratory Bird Treaty Act of 1918 extends Federal protection to migratory bird species. To comply with the Migratory Bird Treaty Act, the timing of resource management activities would be coordinated to avoid impacts on migratory and nesting birds.

5.21.2 Section 404 of the Clean Water Act

USACE under direction of Congress regulates the discharge of dredged and fill material into all waters of the United States, including wetlands. Although USACE does not issue itself permits for construction activities that would affect waters of the United States, USACE must meet the legal requirement of the Act. As stated in Chapter 4, Wetlands and Waters of the U.S., a 404(b)(1) analysis is in progress for the Mitchell Lake project. A draft 404(b)1 analysis can be located in Attachment I of this document, describing potential impacts to water quality within the study area.

5.21.3 Section 176(c) Clean Air Act

The Clean Air Act is the comprehensive federal law that regulates air emission from Federal agencies that are required by this Act to review all air emissions resulting from Federal funded projects or permits to insure conformity with the State Implementation Plans in non-attainment areas. Bexar County is currently in Marginal Nonattainment status for O_3 pollutants. The USACE will ensure the use of BMPs during construction to minimize emissions, including the use of cleaner burning fuels and energy efficient equipment where applicable.

5.21.4 Executive Order 11312, Invasive Species

The Proposed Action would be in compliance with EO 13112 by restoring native aquatic and riparian vegetation species to the degraded habit. Mitchell Lake is dominated by non-native invasive plant species.

5.21.5 Executive Order 11990, Protection of Wetlands

EO 11990 requires Federal agencies to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in executing Federal projects. The Proposed Action complies with EO 11990 by increasing the areal extent of wetlands within the study area.

5.21.6 Executive Order 11988, Floodplain Management

EO 11988 was enacted May 24, 1977, in furtherance of the National Environment Policy Act of 1969, as amended (42 U.S.C. 4321 et seq.), the National Flood Insurance Act of 1968, as amended (42 U.S.C. 4001 et seq.), and the Flood Disaster Protection Act of 1973 (Public Law 93-234, 87 Star. 975). The purpose of the EO was to avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative.

The order states that each agency shall provide and shall take action to reduce the risk of floodloss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities for (1) acquiring, managing, and disposing of Federal lands and facilities; (2) providing Federally undertaken, financed, or assisted construction and improvements; and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities. All alternatives were designed to ensure that the combination of all ecosystem restoration measures proposed would not result in a decrease in the floodplain capacity and an increase in flood risk to the study area. The Proposed Action would remain in compliance with EO 11988 by protecting the values of the Mitchell Lake floodplains.

5.21.7 Executive Order 13186, Migratory Birds

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.

5.21.8 Texas Senate Bill 2

In restoring the ecological and hydraulic functions of Mitchell Lake, the Proposed Action is consistent with this State legislation.

5.21.9 Executive Order 12898, Environmental Justice

EO 12898 “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations” dated February 11, 1994, requires all Federal agencies to identify and address disproportionately high and adverse effect of its programs, policies, and activities on minority and low-income populations. Data were compiled to assess the potential impacts to minority and low-income populations within the study area. Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations and policies. Even though minorities account for a large portion of the local population and the low-income population is above the national and local averages, construction of the proposed alternatives would not have a disproportionately high or adverse effect on these populations. No environmental justice concerns are anticipated and the Proposed Action would be consistent with EO 12898.

5.21.10 Endangered Species Act of 1973

Current lists of threatened or endangered species were compiled for the Mitchell Lake Feasibility Study. There would be no adverse impacts on threatened or endangered species resulting from the Proposed Action. However, continued long-term beneficial impacts, such as habitat enhancement, could occur as a result of the Proposed Action. A threatened and endangered species assessment can be found in Attachment C. A detailed list of Federally threatened and endangered species that may possibly occur within the study area can be found in Attachment D. The purpose of the assessment is to coordinate with USFWS about the likelihood if impacting threatened and endangered species. A rating of “no effect” is currently assumed for the Proposed Action.

5.21.11 Fish and Wildlife Coordination Act

In accordance with the Fish and Wildlife Coordination Act of 1934, as amended, from the initial stages of this study the USFWS and TPWD have been involved in the planning process.

All agencies provided comments throughout the planning process. USFWS and TPWD biologists provided input on the models, participated in field work, and participated in the model projections meetings. The USACE initiated public involvement and agency scoping meetings to solicit input on the Mitchell Lake Feasibility Study process, as well as identify prospective areas, and identify significant issues related to the Proposed Action. Information provided by USFWS and TPWD on fish and wildlife resources has been utilized in the development of the Proposed Action.

A draft Fish and Wildlife Coordination Act Report describing existing and future without project conditions and future with project conditions is currently being prepared for this project.

5.21.12 Advisory Circular 150/5200-33A – Hazardous Wildlife Attractants on Near Airports

The advisory circular provides guidance on locating certain land uses having the potential to attract hazardous wildlife to or in the vicinity of public-use airports. The circular provides guidance on wetlands in and around airports and establishes notification procedures if reasonably foreseeable projects either attract or may attract wildlife.

In response to the Advisory Circular, the U.S. Army as well as other Federal agencies, signed a Memorandum of Agreement (MOA) with the Federal Aviation Administration (FAA) to address aircraft-wildlife strikes. The MOA establishes procedures necessary to coordinate their missions to more effectively address existing and future environmental conditions contributing to aircraft-wildlife strikes throughout the United States.

In accordance with the Advisory Circular, USACE has coordinated with the FAA to address potential hazardous wildlife attractants near airports within San Antonio with respect to the Proposed Action. Attachment J includes the FAA’s decision of no impact from the Proposed Action.

5.22 Adaptive Management and Monitoring Plans

In an effort to ensure the success of the proposed action, the restoration measures implemented will be periodically surveyed to provide feedback on the response of the ecosystem and its resources to the management measures taken. By connecting the ecosystem response to the restoration as well as the management measures, potential beneficial adaptations and adjustments to the project or management plan can be identified to ensure continued success of the project. This is especially true of the plantings that will have to be frequently monitored from their initial planting until reasonable stabilization is achieved. To accomplish this goal, periodic monitoring of the restoration measures will be conducted over a three-year period beginning after the completion of the construction of project features and the initial plantings. A draft adaptive management and monitoring plan is included in Attachment K.

6 Public Involvement

This chapter discusses consultation and coordination that has or will occur during preparation of this document. This includes contacts made during development of the Proposed Action, other alternatives considered, and writing of the Integrated Feasibility Report-Environmental Assessment.

6.1 Agency Coordination

Copies of agency coordination letters are presented in Attachment L. Formal and informal coordination has been and will continue to be conducted with the following resource agencies;

- U.S. Army Corps of Engineers,
- U.S. Fish and Wildlife Service,
- Environmental Protection Agency,
- Texas Parks and Wildlife Department,
- Texas Commission on Environmental Quality,
- Federal Aviation Administration,
- Natural Resources Conservation Service,
- Texas State Historic Preservation Office,
- and the National Audubon Society at the Mitchell Lake Audubon Center

TPWD, USFWS, NRCS, and TCEQ have been involved throughout the study process. These organizations participated in initial brainstorming and problem identification and provided comments throughout the Mitchell Lake Feasibility Study process. TPWD, USFWS, and TCEQ also participated in the data collection and field surveys and contributed in the projections of Future With and Future Without Project benefits.

6.2 Public Information and Review

In accordance with NEPA, a 30-day review period of the Integrated Feasibility Report-Environmental Assessment, and a Draft FONSI will be provided via a Notice of Availability. During the review period, agencies will have the ability to respond in favor of or against the project.

In accordance with 40 CFR §§1501.7, 1503, and 1506.6, the USACE initiated public involvement and agency scoping activities to solicit input on the Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study, as well as identify potential project areas, and identify significant issues related to the Proposed Action. The USACE began its public involvement process with a public scoping meeting to provide an avenue for public and agency stakeholders to ask questions and provide comments. This public scoping meeting was held on 13 March 2019 at the Mitchell Lake Audubon Center, 10750 Pleasanton Road, San Antonio, TX 75221. The USACE, Fort Worth District placed advertisements on the USACE webpage and mailed official Public Notices, while SAWS posted advertisements on social media prior to the public scoping meeting.

Table 6-1 below displays the single public comment that was received after the public scoping meeting on 13 March 2019. Although only one written comment was received, there were seven individuals in attendance that provided verbal comments about the project.

Table 6-1. Public Scoping Meeting Comment and Response

Mitchell Lake Public Scoping Meeting		
Commenter	**Comment Description**	**USACE Response**
Public	I am a member of a club a relatively short distance from Mitchell Lake. Out club, which adjoins the San Antonio River, is experiencing the same excessive aquatic growth and elevated nitrogen levels in our three lakes, though none of our water flows into any river. When I read that a project was to be undertaken at Mitchell Lake to control the problems at the lake with "natural means", I became very interested. It is my hope that the Mitchell Lake project will provide answers which can assist us in controlling the problems at our lakes.	The USACE will keep the public informed of final plans and decisions for the Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study through the Integrated Feasibility Report-Environmental Assessment.

7 References

Alan Plummer Associates, Inc. 2016. Mitchell Lake – Constructed Wetlands Below the Dam Preliminary Feasibility Study. 25 pp.

ARCADIS U.S., Inc. 2014. Hydrologic and Hydraulic Analysis, Mitchell Lake Dam, Cottonmouth Creek, Bexar County, Texas, 30 December 2014.

Ashworth, JB and J Hopkins. 1995. Aquifers of Texas. Texas Water Development Board Report 345. 69 pp.

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

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.

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.

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.

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.

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

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

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.

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.

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. 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.

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

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. 2019. Information, Planning, and Consultation System, Environmental Conservation Online System. https:ecos.fws.gov. Accessed 01 May 2019.

-------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.

8 List of Preparers

Justyss Watson – Biologist, Regional Planning and Environmental Center; 5 years USACE experience.

Daniel Allen – Wildlife Biologist, Regional Planning and Environmental Center; 8 years USACE experience.

ATTACHMENT A

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Austin Ecological Services Field Office
10711 Burnet Road, Suite 200
Austin, TX 78758-4460
Phone: (512) 490-0057 Fax: (512) 490-0974
http://www.fws.gov/southwest/es/AustinTexas/
http://www.fws.gov/southwest/es/EndangeredSpecies/lists/

In Reply Refer To: October 16, 2019
Consultation Code: 02ETAU00-2019-SLI-1005
Event Code: 02ETAU00-2020-E-00229
Project Name: Mitchell Lake

Subject: Updated list of threatened and endangered species that may occur in your proposed project location, and/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: 02ETAU00-2020-E-00229

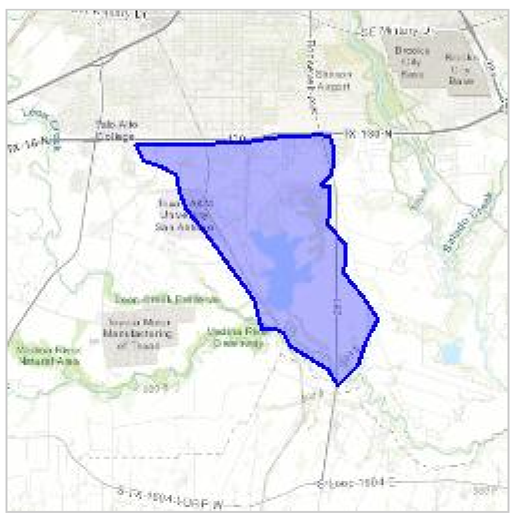
Project Name: Mitchell Lake

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/place/29.284715525042877N98.48958789466792W



Counties: Bexar, TX

Endangered Species Act Species

There is a total of 24 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 3 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
Least Tern *Sterna antillarum* Population: interior pop. No critical habitat has been designated for this species. This species only needs to be considered under the following conditions: ▪ Wind Energy Projects Species profile: https://ecos.fws.gov/ecp/species/8505	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. Your location is outside the critical habitat. 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* No critical habitat has been designated for this species. 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. Your location is outside the critical habitat. 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. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/6374	Threatened
Texas Blind Salamander *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. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5858	Endangered

Clams

NAME	STATUS
Texas Fatmucket *Lampsilis bracteata* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9041	Candidate
Texas Pimpleback *Quadrula petrina* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8966	Candidate

Insects

NAME	STATUS
[no Common Name] Beetle *Rhadine exilis* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/6942	Endangered
[no Common Name] Beetle *Rhadine infernalis* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3804	Endangered
Comal Springs Dryopid Beetle *Stygoparnus comalensis* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/7175	Endangered
Comal Springs Riffle Beetle *Heterelmis comalensis* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3403	Endangered
Helotes Mold Beetle *Batrisodes venyivi* There is **final** critical habitat for this species. Your location is outside the critical habitat. 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. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/7900	Endangered
Cokendolpher Cave Harvestman *Texella cokendolpheri* There is **final** critical habitat for this species. Your location is outside the critical habitat. 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. Your location is outside the critical habitat. 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. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/553	Endangered
Madla Cave Meshweaver *Cicurina madla* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2467	Endangered
Robber Baron Cave Meshweaver *Cicurina baronia* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2361	Endangered

Crustaceans

NAME	STATUS
Peck's Cave Amphipod *Stygobromus (=Stygonectes) pecki* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8575	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. Your location is outside the critical habitat. 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

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 C

Threatened and Endangered Species Assessment

Mitchell Lake, San Antonio, TX

General Investigations Feasibility Study

Integrated Draft Feasibility Report and Environmental Impact Assessment

December 2019

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. Chapter 3 summarizes the alternatives considered and the Recommended Plan. Threatened and endangered species of potential occurrence in Bexar County are described in Chapter 4. Finally, Chapter 5 discusses the potential effects of the Recommended Plan on threatened and endangered species and provides the USACE's determinations of effect.

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.

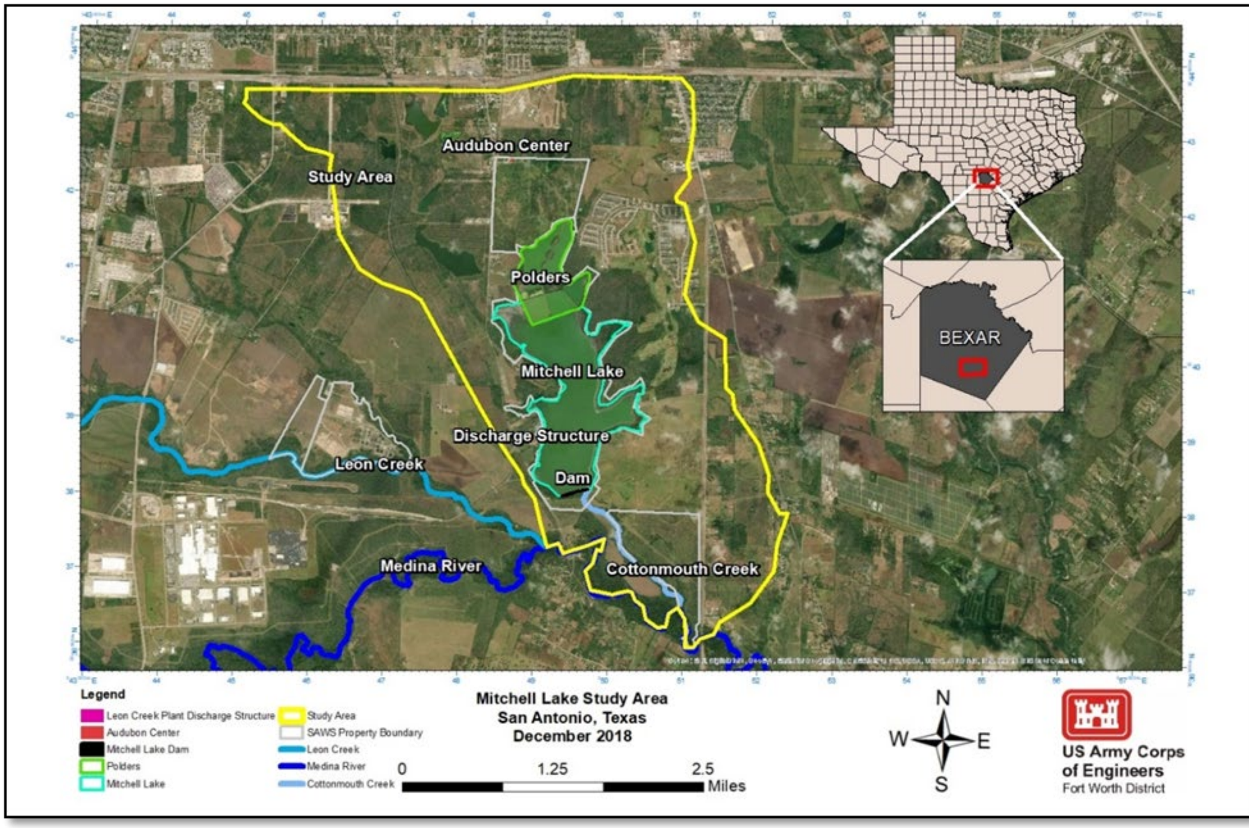


Figure 1. Mitchell Lake Study Area

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.

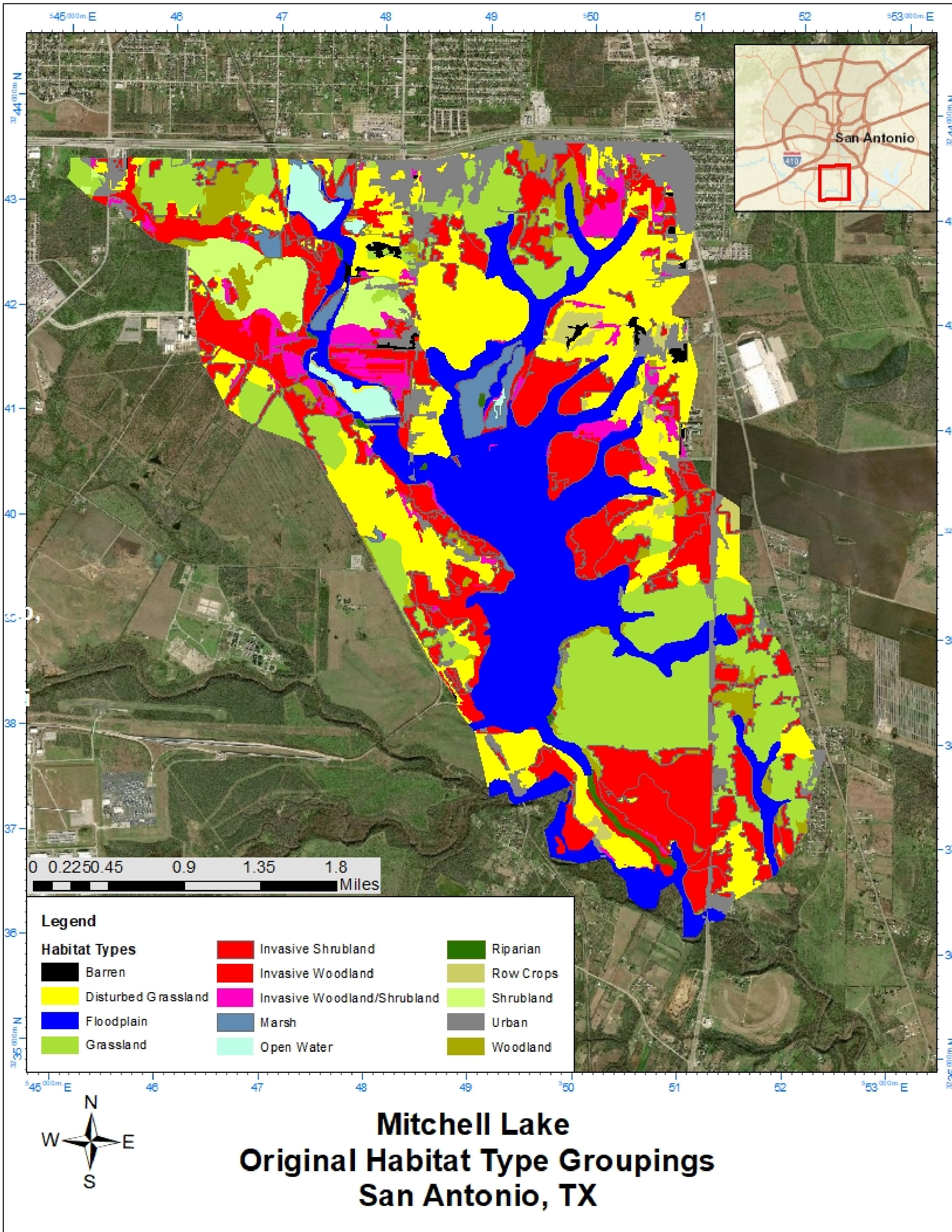


Figure 2. TPWD Ecological Mapping System Habitat Groupings

3 Summary of Alternatives Considered and Recommended Plan

3.1 Management Measures

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 Plans and are categorized as structural and non-structural. Equal consideration was given to these two categories of measures during the alternative planning process.

In May of 2019, the full PDT (USACE and SAWS), along with local resource agencies (Texas Commission on Environmental Quality, Natural Resources Conservation Service, TPWD, and USFWS), met in San Antonio to develop a conceptual ecological model, a list of environmental metrics, identification of appropriate habitat models, and to develop a suite of measures for the initial array of Plans to be considered.

Structural

- **Native Aquatic Plantings -** Emergent and submerged vegetation typically thrive along the perimeter and shallow areas of lakes. This measure entails the establishment of emergent and submerged 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 habitats below the Mitchell Lake Dam and along specified coves within Mitchell Lake. It would include planting a diverse community of high quality native tree and shrub species, including mast producers, bald cypress, and other species native to the San Antonio area.
- **Pipeline 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. The construction of a pipeline to the upper areas would provide a reliable water supply allowing better manipulation and sustainability of the wetlands.
- **Low Quality Vegetation Removal -** The vegetative communities in the Mitchell Lake study area are skewed towards low quality hackberry, huisache, palo verde, willow baccharis, and cattail dominated habitats depending on the area with little to no additional diversity. Most of the areas are dominated by one or two of these species. In order to increase the diversity of the communities, select trees and shrubs would be removed to provide room for the planting of additional site specific native species. Similar to the invasive vegetation management, larger 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 (riparian) 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 east and west polders to create a more manageable and appropriately sized mudflat in Area 6. The utilization of excavated materials from the creation wetland or offsite borrow material could be to create berms within these two polders to create additional mudflat cells. This measure would be dependent on the polder operational measure above. In addition, this measure would include the construction of berms at the downstream wetlands (Area 10) to create wetland cells to create and manage the wetlands.
- **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 Structure –** This measure includes the modification of an existing water control structure or addition of a new water control structure. Water control structures will be used to control the inflow and outflow of water between the discreet areas of Mitchell Lake.

Non-Structural

- **Polder Operations Management** - This measure entails the manipulation of water in the polders to manage the area for migratory shorebirds. By draining the polders on a periodic systematic schedule, mud flats 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 pulse measure would be dependent on either the measures for relocating the WWTP outfall structure and/or 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.

3.2 Project Areas

Individual restoration sites were identified as feasible for project implementation (Figure 3). 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 could be verified. Measure success is dependent upon site conditions at Mitchell Lake.

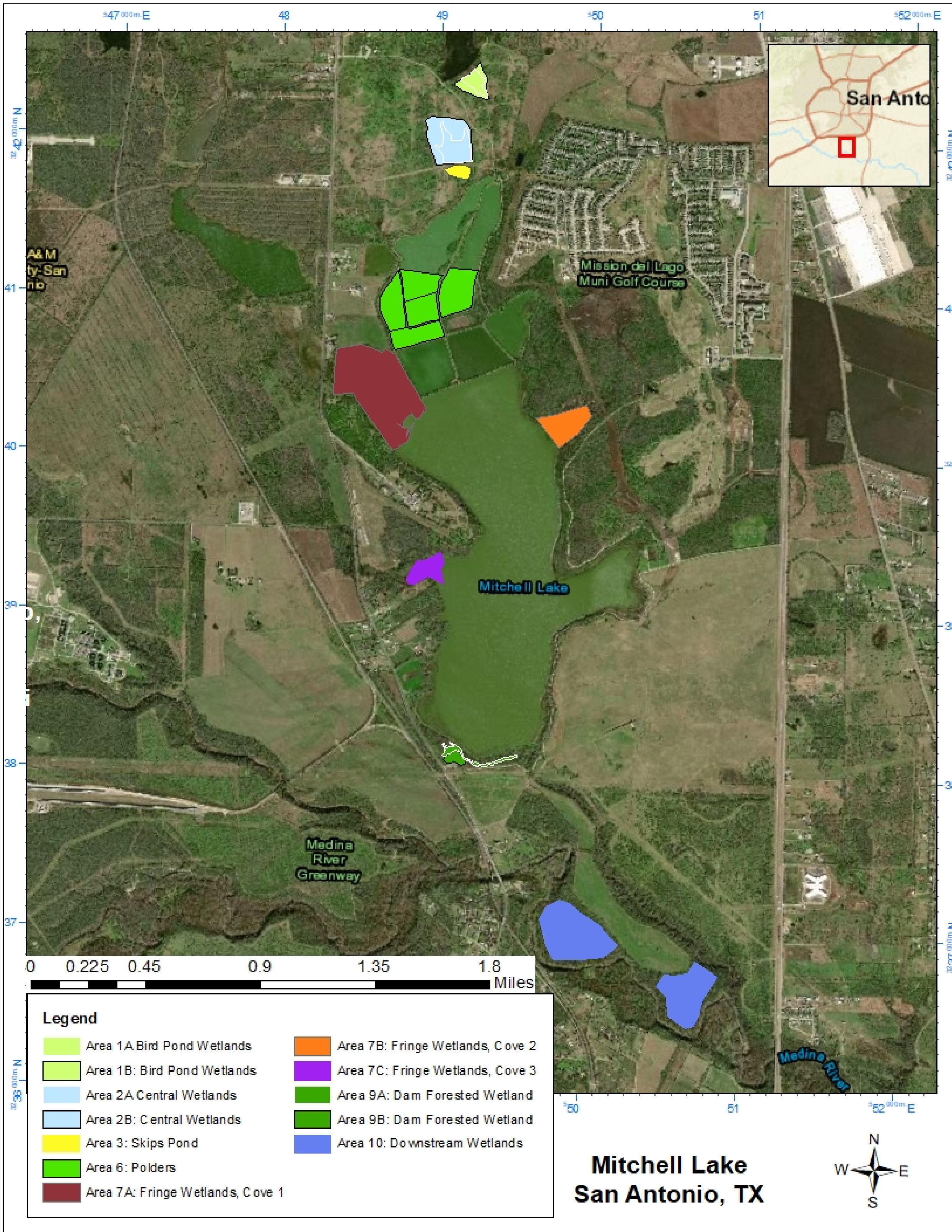


Figure 3. Mitchell Lake Feasible Areas

3.2.1 Area 1: Bird Pond Wetlands

Area 1 is located at the northern extent of the study area adjacent to Bird Pond near the Mitchell Lake Audubon Center (Figure 4). The 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.

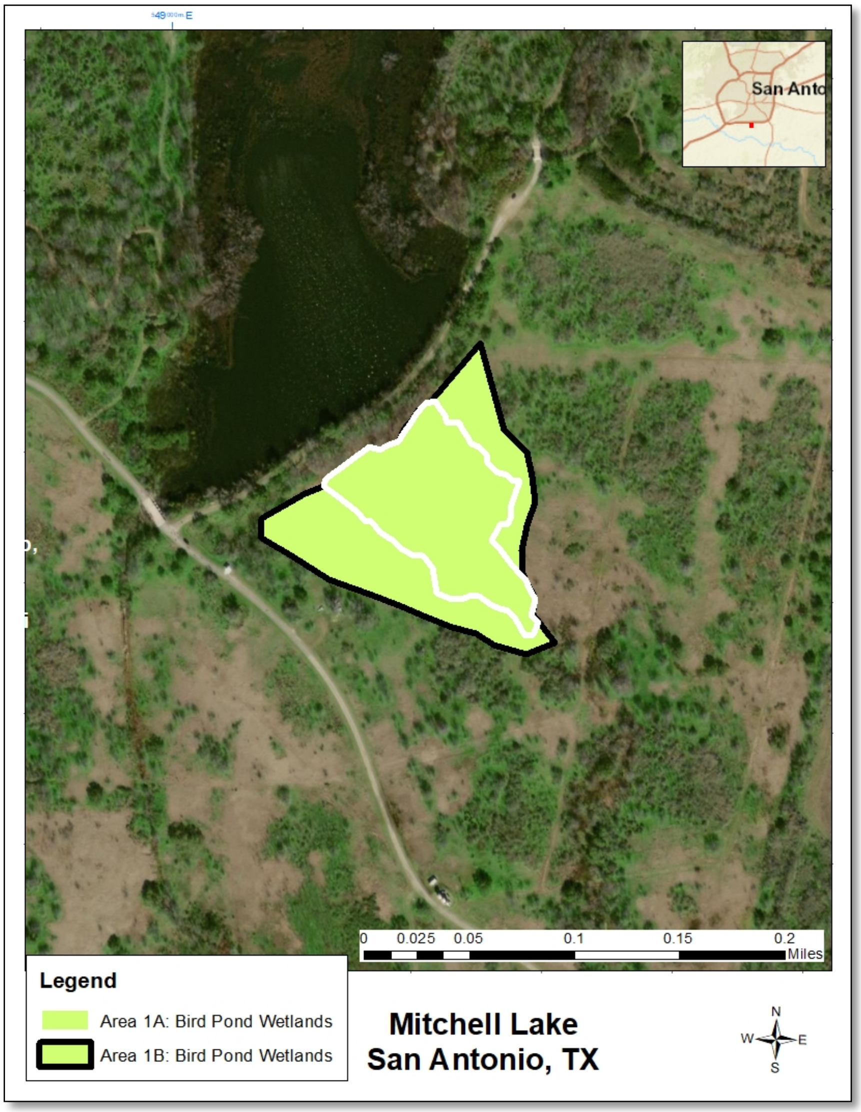


Figure 4. Bird Pond Wetlands Area 1A and 1B

3.2.2 Area 2: Central Wetlands

Area 2 is south of Area 1: Bird Pond Wetlands. The two wetland complexes are connected to each other by a shallow, nondescript drainage channel. This area consists of a complex of wetlands connected to each other by wetland swales with higher, upland areas interspersed throughout (Figure 5). The Central Wetlands are part of the same wetland complex as Area 3 Skip's Pond, but are separated from that area by a pipeline right-of-way between the two areas; therefore, the areas are treated as separate areas. Central Wetland is comprised of a shallow wetland with areas of deeper water (6-12" in depth) and dominated by cattails and willow baccharis.

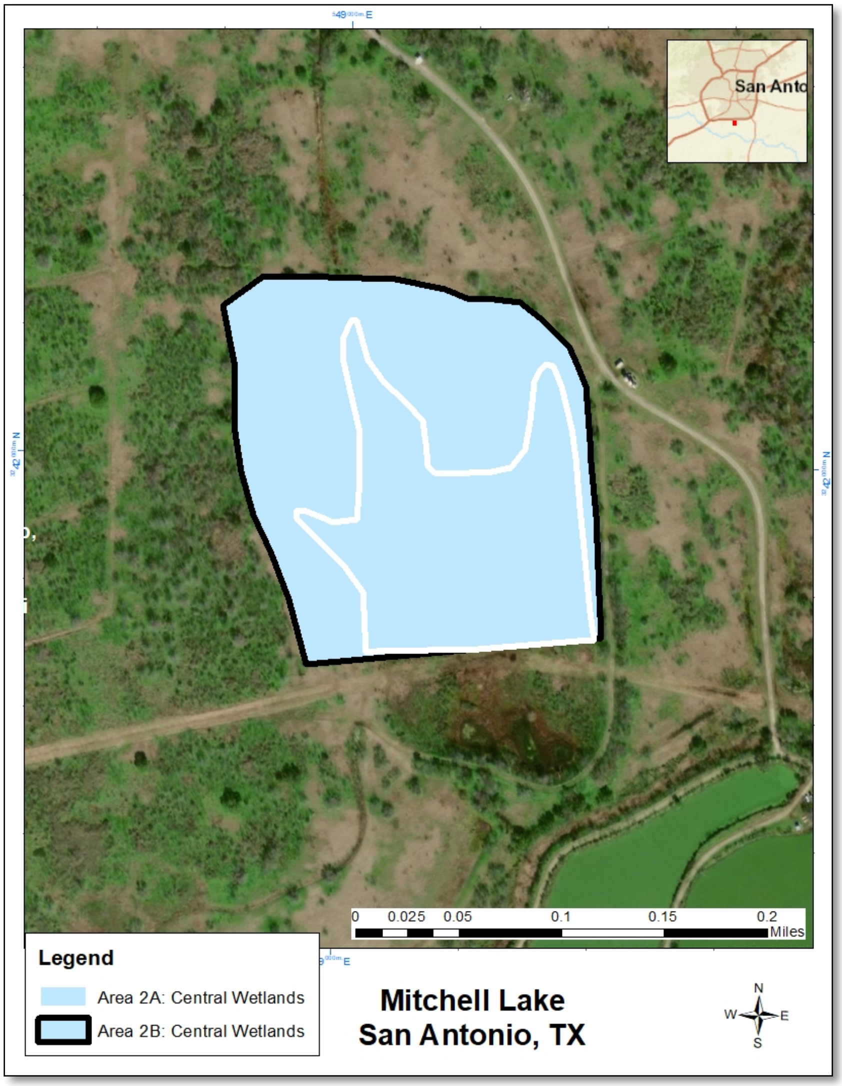


Figure 5. Central Wetlands Area 2A and 2B

3.2.3 Area 3: Skip's Pond

As noted in the Area 2 discussion above, Skip's Pond is part of the same wetland complex as Central Wetland, but is separated from that area by a pipeline that transects the area (Figure 6). 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 Wetland complex.

Figure 6. Skip's Pond

3.2.4 Area 6: Polders

The polders are directly north of Mitchell Lake (Figure 7). Area 6 is separated into two polders and five basins. The plan for this area is focused on structural modification and operational management of the water within the polder cells to create mud flat habitat for shorebirds and migratory birds. 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.

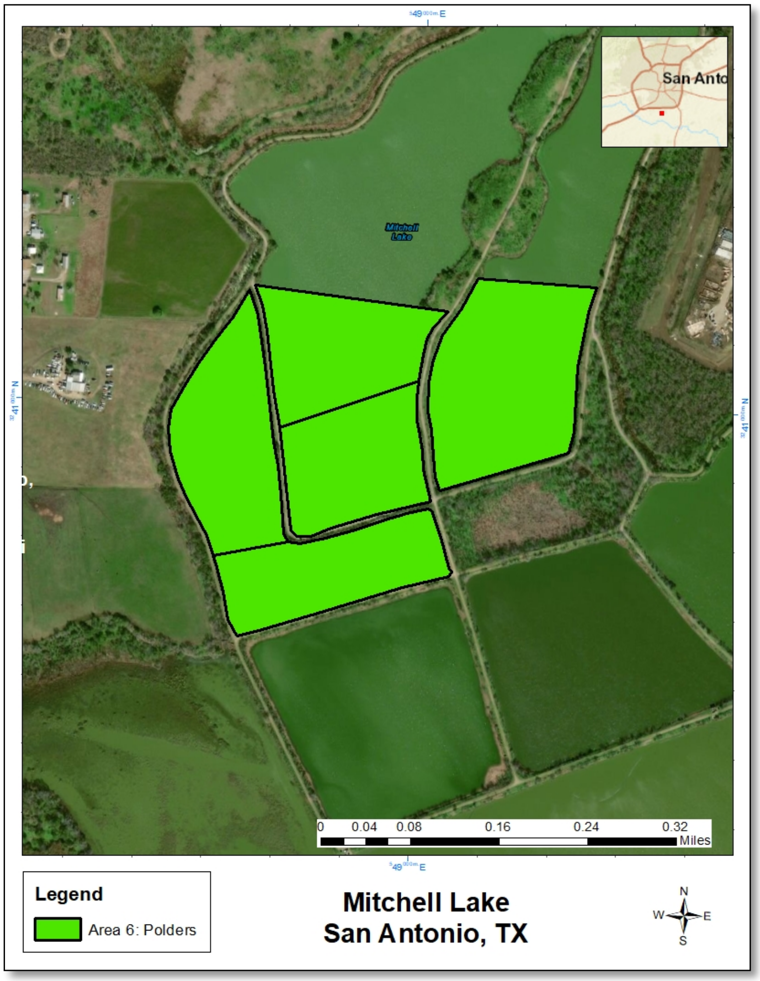


Figure 7. Polders

3.2.5 Area 7: Fringe Wetlands

Area 7 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. 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.

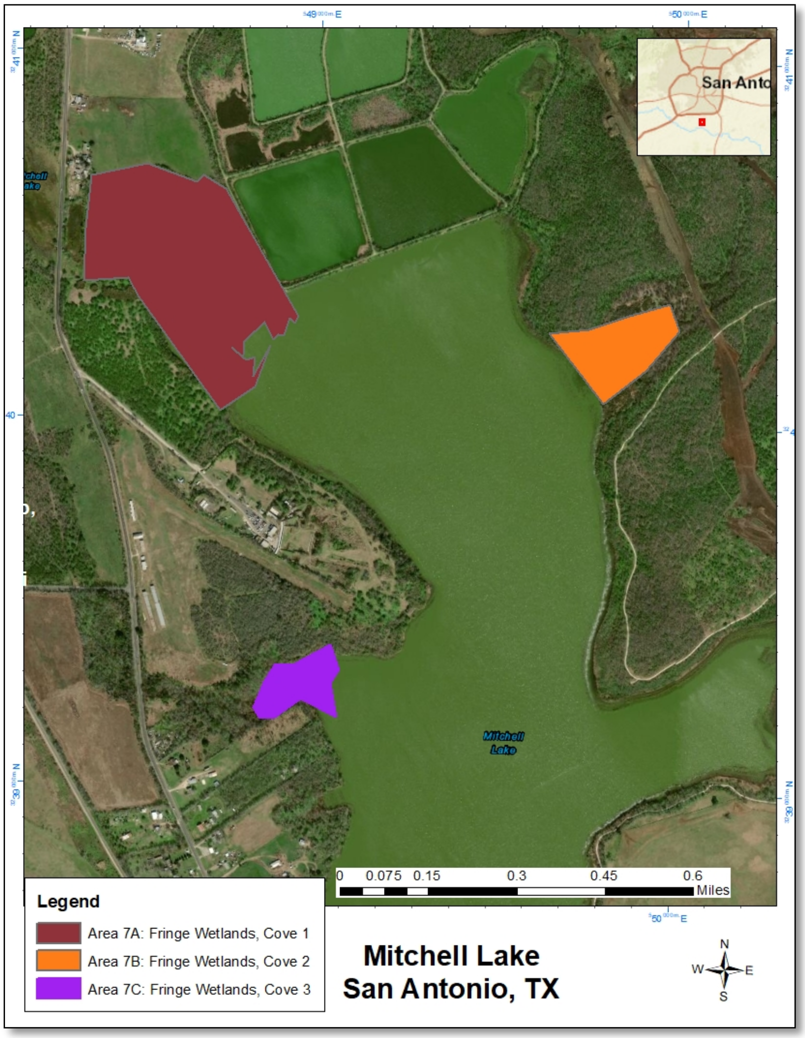


Figure 8. Fringe Wetlands

3.2.6 Area 9: Dam Forested Wetlands

The Dam Forested Wetlands are maintained by seepage through the dam and are dominated by hackberry woodlands. 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 9. Dam Forested Wetlands

3.2.7 Area 10: Downstream Wetlands

The Area 10 restoration plan entails the construction of a wetland complex adjacent to the proposed water quality treatment wetlands that would be constructed by SAWS (Figure 10). 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.

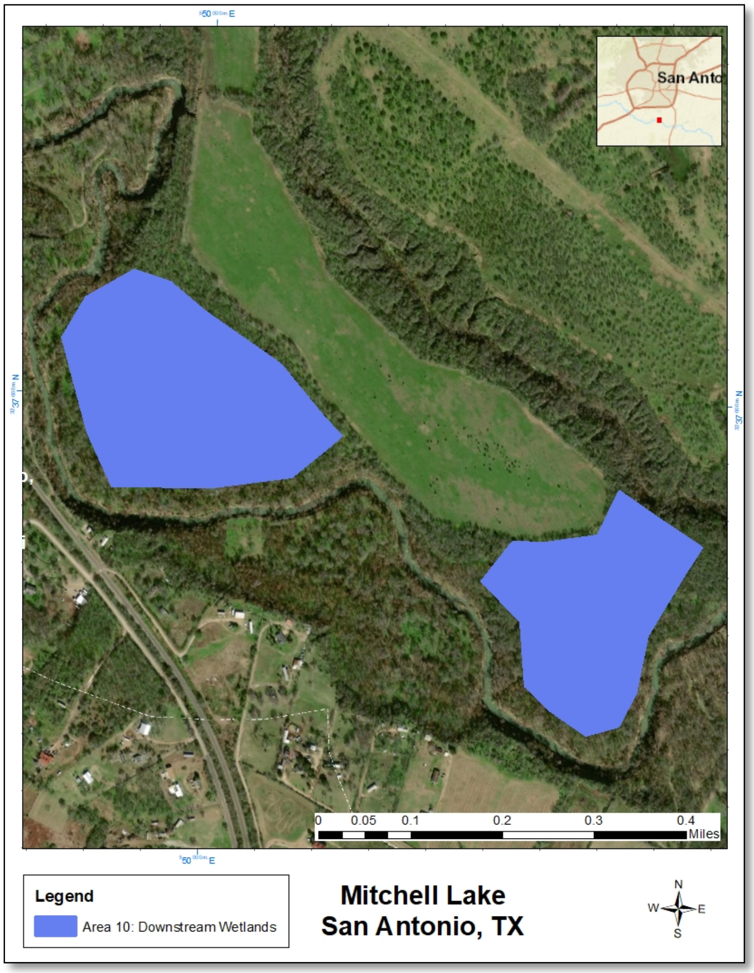


Figure 10. Downstream Wetlands

3.3 Array of Alternatives

For each area remaining, the final array of management measures was combined into individual alternatives within the areas. 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.

3.3.1 Alternatives 1A and 1B: Bird Pond Wetlands

The restoration goals for Alternative 1A and 1B are the enhancement of the existing wetland adjacent to Bird Pond. 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.

The Alternative 1A and 1B Future With Project conditions incorporate Clearing/Excavation, Installation of Pipeline, Seasonal Pulses, Native Wetland Species Plantings, Invasive Species Management, Low Quality Vegetation Removal, Habitat Structure Augmentation, and the 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 measure would provide a dependable water supply to ensure that the wetland is inundated to a level that supports a diverse vegetation 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 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 and submergent plant species would be planted to establish a diverse community. In an effort to minimize the establishment 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 control.

3.3.2 Alternatives 2A and 2B: Central Wetlands

Alternatives 2A and 2B would follow the same trend as Alternative 1A and 1B

3.3.3 Alternative 3: Skip's Pond Wetland

Alternative 3 would follow the same trend as Alternatives 1A, 1B, 2A, and 2B.

3.3.4 Alternative 6: Polders

Alternative 6 utilizes the existing polders of the old Mitchell Lake waste water 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.

3.3.5 Alternative 7A, 7B, 7C, 7D, 7E, 7E, 7F, and 7G: Fringe Wetlands

The limited and degraded fringe wetlands found in Coves 1, 2, and 3 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 alternatives for the Fringe Wetlands single out and/or combine the three coves identified for restoration.

- 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

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 Alternative 7 alternatives and 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.

3.3.6 Alternative 9: Dam Forested Wetlands

Measures appropriate for Alternative 9 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 Proposed Action would entail the thinning of hackberry trees for use as structural habitat and the creation of standing snags.

3.3.7 Alternative 10: Downstream Wetland Alternative

Implementation of Alternative 10 would involve the creation of wetlands downstream of the Mitchell Lake dam.

3.4 Plans

- Plan 1: No Action
- Plan 2: Polders (Alternative 6 alone)
- Plan 3: Polders + Cove 3 (Alternatives 6 + 7C)
- Plan 4: Polders, Cove 3, and Downstream Wetlands (Alternatives 6 + 7C + 10)
- Plan 5: Polders, Coves 1 - 3, and Downstream Wetlands (Alternatives 6 + 7G + 10)
- Plan 6: Skip's Pond + Plan 5 (Alternatives 3+ 6 + 7G + 10)
- Plan 7: Central Wetlands (2B) + Plan 6 (Alternatives 2B + 3+ 6 + 7G + 10)
- Plan 8: Bird Pond Wetlands (1B) + Plan 7 (Alternatives 1B + 2B + 3+ 6 + 7G + 10)
- Plan 9: Forested Wetlands below the Dam + Plan 8 (Alternatives 1B + 2B + 3+ 6 + 7G + 9B + 10)

3.5 Plan Selection

Plan 8 increases the synergistic water quality benefits of the previous Plans by adding the nutrient filtering function of the Bird Pond Wetlands with the channel to the Central Wetland/Skip's Pond/Linear Wetland/Cove 3 system. Plan 8 is worth the Federal and local investment because of:

- The increased diversity of bird species benefiting from the restoration and
- The increased water quality function resulting from adding the Bird Pond Wetland to the Plan.

Migratory birds are the primary resource of national significance identified within the study area. Based on historical descriptions of the study area, the large wetland complex that occupied the study area prior to the impoundment of Mitchell Lake would have acted as extremely valuable stopover habitats 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 8 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 creation of a complex of wetlands that can be managed to improve water quality as an ancillary benefit;
- The restoration of 97.8% of the proposed restoration areas;
- An incremental cost per incremental output of $8,787 over Plan 7;
- An approximate first cost of $5.2 million.

Plans were screened and compared based on how well an 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).

3.5.1 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.

3.5.2 Effectiveness

Plan 8 contributes to the achievement of the planning objectives and avoids all constraints.

3.5.3 Acceptability

Plan 8 is acceptable in terms of all known applicable laws, regulations, and public policies by the USACE and the Non-Federal Sponsor.

3.5.4 Efficiency

Plan 8 is the NER plan and the most cost effective means of achieving the objectives of all of this study's alternatives, plans, and scales of Plans.

4 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

Name	Scientific Name	Federal Listing	Habitat Present
Birds			
Golden-cheeked Warbler	*Dendroica chrysoparia*	E	No

Least Tern (Interior)	*Sterna antillarum athalassos*	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			
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 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

4.1 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.

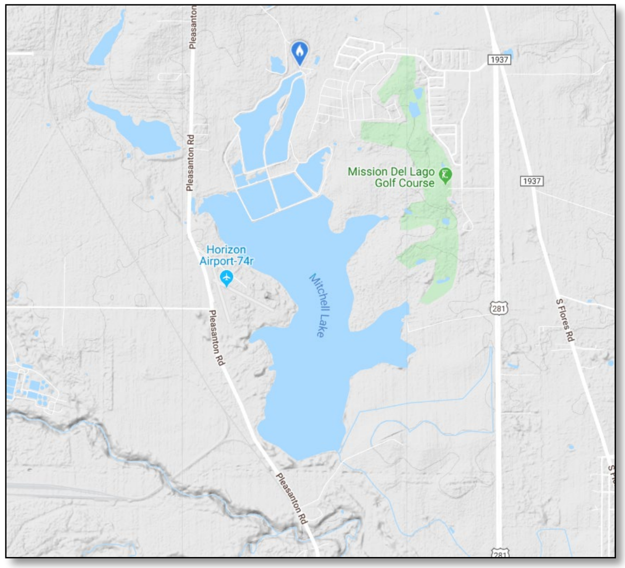


Figure 11. Golden-Cheeked Warbler Sighting (Image provided by eBird (www.ebird.org) and created [17 October 2019])

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).

4.2 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).

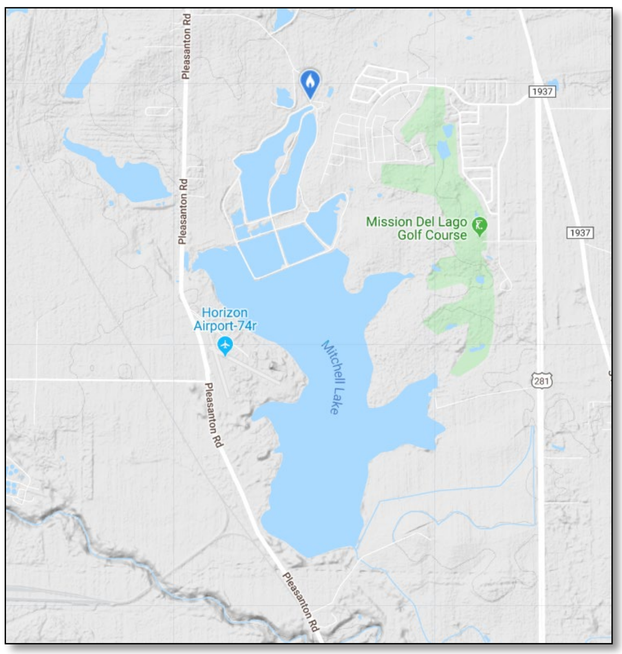


Figure 12. Red Knot Occurrence Location (Image provided by eBird (www.ebird.org) and created [17 October 2019])

4.3 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).

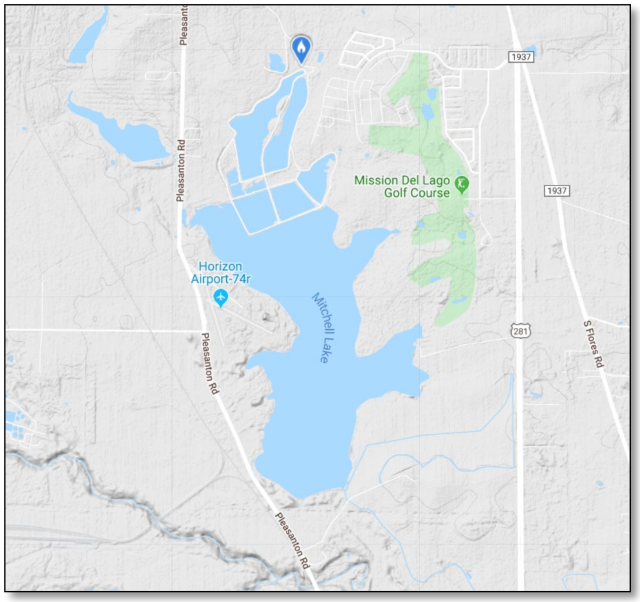


Figure 13. Piping Plover Occurrence Location (Image provided by eBird (www.ebird.org) and created [17 October 2019])

4.4 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 14; eBird 2019).

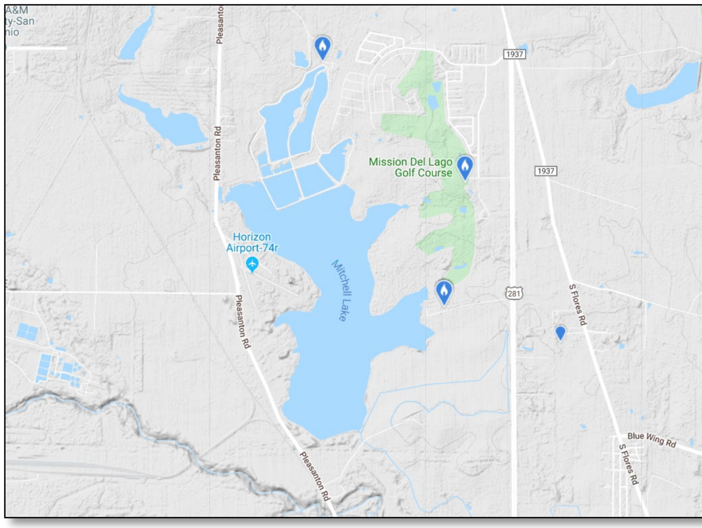


Figure 14. Least Tern Occurrence Locations (Image provided by eBird (www.ebird.org) and created [17 October 2019])

4.5 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). 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).

5 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.

5.1 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*.

5.2 Red Knot, Piping Plover, and Least Tern

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, piping plover, or least terns.

5.3 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.

6 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
Least Tern (Interior)	*Sterna antillarum athalassos*	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				
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				
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

7 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.

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.

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].

ATTACHMENT D

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.

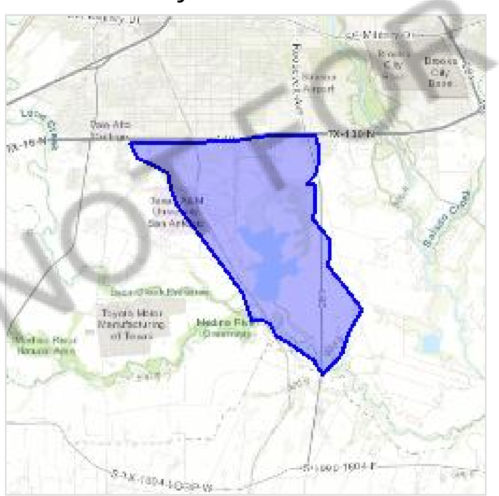
Project information

NAME

Mitchell Lake

LOCATION

Bexar County, Texas



DESCRIPTION

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.
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 — Endangered

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/33

Least Tern Sterna antillarum — Endangered

This species only needs to be considered if the following condition applies:

- Wind Energy Projects

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/8505

Piping Plover Charadrius melodus — Threatened

This species only needs to be considered if the following condition applies:

- Wind Energy Projects

There is **final** critical habitat for this species. Your location is outside the critical habitat.
https://ecos.fws.gov/ecp/species/6039

Red Knot Calidris canutus rufa — Threatened

This species only needs to be considered if the following condition applies:

- Wind Energy Projects

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/1864

Whooping Crane Grus americana — Endangered

There is **final** critical habitat for this species. Your location is outside the critical habitat.
https://ecos.fws.gov/ecp/species/758

Amphibians

NAME	STATUS

San Marcos Salamander Eurycea nana — Threatened

There is **final** critical habitat for this species. Your location is outside the critical habitat.
https://ecos.fws.gov/ecp/species/6374

Texas Blind Salamander Typhlomolge rathbuni — Endangered

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/5130

Fishes

NAME	STATUS

Fountain Darter Etheostoma fonticola | Endangered

There is **final** critical habitat for this species. Your location is outside the critical habitat.
https://ecos.fws.gov/ecp/species/5858

Clams

NAME	STATUS
Texas Fatmucket Lampsilis bracteata No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9041	Candidate
Texas Pimpleback Quadrula petrina No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/8966	Candidate

Insects

NAME	STATUS
[no Common Name] Beetle Rhadine exilis There is **final** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/6942	Endangered
[no Common Name] Beetle Rhadine infernalis There is **final** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/3804	Endangered
Comal Springs Dryopid Beetle Stygoparnus comalensis There is **final** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/7175	Endangered
Comal Springs Riffle Beetle Heterelmis comalensis There is **final** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/3403	Endangered
Helotes Mold Beetle Batrisodes venyivi There is **final** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/1149	Endangered

Arachnids

NAME	STATUS

Braken Bat Cave Meshweaver Cicurina venii — Endangered
There is **final** critical habitat for this species. Your location is outside the critical habitat.
https://ecos.fws.gov/ecp/species/7900

Cokendolpher Cave Harvestman Texella cokendolpheri — Endangered
There is **final** critical habitat for this species. Your location is outside the critical habitat.
https://ecos.fws.gov/ecp/species/676

Government Canyon Bat Cave Meshweaver Cicurina vespera — Endangered
There is **final** critical habitat for this species. Your location is outside the critical habitat.
https://ecos.fws.gov/ecp/species/7037

Government Canyon Bat Cave Spider Neoleptoneta microps — Endangered
There is **final** critical habitat for this species. Your location is outside the critical habitat.
https://ecos.fws.gov/ecp/species/553

Madla Cave Meshweaver Cicurina madla — Endangered
There is **final** critical habitat for this species. Your location is outside the critical habitat.
https://ecos.fws.gov/ecp/species/2467

Robber Baron Cave Meshweaver Cicurina baronia — Endangered
There is **final** critical habitat for this species. Your location is outside the critical habitat.
https://ecos.fws.gov/ecp/species/2361

Crustaceans

NAME	STATUS
Peck's Cave Amphipod Stygobromus (=Stygonectes) pecki There is **final** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/8575	Endangered

Flowering Plants

NAME	STATUS
Bracted Twistflower Streptanthus bracteatus No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/2856	Candidate

Texas Wild-rice *Zizania texana* — Endangered

There is **final** critical habitat for this species. Your location is outside the critical habitat.
https://ecos.fws.gov/ecp/species/805

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.

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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 This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Bald Eagle Haliaeetus leucocephalus 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	Breeds Sep 1 to Jul 31
Harris's Sparrow Zonotrichia querula This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Lesser Yellowlegs Tringa flavipes This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9679	Breeds elsewhere
Long-billed Curlew Numenius americanus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/5511	Breeds elsewhere
Semipalmated Sandpiper Calidris pusilla This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere

Willet *Tringa semipalmata* Breeds elsewhere

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

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.

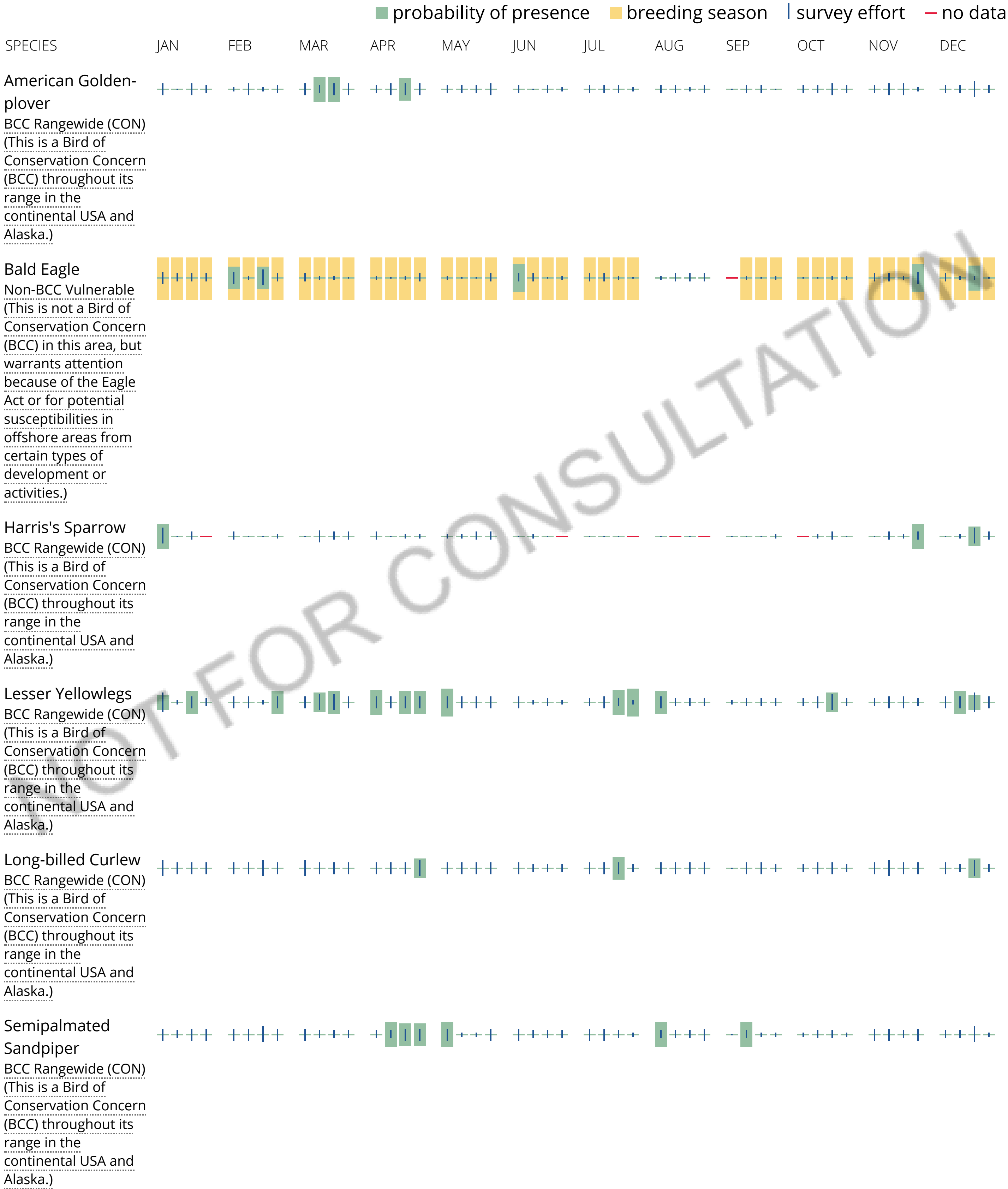
Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

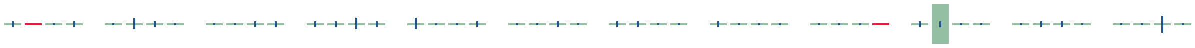
No Data (–)
A week is marked as having no data if there were no survey events for that week.

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.



Willet
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



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 and/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 E

ATTACHMENT I – Blackland Prairie's Species of Greatest Conservation Need

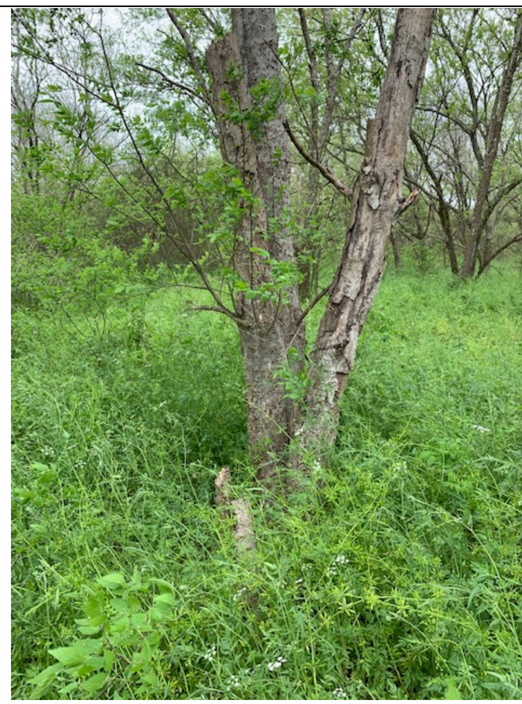
Name	*Scientific Name*
Birds	
Northern Pintail	*Anas acuta*
Northern Bobwhite	*Colinus virginianus*
Greater Prairie-Chicken (Interior)	*Tympanuchus cupido*
Wild Turkey	*Meleagris gallopavo*
Least Bittern	*Ixobrychus exilis*
Snowy Egret	*Egretta thula*
Little Blue Heron	*Egretta caerulea*
Green Heron	*Butorides virescens*
Wood Stork	*Mycteria americana*
Mississippi Kite	*Ictinia mississippiensis*
Bald Eagle	*Haliaeetus leucocephalus*
Northern Harrier	*Circus cyaneus*
Red-shouldered Hawk	*Buteo lineatus*
American Golden-Plover	*Pluvialis dominica*
Mountain Plover	*Charadrius montanus*
American Woodcock	*Scolopax minor*
Least Tern	*Sternula antillarum*
Short-eared Owl	*Asio flammeus*
Chuck-will's-widow	*Caprimulgus carolinensis*
Red-headed Woodpecker	*Melanerpes erythrocephalus*
Pileated Woodpecker	*Dryocopus pileatus*
Scissor-tailed Flycatcher	*Tyrannus forficatus*
Loggerhead Shrike	*Lanius ludovicianus*
Bell's Vireo	*Vireo bellii*
Carolina Chickadee	*Poecile carolinensis*

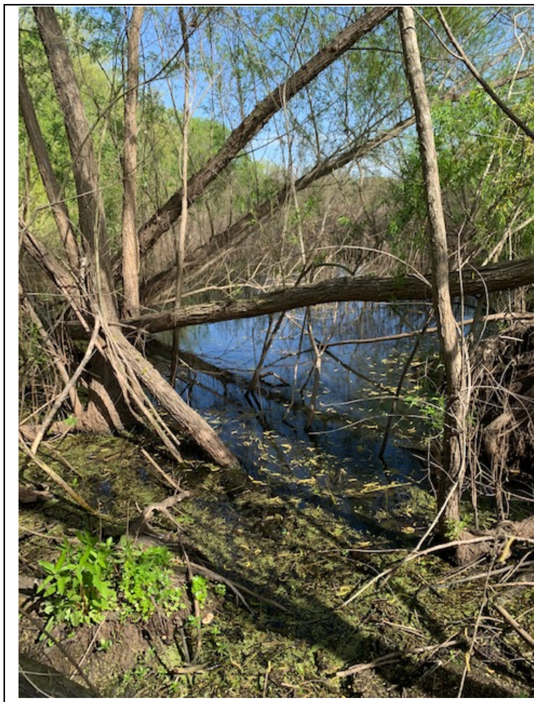
Bewick's Wren	*Thryomanes bewickii (bewickii)*
Sedge Wren	*Cistothorus platensis*
Wood Thrush	*Hylocichla mustelina*
Sprague's Pipit	*Anthus spragueii*
Yellow-throated Warbler	*Dendroica dominica*
Prothonotary Warbler	*Protonotaria citrea*
Swainson's Warbler	*Limnothlypis swainsonii*
Louisiana Waterthrush	*Seiurus motacilla*
Kentucky Warbler	*Oporornis formosus*
Field Sparrow	*Spizella pusilla*
Grasshopper Sparrow	*Ammodramus savannarum*
Lark Sparrow	*Chondestes grammacus*
Henslow's Sparrow	*Ammodramus henslowii*
Le Conte's Sparrow	*Ammodramus leconteii*
Harris's Sparrow	*Zonotrichia querula*
McCown's Longspur	*Calcarius mccownii*
Smith's Longspur	*Calcarius pictus*
Summer Tanager	*Piranga rubra*
Painted Bunting	*Passerina ciris*
Dickcissel	*Spiza americana*
Eastern Meadowlark	*Sturnella magna*
Rusty Blackbird	*Euphagus carolinus*
Orchard Oriole	*Icterus spurius*
Mammals	
Elliot's short-tailed shrew	*Blarina hylophaga plumblea*
Attwater's pocket gopher	*Geomys attwateri*
River otter	*Lutra canadensis*
Long-tailed weasel	*Mustela frenata*

Southeastern myotis	*Myotis austroriparius*
Cave myotis	*Myotis velifer*
Mountain lion	*Puma concolor*
Eastern spotted skunk	*Spilogale putorius*
Swamp rabbit	*Sylvilagus aquaticus*
Brazilian free-tailed bat	*Tadarida brasiliensis*
American badger	*Taxidea taxus*
Black bear	*Ursus americanus*
Reptiles and Amphibians	
Woodhouse's toad	*Anaxyrus (Bufo) woodhousii*
smooth softshell turtle	*Apalone mutica*
spiny softshell turtle	*Apalone spinifera*
Common snapping turtle	*Cheylydra serpentina*
Western diamondback rattlesnake	*Crotalus atrox*
Timber (Canebrake) Rattlesnake	*Crotalus horridus*
Cagle's map turtle	*Graptemys caglei*
Texas map turtle	*Graptemys versa*
Western hognosed snake	*Heterodon nasicus*
alligator snapping turtle	*Macrochelys temminckii*
western slender glass lizard	*Ophisaurus attenuatus*
Texas horned lizard	*Phrynosoma cornutum*
Strecker's Chorus Frog	*Pseudacris streckeri*
massasauga	*Sistrurus catenatus*
Eastern box turtle	*Terrapene carolina*
Ornate box turtle	*Terrapene ornata*
Texas Garter Snake (Eastern/Texas/ New Mexico)	*Thamnophis sirtalis annectans*
Red-eared slider	*Trachemys scripta*
Fishes	

American eel	*Anguilla rostrata*
alligator gar	*Atractosteus spatula*
Blue sucker	*Cycleptus elongatus*
Fountain darter	*Etheostoma fonticola*
Silver chub	*Macryhbopsis storeriana*
Guadalupe bass	*Micropterus treculii*
Blackspot shiner	*Notropis atrocaudalis*
Red River shiner	*Notropis bairdi*
Small eye shiner	*Notropis buccula*
Ironcolor shiner	*Notropis chalybaeus*
Sharpnose shiner	*Notropis oxyrhynchus*
Chub shiner	*Notropis potteri*
Silverband shiner	*Notropis shumardi*
Guadalupe darter	*Percina apristis*
Paddlefish	*Polyodon spathula*
Widemouth blindcat	*Satan eurystomus*
Toothless blindcat	*Trogloglanis pattersoni*
Invertebrates	
American bumblebee	*Bombus pensylvanicus*
Holzenthal's Philopotamid caddisfly	*Chimarra holzenthali*
A scarab beetle	*Cotinis boylei*
American Burying Beetle	*Nicrophorus americanus*
Texas heelsplitter	*Potamilus amphichaenus*
Regal burrowing crayfish	*Procambarus regalis*
Parkhill prairie crayfish	*Procambarus steigmani*
A mayfly	*Pseudocentroptiloides morihari*
Sage sphinx	*Sphinx eremitoides*
A mayfly	*Susperatus tonkawa*

ATTACHMENT F

 1-North	 1-East
 1-South	 1-West



2-North

2-East

2-South

2-West

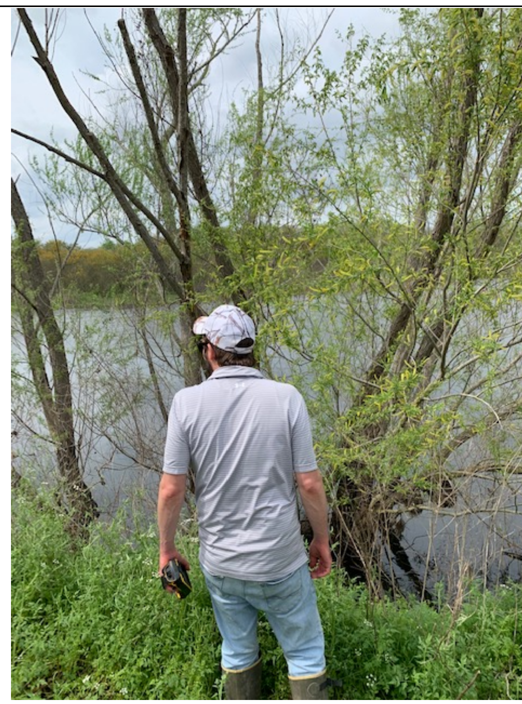
 3-North	 3-East
 3-South	 3-West

 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
 18-South	 18-West


19-North


19-East


19-South


19-West


20-North


20-East

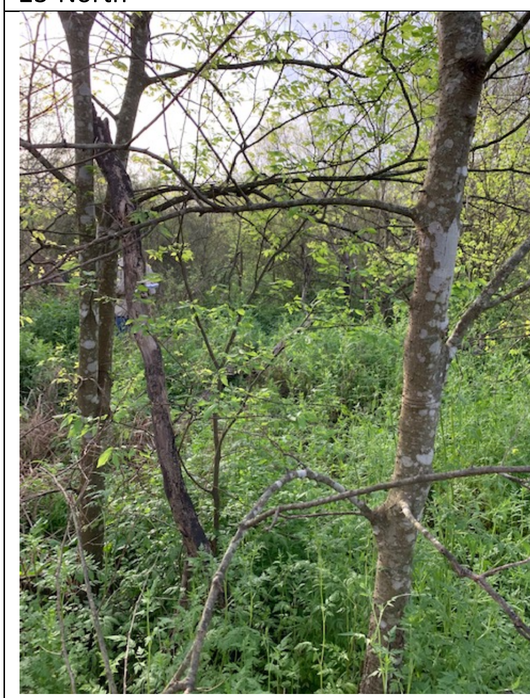

20-South


20-West

 21-North	 21-East
 21-South	 21-West


23-North


23-East


23-South


23-West

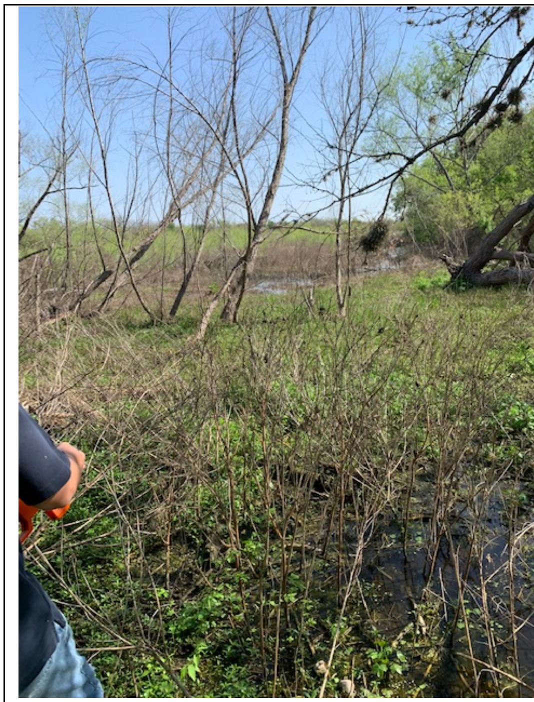
 24-North	 24-East
 24-South	 24-West

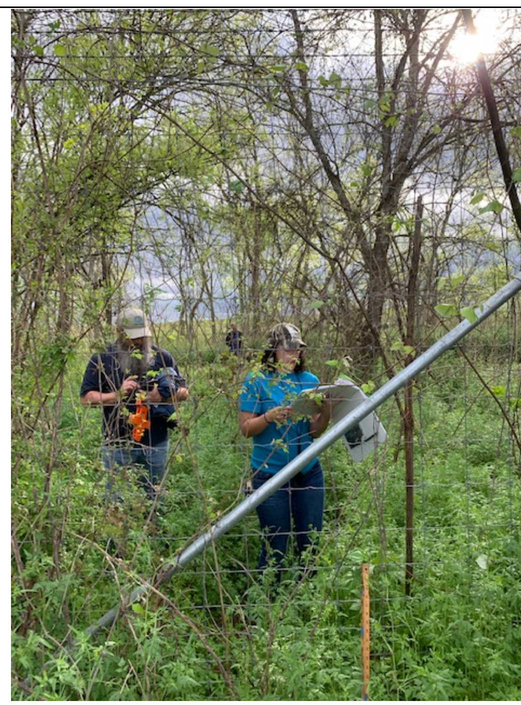

28-North


28-East


28-South


28-West

 29-North	 29-East
 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

 46-North	 46-East
 46-South	 46-West


EM1-North

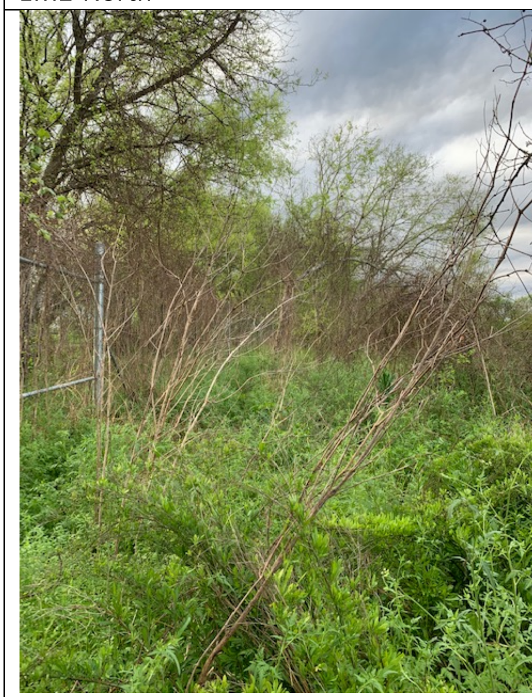

EM1-East


EM1-South


EM1-West


EM2-North

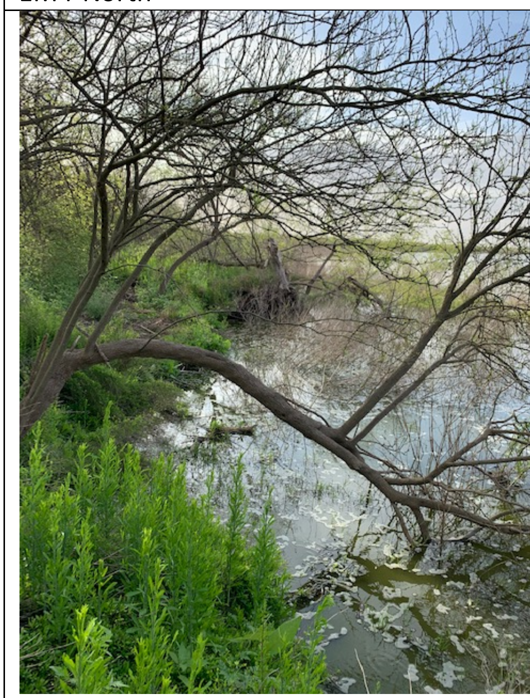

EM2-East


EM2-South

 EM3-North	 EM3-East
 EM3-South	 EM3-West

EM4-North

EM4-East



EM4-South

EM4-West


SH1-North


SH1-East


SH1-South


SH1-West

ATTACHMENT G

Site # 40

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: 40 **Photo #:** N E S W

Team: Tom, Brittany, Dan, Gregg, Pat, Aaron, Justyss, Danny **Date:** *March 12th* *March 13th* *March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* *GL* *SL* ***Other:*** **Coordinates** UTM

N: 3237967.14 meters **E:** 549452.93 meters

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	%
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	%
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	%
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	%
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	%
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	%
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	%
	V5	Percent shrub** crown cover [≤30%= 1.0]	%
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site #

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	%
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	%
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	%
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	%
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	%
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	
	SIV9	Mean water temperature at mid-depth during summer (^{0}C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	^{0}C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	100 %

Site # 40

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	0 %
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	50 centimeters
	V4	Distance to perch site [≤30=1.0]	30 meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	0 %
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	0 %
	SIV2	Percent tree canopy closure [≥25 and ≤50]	0 %
	SIV3	Percent canopy closure of persistent herbaceous vegetation	30 %
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	%
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	%

*Tree height - woody vegetation > 5.0 m

**Shrub height – Woody vegetation < 5.0 m

***Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.

EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):

Metacago, Bedstraw, hedge parsley, giant ragweed
bastard cabbage, johnson grass

Site # 39

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: 39 **Photo #:**

Team: Same **Date:** *March 12th* *March 13th* *March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* **Coordinates**

GL *SL* ***Other:*** **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	%
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	%
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	%
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	%
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	%
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	%
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	%
	V5	Percent shrub** crown cover [≤30%= 1.0]	%
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site # 39

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	%
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	%
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	%
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	%
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	%
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	
	SIV9	Mean water temperature at mid-depth during summer (^{0}C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	^{0}C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	70 %

Site #

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	30 %
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	10 centimeters
	V4	Distance to perch site [≤30=1.0]	≤30 meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	≤5 %
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	2 %
	SIV2	Percent tree canopy closure [≥25 and ≤50]	0 %
	SIV3	Percent canopy closure of persistent herbaceous vegetation	5 %
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	%
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	%

**Tree height - woody vegetation > 5.0 m*
***Shrub height – Woody vegetation < 5.0 m*
****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*
EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):
Silverleaf nightshade, white prickly poppy, metacaiao, bermuda grass, red gated thistle, bastard cabbage, shepard's purse jacobea

Site #

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: 41

Photo #:

Team:

Date: *March 12th* *March 13th* *March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* *GL* *SL* ***Other:***

Coordinates

N: **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	%
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	%
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	%
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	%
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	%
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	%
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	%
	V5	Percent shrub** crown cover [≤30%= 1.0]	%
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site #

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	%
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	%
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	%
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	%
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	%
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	
	SIV9	Mean water temperature at mid-depth during summer (°C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	°C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	%

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	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	%
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	35 %
	SIV2	Percent tree canopy closure [≥25 and ≤50]	0 %
	SIV3	Percent canopy closure of persistent herbaceous vegetation	2 %
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	.1 thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	0 %
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	0 %

**Tree height - woody vegetation > 5.0 m*
***Shrub height – Woody vegetation < 5.0 m*
****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*
EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):

Cheat grass, white prickly poppy, bee balm, prickly pear, mesquite, storks' bill, hedge parsley, common mullein, bedstraw, shepard's purse, ragweed

Site # 44

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: 44 **Photo #:**

Team: Same **Date:** *March 12th* *March 13th* *March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* **Coordinates**

GL *SL* ***Other:*** **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	%
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	%
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	%
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	%
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	%
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	%
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	%
	V5	Percent shrub** crown cover [≤30%= 1.0]	%
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site #

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	%
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	%
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	%
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	%
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	%
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	
	SIV9	Mean water temperature at mid-depth during summer (^{0}C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	^{0}C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	%

Site # 40

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	%
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	60 %
	SIV2	Percent tree canopy closure [≥25 and ≤50]	0 %
	SIV3	Percent canopy closure of persistent herbaceous vegetation	1 %
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	.5 thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	0 %
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	0 %

Tree height - woody vegetation > 5.0 m
**Shrub height – Woody vegetation < 5.0 m*
***Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*
EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):
shepards purse, ragweed, prickly pear
mesquite, thistle, cheatgrass, sonchos
metacago, beggars' tick (hedge parsley)
Sugar berry, texas vervain, plantheago
wild geranium, bee balm

Site # 45

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: 45 **Photo #:**

Team: Same **Date:** *March 12th* *March 13th* *March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* **Coordinates**

GL *SL* ***Other:*** **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	%
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	%
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	%
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	%
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	%
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	%
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	%
	V5	Percent shrub** crown cover [≤30%= 1.0]	%
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site #

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	%
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	%
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	%
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	%
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	%
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	
	SIV9	Mean water temperature at mid-depth during summer (^{0}C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	^{0}C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	%

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	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	%
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	70 %
	SIV2	Percent tree canopy closure [≥25 and ≤50]	0 %
	SIV3	Percent canopy closure of persistent herbaceous vegetation	0 %
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	.7 thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	0 %
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	0 %

**Tree height - woody vegetation > 5.0 m*
***Shrub height – Woody vegetation < 5.0 m*
****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*
EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):

hedge parsley, mesquite, bastard cabbage
shepherd's purse, bedstraw, cheat grass
verigated thistle metacago clover
giant ragweed, frostweed, sonchis
prickly pear

Site #

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: 43 **Photo #:**

Team: **Date:** *March 12th* *March 13th* *March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* **Coordinates**

GL *SL* ***Other:*** **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	%
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	%
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	%
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	%
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	%
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	%
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	%
	V5	Percent shrub** crown cover [≤30%= 1.0]	%
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site #

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	%
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	%
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	%
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	%
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	%
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	
	SIV9	Mean water temperature at mid-depth during summer (°C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	°C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	%

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	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	%
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	20 %
	SIV2	Percent tree canopy closure [≥25 and ≤50]	0 %
	SIV3	Percent canopy closure of persistent herbaceous vegetation	1 %
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	.2 thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	0 %
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	3 %

**Tree height - woody vegetation > 5.0 m*
***Shrub height – Woody vegetation < 5.0 m*
****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*
EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):
prickly pear, bee balm, metacago
hedge parsley, texas vervain
Common mullein, bedstraw, mesquite
white prickly poppy, ground cherry
Sonchis, stemless primrose

Site # Have be no dirt work possibly bald cypress planting Seepage from lake?

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: 42 **Photo #:**

Team: Same **Date:** *March 12th* *March 13th* *March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* **Coordinates**

GL *SL* ***Other:*** **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	0
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	7 inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	25 %
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	27 feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	35 %
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	240 acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	0 %
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	25 %
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	25 %
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	5 inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	0 %
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	5 inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	25 %
	V5	Percent shrub** crown cover [≤30%= 1.0]	15 %
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	7661
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained 75 %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained 15 %

Site #

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained 25 %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	%
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	%
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	%
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	%
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	%
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	
	SIV9	Mean water temperature at mid-depth during summer (^{0}C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	^{0}C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	%

Site # 4

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	%
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	%
	SIV2	Percent tree canopy closure [≥25 and ≤50]	%
	SIV3	Percent canopy closure of persistent herbaceous vegetation	%
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	%
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	%

**Tree height - woody vegetation > 5.0 m*
***Shrub height – Woody vegetation < 5.0 m*
****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*
EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):

Cedar elm, sugar berry, gumbumbila
bedstraw, sonchis, hedge parsley,
dayflower, baby blue eyes, giant ragweed
wild onion, chinaberry tree, green bria

Site #

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: 46 (dropped sooner) **Photo #:**

Team: Same **Date:** *March 12th* *March 13th* *March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* **Coordinates**

GL *SL* ***Other:*** **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	0
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	6 inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	60 %
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	28 feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	65 %
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	~40 acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	0 %
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	60 %
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	60 %
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	6 inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	0 %
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	6 inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	60 %
	V5	Percent shrub** crown cover [≤30%= 1.0]	15 %
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	7661
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained 50 %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained 15 %

Site #

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained 60 %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	%
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	%
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	%
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	%
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	%
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	
	SIV9	Mean water temperature at mid-depth during summer (^{0}C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	^{0}C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	%

Site # 46

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	%
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	%
	SIV2	Percent tree canopy closure [≥25 and ≤50]	%
	SIV3	Percent canopy closure of persistent herbaceous vegetation	%
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	%
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	%

**Tree height - woody vegetation > 5.0 m*
***Shrub height – Woody vegetation < 5.0 m*
****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*
EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):

cedar elm, box elder, china berry
sugar berry, ligustrum, giant ragweed
beggars tick, dayflower, dew berry
climatus, lactuca, carix sp.
bamboo, buttercup, sonchis, yucca

Site #

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: | **Photo #:**

Team: | **Date:** *March 12th* *March 13th* *March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* | **Coordinates**

GL *SL* ***Other:*** | **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	%
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	%
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	0 %
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	80 %
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	80 %
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	18" >15 inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	0 %
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	18" >15 inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	1.0 %
	V5	Percent shrub** crown cover [≤30%= 1.0]	15 %
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site #

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	%
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	%
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	%
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	%
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	%
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	
	SIV9	Mean water temperature at mid-depth during summer (^{0}C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	^{0}C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	%

Site #)

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	%
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	%
	SIV2	Percent tree canopy closure [≥25 and ≤50]	%
	SIV3	Percent canopy closure of persistent herbaceous vegetation	%
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	%
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	%

**Tree height - woody vegetation > 5.0 m*
***Shrub height – Woody vegetation < 5.0 m*
****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*
EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):

Sugar berry, spiny hackberry, beggar-ticks, bedstraws, Sonchus, lactuca, arborensis

Site # 5

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: 5 **Photo #:**

Team: **Date:** *March 12th* *March 13th* *March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* **Coordinates**

GL *SL* **Other:** Riparian to the pond **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	0
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	6 inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	40 %
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	25 feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	40 %
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	~1 acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	0 %
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	40 %
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	40 %
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	6 inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	0 %
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	6 inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	40 %
	V5	Percent shrub** crown cover [≤30%= 1.0]	52 %
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site # 5

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	%
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	%
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	%
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	%
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	%
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	
	SIV9	Mean water temperature at mid-depth during summer (^{0}C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	^{0}C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	%

Site # 5

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	%
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	%
	SIV2	Percent tree canopy closure [≥25 and ≤50]	%
	SIV3	Percent canopy closure of persistent herbaceous vegetation	%
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	%
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	%

Tree height - woody vegetation > 5.0 m

**Shrub height – Woody vegetation < 5.0 m*

***Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*

EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):

willow, spiny hackberry, sugarberry, giant ragweed, dakota mock vervain, beggarsticks
sonchus, bedstraw, yellow oxalis, Ranunculus, bermuda grass,
rescue grass, ludwigia, horseweed, ash sapling, mulberry sapling
american germander, alligator weed

Site # 3

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: 3 **Photo #:**

Team: **Date:** *March 12th* *March 13th* *March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* **Coordinates**

GL *SL* ***Other:*** **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	%
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	%
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	%
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	%
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	%
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	%
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	%
	V5	Percent shrub** crown cover [≤30%= 1.0]	%
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site #

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	%
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	%
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	%
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	%
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	%
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	
	SIV9	Mean water temperature at mid-depth during summer (^{0}C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	^{0}C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	%

Site # 3

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	%
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	65 %
	SIV2	Percent tree canopy closure [≥25 and ≤50]	0 %
	SIV3	Percent canopy closure of persistent herbaceous vegetation	0 %
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	10 thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	0 %
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	0 %

**Tree height - woody vegetation > 5.0 m*
***Shrub height – Woody vegetation < 5.0 m*
****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*
EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):

paloverde, beggarsticks, spiny hackberry, elbow bush, sonchus, [illegible]
white brush, lactuca, huisache, sugarberry (9)

Site # Em1

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: Em1 **Photo #:**

Team: **Date:** *March 12th* *March 13th* *March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* **Coordinates**

GL *SL* ***Other:*** **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	%
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	%
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	%
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	%
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	%
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	%
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	%
	V5	Percent shrub** crown cover [≤30%= 1.0]	%
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site #

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes in between	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	95 %
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	5 centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	<1% %
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	>30 meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	0 %
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	15 %
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	5 centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	65 %
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	0 Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	6.89
	SIV9	Mean water temperature at mid-depth during summer (^{0}C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	27.0 ^{0}C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	0 meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	95 %

Site # EM 1

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	21 %
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	2.5ft centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	%
	SIV2	Percent tree canopy closure [≥25 and ≤50]	%
	SIV3	Percent canopy closure of persistent herbaceous vegetation	%
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	%
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	%

Tree height - woody vegetation > 5.0 m

***Shrub height – Woody vegetation < 5.0 m*

****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*

EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):

slender spikerush, cattails, sonchus, bermuda grass, beggarsticks
western ragweed, sugarberry, bee balm.

Site # 6

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: **Photo #:**

Team: **Date:** *March 12th* *March 13th* *March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* **Coordinates**

GL *SL* ***Other:*** **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	0
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	8 inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	15 %
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	20 feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	60 %
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	0.3 acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	0 %
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	15 %
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	15 %
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	8 inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	0 %
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	8 inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	15 %
	V5	Percent shrub** crown cover [≤30%= 1.0]	65 %
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	7661
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover*** 15	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover*** 65	Maintained or Unmaintained %

Site # 6

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained 15 %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	%
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	%
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	0 meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	25 %
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	80 %
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	10.16 centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	80 %
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	3 Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	7.49
	SIV9	Mean water temperature at mid-depth during summer (^{o}C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	21.3 ^{o}C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	0 meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	95 %

Site #

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	2 %
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	2.5 7.5 centimeters
	V4	Distance to perch site [≤30=1.0]	0 meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	%
	SIV2	Percent tree canopy closure [≥25 and ≤50]	%
	SIV3	Percent canopy closure of persistent herbaceous vegetation	%
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	%
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	%

**Tree height - woody vegetation > 5.0 m*
***Shrub height – Woody vegetation < 5.0 m*
****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*
EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):

Anacua, sugar berry, bed straw, spiny hackberry, giant ragweed
beggarstick, huisache, bastard cabbage

Site #

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: 38 **Photo #:**

Team: Gregg, Danny, Aaron, Tom, Justyss, Pat **Date:** *March 12th* *March 13th* *March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* **Coordinates**

GL *SL* ***Other:*** **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	0
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	6 inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	80 %
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	32.5 feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	80 %
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	~14 acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	0 %
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	80 %
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	80 %
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	6 inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	0 %
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	6 inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	80 %
	V5	Percent shrub** crown cover [≤30%= 1.0]	30 %
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	7661
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained 85 %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained 30 %

Site #

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained 80 %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	%
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	%
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	%
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	%
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	%
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	
	SIV9	Mean water temperature at mid-depth during summer (^{0}C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	^{0}C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	%

Site # 38

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	%
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	%
	SIV2	Percent tree canopy closure [≥25 and ≤50]	%
	SIV3	Percent canopy closure of persistent herbaceous vegetation	%
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	%
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	%

**Tree height - woody vegetation > 5.0 m*

***Shrub height – Woody vegetation < 5.0 m*

****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*

EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):

sugarberry, beggars tick, cheat grass, mesquite
horse herb, spiny hackberry, giant ragweed
Panicum sp., Oxalis, white brush, bed straw

Stream in site is dry, but ephemeral

Site #

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: 37 **Photo #:**

Team: **Date:** *March 12th* *March 13th* *March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* **Coordinates**

GL *SL* ***Other:*** **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	0
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	9 inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	90 %
Shelterbelt (RF) wetland not stream	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	%
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	0 %
	SIV2	Number of hard mast tree* species	0 1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	90 %
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	90 %
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	9 inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	0 %
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	9 inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	90 %
	V5	Percent shrub** crown cover [≤30%= 1.0]	55 %
Avian IBI (RF & AQ) no channel	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site # 37

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	%
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	%
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	%
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	%
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	%
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	
	SIV9	Mean water temperature at mid-depth during summer (^{0}C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	^{0}C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	%

Site #

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	%
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	%
	SIV2	Percent tree canopy closure [≥25 and ≤50]	%
	SIV3	Percent canopy closure of persistent herbaceous vegetation	%
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	%
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	%

**Tree height - woody vegetation > 5.0 m*
***Shrub height – Woody vegetation < 5.0 m*
****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*
EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):
sonchis, paloverdie, mesquite, sugar berry
chinaberry, woody baccharis, bed straw
meta cargo clover, himbit, Panicum sp
Oxalis, buttercup

Site # EM2

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: EM2 **Photo #:**

Team: **Date:** *March 12th* *March 13th* *March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* **Coordinates**

GL *SL* ***Other:*** **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	%
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	%
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	%
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	%
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	%
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	%
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	%
	V5	Percent shrub** crown cover [≤30%= 1.0]	%
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site # EM2

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	ragweed 10 %
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	7.5 centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	20 %
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	0 meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	duckweed spikerush 100 %
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	17.5 %
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	7.5 centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	organic matter dominate %
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	0 Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	
	SIV9	Mean water temperature at mid-depth during summer (^oC) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	^oC
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	0 meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	%

Site #

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	%
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	%
	SIV2	Percent tree canopy closure [≥25 and ≤50]	%
	SIV3	Percent canopy closure of persistent herbaceous vegetation	%
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	%
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	%

**Tree height - woody vegetation > 5.0 m*
***Shrub height – Woody vegetation < 5.0 m*
****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*
EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):
slender spikerush smartweed, buttercup
giant ragweed, duckweed, palo Verde, Carix sp.

Arundo adjacent to site
Might not have opposition to putting wetland here

Site #

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: 36 **Photo #:**

Team: **Date:** *March 12th* *March 13th* *March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* **Coordinates**

GL *SL* ***Other:*** **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	0
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	6 inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	55 %
Shelterbelt (RF) no stream	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	%
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	0 %
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	55 %
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	55 %
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	6 inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	0 %
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	6 inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	55 %
	V5	Percent shrub** crown cover [≤30%= 1.0]	15 %
Avian IBI (RF & AQ) no stream	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site #

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	%
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	%
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	%
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	%
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	%
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	
	SIV9	Mean water temperature at mid-depth during summer (^{0}C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	^{0}C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	%

Site # 7,10

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	%
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	%
	SIV2	Percent tree canopy closure [≥25 and ≤50]	%
	SIV3	Percent canopy closure of persistent herbaceous vegetation	%
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	%
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	%

**Tree height - woody vegetation > 5.0 m*
***Shrub height – Woody vegetation < 5.0 m*
****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*
EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):

chinaberry, red mulberry, hackberry, mustang grape, beggars tick, giant ragweed, peppervine, baccharis

Site # EM3

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: **Photo #:**

Team: **Date:** *March 12th* *March 13th* *March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* **Coordinates**

GL *SL* ***Other:*** **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	%
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	%
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	%
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	%
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	%
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	%
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	%
	V5	Percent shrub** crown cover [≤30%= 1.0]	%
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site # EM3

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	60 %
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	22-45.72 centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	1 %
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	30.48 meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	60 %
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	90 %
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	10.16 centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	10 %
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	0 Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	
	SIV9	Mean water temperature at mid-depth during summer (°C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	°C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	0 meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	%

Site #

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	%
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	%
	SIV2	Percent tree canopy closure [≥25 and ≤50]	%
	SIV3	Percent canopy closure of persistent herbaceous vegetation	%
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	%
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	%

**Tree height - woody vegetation > 5.0 m*
***Shrub height – Woody vegetation < 5.0 m*
****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*
EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):

alligator weed, joint grass, buttercup, salt cedar, giant cedar, American germander baccharis, hackberry, sumpweed, bed straw, beggars tick, rumax

Site #

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: 28 **Photo #:**

Team: **Date:** *March 12th* *March 13th* *March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* **Coordinates**

GL *SL* ***Other:*** **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	1
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	9 inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	>60 - 90 %
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	%
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	acres

Site # Vb

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	0 %
	SIV2	Number of hard mast tree* species	0 ~~1.~~ Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	%
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	%
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	0 %
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	90 %
	V5	Percent shrub** crown cover [≤30%= 1.0]	10 %
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site # 28

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	%
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	%
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	%
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	%
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	%
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	
	SIV9	Mean water temperature at mid-depth during summer (^{o}C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	^{o}C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	%

Site # 1D2

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	%
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	%
	SIV2	Percent tree canopy closure [≥25 and ≤50]	%
	SIV3	Percent canopy closure of persistent herbaceous vegetation	%
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	%
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	%

**Tree height - woody vegetation > 5.0 m*

***Shrub height – Woody vegetation < 5.0 m*

****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*

EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):

Hackberry, beggars Tick, bedstraw, chinaberry
giant ragweed, day flower, Johnson grass
Sonchus, chinaberry, [illegible]

Site #

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: Z9 **Photo #:**

Team: **Date:** *March 12th* *March 13th* *March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* **Coordinates**

GL *SL* ***Other:*** **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	0
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	10 inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	15 %
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	%
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	%
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	%
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	%
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	%
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	%
	V5	Percent shrub** crown cover [≤30%= 1.0]	%
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site # 24

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	90 %
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	5 centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	0 %
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	200 meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	90 all alligator weed %
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	20 %
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	5 centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	10 %
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	0 Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	7.12
	SIV9	Mean water temperature at mid-depth during summer (°C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	23.0 °C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	200 meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	%

Site #

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	%
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	%
	SIV2	Percent tree canopy closure [≥25 and ≤50]	%
	SIV3	Percent canopy closure of persistent herbaceous vegetation	%
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	%
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	%

**Tree height - woody vegetation > 5.0 m*

***Shrub height – Woody vegetation < 5.0 m*

****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*

EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):

[illegible] Sugarberry, Ranunculus, Sumpweed, Alligator weed, giant ragweed, Duckweed, willow, cheat grass, paspalum, [illegible] balloon

Site #

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: 16 **Photo #:**

Team: **Date:** *March 12th* *March 13th* *March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* **Coordinates**

GL *SL* ***Other:*** **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	%
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	%
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	%
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	%
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	%
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	%
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	%
	V5	Percent shrub** crown cover [≤30%= 1.0]	%
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site # 16

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes Sesbania	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	2 %
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	5 centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	0 %
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	7 30 meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	0 %
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	90 %
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	5 centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	low %
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	0 Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	6.51
	SIV9	Mean water temperature at mid-depth during summer (^{0}C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	31.9 ^{0}C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	113 meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	%

Site #

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	%
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	%
	SIV2	Percent tree canopy closure [≥25 and ≤50]	%
	SIV3	Percent canopy closure of persistent herbaceous vegetation	%
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	%
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	%

Tree height - woody vegetation > 5.0 m

Shrub height – Woody vegetation < 5.0 m

Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.

EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):

sesbania, buttercup, bermuda grass

rumex

Site #

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: 27 Polker - Busiky **Photo #:**

Team: **Date:** *March 12th* *March 13th* *March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* **Coordinates**

GL *SL* ***Other:*** **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	%
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	%
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	%
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	%
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	%
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	%
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	%
	V5	Percent shrub** crown cover [≤30%= 1.0]	%
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site # 22 P

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	2 %
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	5ftus centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	0% %
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	5. Ans meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	2% %
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	0% %
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	3 centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	7. %
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	9.45
	SIV9	Mean water temperature at mid-depth during summer (^{0}C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	25.4 ^{0}C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	0 meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	%

Site # 228

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	%
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	%
	SIV2	Percent tree canopy closure [≥25 and ≤50]	%
	SIV3	Percent canopy closure of persistent herbaceous vegetation	%
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	%
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	%

**Tree height - woody vegetation > 5.0 m*
***Shrub height – Woody vegetation < 5.0 m*
****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*
EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):

Sugarberry, Palo Verde, Anacua
Mustard Cabbage, willow, Baccharis
Paspalum, Goat grass
Beggars tick, Sonchus, Dakota Mock
vervain, pepper vine

Site #

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: 24 Lake **Photo #:**

Team: **Date:** *March 12th March 13th March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* **Coordinates**

GL *SL* ***Other:*** **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	%
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	%
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	%
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	%
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	%
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	%
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	%
	V5	Percent shrub** crown cover [≤30%= 1.0]	%
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site # 22L

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	0 %
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	SAVS centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	5% %
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	SAVS meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	2% %
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	5% %
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	3 centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	2 %
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	9.7
	SIV9	Mean water temperature at mid-depth during summer (^{0}C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	27.7 ^{0}C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	0 meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	%

Site #

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	%
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	%
	SIV2	Percent tree canopy closure [≥25 and ≤50]	%
	SIV3	Percent canopy closure of persistent herbaceous vegetation	%
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	%
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	%

**Tree height - woody vegetation > 5.0 m*
***Shrub height – Woody vegetation < 5.0 m*
****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*
EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):

See 22P

Site # 21 Polder 4

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: **Photo #:**

Team: **Date:** *March 12th March 13th March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* **Coordinates**

GL *SL* ***Other:*** **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	%
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	%
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	%
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	%
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	%
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	%
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	%
	V5	Percent shrub** crown cover [≤30%= 1.0]	%
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site # 21 Alder 4

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	%
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	SAWS centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	%
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	SAWS meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	0 %
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	5 %
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	2 centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	– %
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	9.16
	SIV9	Mean water temperature at mid-depth during summer (^0C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	26.2 ^0C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	0 meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	%

Site #

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	%
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	%
	SIV2	Percent tree canopy closure [≥25 and ≤50]	%
	SIV3	Percent canopy closure of persistent herbaceous vegetation	%
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	%
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	%

**Tree height - woody vegetation > 5.0 m*
***Shrub height – Woody vegetation < 5.0 m*
****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*
EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):
Beggartick Sugarberry Palo Verde Baccharis
Bastard Cabbage, Paspalum ll., Ragweed
[illegible] thistle , spiny hackberry
cheatgrass

Site # 20 Basin 3

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: **Photo #:**

Team: **Date:** *March 12th March 13th March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* **Coordinates**

GL *SL* ***Other:*** **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	%
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	%
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	%
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	%
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	%
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	%
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	%
	V5	Percent shrub** crown cover [≤30%= 1.0]	%
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site # 20 basin 3

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	0 %
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	Staus centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	2 %
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	Staus meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	0 %
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	15 %
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	4 centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	- %
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	0 Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	9.00
	SIV9	Mean water temperature at mid-depth during summer (^{0}C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	24.7 ^{0}C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	0 meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	%

Site #

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	%
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	%
	SIV2	Percent tree canopy closure [≥25 and ≤50]	%
	SIV3	Percent canopy closure of persistent herbaceous vegetation	%
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	%
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	%

**Tree height - woody vegetation > 5.0 m*
***Shrub height – Woody vegetation < 5.0 m*
****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*
EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):

Bastard cabbage, Beggars tick, cheatgrass, W ragweed, Palo verde, Huisache, spiny hackberry, Baccharis, Sonchus, Paspalum, bermuda, Rumex, sugarberry, mistletoe, Site # 19 (1 or 2?)

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: **Photo #:**

Team: **Date:** *March 12th* *March 13th* *March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* **Coordinates**

GL *SL* ***Other:*** **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	%
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	%
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	%
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	%
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	%
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	%
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	%
	V5	Percent shrub** crown cover [≤30%= 1.0]	%
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site # 19

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	Bush / Knot Way 0 %
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	0 centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	5 %
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	Saws meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	0 %
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	0 %
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	0 centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	%
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	0 Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	–
	SIV9	Mean water temperature at mid-depth during summer (^{0}C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	– ^{0}C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	54 meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	%

Site #

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	%
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	%
	SIV2	Percent tree canopy closure [≥25 and ≤50]	%
	SIV3	Percent canopy closure of persistent herbaceous vegetation	%
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	%
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	%

Tree height - woody vegetation > 5.0 m

***Shrub height – Woody vegetation < 5.0 m*

****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*

EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):

W Ragweed Palo Verde B. [illegible] Ranunculus

Annual Sunflower, Iva annua, Baccharis, Thistle

beggars tick

Site # 18

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: **Photo #:**

Team: **Date:** *March 12th* *March 13th* *March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* **Coordinates**

GL *SL* ***Other:*** **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	%
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	%
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	%
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	%
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	%
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	%
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	%
	V5	Percent shrub** crown cover [≤30%= 1.0]	%
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site #

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	%
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	%
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	%
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	%
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	%
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	
	SIV9	Mean water temperature at mid-depth during summer (^{0}C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	^{0}C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	%

Site # 18

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	%
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	65 %
	SIV2	Percent tree canopy closure [≥25 and ≤50]	22.5 %
	SIV3	Percent canopy closure of persistent herbaceous vegetation	0 %
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	20,000 thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	22.5 %
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	55 %

Tree height - woody vegetation > 5.0 m

***Shrub height – Woody vegetation < 5.0 m*

****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*

EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):

Mulberry, Malva, beggars tick, sugarberry, pale vetch, pepperVine, annual sunflower bedstraw, bastard cabbage, giant ragweed, thistle, spiny hackberry

Site #

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: 23 **Photo #:**

Team: Aaron, Pat, Danny Brittany, Justyss **Date:** *March 12th March 13th March 14th 2019*

Habitat Type: *EM UF RF AQ GL SL* ***Other:*** **Coordinates**

N: **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	%
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	%
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	%
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	%
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	%
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	%
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	%
	V5	Percent shrub** crown cover [≤30%= 1.0]	%
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site # 23

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	%
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	%
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	%
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	%
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	%
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	
	SIV9	Mean water temperature at mid-depth during summer (^{o}C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	^{o}C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	%

Site #

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	%
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	30 %
	SIV2	Percent tree canopy closure [≥25 and ≤50]	10 %
	SIV3	Percent canopy closure of persistent herbaceous vegetation johnsongrass	3 %
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	1.5 thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	10 %
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	45 %

**Tree height - woody vegetation > 5.0 m*
***Shrub height – Woody vegetation < 5.0 m*
****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*
EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):
beggars tick, wee sax, spiny hackberry
sugarberry, Palo Verde, bastard cabbage
bed straw, johnsongrass, bermuda,
white prickly poppy, prickly pear, white brush
ball moss

Site #

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: EM 4 **Photo #:**

Team: **Date:** *March 12th* *March 13th* *March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* **Coordinates**

GL *SL* ***Other:*** **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	%
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	%
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	%
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	%
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	%
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	%
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	%
	V5	Percent shrub** crown cover [≤30%= 1.0]	%
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site # EM4

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. ~~Buttonbush~~, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	5 %
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	15.24 + centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	40 %
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	24.38 meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	0 %
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	90 %
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	5.08 centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	— %
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	0 Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	7.27
	SIV9	Mean water temperature at mid-depth during summer (^{0}C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	21.2 ^{0}C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	0 meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	%

Site #

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	%
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	%
	SIV2	Percent tree canopy closure [≥25 and ≤50]	%
	SIV3	Percent canopy closure of persistent herbaceous vegetation	%
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	%
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	%

**Tree height - woody vegetation > 5.0 m*

***Shrub height – Woody vegetation < 5.0 m*

****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*

EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):

Sesbania, mesquite, black willow
rattlebox, Palo Verde, buttercup
~~horse tail~~, goldenrod, beggars tick,
bed straw, bermuda grass, ragweed
spiny hackberry,

Site # SH 1

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: **Photo #:**

Team: **Date:** *March 12th* *March 13th* *March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* **Coordinates**

GL *SL* ***Other:*** **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	%
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	%
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	%
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	%
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	%
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	%
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	%
	V5	Percent shrub** crown cover [≤30%= 1.0]	%
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site # SH 1

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	%
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	%
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	%
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	%
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	%
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	
	SIV9	Mean water temperature at mid-depth during summer (^{0}C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	^{0}C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	%

Site #

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	%
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	40 %
	SIV2	Percent tree canopy closure [≥25 and ≤50]	5 %
	SIV3	Percent canopy closure of persistent herbaceous vegetation	1 %
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	2 thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	5 %
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	40 %

Tree height - woody vegetation > 5.0 m

***Shrub height – Woody vegetation < 5.0 m*

****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*

EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):

johnsongrass, giant ragweed, Palo Verde
mesquite, bedstraw, beggars tick
sugarberry, spiny hackberry, weesax
Panicum, Sonchus, hoary bowlesia

Site #

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: 24 **Photo #:**

Team: **Date:** *March 12th March 13th March 14th 2019*

Habitat Type: *EM UF RF AQ* **Coordinates**

GL SL ***Other:*** **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	%
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	%
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	%
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	%
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	%
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	%
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	%
	V5	Percent shrub** crown cover [≤30%= 1.0]	%
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site # 24

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	5 %
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	15.24 centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	25 %
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	200 meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	15 %
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	60 %
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	5.08 centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	— %
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	0 Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	7.10
	SIV9	Mean water temperature at mid-depth during summer (^{0}C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	20.0 ^{0}C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	200 meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	%

Site #

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	%
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	%
	SIV2	Percent tree canopy closure [≥25 and ≤50]	%
	SIV3	Percent canopy closure of persistent herbaceous vegetation	%
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	%
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	%

**Tree height - woody vegetation > 5.0 m*
***Shrub height – Woody vegetation < 5.0 m*
****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*
EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):
Buttercup, black willow, huisache
duckweed, giant ragweed, rumex
baccharis

Site #

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: 2 **Photo #:**

Team: Danny, Pat, Brittany, Justyss **Date:** *March 12th* *March 13th* *March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* **Coordinates**

GL *SL* ***Other:*** **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	%
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	%
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	%
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	%
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	%
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	%
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	%
	V5	Percent shrub** crown cover [≤30%= 1.0]	%
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site # 2

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes willow	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	3 %
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	10.16 + centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	40 %
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	0 meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	2 %
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	50 %
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	10.16 + centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	— %
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	0 Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	
	SIV9	Mean water temperature at mid-depth during summer (^{o}C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	^{o}C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	0 meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	%

Site #

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	%
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	%
	SIV2	Percent tree canopy closure [≥25 and ≤50]	%
	SIV3	Percent canopy closure of persistent herbaceous vegetation	%
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	%
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	%

**Tree height - woody vegetation > 5.0 m*
***Shrub height – Woody vegetation < 5.0 m*
****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*
EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):

black willow, duck weed, beggars tick
bed straw, sugarberry, buttercup
smartweed, sesbania, giant ragweed

Site #

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: 4 **Photo #:**

Team: **Date:** *March 12th* *March 13th* *March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* **Coordinates**

GL *SL* ***Other:*** **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	%
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	%
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	%
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	%
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	%
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	%
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	%
	V5	Percent shrub** crown cover [≤30%= 1.0]	%
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site # 4

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0] alligator weed	80 %
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	15.24 centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2** Palo Verde	40 %
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	18.28 meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	40 algae % 0 other
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	80 %
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	10.16 centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	— %
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	0 Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	7.34
	SIV9	Mean water temperature at mid-depth during summer (^{0}C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	19.2 ^{0}C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	0 meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	%

Site #

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	%
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	%
	SIV2	Percent tree canopy closure [≥25 and ≤50]	%
	SIV3	Percent canopy closure of persistent herbaceous vegetation	%
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	%
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	%

**Tree height - woody vegetation > 5.0 m*
***Shrub height – Woody vegetation < 5.0 m*
****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*
EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):
Palo Verde, alligator weed, buttercup
esclepius, switch grass, pigweed
red root pigweed

Site #

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: 14 **Photo #:**

Team: **Date:** *March 12th* *March 13th* *March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* **Coordinates**

GL *SL* ***Other:*** **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	%
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	%
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	%
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	%
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	%
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	%
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	%
	V5	Percent shrub** crown cover [≤30%= 1.0]	%
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site # 14

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	40 %
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	20.32+ centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	1 %
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	SAWS meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	0 %
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	75 %
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	20.32 centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	— %
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	8.15
	SIV9	Mean water temperature at mid-depth during summer (^{0}C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	23 ^{0}C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	5 meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	%

Site #

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	%
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	%
	SIV2	Percent tree canopy closure [≥25 and ≤50]	%
	SIV3	Percent canopy closure of persistent herbaceous vegetation	%
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	%
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	%

**Tree height - woody vegetation > 5.0 m*
***Shrub height – Woody vegetation < 5.0 m*
****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*
EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):
buttercup, alligator weed, mint sp, ludwigia
milkweed, rumex, beggars tick, Carex sp
bed straw

Site #

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: 11 **Photo #:**

Team: **Date:** *March 12th* *March 13th* *March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* **Coordinates**

GL *SL* ***Other:*** **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	%
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	%
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	%
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	%
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	%
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	%
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	%
	V5	Percent shrub** crown cover [≤30%= 1.0]	%
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site # 11

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	90 %
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	~ 5.08 centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	0 %
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	1 30 meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	≤ 80 %
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	90 %
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	5.08 centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	— %
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	0 Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	7.35
	SIV9	Mean water temperature at mid-depth during summer (°C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	21 °C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	174 meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	%

Site #

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	%
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	%
	SIV2	Percent tree canopy closure [≥25 and ≤50]	%
	SIV3	Percent canopy closure of persistent herbaceous vegetation	%
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	%
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	%

**Tree height - woody vegetation > 5.0 m*
***Shrub height – Woody vegetation < 5.0 m*
****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*
EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):
cattails, baccharis, oxalis, carex
cypparis, rumex

Site #

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: 12 **Photo #:**

Team: **Date:** *March 12th* *March 13th* *March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* **Coordinates**

GL *SL* ***Other:*** **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	%
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	%
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	%
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	%
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	%
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	%
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	%
	V5	Percent shrub** crown cover [≤30%= 1.0]	%
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site # 12

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	%
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	%
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	%
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	%
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	%
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	
	SIV9	Mean water temperature at mid-depth during summer (^{0}C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	^{0}C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	%

Site #

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	%
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	30 %
	SIV2	Percent tree canopy closure [≥25 and ≤50]	0 %
	SIV3	Percent canopy closure of persistent herbaceous vegetation	1 %
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	15 thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	0 %
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	5 %

**Tree height - woody vegetation > 5.0 m*
***Shrub height – Woody vegetation < 5.0 m*
****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*
EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):

Baccharis, Palo Verde, beggar tick
bastard cabbage, sorghis, spiny hackberry
white brush

Site #

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: 8 **Photo #:**

Team: **Date:** *March 12th March 13th March 14th 2019*

Habitat Type: *EM UF RF AQ GL SL* ***Other:*** **Coordinates** **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	%
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	%
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	%
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	%
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	%
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	%
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	%
	V5	Percent shrub** crown cover [≤30%= 1.0]	%
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site # 8

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	%
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	%
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	%
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	%
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	%
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	
	SIV9	Mean water temperature at mid-depth during summer (^{0}C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	^{0}C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	100 %

Site #

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	99 %
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	145.72 centimeters
	V4	Distance to perch site [≤30=1.0]	15 meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	1 %
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	1 %
	SIV2	Percent tree canopy closure [≥25 and ≤50]	0 %
	SIV3	Percent canopy closure of persistent herbaceous vegetation	100 %
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	%
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	%

**Tree height - woody vegetation > 5.0 m*

***Shrub height – Woody vegetation < 5.0 m*

****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*

EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):

bermuda grass, Sonchus, Palo Verde
hackberry, beggars tick, prickly poppy
bed straw

Site #

Mitchell Lake Avian IBI and HSI Data Sheets
(QHEI data sheet separate)

Site #: 15 **Photo #:**

Team: **Date:** *March 12th* *March 13th* *March 14th* *2019*

Habitat Type: *EM* *UF* *RF* *AQ* **Coordinates**

GL *SL* ***Other:*** **N:** **E:**

Unless otherwise specified, data taken from 0.1-acre circular plot (radius is 37 ft)

Species	Variable	Variable Description	
Barred Owl (RF)	SIV1	Number of trees* ≥20 in DBH/acre [≥2=1.0]	
	SIV2	Mean DBH of overstory trees* that are ≥ 80% of the height of the tallest tree in the stand [≤5"= 0.0]	inches
	SIV3	Percent canopy cover of overstory trees* [≤20%= 0.0 & ≥60%= 1.0]	%
Shelterbelt (RF)	SIV1	Average height of the two tallest shelterbelt rows [≥ 52'= 1.0]	feet
	SIV2	Percent tree* and/or shrub** canopy closure [≥50% and ≤70%= 1.0]	%
	SIV3	Number of shelterbelt rows	1 2 3 4 5 6 7 8+
	SIV4	Number of woody plant species	1 2 3 4 5 6+
	SIV5	Shelterbelt configuration	1. Shrubs** only 2. Trees* only, or trees on outside rows 3. Trees and shrubs, with an outside shrub row(s) on only one side 4. Trees and shrubs, with two or more outside shrub rows, with at least one on each side of the shelterbelt
	SIV6	Shelterbelt size (acres) [≥12.35 acres=1.0]	acres

Site #

Gray Squirrel (RF & UF)	SIV1	Proportion of the total tree* canopy that is hard mast producing trees ≥ 10" DBH	%
	SIV2	Number of hard mast tree* species	1. Hard mast species absent 2. One species present 3. Two species present 4. Three species present 5. ≥ four species present
	SIV3	Percent canopy cover of trees* [≥40% and ≤75% = 1.0] **See BO SIV3**	%
	SIV4	Percent canopy cover of trees* [≥40%= 1.0] **See BO SIV3**	%
	SIV5	Mean DBH of overstory trees* [≤5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
Fox Squirrel (RF & UF)	V1	Percent canopy closure of trees* that produce hard mast ≥ 10" DBH [≥40% and ≤60%= 1.0]	%
	V2	Distance to available grain [≤220 yds=1.0; ≥660 yds=0.1]	yards
	V3	Average DBH of overstory trees* [≤7.5"= 0.0 & ≥15"= 1.0] **See BO SIV2**	inches
	V4	Percent tree* canopy closure [≥20% and ≤60%= 1.0]	%
	V5	Percent shrub** crown cover [≤30%= 1.0]	%
Avian IBI (RF & AQ)	1	Land use category weight (desktop exercise)	
	2	Area of land use (desktop exercise)	
	3	Total area of watershed (desktop exercise)	
	4	Channel Coefficient	1. Natural Stream 2. Channelized - Grasslined 3. Channelized – Hardened
	5	Maintenance Coefficient – mean herbaceous canopy cover***	Maintained or Unmaintained %
	6	Maintenance Coefficient – mean shrub canopy cover***	Maintained or Unmaintained %

Site # 15

	7	Maintenance Coefficient – mean overstory canopy cover***	Maintained or Unmaintained %
Marsh Wren (EM)	SIV1	Growth form of emergent hydrophytes	1. Cattails, cordgrasses, bulrushes 2. Bluejoint reedgrass, reed canarygrass, sedges 3. Buttonbush, mangrove 4. Other growth forms not listed
	SIV2	Percent canopy cover of emergent herbaceous vegetation [≥80%= 1.0]	%
	SIV3	Mean water depth (cm) [≥15 cm=1.0]	centimeters
	SIV4	Percent canopy cover of woody vegetation **See SB SIV2**	%
Bullfrog (EM & AQ)	SIV1	Mean distance from shore to water >1.5 m deep [≥10 m and ≤20m=1.0 and ≥30m=0.5]	meters
	SIV2	Percent canopy cover of aquatic vegetation in the littoral zone [≥55% and ≤80%=1.0]	%
	SIV3	Percent shoreline cover [Vegetation, overhanging shrub and trees, woody downfall and debris within 1m of shoreline]	%
	SIV4	Mean water transparency (cm) [≥100cm and ≤300cm = 1.0]	centimeters
	SIV5	Winter water: Ice Depth Ratio [Always 1.0]	1
	SIV6	Percent silt in substrate [Collect sample]	%
	SIV7	Mean current velocity at mid-depth during summer (cm/s) [≤15 cm/s=1.0]	Centimeters/second
	SIV8	pH [≤4=0.0 & ≥4.5 and ≤8.5=1.0]	
	SIV9	Mean water temperature at mid-depth during summer (^{o}C) [≤15 and ≥35 =0.0 & ≥22.5 and ≤32.5=1.0]	^{o}C
	SIV10	Frequency of water level fluctuations >2m	≤1 per year 2 per year 3+ per year
	SIV11	Distance to permanent water (m) [≤100=1.0; ≥1600=0.5]	meters
Meadowlark (GL)	V1	Percent herbaceous canopy cover [≤20% =0.0 & ≥90%=1.0]	%

Site #

	V2	Proportion of herbaceous canopy cover that is grass [≤20%=0.0 & ≥80%=1.0]	%
	V3	Average height of herbaceous canopy (average spring conditions) [≤2.5 and ≥80= 0.0 & ≥10 and ≤35=1.0]	centimeters
	V4	Distance to perch site [≤30=1.0]	meters
	V5	Percent shrub crown cover [≤5%=1.0, ≥35%=0.0]	%
Cottontail (GL & SL)	SIV1	Percent shrub crown closure [≥20 and ≤50=1.0]	60 %
	SIV2	Percent tree canopy closure [≥25 and ≤50]	0 %
	SIV3	Percent canopy closure of persistent herbaceous vegetation	0 %
Brown Thrasher (SL)	SIV1	Density of woody stem ≥ 1.0 m (3.3 ft) tall (in thousands of stems) [≥24.7 and ≤98.8= 1.0]	21 thousands/per acre
	SIV2	Percent canopy cover of trees [≥10 and ≤30= 1.0]	0 %
	SIV3	Percent of ground surface covered by litter ≥ 1 cm deep [≥80=1.0]	5 %

**Tree height - woody vegetation > 5.0 m*
***Shrub height – Woody vegetation < 5.0 m*
****Avian IBI-Metrics 1-7, choose maintained or unmaintained and record percentage.*
EM: Emergent Marsh, UF: Upland Forest, RF: Riparian Forest, AQ: Aquatic, GL: Grassland, SL: Shrubland

Notes (Site description, Dominant Plant Species, etc.):

Dakota mock vervain, mesquite, white brush
cheat grass, beggars tick, songhiy
primrose, spiny hackberry, bed straw
prairie vervina, wild geranium
Palo verde, ~~yellow clove~~, Oxalis
Texas winter grass, globe mallow
Croton, hackberry, sugar berry, ball moss

yellow sweet clover

Select Texas Ecozone: Edwards Plateau | Other Texas Ecozone: 2

OhioEPA	Qualitative Habitat Evaluation Index and Use Assessment Field Sheet: VERSION: TEXAS	QHEI_TX Score:	#DIV/0!

Substrate	Cover	Channel	Riparian	Pool/Current	Riffle/Run	Gradient
#DIV/0!	0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	2.0
Max 20	Max 20	Max 20	Max 10	Max 12	Max 8	Max 10

6?
(38)

Stream & Location: RM: Date: 12 March 2019

Scorers Full Name & Affiliation:

River Code: STORET #: Lat./Long.: (NAD 83 - decimal °) Office Verified ☐ Location

1] SUBSTRATE

BEST TYPES			OTHER TYPES			ORIGIN	QUALTIY	
	POOL	RIFFLE		POOL	RIFFLE			
☐☐ BLDR / SLABS			☐☐ HARDPA			☐ LIMESTONE	SILT	☑ HEAVY
☐☐ BOULDER			☐☐ DETRITU			☐ TILLS		☐ MODERATE
☐☐ COBBLE			☐☐ MUCK			☐ WETLANDS		☐ NORMAL
☐☐ GRAVEL			☑☐ SILT			☐ HARDPAN		☐ FREE
☐☐ SAND			☐☐ ARTIFICI			☑ SANDSTONE		
☐☐ BEDROCK						☐ RIP/RAP	EMBED	☑ EXTENSIVE
						☐ LACUSTURINE		☐ MODERATE
NUMBER OF BEST TYPES:			☐ 4 or more			☐ SHALE		☐ NORMAL
			☐ 3 or less			☐ COAL FINES		☐ NONE

Substrate: #DIV/0! Max 20

2] INSTREAM COVER

UNDERCUT BANKS	POOLS > 70cm	OXBOWS, BACKWATERS
OVERHANGING VEGETATION	ROOTWADS	AQUATIC MACROPHYTES 10
SHALLOWS (IN SLOW WATER)	BOULDERS	LOGS OR WOODY DEBRIS
ROOTMATS		

Cover: 0 Max 20

3] CHANNEL MORPHOLOGY

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH	☐ EXCELLENT	☑ NONE	☑ HIGH
☐ MODERATE	☐ GOOD	☐ RECOVERED	☐ MODERATE
☑ LOW	☐ FAIR	☐ RECOVERING	☐ LOW
☐ NONE	☑ POOR	☐ RECENT OR NO RECOVERY	

Channel: #DIV/0! Max 20

4] BANK EROSION AND RIPARIAN ZONE

EROSION	RIPARIAN WIDTH	FLOOD PLAIN QUALITY	
L R	L R	L R	L R
NONE / LITTLE	WIDE > 50m	FOREST, SWAMP	CONSERVATION TILLAGE
MODERATE	MODERATE 10-50m	SHRUB OR OLD FIELD	URBAN OR INDUSTRIAL
HEAVY / SEVERE	NARROW 5-10m	RESIDENTIAL, PARK, NEW FIELD	MINING/CONSTRUCTION
	VERY NARROW <5m	FENCED PASTURE	
	NONE	OPEN PASTURE, ROW CROP	

Riparian
#DIV/0!
Max 10

5] POOL/SLIDE AND RIFFLE/RUN QUALITY

MAXIMUM DEPTH	CHANNEL WIDTH	CURRENT VELOCITY		Recreation Potential
> 1m	POOL > RIFFLE	TORRENTIAL	SLOW	PRIMARY CONTACT
0.7 =< 1m	POOL = RIFFLE	VERY FAST	INTERSTITIAL	
0.4 =< 0.7m	POOL < RIFFLE	FAST	INTERMITTENT	
0.2 =< 0.4m		MODERATE	EDDIES	
< 0.2m	No riffle			

Pool/Current
#DIV/0!
Max 12

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species:

NO RIFFLE

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
BEST AREAS >10cm	MAXIMUM >50cm	STABLE	NONE
BEST AREAS 5-10cm	MAXIMUM <50cm	MOD. STABLE	LOW
BEST AREAS <5cm		UNSTABLE	MODERATE
none			EXTENSIVE

Riffle/Run
#DIV/0!
Max 8

6] GRADIENT

9.2-41.6

		Stream Width (ft)
DRAINAGE AREA (sq mi)	< 9.2	<= 4.7
		Classification
GRADIENT (feet/mile)	0 - 1.0	VERY LOW

% POOL:	100	% GLIDE:	
% RUN:		% RIFFLE:	

Gradient
2
Max 10

Note: Gradient Ranges Modified for Texas River Conditions

27' / .23 miles

QHEI_TX Score: #DIV/0!

OhioEPA	*Qualitative Habitat Evaluation Index and Use Assessment Field Sheet*

6?
(38)

This is the reverse side of the QHEI sheet. It is for notational purposes only and has no effect on the QHEI total score.

A] SAMPLED REACH

METHOD

☐	Boat
☐	Wade
☐	L. Line
☐	Other

STAGE

1st - sample pass - 2nd		
☐	High	☐
☐	Up	☐
☐	Normal	☐
☐	Low	☐

DISTANCE

☐	Dry	
☐	0.2 Km	
☐	0.5 Km	
☐	0.15 Km	
☐	0.12 Km	
☐	Other	0 Km

CLARITY

1st - sample pass - 2nd			*Succhi Depth*	
☐	< 20 cm	☐		
☐	20 - < 40 cm	☐		
☐	40 - 70 cm	☐		
☐	> 70 cm / CTB	☐		
☐	SECCHI Depth	☐	0	0

CANOPY

☐	> 85% Open
☐	55% - < 85%

D] MAINTENANCE (Comment)

Site 6 - Aquatic Species
Typha, germander, ragweed, coontail, water speedwell, beggarsticks, filamentous algae, duckweed, duckweed, ludwigia

E] ISSUES (Comment)

E] MEASUREMENTS

$\bar{x}$ width	
$\bar{x}$ depth	
max. depth	
$\bar{x}$ bankfull width	
bankfull $\bar{x}$ depth	
W/D ratio	
bankfull max. depth	
floodprone x^2 width	
entrench. Ratio	

☐ 30% - <55%
☐ 10% - < 30%
< 10% - Closed

B] AESTHETICS

☐ Nuisance Algae
☐ Invasice Macrophytes
☐ Excess Turbidity
☐ Discoloration
☐ Foam / Scum
☐ Oil Sheen
☐ Trash / Liter
☐ Nuisance Odor
☐ Sludge Deposits
☐ CSOs / SSOs / Outfalls

ADDITIONAL COMMENTS

C] RECREATION

POOL

Area	Depth
☐ > 100 ft^2	☐ > 3 ft

Select Texas Ecozone:	Edwards Plateau	○	Other Texas Ecozone:	◉

2

OhioEPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet: VERSION: TEXAS

QHEI_TX Score: #DIV/0!

Substrate	*Cover*	*Channel*	*Riparian*	*Pool/Current*	*Riffle/Run*	*Gradient*
#DIV/0!	0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	2.0
Max 20	Max 20	Max 20	Max 10	Max 12	Max 8	Max 10

Stream & Location: 46 *RM:* *Date:* 12 March

Scorers Full Name & Affiliation:

River Code: *STORET #:* *Lat./Long.:* *(NAD 83 - decimal °)* Office Verified ☐ Location

1] SUBSTRATE

BEST TYPES	POOL	RIFFLE	*OTHER TYPES*	POOL	RIFFLE	*ORIGIN*	*QUALTIY*	
BLDR / SLABS	☐	☐	HARDPA	☐	☐	☐ LIMESTONE	SILT	☒ HEAVY
BOULDER	☐	☐	DETRITU	☐	☐	☐ TILLS		☐ MODERATE
COBBLE	☐	☐	MUCK	☐	☐	☐ WETLANDS		☐ NORMAL
GRAVEL	☐	☐	SILT	☐	☒	☐ HARDPAN		☐ FREE
SAND	☒	☐	ARTIFICI.	☐	☐	☒ SANDSTONE	EMBED	☒ EXTENSIVE
BEDROCK	☐	☐				☐ RIP/RAP		☐ MODERATE
						☐ LACUSTURINE		☐ NORMAL
						☐ SHALE		☐ NONE
						☐ COAL FINES		

NUMBER OF BEST TYPES: ☐ 4 or more ☐ 3 or less

Substrate #DIV/0! Max 20

2] INSTREAM COVER

UNDERCUT BANKS	POOLS > 70cm	OXBOWS, BACKWATERS
☒ OVERHANGING VEGETATION	ROOTWADS	☒ AQUATIC MACROPHYTES
☒ SHALLOWS (IN SLOW WATER)	BOULDERS	☒ LOGS OR WOODY DEBRIS
☒ ROOTMATS		

Cover 0 Max 20

3] CHANNEL MORPHOLOGY

SINUOSITY	*DEVELOPMENT*	*CHANNELIZATION*	*STABILITY*
☐ HIGH	☐ EXCELLENT	☒ NONE	☒ HIGH
☒ MODERATE	☐ GOOD	☐ RECOVERED	☐ MODERATE
☐ LOW	☒ FAIR	☐ RECOVERING	☐ LOW
☐ NONE	☐ POOR	☐ RECENT OR NO RECOVERY	

Channel #DIV/0! Max 20

4] BANK EROSION AND RIPARIAN ZONE

EROSION	RIPARIAN WIDTH	FLOOD PLAIN QUALITY	
L R	L R	L R	L R
NONE / LITTLE	WIDE > 50m	FOREST, SWAMP	CONSERVATION TILLAGE
MODERATE	MODERATE 10-50m	SHRUB OR OLD FIELD	URBAN OR INDUSTRIAL
HEAVY / SEVERE	NARROW 5-10m	RESIDENTIAL, PARK, NEW FIELD	MINING/CONSTRUCTION
	VERY NARROW <5m	FENCED PASTURE	
	NONE	OPEN PASTURE, ROW CROP	

Riparian: #DIV/0!

Max 10

5] POOL/SLIDE AND RIFFLE/RUN QUALITY

MAXIMUM DEPTH	CHANNEL WIDTH	CURRENT VELOCITY		Recreation Potential
> 1m	POOL > RIFFLE	TORRENTIAL	SLOW	PRIMARY CONTACT
0.7 =< 1m	POOL = RIFFLE	VERY FAST	INTERSTITIAL	
0.4 =< 0.7m	POOL < RIFFLE	FAST	INTERMITTENT	
0.2 =< 0.4m		MODERATE	EDDIES	
< 0.2m				

Pool/Current: #DIV/0!

Max 12

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species:

NO RIFFLE

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
BEST AREAS >10cm	MAXIMUM >50cm	STABLE	NONE
BEST AREAS 5-10cm	MAXIMUM <50cm	MOD. STABLE	LOW
BEST AREAS <5cm		UNSTABLE	MODERATE
			EXTENSIVE

Riffle/Run: #DIV/0!

Max 8

6] GRADIENT

9.2-41.6

DRAINAGE AREA (sq mi) < 9.2

Stream Width (ft) <= 4.7

GRADIENT (feet/mile) 0 - 1.0

Classification VERY LOW

% POOL:	70	% GLIDE:	
% RUN:		% RIFFLE:	30

Gradient: 2

Max 10

Note: Gradient Ranges Modified for Texas River Conditions

27'/1.31

QHEI_TX Score: #DIV/0!

OhioEPA	*Qualitative Habitat Evaluation Index and Use Assessment Field Sheet*

This is the reverse side of the QHEI sheet. It is for notational purposes only and has no effect on the QHEI total score.

A] SAMPLED REACH

METHOD

- ☐ Boat
- ☐ Wade
- ☐ L. Line
- ☐ Other

STAGE

1st - sample pass - 2nd		
☐	High	☐
☐	Up	☐
☐	Normal	☐
☐	Low	☐

DISTANCE

- ☐ Dry
- ☐ 0.2 Km
- ☐ 0.5 Km
- ☐ 0.15 Km
- ☐ 0.12 Km
- ☐ Other 0 Km

CLARITY

1st - sample pass - 2nd		
☐	< 20 cm	☐
☐	20 - < 40 cm	☐
☐	40 - 70 cm	☐
☐	> 70 cm / CTB	☐
☐	SECCHI Depth	☐

Succhi Depth: 0 | 0

CANOPY

- ☐ > 85% Open
- ☐ 55% - < 85%

D] MAINTENANCE (Comment)

Sedges

E] ISSUES (Comment)

8.08 pH
20.4 °C

E] MEASUREMENTS

$\bar{x}$ width	
$\bar{x}$ depth	
max. depth	
$\bar{x}$ bankfull width	
bankfull $\bar{x}$ depth	
W/D ratio	
bankfull max. depth	
floodprone x^2 width	
entrench. Ratio	

☐	30% - <55%
☐	10% - < 30%
	< 10% - Closed

B] AESTHETICS

☐	Nuisance Algae
☐	Invasice Macrophytes
☐	Excess Turbidity
☐	Discoloration
☐	Foam / Scum
☐	Oil Sheen
☐	Trash / Liter
☐	Nuisance Odor
☐	Sludge Deposits
☐	CSOs / SSOs / Outfalls

ADDITIONAL COMMENTS

C] RECREATION

POOL

Area	Depth
☐ > 100 ft^2	☐ > 3 ft

Select Texas Ecozone: Edwards Plateau | Other Texas Ecozone: | 2

OhioEPA	Qualitative Habitat Evaluation Index and Use Assessment Field Sheet: VERSION: TEXAS	QHEI_TX Score:	#DIV/0!

Substrate	Cover	Channel	Riparian	Pool/Current	Riffle/Run	Gradient
#DIV/0!	0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	2.0
Max 20	Max 20	Max 20	Max 10	Max 12	Max 8	Max 10

Stream & Location: Point 42 *RM:* *Date:* 12 March

Scorers Full Name & Affiliation:

River Code: *STORET #:* *Lat./Long.:* (NAD 83 - decimal °) Office Verified ☐ Location

1] SUBSTRATE

BEST TYPES	OTHER TYPES	ORIGIN	QUALTIY

BEST TYPES (POOL / RIFFLE):
- ☐☐ BLDR / SLABS
- ☐☐ BOULDER
- ☐☐ COBBLE
- ☐☐ GRAVEL
- ☐☐ SAND
- ☒☒ BEDROCK

NUMBER OF BEST TYPES: ☐ 4 or more ☐ 3 or less

OTHER TYPES (POOL / RIFFLE):
- ☐☐ HARDPA
- ☐☐ DETRITU
- ☐☐ MUCK
- ☒☒ SILT
- ☐☐ ARTIFICI.

ORIGIN:
- ☐ LIMESTONE
- ☐ TILLS
- ☐ WETLANDS
- ☐ HARDPAN
- ☒ SANDSTONE
- ☐ RIP/RAP
- ☐ LACUSTURINE
- ☐ SHALE
- ☐ COAL FINES

QUALTIY:

SILT
- ☐ HEAVY
- ☐ MODERATE
- ☒ NORMAL
- ☐ FREE

EMBED
- ☐ EXTENSIVE
- ☐ MODERATE
- ☒ NORMAL
- ☐ NONE

Substrate: #DIV/0! Max 20

2] INSTREAM COVER

- UNDERCUT BANKS
- OVERHANGING VEGETATION
- SHALLOWS (IN SLOW WATER)
- ROOTMATS
- POOLS > 70cm
- ROOTWADS
- BOULDERS
- OXBOWS, BACKWATERS
- AQUATIC MACROPHYTES
- LOGS OR WOODY DEBRIS

Cover: 0 Max 20

3] CHANNEL MORPHOLOGY

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH	☐ EXCELLENT	☒ NONE	☐ HIGH
☒ MODERATE	☒ GOOD	☐ RECOVERED	☒ MODERATE
☐ LOW	☐ FAIR	☐ RECOVERING	☐ LOW
☐ NONE	☐ POOR	☐ RECENT OR NO RECOVERY	

Channel: #DIV/0! Max 20

4] BANK EROSION AND RIPARIAN ZONE

EROSION	*RIPARIAN WIDTH*	*FLOOD PLAIN QUALITY*	
L R	L R	L R	L R
[X] [ ] NONE / LITTLE	[ ] [ ] WIDE > 50m	[X] [X] FOREST, SWAMP	[ ] [ ] CONSERVATION TILLAGE
[ ] [X] MODERATE	[X] [X] MODERATE 10-50m	[ ] [ ] SHRUB OR OLD FIELD	[ ] [ ] URBAN OR INDUSTRIAL
[ ] [ ] HEAVY / SEVERE	[ ] [ ] NARROW 5-10m	[ ] [ ] RESIDENTIAL, PARK, NEW FIELD	[ ] [ ] MINING/CONSTRUCTION
	[ ] [ ] VERY NARROW <5m	[ ] [ ] FENCED PASTURE	
	[ ] [ ] NONE	[ ] [ ] OPEN PASTURE, ROW CROP	

Riparian
#DIV/0!
Max 10

5] POOL/SLIDE AND RIFFLE/RUN QUALITY

MAXIMUM DEPTH	*CHANNEL WIDTH*	*CURRENT VELOCITY*		Recreation Potential
[ ] > 1m	[ ] POOL > RIFFLE	[ ] TORRENTIAL	[ ] SLOW	PRIMARY CONTACT
[ ] 0.7 =< 1m	[X] POOL = RIFFLE	[ ] VERY FAST	[ ] INTERSTITIAL	
[ ] 0.4 =< 0.7m	[ ] POOL < RIFFLE	[ ] FAST	[ ] INTERMITTENT	
[X] 0.2 =< 0.4m		[X] MODERATE	[ ] EDDIES	
[ ] < 0.2m				

Pool/Current
#DIV/0!
Max 12

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species:

[ ] *NO RIFFLE*

RIFFLE DEPTH	*RUN DEPTH*	*RIFFLE / RUN SUBSTRATE*	*RIFFLE / RUN EMBEDDEDNESS*
[ ] BEST AREAS >10cm	[ ] MAXIMUM >50cm	[X] STABLE	[ ] NONE
[ ] BEST AREAS 5-10cm	[X] MAXIMUM <50cm	[ ] MOD. STABLE	[ ] LOW
[X] BEST AREAS <5cm		[ ] UNSTABLE	[X] MODERATE
			[ ] EXTENSIVE

Riffle/Run
#DIV/0!
Max 8

6] GRADIENT

9.2-41.6

DRAINAGE AREA (sq mi)	< 9.2	*Stream Width (ft)* <= 4.7
GRADIENT (feet/mile)	0 - 1.0	*Classification* VERY LOW

% POOL:	50	% GLIDE:	
% RUN:		% RIFFLE:	50

Gradient
2
Max 10

Note: Gradient Ranges Modified for Texas River Conditions

39'/1.41 miles

27'/1.31 miles

QHEI_TX Score: #DIV/0!

42

OhioEPA	*Qualitative Habitat Evaluation Index and Use Assessment Field Sheet*

This is the reverse side of the QHEI sheet. It is for notational purposes only and has no effect on the QHEI total score.

A] SAMPLED REACH

METHOD

- [ ] Boat
- [ ] Wade
- [ ] L. Line
- [x] Other

STAGE

1st - sample pass - 2nd		
☐	High	☐
☐	Up	☐
☐	Normal	☐
☐	Low	☐

DISTANCE

- [ ] Dry
- [ ] 0.2 Km
- [ ] 0.5 Km
- [ ] 0.15 Km
- [ ] 0.12 Km
- [ ] Other 0 Km

CLARITY

1st - sample pass - 2nd		
☐	< 20 cm	☐
☐	20 - < 40 cm	☐
☐	40 - 70 cm	☐
☐	> 70 cm / CTB	☐
☐	SECCHI Depth	☐

Succhi Depth	
0	0

CANOPY

- [ ] > 85% Open
- [ ] 55% - < 85%

D] MAINTENANCE (Comment)

duckweed buttercup
floating algae
bermuda grass
smartweed, ludwigia

E] ISSUES (Comment)

7.88 pH
18.9 °C

E] MEASUREMENTS

$\bar{x}$ width	
$\bar{x}$ depth	
max. depth	
$\bar{x}$ bankfull width	
bankfull $\bar{x}$ depth	
W/D ratio	
bankfull max. depth	
floodprone x^2 width	
entrench. Ratio	

42

☐ 30% - <55%
☐ 10% - < 30%
< 10% - Closed

B] AESTHETICS

☐ Nuisance Algae
☐ Invasice Macrophytes
☐ Excess Turbidity
☐ Discoloration
☐ Foam / Scum
☐ Oil Sheen
☐ Trash / Liter
☐ Nuisance Odor
☐ Sludge Deposits
☐ CSOs / SSOs / Outfalls

ADDITIONAL COMMENTS

C] RECREATION

POOL

Area	Depth
☐ > 100 ft^2	☐ > 3 ft

ATTACHMENT H

ATTACHMENT F – Future Without and Future With the Project Projections and Annualization

Future Without the Project

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	3.17	Marsh Wren	4.00	75.00	10.00	0.50	0.00	0.00		
Area 1		1	3.17	Marsh Wren	4.00	75.00	10.00	0.50	0.00	0.00	0.00	
Bird Pond		5	3.17	Marsh Wren	4.00	75.00	10.00	0.50	0.00	0.00	0.00	
Scale 1		10	3.17	Marsh Wren	4.00	75.00	10.00	0.50	0.00	0.00	0.00	
		25	3.17	Marsh Wren	4.00	75.00	10.00	0.50	0.00	0.00	0.00	
		50	3.17	Marsh Wren	4.00	75.00	10.00	0.50	0.00	0.00	0.00	0.00

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	SIF	SIVC	SIR	HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	3.17	Bullfrog	0.50	0.53	0.60	1.00	1.00	0.30	1.00	1.00	1.00	1.00	1.00	0.66	0.30	1.00	0.58	1.85		
Area 1		1	3.17	Bullfrog	0.50	0.53	0.35	1.00	1.00	0.30	1.00	1.00	1.00	1.00	1.00	0.59	0.30	1.00	0.56	1.79	1.82	
Bird Pond		5	3.17	Bullfrog	0.50	0.53	0.10	1.00	1.00	0.30	1.00	1.00	1.00	1.00	1.00	0.53	0.30	1.00	0.54	1.72	7.01	
Scale 1		10	3.17	Bullfrog	0.50	0.53	0.07	1.00	1.00	0.30	1.00	1.00	1.00	1.00	1.00	0.52	0.30	1.00	0.54	1.71	8.58	
		25	3.17	Bullfrog	0.50	0.53	0.07	1.00	1.00	0.30	1.00	1.00	1.00	1.00	1.00	0.52	0.30	1.00	0.54	1.71	25.69	
		50	3.17	Bullfrog	0.50	0.53	0.07	1.00	1.00	0.30	1.00	1.00	1.00	1.00	1.00	0.52	0.30	1.00	0.54	1.71	42.81	1.72

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	3.25	Marsh Wren	4.00	0.00	0.00	0.50	0.00	0.00		
Area 1		1	3.25	Marsh Wren	4.00	0.00	0.00	0.50	0.00	0.00	0.00	
Bird Pond		5	3.25	Marsh Wren	4.00	0.00	0.00	0.50	0.00	0.00	0.00	
Scale 2		10	3.25	Marsh Wren	4.00	0.00	0.00	0.50	0.00	0.00	0.00	
		25	3.25	Marsh Wren	4.00	0.00	0.00	0.50	0.00	0.00	0.00	
		50	3.25	Marsh Wren	4.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	SIF	SIVC	SIR	HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	3.25	Bullfrog	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.30	0.50	0.00	0.00	0.00	0.00	0.00		
Area 1		1	3.25	Bullfrog	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.30	0.50	0.00	0.00	0.00	0.00	0.00	0.00	
Bird Pond		5	3.25	Bullfrog	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.30	0.50	0.00	0.00	0.00	0.00	0.00	0.00	
Scale 2		10	3.25	Bullfrog	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.30	0.50	0.00	0.00	0.00	0.00	0.00	0.00	
		25	3.25	Bullfrog	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.30	0.50	0.00	0.00	0.00	0.00	0.00	0.00	
		50	3.25	Bullfrog	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.30	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	10.46	Marsh Wren	4.00	75.00	10.00	0.50	0.00	0.00		
Area 2		1	10.46	Marsh Wren	4.00	75.00	10.00	0.50	0.00	0.00	0.00	
Central Wetland		5	10.46	Marsh Wren	4.00	75.00	10.00	0.50	0.00	0.00	0.00	
Scale 1		10	10.46	Marsh Wren	4.00	75.00	10.00	0.50	0.00	0.00	0.00	
		25	10.46	Marsh Wren	4.00	75.00	10.00	0.50	0.00	0.00	0.00	
		50	10.46	Marsh Wren	4.00	75.00	10.00	0.50	0.00	0.00	0.00	0.00

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	SIF	SIVC	SIR	HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	10.46	Bullfrog	0.50	0.53	0.60	1.00	1.00	0.30	1.00	1.00	1.00	1.00	1.00	0.66	0.30	1.00	0.58	6.12		
Area 2		1	10.46	Bullfrog	0.50	0.53	0.35	1.00	1.00	0.30	1.00	1.00	1.00	1.00	1.00	0.59	0.30	1.00	0.57	5.92	6.02	
Central Wetland		5	10.46	Bullfrog	0.50	0.53	0.10	1.00	1.00	0.30	1.00	1.00	1.00	1.00	1.00	0.53	0.30	1.00	0.55	5.70	23.24	
Scale 1		10	10.46	Bullfrog	0.50	0.53	0.07	1.00	1.00	0.30	1.00	1.00	1.00	1.00	1.00	0.52	0.30	1.00	0.54	5.68	28.44	
		25	10.46	Bullfrog	0.50	0.53	0.07	1.00	1.00	0.30	1.00	1.00	1.00	1.00	1.00	0.52	0.30	1.00	0.54	5.68	85.13	
		50	10.46	Bullfrog	0.50	0.53	0.07	1.00	1.00	0.30	1.00	1.00	1.00	1.00	1.00	0.52	0.30	1.00	0.54	5.68	141.88	5.69

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	7.91	Marsh Wren	4.00	0.00	0.00	0.50	0.00	0.00		
Area 2		1	7.91	Marsh Wren	4.00	0.00	0.00	0.50	0.00	0.00	0.00	
Central Wetland		5	7.91	Marsh Wren	4.00	0.00	0.00	0.50	0.00	0.00	0.00	
Scale 2		10	7.91	Marsh Wren	4.00	0.00	0.00	0.50	0.00	0.00	0.00	
		25	7.91	Marsh Wren	4.00	0.00	0.00	0.50	0.00	0.00	0.00	
		50	7.91	Marsh Wren	4.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	SIF	SIVC	SIR	HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	7.91	Bullfrog	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.30	0.50	0.00	0.00	0.00	0.00	0.00		
Area 2		1	7.91	Bullfrog	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.30	0.50	0.00	0.00	0.00	0.00	0.00	0.00	
Central Wetland		5	7.91	Bullfrog	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.30	0.50	0.00	0.00	0.00	0.00	0.00	0.00	
Scale 2		10	7.91	Bullfrog	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.30	0.50	0.00	0.00	0.00	0.00	0.00	0.00	
		25	7.91	Bullfrog	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.30	0.50	0.00	0.00	0.00	0.00	0.00	0.00	
		50	7.91	Bullfrog	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.30	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4			HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	2.18	Marsh Wren	4.00	75.00	10.00	0.50			0.00	0.00		
Area 3		1	2.18	Marsh Wren	4.00	75.00	10.00	0.50			0.00	0.00	0.00	
Skip's Pond		5	2.18	Marsh Wren	4.00	75.00	10.00	0.50			0.00	0.00	0.00	
		10	2.18	Marsh Wren	4.00	75.00	10.00	0.50			0.00	0.00	0.00	
		25	2.18	Marsh Wren	4.00	75.00	10.00	0.50			0.00	0.00	0.00	
		50	2.18	Marsh Wren	4.00	75.00	10.00	0.50			0.00	0.00	0.00	0.00

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	SIF	SIWC	SIR	HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	2.18	Bullfrog	0.50	0.53	0.60	1.00	1.00	0.30	1.00	1.00	1.00	1.00	1.00	0.66	0.30	1.00	0.58	1.27		
Area 3		1	2.18	Bullfrog	0.50	0.53	0.35	1.00	1.00	0.30	1.00	1.00	1.00	1.00	1.00	0.59	0.30	1.00	0.57	1.23	1.25	
Skip's Pond		5	2.18	Bullfrog	0.50	0.53	0.10	1.00	1.00	0.30	1.00	1.00	1.00	1.00	1.00	0.53	0.30	1.00	0.55	1.19	4.84	
		10	2.18	Bullfrog	0.50	0.53	0.07	1.00	1.00	0.30	1.00	1.00	1.00	1.00	1.00	0.52	0.30	1.00	0.54	1.18	5.93	
		25	2.18	Bullfrog	0.50	0.53	0.07	1.00	1.00	0.30	1.00	1.00	1.00	1.00	1.00	0.52	0.30	1.00	0.54	1.18	17.74	
		50	2.18	Bullfrog	0.50	0.53	0.07	1.00	1.00	0.30	1.00	1.00	1.00	1.00	1.00	0.52	0.30	1.00	0.54	1.18	29.57	1.19

Measure	Cover Type	Target Year	Acres	Model	HSI	HUs	CHUs	AAHUs
Mitchell Lake	Shorebird	0	49.52	Shorebird	0.61	30.21		
Area 6		1	49.52	Shorebird	0.61	30.21	30.21	
Polders		5	49.52	Shorebird	0.61	30.21	120.83	
		10	49.52	Shorebird	0.61	30.21	151.04	
		25	49.52	Shorebird	0.61	30.21	604.14	
		50	49.52	Shorebird	0.61	30.21	755.18	**30.21**

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4			HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	175.7	Marsh Wren	4.00	34.00	30.48	17.20			0.00	0.00		
Area 7		1	175.7	Marsh Wren	4.00	15.00	0.00	0.00			0.00	0.00	0.00	
Fringe-All		5	175.7	Marsh Wren	4.00	34.00	0.00	2.00			0.00	0.00	0.00	
		10	175.7	Marsh Wren	4.00	34.00	0.00	10.00			0.00	0.00	0.00	
		25	175.7	Marsh Wren	4.00	34.00	0.00	15.00			0.00	0.00	0.00	
		50	175.7	Marsh Wren	4.00	34.00	0.00	17.20			0.00	0.00	0.00	0.00

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	SIF	SIWC	SIR	HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	175.70	Bullfrog	0.50	0.00	0.55	1.00	1.00	0.28	1.00	1.00	1.00	1.00	1.00	0.51	0.28	1.00	0.52	92.05		
Area 7		1	175.70	Bullfrog	0.50	0.00	0.00	1.00	1.00	0.28	1.00	1.00	1.00	1.00	1.00	0.38	0.28	1.00	0.47	82.95	87.50	
Fringe-All		5	175.70	Bullfrog	0.50	0.00	0.00	1.00	1.00	0.28	1.00	1.00	1.00	1.00	1.00	0.38	0.28	1.00	0.47	82.95	331.81	
		10	175.70	Bullfrog	0.50	0.00	0.15	1.00	1.00	0.28	1.00	1.00	1.00	1.00	1.00	0.41	0.28	1.00	0.49	85.63	421.45	
		25	175.70	Bullfrog	0.50	0.00	0.30	1.00	1.00	0.28	1.00	1.00	1.00	1.00	1.00	0.45	0.28	1.00	0.50	88.14	1303.29	
		50	175.70	Bullfrog	0.50	0.00	0.55	1.00	1.00	0.28	1.00	1.00	1.00	1.00	1.00	0.51	0.28	1.00	0.52	92.05	2252.38	87.93

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4			HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	53.68	Marsh Wren	4.00	34.00	30.48	17.20			0.00	0.00		
Area 7		1	53.68	Marsh Wren	4.00	15.00	0.00	0.00			0.00	0.00	0.00	
Fringe-Cove 1		5	53.68	Marsh Wren	4.00	34.00	0.00	2.00			0.00	0.00	0.00	
		10	53.68	Marsh Wren	4.00	34.00	0.00	10.00			0.00	0.00	0.00	
		25	53.68	Marsh Wren	4.00	34.00	0.00	15.00			0.00	0.00	0.00	
		50	53.68	Marsh Wren	4.00	34.00	0.00	17.20			0.00	0.00	0.00	0.00

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	SIF	SIWC	SIR	HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	53.68	Bullfrog	0.50	0.00	0.55	1.00	1.00	0.28	1.00	1.00	1.00	1.00	1.00	0.51	0.28	1.00	0.52	28.12		
Area 7		1	53.68	Bullfrog	0.50	0.00	0.00	1.00	1.00	0.28	1.00	1.00	1.00	1.00	1.00	0.38	0.28	1.00	0.47	25.34	26.73	
Fringe-Cove 1		5	53.68	Bullfrog	0.50	0.00	0.00	1.00	1.00	0.28	1.00	1.00	1.00	1.00	1.00	0.38	0.28	1.00	0.47	25.34	101.37	
		10	53.68	Bullfrog	0.50	0.00	0.15	1.00	1.00	0.28	1.00	1.00	1.00	1.00	1.00	0.41	0.28	1.00	0.49	26.16	128.76	
		25	53.68	Bullfrog	0.50	0.00	0.30	1.00	1.00	0.28	1.00	1.00	1.00	1.00	1.00	0.45	0.28	1.00	0.50	26.93	398.18	
		50	53.68	Bullfrog	0.50	0.00	0.55	1.00	1.00	0.28	1.00	1.00	1.00	1.00	1.00	0.51	0.28	1.00	0.52	28.12	688.15	26.86

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	11.84	Marsh Wren	4.00	34.00	30.48	17.20	0.00	0.00		
Area 7		1	11.84	Marsh Wren	4.00	15.00	0.00	0.00	0.00	0.00	0.00	
Fringe-Cove 2		5	11.84	Marsh Wren	4.00	34.00	0.00	2.00	0.00	0.00	0.00	
		10	11.84	Marsh Wren	4.00	34.00	0.00	10.00	0.00	0.00	0.00	
		25	11.84	Marsh Wren	4.00	34.00	0.00	15.00	0.00	0.00	0.00	
		50	11.84	Marsh Wren	4.00	34.00	0.00	17.20	0.00	0.00	0.00	0.00

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	SIF	SIVC	SIR	HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	11.84	Bullfrog	0.50	0.00	0.55	1.00	1.00	0.28	1.00	1.00	1.00	1.00	1.00	0.51	0.28	1.00	0.52	6.20		
Area 7		1	11.84	Bullfrog	0.50	0.00	0.00	1.00	1.00	0.28	1.00	1.00	1.00	1.00	1.00	0.38	0.28	1.00	0.47	5.59	5.90	
Fringe-Cove 2		5	11.84	Bullfrog	0.50	0.00	0.00	1.00	1.00	0.28	1.00	1.00	1.00	1.00	1.00	0.38	0.28	1.00	0.47	5.59	22.36	
		10	11.84	Bullfrog	0.50	0.00	0.15	1.00	1.00	0.28	1.00	1.00	1.00	1.00	1.00	0.41	0.28	1.00	0.49	5.77	28.40	
		25	11.84	Bullfrog	0.50	0.00	0.30	1.00	1.00	0.28	1.00	1.00	1.00	1.00	1.00	0.45	0.28	1.00	0.50	5.94	87.83	
		50	11.84	Bullfrog	0.50	0.00	0.55	1.00	1.00	0.28	1.00	1.00	1.00	1.00	1.00	0.51	0.28	1.00	0.52	6.20	151.78	5.93

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	6.84	Marsh Wren	4.00	34.00	30.48	17.20	0.00	0.00		
Area 7		1	6.84	Marsh Wren	4.00	15.00	0.00	0.00	0.00	0.00	0.00	
Fringe-Cove 3		5	6.84	Marsh Wren	4.00	34.00	0.00	2.00	0.00	0.00	0.00	
		10	6.84	Marsh Wren	4.00	34.00	0.00	10.00	0.00	0.00	0.00	
		25	6.84	Marsh Wren	4.00	34.00	0.00	15.00	0.00	0.00	0.00	
		50	6.84	Marsh Wren	4.00	34.00	0.00	17.20	0.00	0.00	0.00	0.00

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	SIF	SIVC	SIR	HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	6.84	Bullfrog	0.50	0.00	0.55	1.00	1.00	0.28	1.00	1.00	1.00	1.00	1.00	0.51	0.28	1.00	0.52	3.58		
Area 7		1	6.84	Bullfrog	0.50	0.00	0.00	1.00	1.00	0.28	1.00	1.00	1.00	1.00	1.00	0.38	0.28	1.00	0.47	3.23	3.41	
Fringe-Cove 3		5	6.84	Bullfrog	0.50	0.00	0.00	1.00	1.00	0.28	1.00	1.00	1.00	1.00	1.00	0.38	0.28	1.00	0.47	3.23	12.92	
		10	6.84	Bullfrog	0.50	0.00	0.15	1.00	1.00	0.28	1.00	1.00	1.00	1.00	1.00	0.41	0.28	1.00	0.49	3.33	16.41	
		25	6.84	Bullfrog	0.50	0.00	0.30	1.00	1.00	0.28	1.00	1.00	1.00	1.00	1.00	0.45	0.28	1.00	0.50	3.43	50.74	
		50	6.84	Bullfrog	0.50	0.00	0.55	1.00	1.00	0.28	1.00	1.00	1.00	1.00	1.00	0.51	0.28	1.00	0.52	3.58	87.69	3.42

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	HSI	HUs	CHUs	AAHU	Ta
Mitchell Lake	Riparian	0	2.55	Barred Owl	0.30	8.00	76.00	0.22	0.55			
Area 9		1	2.55	Barred Owl	0.30	8.00	76.00	0.22	0.55	0.55		
Enhanced Forested Wetland Below Dam		5	2.55	Barred Owl	0.30	9.00	79.00	0.25	0.64	2.38		
Scale 1		10	2.55	Barred Owl	0.30	12.00	80.00	0.33	0.84	3.71		
		25	2.55	Barred Owl	0.50	15.00	80.00	0.47	1.19	15.24		
		50	2.55	Barred Owl	1.00	18.00	80.00	0.69	1.76	36.86	1.17	

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	V5	SI Winter	SI Cover	HSI	HUs	CHUs	AAHU
Mitchell Lake	Riparian	0	2.55	Gray Squirrel	0.10	0.10	0.99	1.00	0.30	0.10	0.55	0.10	0.25		
Area 9		1	2.55	Gray Squirrel	0.10	0.10	0.99	1.00	0.30	0.10	0.55	0.10	0.25	0.25	
Enhanced Forested Wetland Below Dam		5	2.55	Gray Squirrel	0.10	0.10	0.96	1.00	0.70	0.10	0.84	0.10	0.24	1.00	
Scale 1		10	2.55	Gray Squirrel	0.10	0.10	0.97	1.00	0.40	0.10	0.63	0.10	0.25	1.23	
		25	2.55	Gray Squirrel	0.10	0.10	0.96	1.00	0.90	0.10	0.95	0.10	0.24	3.69	
		50	2.55	Gray Squirrel	0.10	0.10	0.96	1.00	1.00	0.10	1.00	0.10	0.24	6.12	0.25

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	HSI	HUs	CHUs	AAHU
Mitchell Lake	Riparian	0	4.48	Barred Owl	0.30	8.00	76.00	0.22	0.97		
Area 9		1	4.48	Barred Owl	0.30	8.00	76.00	0.22	0.97	0.97	
Excavated Forested Wetland Below Dam		5	4.48	Barred Owl	0.30	9.00	79.00	0.25	1.12	4.19	
Scale 2		10	4.48	Barred Owl	0.30	12.00	80.00	0.33	1.48	6.52	
		25	4.48	Barred Owl	0.50	15.00	80.00	0.47	2.09	26.78	
		50	4.48	Barred Owl	1.00	18.00	80.00	0.69	3.09	64.75	2.06

Target Ye	IVR Average HUs
0	0.71
1	0.71
5	0.78
10	0.96
25	1.26
50	1.76

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	V5	SI Winter	SI Cove	HSI	HUs	CHUs	AAHU
Mitchell Lake	Riparian	0	4.48	Gray Squirrel	0.10	0.10	0.99	1.00	0.30	0.10	0.55	0.10	0.44		
Area 9		1	4.48	Gray Squirrel	0.10	0.10	0.99	1.00	0.30	0.10	0.55	0.10	0.44	0.44	
Excavated Forested Wetland Below Dam		5	4.48	Gray Squirrel	0.10	0.10	0.96	1.00	0.70	0.10	0.84	0.10	0.43	1.75	
Scale 2		10	4.48	Gray Squirrel	0.10	0.10	0.97	1.00	0.40	0.10	0.63	0.10	0.43	2.16	
		25	4.48	Gray Squirrel	0.10	0.10	0.96	1.00	0.90	0.10	0.95	0.10	0.43	6.48	
		50	4.48	Gray Squirrel	0.10	0.10	0.96	1.00	1.00	0.10	1.00	0.10	0.43	10.75	0.43

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	51.32	Marsh Wren	4.00	0.00	0.00	21.00	0.00	0.00		
Area 10		1	51.32	Marsh Wren	4.00	0.00	0.00	21.00	0.00	0.00	0.00	
Downstream Wetland		5	51.32	Marsh Wren	4.00	0.00	0.00	21.00	0.00	0.00	0.00	
		10	51.32	Marsh Wren	4.00	0.00	0.00	21.00	0.00	0.00	0.00	
		25	51.32	Marsh Wren	4.00	0.00	0.00	21.00	0.00	0.00	0.00	
		50	51.32	Marsh Wren	4.00	0.00	0.00	21.00	0.00	0.00	0.00	0.00

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	SIF	SIVC	SIR	HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	51.32	Bullfrog	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.30	0.50	0.00	0.00	0.00	0.00	0.00		
Area 10		1	51.32	Bullfrog	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.30	0.50	0.00	0.00	0.00	0.00	0.00	0.00	
Downstream Wetland		5	51.32	Bullfrog	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.30	0.50	0.00	0.00	0.00	0.00	0.00	0.00	
		10	51.32	Bullfrog	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.30	0.50	0.00	0.00	0.00	0.00	0.00	0.00	
		25	51.32	Bullfrog	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.30	0.50	0.00	0.00	0.00	0.00	0.00	0.00	
		50	51.32	Bullfrog	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.30	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Future With the Project

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	3.17	Marsh Wren	4.00	75.00	10.00	0.50	0.00	0.00		
Area 1		1	3.17	Marsh Wren	1.00	80.00	59.00	1.00	0.99	3.14	1.57	
Bird Pond		5	3.17	Marsh Wren	1.00	80.00	59.00	10.00	0.90	2.85	11.98	
Scale 1		10	3.17	Marsh Wren	1.00	80.00	59.00	25.00	0.75	2.38	13.08	
		25	3.17	Marsh Wren	1.00	80.00	59.00	60.00	0.40	1.27	27.34	
		50	3.17	Marsh Wren	1.00	80.00	59.00	60.00	0.40	1.27	31.70	1.71

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	SIF	SIWC	SIR	HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	3.17	Bullfrog	0.50	0.53	0.60	1.00	1.00	0.28	1.00	1.00	1.00	1.00	1.00	0.66	0.28	1.00	0.57	1.80		
Area 1		1	3.17	Bullfrog	1.00	0.55	0.60	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.79	1.00	1.00	0.92	2.93	2.37	
Bird Pond		5	3.17	Bullfrog	1.00	0.91	0.60	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.88	1.00	1.00	0.96	3.04	11.93	
Scale 1		10	3.17	Bullfrog	1.00	1.00	0.65	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	1.00	0.97	3.07	15.27	
		25	3.17	Bullfrog	1.00	1.00	0.70	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.93	1.00	1.00	0.97	3.09	46.23	
		50	3.17	Bullfrog	1.00	1.00	0.70	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.93	1.00	1.00	0.97	3.09	77.22	3.06

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	3.25	Marsh Wren	4.00	0.00	0.00	0.50	0.00	0.00		
Area 1		1	3.25	Marsh Wren	1.00	50.00	59.00	1.00	0.46	1.50	0.75	
Bird Pond		5	3.25	Marsh Wren	1.00	75.00	59.00	10.00	0.85	2.76	8.52	
Scale 2		10	3.25	Marsh Wren	1.00	75.00	59.00	25.00	0.71	2.31	12.68	
		25	3.25	Marsh Wren	1.00	75.00	59.00	60.00	0.38	1.24	26.57	
		50	3.25	Marsh Wren	1.00	75.00	59.00	60.00	0.38	1.24	30.88	1.59

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	SIF	SIWC	SIR	HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	3.25	Bullfrog	0.00	0.00	0.00	1.00	0.00	0.30	0.00	0.00	0.00	0.30	0.50	0.25	0.00	0.00	0.00	0.00		
Area 1		1	3.25	Bullfrog	1.00	0.46	0.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.62	1.00	1.00	0.85	2.77	1.38	
Bird Pond		5	3.25	Bullfrog	1.00	0.82	0.10	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.73	1.00	1.00	0.90	2.93	11.39	
Scale 2		10	3.25	Bullfrog	1.00	1.00	0.40	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.85	1.00	1.00	0.95	3.08	15.01	
		25	3.25	Bullfrog	1.00	1.00	0.60	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	1.00	1.00	0.97	3.14	46.63	
		50	3.25	Bullfrog	1.00	1.00	0.70	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.93	1.00	1.00	0.97	3.17	78.81	3.06

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	10.46	Marsh Wren	4.00	75.00	10.00	0.50	0.00	0.00		
Area 2		1	10.46	Marsh Wren	1.00	80.00	59.00	1.00	0.99	10.36	5.18	
Central Wetland		5	10.46	Marsh Wren	1.00	80.00	59.00	10.00	0.90	9.41	39.54	
Scale 1		10	10.46	Marsh Wren	1.00	80.00	59.00	25.00	0.75	7.85	43.15	
		25	10.46	Marsh Wren	1.00	80.00	59.00	60.00	0.40	4.18	90.22	
		50	10.46	Marsh Wren	1.00	80.00	59.00	60.00	0.40	4.18	104.60	5.65

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	SIF	SIWC	SIR	HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	10.46	Bullfrog	0.50	0.53	0.60	1.00	1.00	0.28	1.00	1.00	1.00	1.00	1.00	0.66	0.28	1.00	0.57	5.95		
Area 2		1	10.46	Bullfrog	1.00	0.55	0.60	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.79	1.00	1.00	0.92	9.66	7.81	
Central Wetland		5	10.46	Bullfrog	1.00	0.91	0.60	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.88	1.00	1.00	0.96	10.01	39.35	
Scale 1		10	10.46	Bullfrog	1.00	1.00	0.65	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	1.00	0.97	10.15	50.40	
		25	10.46	Bullfrog	1.00	1.00	0.70	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.93	1.00	1.00	0.97	10.19	152.53	
		50	10.46	Bullfrog	1.00	1.00	0.70	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.93	1.00	1.00	0.97	10.19	254.80	10.10

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4			HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	7.91	Marsh Wren	4.00	75.00	10.00	0.50			0.00	0.00		
Area 2		1	7.91	Marsh Wren	1.00	50.00	59.00	1.00			0.46	3.64	1.82	
Central Wetland		5	7.91	Marsh Wren	1.00	75.00	59.00	10.00			0.85	6.72	20.72	
Scale 2		10	7.91	Marsh Wren	1.00	75.00	59.00	25.00			0.71	5.62	30.85	
		25	7.91	Marsh Wren	1.00	75.00	59.00	60.00			0.38	3.01	64.66	
		50	7.91	Marsh Wren	1.00	75.00	59.00	60.00			0.38	3.01	75.15	3.86

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	SIF	SIWC	SIR	HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	7.91	Bullfrog	0.00	0.00	0.00	1.00	0.00	0.30	0.00	0.00	0.00	0.30	0.50	0.25	0.00	0.00	0.00	0.00		
Area 2		1	7.91	Bullfrog	1.00	0.46	0.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.62	1.00	1.00	0.85	6.74	3.37	
Central Wetland		5	7.91	Bullfrog	1.00	0.82	0.10	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.73	1.00	1.00	0.90	7.12	27.72	
Scale 2		10	7.91	Bullfrog	1.00	1.00	0.40	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.85	1.00	1.00	0.95	7.49	36.54	
		25	7.91	Bullfrog	1.00	1.00	0.60	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	1.00	1.00	0.97	7.64	113.48	
		50	7.91	Bullfrog	1.00	1.00	0.70	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.93	1.00	1.00	0.97	7.71	191.81	7.46

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4			HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	2.18	Marsh Wren	4.00	75.00	10.00	0.50			0.00	0.00		
Area 3		1	2.18	Marsh Wren	1.00	80.00	59.00	1.00			0.99	2.16	1.08	
Skip's Pond		5	2.18	Marsh Wren	1.00	80.00	59.00	10.00			0.90	1.96	8.24	
		10	2.18	Marsh Wren	1.00	80.00	59.00	25.00			0.75	1.64	8.99	
		25	2.18	Marsh Wren	1.00	80.00	59.00	60.00			0.40	0.87	18.80	
		50	2.18	Marsh Wren	1.00	80.00	59.00	60.00			0.40	0.87	21.80	1.18

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	SIF	SIWC	SIR	HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	2.18	Bullfrog	0.50	0.53	0.60	1.00	1.00	0.28	1.00	1.00	1.00	1.00	1.00	0.66	0.28	1.00	0.57	1.24		
Area 3		1	2.18	Bullfrog	1.00	0.55	0.60	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.79	1.00	1.00	0.92	2.01	1.63	
Skip's Pond		5	2.18	Bullfrog	1.00	0.91	0.60	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.88	1.00	1.00	0.96	2.09	8.20	
		10	2.18	Bullfrog	1.00	1.00	0.65	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	1.00	0.97	2.11	10.50	
		25	2.18	Bullfrog	1.00	1.00	0.70	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.93	1.00	1.00	0.97	2.12	31.79	
		50	2.18	Bullfrog	1.00	1.00	0.70	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.93	1.00	1.00	0.97	2.12	53.10	2.10

Measure	Cover Type	Target Year	Acres	Model	HSI	HUs	CHUs	AAHUs
Mitchell Lake	Shorebird	0	49.52	Shorebird	0.61	30.21		
Area 6		1	49.52	Shorebird	0.98	48.53	39.37	
Polders		5	49.52	Shorebird	0.98	48.53	194.12	
		10	49.52	Shorebird	0.98	48.53	242.65	
		25	49.52	Shorebird	0.98	48.53	970.59	
		50	49.52	Shorebird	0.98	48.53	1213.24	**48.35**

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4			HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	175.7	Marsh Wren	4.00	34.00	30.48	17.20			0.00	0.00		
Area 7		1	175.7	Marsh Wren	4.00	34.00	30.48	1.00			0.00	0.00	0.00	
Fringe-All		5	175.7	Marsh Wren	1.00	50.00	30.48	5.00			0.44	77.31	154.62	
		10	175.7	Marsh Wren	1.00	75.00	30.48	15.00			0.81	142.32	549.06	
		25	175.7	Marsh Wren	1.00	75.00	30.48	20.00			0.76	133.53	2068.87	
		50	175.7	Marsh Wren	1.00	75.00	30.48	20.00			0.76	133.53	3338.30	122.22

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	SIF	SIVC	SIR	HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	175.7	Bullfrog	1.00	0.00	0.55	1.00	1.00	0.28	1.00	1.00	1.00	1.00	1.00	0.64	0.28	1.00	0.56	98.98		
Area 7		1	175.7	Bullfrog	1.00	0.64	0.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.66	1.00	1.00	0.87	153.19	126.09	
Fringe-All		5	175.7	Bullfrog	1.00	0.91	0.05	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.74	1.00	1.00	0.90	158.94	624.25	
		10	175.7	Bullfrog	1.00	1.00	0.15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.79	1.00	1.00	0.92	162.26	803.00	
		25	175.7	Bullfrog	1.00	1.00	0.20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.80	1.00	1.00	0.93	163.12	2440.36	
		50	175.7	Bullfrog	1.00	1.00	0.20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.80	1.00	1.00	0.93	163.12	4077.94	161.43

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4			HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	53.68	Marsh Wren	4.00	34.00	30.48	17.20			0.00	0.00		
Area 7		1	53.68	Marsh Wren	4.00	34.00	30.48	1.00			0.00	0.00	0.00	
Fringe-Cove 1		5	53.68	Marsh Wren	1.00	50.00	30.48	5.00			0.44	23.62	47.24	
		10	53.68	Marsh Wren	1.00	75.00	30.48	15.00			0.81	43.48	167.75	
		25	53.68	Marsh Wren	1.00	75.00	30.48	20.00			0.76	40.80	632.08	
		50	53.68	Marsh Wren	1.00	75.00	30.48	20.00			0.76	40.80	1019.92	37.34

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	SIF	SIVC	SIR	HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	53.68	Bullfrog	1.00	0.00	0.55	1.00	1.00	0.28	1.00	1.00	1.00	1.00	1.00	0.64	0.28	1.00	0.56	30.24		
Area 7		1	53.68	Bullfrog	1.00	0.64	0.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.66	1.00	1.00	0.87	46.80	38.52	
Fringe-Cove 1		5	53.68	Bullfrog	1.00	0.91	0.05	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.74	1.00	1.00	0.90	48.56	190.72	
		10	53.68		1.00	1.00	0.15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.79	1.00	1.00	0.92	49.58	245.33	
		25	53.68	Bullfrog	1.00	1.00	0.20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.80	1.00	1.00	0.93	49.84	745.58	
		50	53.68	Bullfrog	1.00	1.00	0.20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.80	1.00	1.00	0.93	49.84	1245.90	49.32

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4			HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	11.84	Marsh Wren	4.00	34.00	30.48	17.20			0.00	0.00		
Area 7		1	11.84	Marsh Wren	4.00	34.00	30.48	1.00			0.00	0.00	0.00	
Fringe-Cove 2		5	11.84	Marsh Wren	1.00	50.00	30.48	5.00			0.44	5.21	10.42	
		10	11.84	Marsh Wren	1.00	75.00	30.48	15.00			0.81	9.59	37.00	
		25	11.84	Marsh Wren	1.00	75.00	30.48	20.00			0.76	9.00	139.42	
		50	11.84	Marsh Wren	1.00	75.00	30.48	20.00			0.76	9.00	224.96	8.24

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	SIF	SIVC	SIR	HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	11.84	Bullfrog	1.00	0.00	0.55	1.00	1.00	0.28	1.00	1.00	1.00	1.00	1.00	0.64	0.28	1.00	0.56	6.67		
Area 7		1	11.84	Bullfrog	1.00	0.64	0.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.66	1.00	1.00	0.87	10.32	8.50	
Fringe-Cove 2		5	11.84	Bullfrog	1.00	0.91	0.05	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.74	1.00	1.00	0.90	10.71	42.07	
		10	11.84		1.00	1.00	0.15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.79	1.00	1.00	0.92	10.93	54.11	
		25	11.84	Bullfrog	1.00	1.00	0.20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.80	1.00	1.00	0.93	10.99	164.45	
		50	11.84	Bullfrog	1.00	1.00	0.20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.80	1.00	1.00	0.93	10.99	274.80	10.88

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	6.84	Marsh Wren	4.00	34.00	30.48	17.20	0.00	0.00		
Area 7		1	6.84	Marsh Wren	4.00	34.00	30.48	1.00	0.00	0.00	0.00	
Fringe-Cove 3		5	6.84	Marsh Wren	1.00	50.00	30.48	5.00	0.44	3.01	6.02	
		10	6.84	Marsh Wren	1.00	75.00	30.48	15.00	0.81	5.54	21.38	
		25	6.84	Marsh Wren	1.00	75.00	30.48	20.00	0.76	5.20	80.54	
		50	6.84	Marsh Wren	1.00	75.00	30.48	20.00	0.76	5.20	129.96	4.76

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	SIF	SIVC	SIR	HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	6.84	Bullfrog	1.00	0.00	0.55	1.00	1.00	0.28	1.00	1.00	1.00	1.00	1.00	0.64	0.28	1.00	0.56	3.85		
Area 7		1	6.84	Bullfrog	1.00	0.64	0.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.66	1.00	1.00	0.87	5.96	4.91	
Fringe-Cove 3		5	6.84	Bullfrog	1.00	0.91	0.05	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.74	1.00	1.00	0.90	6.19	24.30	
		10	6.84	Bullfrog	1.00	1.00	0.15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.79	1.00	1.00	0.92	6.32	31.26	
		25	6.84	Bullfrog	1.00	1.00	0.20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.80	1.00	1.00	0.93	6.35	95.00	
		50	6.84	Bullfrog	1.00	1.00	0.20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.80	1.00	1.00	0.93	6.35	158.75	6.28

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	HSI	HUs	CHUs	AAHU	Target Ye	IVR Average HUs
Mitchell Lake	Riparian	0	2.55	Barred Owl	0.30	8.00	76.00	0.22	0.55			0	0.40
Area 9		1	2.55	Barred Owl	0.30	8.00	40.00	0.11	0.28	0.41		1	0.54
Enhanced Forested Wetland Below Dam		5	2.55	Barred Owl	0.30	8.00	50.00	0.16	0.41	1.38		5	0.61
Scale 1		10	2.55	Barred Owl	0.50	8.00	60.00	0.26	0.65	2.66		10	0.73
		25	2.55	Barred Owl	2.00	9.00	70.00	0.52	1.32	14.76		25	1.36
		50	2.55	Barred Owl	2.00	10.00	75.00	0.58	1.47	34.88	1.08	50	1.64

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	V5	SI Winter	SI Cover	HSI	HUs	CHUs	AAHU
Mitchell Lake	Riparian	0	2.55	Gray Squirrel	0.10	0.10	0.99	1.00	0.30	0.10	0.55	0.10	0.25		
Area 9		1	2.55	Gray Squirrel	0.10	1.00	1.00	1.00	0.50	0.32	0.71	0.32	0.81	0.53	
Enhanced Forested Wetland Below Dam		5	2.55	Gray Squirrel	0.10	1.00	1.00	1.00	0.55	0.32	0.74	0.32	0.81	3.23	
Scale 1		10	2.55	Gray Squirrel	0.19	1.00	1.00	1.00	0.10	0.44	0.32	0.32	0.81	4.03	
		25	2.55	Gray Squirrel	0.55	1.00	1.00	1.00	0.30	0.74	0.55	0.55	1.40	16.52	
		50	2.55	Gray Squirrel	0.64	1.00	1.00	1.00	0.50	0.80	0.71	0.71	1.80	40.00	1.29

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	HSI	HUs	CHUs	AAHU	Target Ye	IVR Average HUs
Mitchell Lake	Riparian	0	4.48	Barred Owl	0.30	8.00	76.00	0.22	0.97			0	0.71
Area 9		1	4.48	Barred Owl	0.30	8.00	40.00	0.11	0.49	0.73		1	0.95
Enhanced Forested Wetland Below Dam		5	4.48	Barred Owl	0.30	8.00	50.00	0.16	0.73	2.43		5	1.07
Scale 2		10	4.48	Barred Owl	0.50	8.00	60.00	0.26	1.14	4.68		10	1.28
		25	4.48	Barred Owl	2.00	9.00	70.00	0.52	2.31	25.93		25	2.38
		50	4.48	Barred Owl	2.00	10.00	75.00	0.58	2.59	61.29	1.90	50	2.88

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	V5	SI Winter	SI Cover	HSI	HUs	CHUs	AAHU
Mitchell Lake	Riparian	0	4.48	Gray Squirrel	0.10	0.10	0.99	1.00	0.30	0.10	0.55	0.10	0.44		
Area 9		1	4.48	Gray Squirrel	0.10	1.00	1.00	1.00	0.50	0.32	0.71	0.32	1.42	0.93	
Enhanced Forested Wetland Below Dam		5	4.48	Gray Squirrel	0.10	1.00	1.00	1.00	0.55	0.32	0.74	0.32	1.42	5.67	
Scale 2		10	4.48	Gray Squirrel	0.19	1.00	1.00	1.00	0.10	0.44	0.32	0.32	1.42	7.08	
		25	4.48	Gray Squirrel	0.55	1.00	1.00	1.00	0.30	0.74	0.55	0.55	2.45	29.03	
		50	4.48	Gray Squirrel	0.64	1.00	1.00	1.00	0.50	0.80	0.71	0.71	3.17	70.27	2.26

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	51.32	Marsh Wren	4.00	0.00	0.00	50.00	0.00	0.00		
Area 10		1	51.32	Marsh Wren	1.00	50.00	59.00	1.00	0.46	23.61	11.80	
Downstream Wetland		5	51.32	Marsh Wren	1.00	75.00	59.00	10.00	0.85	43.62	134.46	
		10	51.32	Marsh Wren	1.00	75.00	59.00	25.00	0.71	36.44	200.15	
		25	51.32	Marsh Wren	1.00	75.00	59.00	60.00	0.38	19.50	419.54	
		50	51.32	Marsh Wren	1.00	75.00	59.00	60.00	0.38	19.50	487.54	25.07

Location	Cover Type	Target Year	Acres	Species	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	SIF	SIVC	SIR	HSI	HUs	CHUs	AAHU
Mitchell Lake	Emergent	0	51.32	Bullfrog	0.00	0.00	0.00	1.00	0.00	0.30	0.00	0.00	0.00	0.30	0.50	0.25	0.00	0.00	0.00	0.00		
Area 10		1	51.32	Bullfrog	1.00	0.46	0.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.62	1.00	1.00	0.85	43.71	21.85	
Downstream Wetland		5	51.32	Bullfrog	1.00	0.82	0.10	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.73	1.00	1.00	0.90	46.21	179.85	
		10	51.32	Bullfrog	1.00	1.00	0.40	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.85	1.00	1.00	0.95	48.62	237.08	
		25	51.32	Bullfrog	1.00	1.00	0.60	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	1.00	1.00	0.97	49.55	736.25	
		50	51.32	Bullfrog	1.00	1.00	0.70	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.93	1.00	1.00	0.97	50.00	1244.44	48.39

ATTACHMENT I

Section 404(b)(1) Analysis

Mitchell Lake, San Antonio, TX

General Investigations Feasibility Study

Integrated Draft Feasibility Report and Environmental Impact Assessment

November 2019

US Army Corps
of Engineers®
Fort Worth District

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Table of Contents

1 Project Description

Mitchell Lake is located in southern Bexar County within 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 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 and was subsequently diked and isolated in the early 1970s, known now 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, 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 non-Federal sponsor, 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 open water habitat in Mitchell Lake and the surrounding terrestrial 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.

Mitchell Lake 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.

SAWS continues to release water from the Leon Creek Wastewater Treatment Plan 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' above mean sea level (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 78221 (Figure 1). The study area is located south of US 410 and west of US 281. 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 Lower 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.

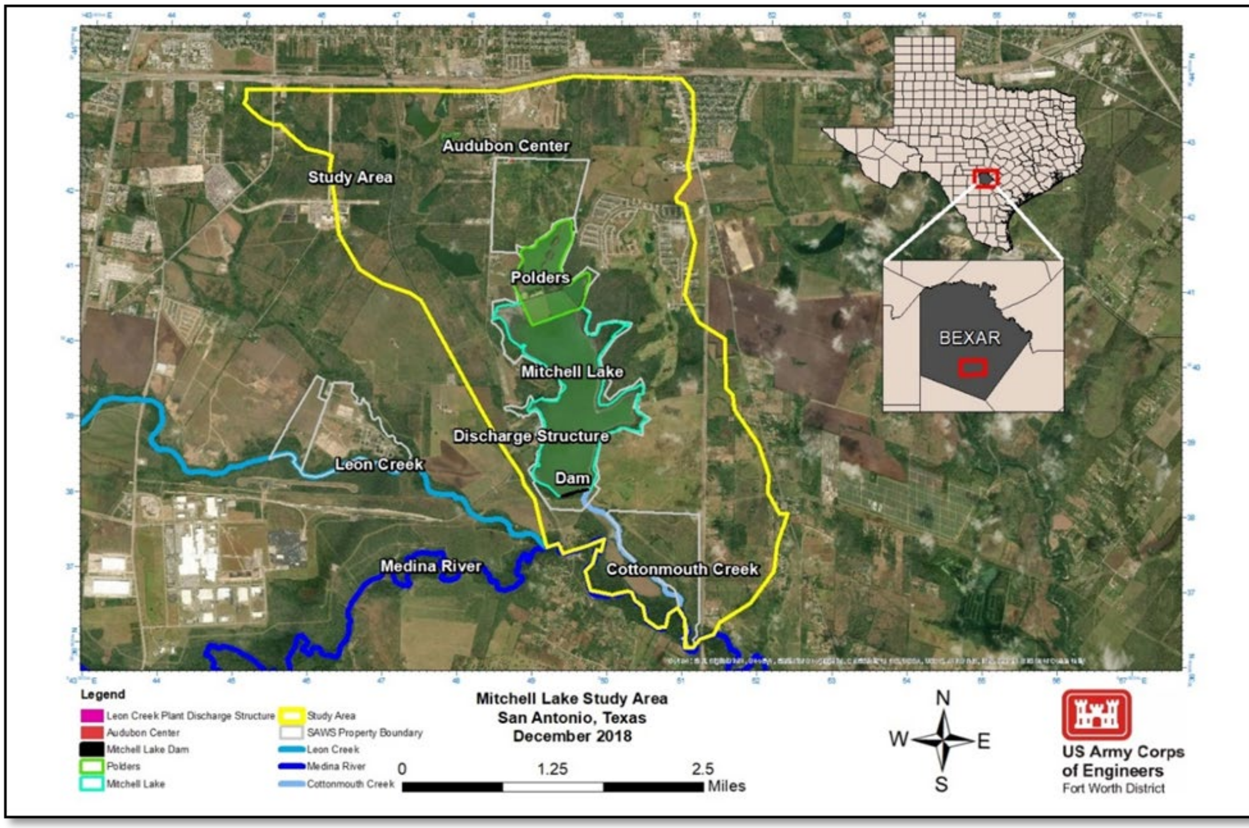

Figure 1. Mitchell Lake Study Area

1.2 General Description

Mitchell Lake, TX 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 USACE and SAWS on 05 September 2018. A combination Charette and Alternatives Milestone Meeting (AMM) was successfully conducted on 16 January 2019 and a Tentatively Selected Plan (TSP) milestone meeting was held on 25 October 2019.

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 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.

Resolution of the Committee on Transportation and Infrastructure, U.S. House of Representatives, House Resolution Docket No. 2547, dated 11 March 1998.

> "*Resolved by the Committee on Transportation and Infrastructure of the United States House of Representatives, That, the Secretary of the Army is requested to review the report of the Chief of Engineers on the Guadalupe and San Antonio Rivers, Texas, published as House Document 344, 83rd Congress, 2nd Session, and other pertinent reports, with a view to determining whether any modifications of the recommendations contained therein are advisable at the present time, with particular reference to providing improvements in the interest of flood control, environmental restoration and protection, water quality, water supply and allied purposes on the Guadalupe and San Antonio Rivers in Texas*."

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 hydrologies.
- Improve water quality through ecosystem restoration.
- Provide additional recreation and ecotourism benefits to the community.

Specific planning objectives include:

- Increase the areal extent and quality of fish and wildlife habitat in the study area for the life of the project.
- Increase the floral and faunal species diversity and richness in the study area for the life of the project.
- Manage and control invasive species in the study area for the life of the project.

2 Plan Evaluation

2.1 Management Measures

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 Plans 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.

In May of 2019, the USACE and SAWS, along with local resource agencies (Texas Council on Environmental Quality [TCEQ], Natural Resources Conservation Service [NRCS], Texas Parks and Wildlife Department [TPWD], and U.S. Fish and Wildlife Service [USFWS]), met in San Antonio to develop a conceptual ecological model, a list of environmental metrics, identification of appropriate habitat models, and a suite of measures for the initial array of plans to be considered.

Structural

1. **Native Aquatic Plantings** - Emergent and submerged wetland vegetation typically thrive along the perimeter and shallow areas of lakes. This measure entails the establishment of emergent and submerged 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.
2. **Native Riparian Plantings** - This measure entails increasing the vegetative structure and species diversity of riparian habitats along the Cottonmouth Creek below the Mitchell Lake Dam and along specified coves within Mitchell Lake. It would include planting a diverse community of high quality native tree and shrub species, including mast producers, bald cypress, and other species native to the San Antonio area.
3. **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. 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.
4. **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.
5. **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.
6. **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.

7. **Invasive Animal Management** - Non-native invasive animals such as feral hogs (*Sus scrofa)* and nutria (*Myocastor coypus*) 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.
8. **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.
9. **Berm Construction** - This measure would entail reducing the size of the east and west polders to create a more manageable and appropriately sized mudflat in the polders. The utilization of excavated materials from the creation wetland or offsite borrow material could be to create berms within these two polders to create additional mudflat cells. This measure would be dependent on the polder operational measure above. In addition, this measure would include the construction of berms at the downstream wetlands to create wetland cells to create and manage the wetlands.
10. **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.
11. **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

1. **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, mud flats 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.
2. **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 (*Typha spp*.) within the existing and/or proposed wetland areas in the study area. The seasonal pulse measure would be dependent on either the measures for relocating the wastewater treatment plant outfall structure and/or 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.

2.2 Project Areas

Individual restoration sites were identified as feasible for project implementation (Figure 2). 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 could be verified. Measure success is dependent upon site conditions at Mitchell Lake.

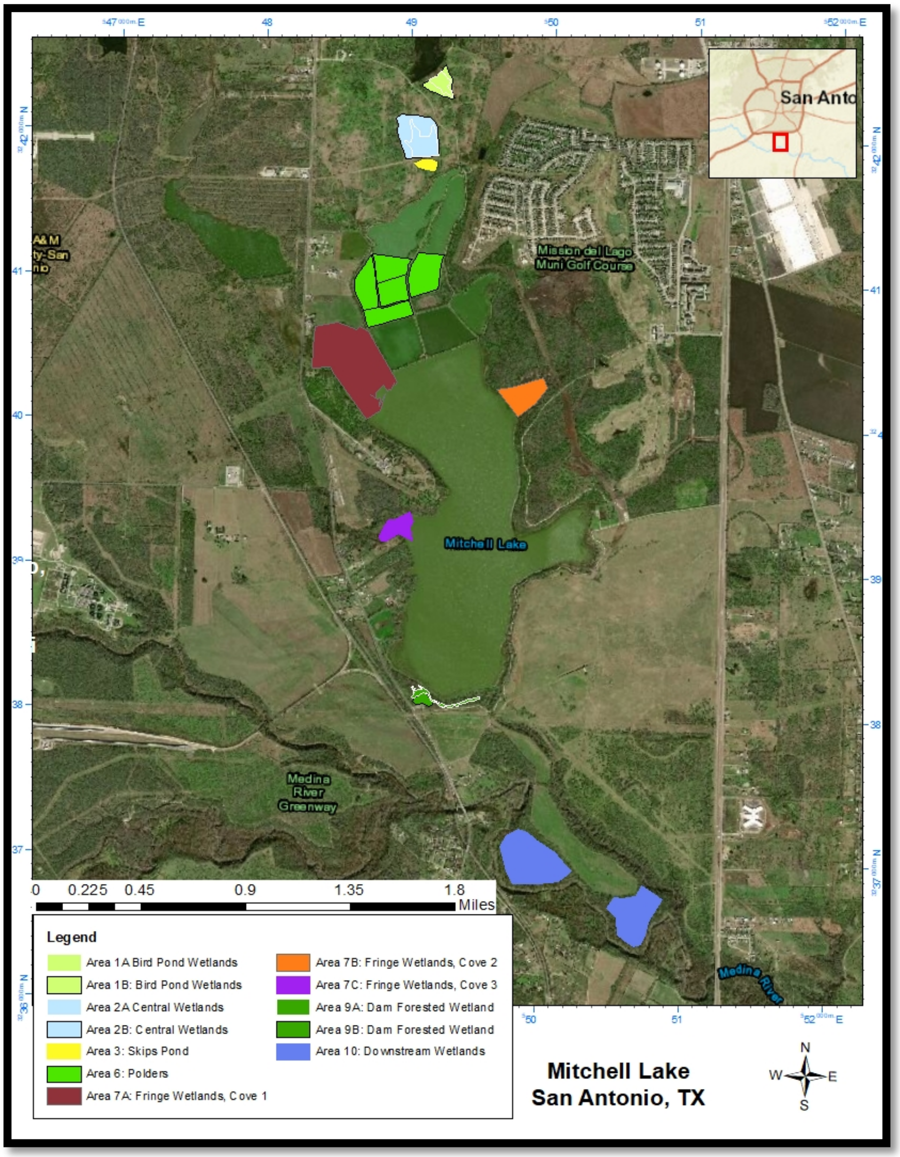

Figure 2. Mitchell Lake Project Areas

2.2.1 Area 1: Bird Pond Wetlands

Area 1 is located at the northern extent of the study area adjacent to Bird Pond near the Mitchell Lake Audubon Center (Figure 3). The 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.

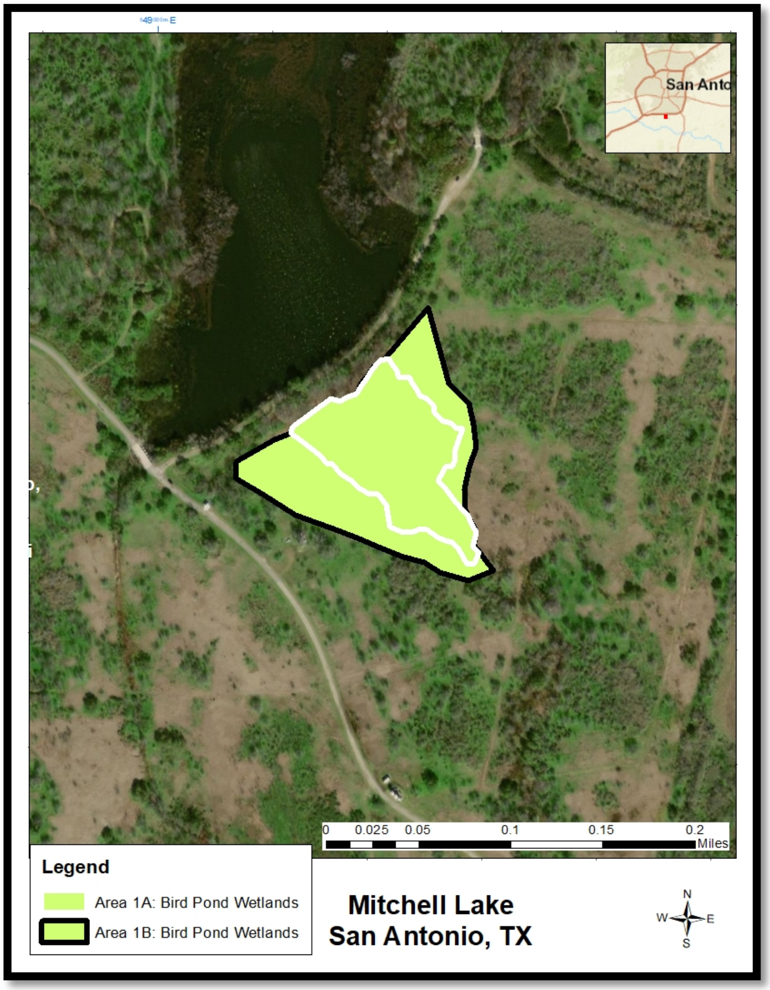

Figure 3. Area 1: Bird Pond Wetlands, Existing Wetlands Outlined in White (1A) and Expanded Wetlands Outlined in Black (1B)

2.2.2 Area 2: Central Wetlands

Area 2 is south of Area 1 Bird Pond Wetland (Figure 4). The two wetland complexes are connected to each other by a shallow, nondescript drainage channel. This area consists of a complex of wetlands connected to each other by wetland swales with higher, upland areas interspersed throughout. Central Wetland is part of the same wetland complex as Area 3, but they are separated by a pipeline right-of-way; therefore, the areas are treated as separate areas. 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*).

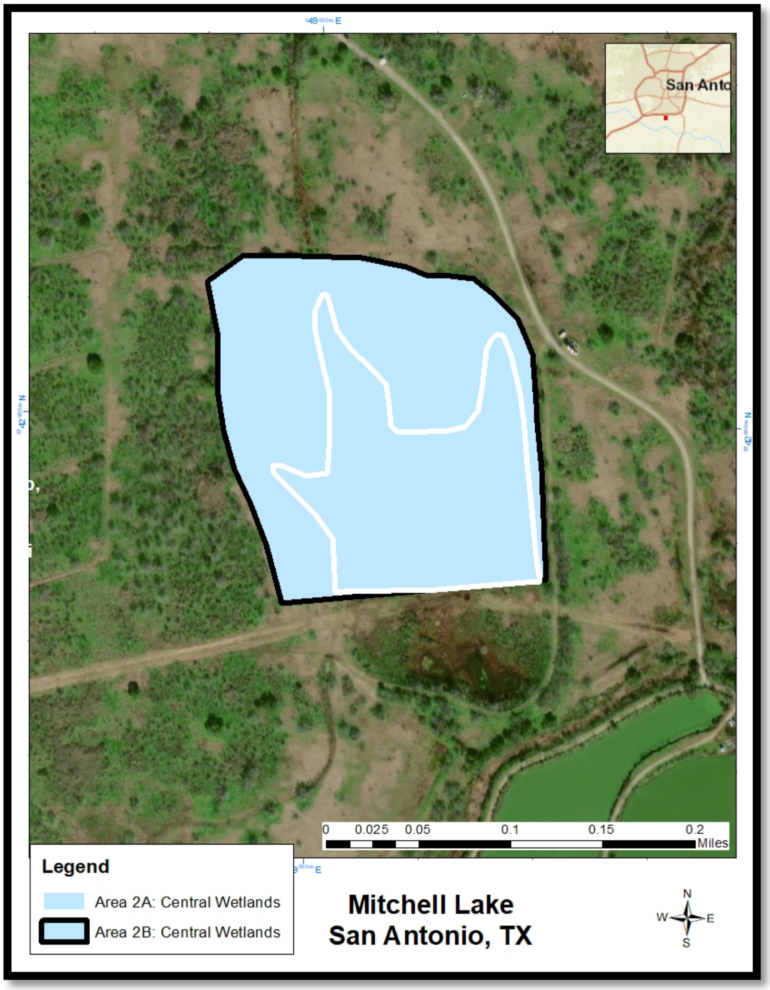

Figure 4. Area 2: Central Wetlands, Existing Wetlands Outlined in White (2A) and Expanded Wetlands Outlined in Black (2B)

2.2.3 Area 3: Skip's Pond

As noted in the Area 2 discussion above, 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 Wetland complex.

Figure 5. Area 3: Skip's Pond

2.2.4 Area 6: Polders

The polders are directly north of Mitchell Lake. Area 6 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 mud flat 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 consisted of completely open water habitat. Vegetative diversity within this area is incredibly low and consists of low quality wildlife habitat.

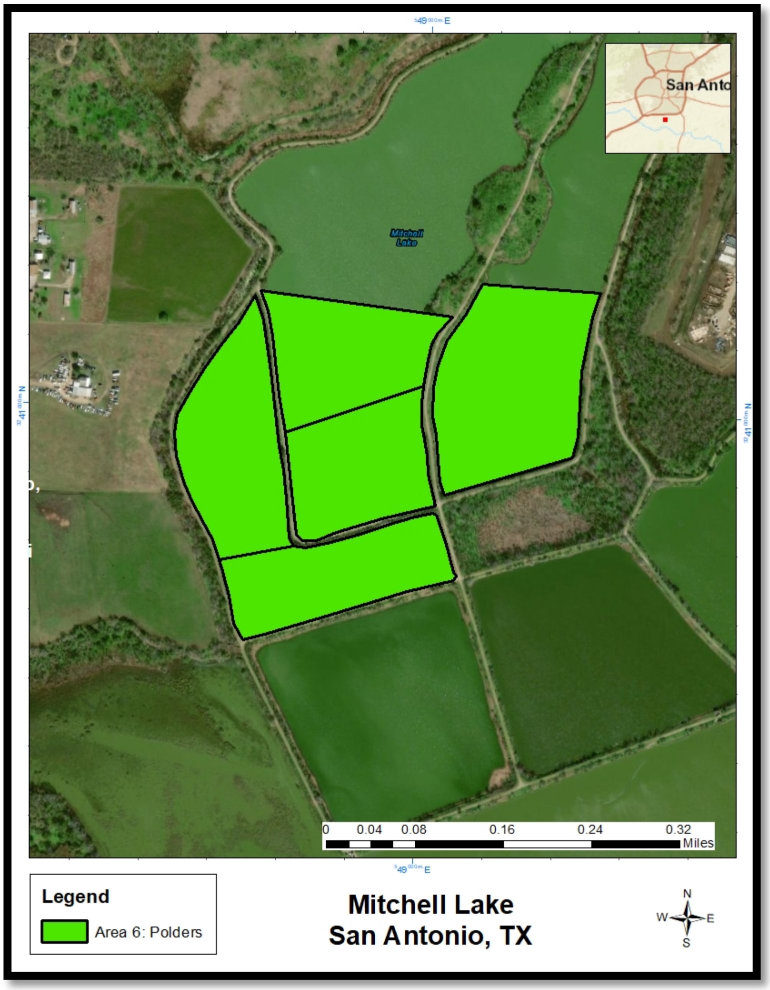

Figure 6. Area 6: Polders

2.2.5 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 517'. 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 close proximity of the dam and is approximately 6.84 acres.

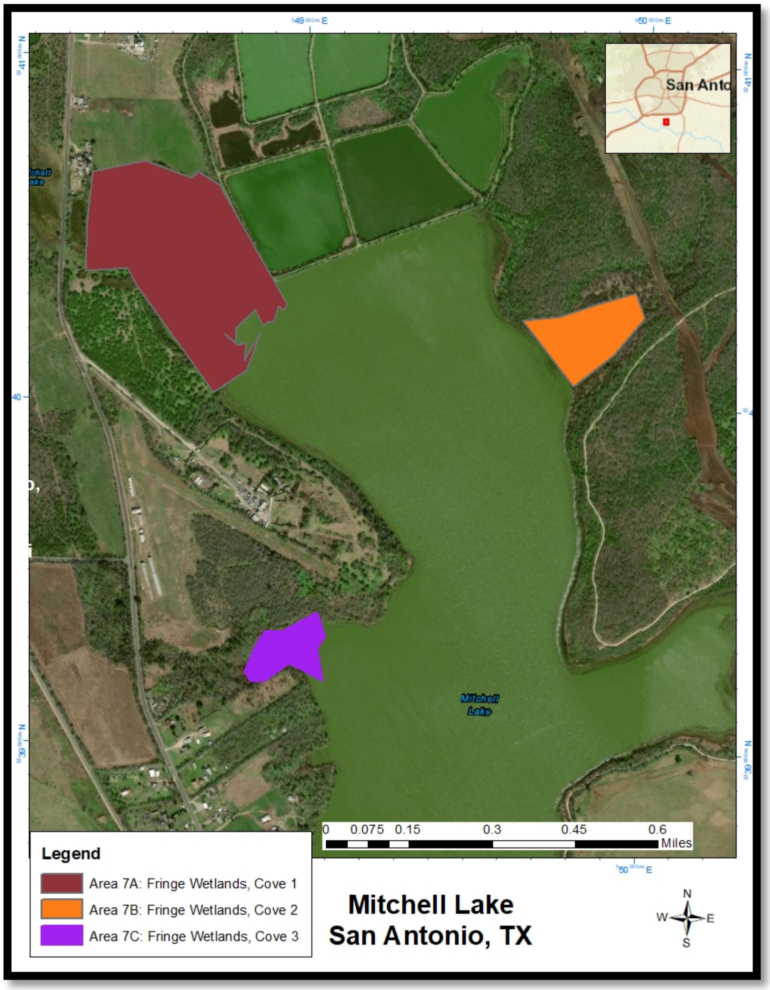

Figure 7. Area 7: Fringe Wetlands, Coves 1, 2, and 3

2.2.6 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. Area 9: Dam Forested Wetlands, Existing Wetlands Outlined in White (9A) and Expanded Wetlands Outlined in Black (9B)

2.2.7 Area 10: Downstream Wetlands

Area 10 is currently shrubland/upland habitat. Enhancement of this area entails 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.

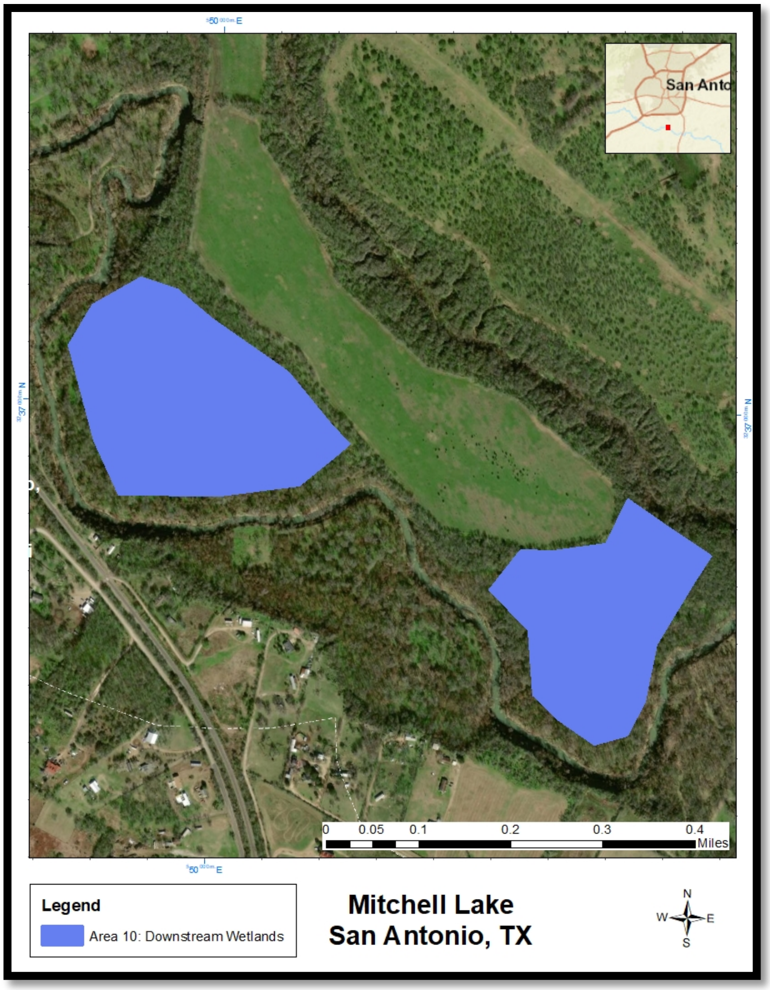

Figure 9. Area 10: Downstream Wetlands

2.3 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 alternatives were developed for each area in order to achieve differing levels of captured and uncaptured benefits.

2.3.1 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 1B includes the enhancement 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.

The Alternative 1A and 1B Future With Project (FWP) conditions incorporate Clearing/Excavation, Installation of Pipeline, Seasonal Pulses, Native Aquatic Species Plantings, Invasive Species Management, Low Quality Vegetation Removal, Habitat Structure Augmentation, and the 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 measure would provide a dependable water supply to ensure that the wetland is inundated to a level that supports a diverse vegetation 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 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 and submergent plant species would be planted to establish a diverse community. In an effort to minimize the establishment 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 control.

Alternative 1A would enact all of the above listed measures on 3.17 acres, while Alternative 1B would enact these measures on 6.42 acres.

2.3.2 Alternatives 2A and 2B: Central Wetlands

Alternative 2A would follow the same trend as Alternatives 1A and 1B, but for 10.16 acres of emergent wetland habitat. Alternative 2B would enact those measures on 18.37 acres of emergent and upland/shrubland habitat.

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

- Clearing/Excavation,
- Installation of Pipeline,
- Seasonal Pulses,
- Native Aquatic Species Plantings,
- Invasive Species Management,
- Low Quality Vegetation Removal,
- Water Control Structure
- Habitat Structure Augmentation, and
- Installation of Bat/Nest Boxes measures.

2.3.3 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.

Alternative 3 FWP conditions incorporate the following measures on 2.18 acres of emergent wetland habitat:

- Clearing/Excavation,
- Seasonal Pulses,
- Native Wetland Species Plantings,
- Invasive Species Management,
- Low Quality Vegetation Removal,
- Water Control Structure (only needed if Area 2 measures are implemented)
- Habitat Structure Augmentation, and
- Installation of Bat/Nest Boxes measures.

2.3.4 Alternative 6: Polders

Alternative 6 utilizes the existing polders and basins to create mud flat habitat for migrating birds and shorebirds. Currently, these polders are maintained as open water habitats to prevent the polder sediments from drying out and becoming airborne. The polder cells incorporated in Alternative 6 would be cycled to prevent the complete drying of the sediments and ensure there is a water supply to inundate the drained polders.

The Alternative 6 FWP conditions incorporate the following measures on 49.52 acres:

- Polder Operational Management,
- Installation of Bat/Nest Boxes, and
- Construction of Berms.

2.3.5 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, 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, 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.

2.3.6 Alternative 9: Dam Forested Wetlands

Measures appropriate for Alternative 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 sugarberry which provide limited wildlife habitat. The Proposed Action would entail the thinning of these trees for use as structural habitat and the creation of standing snags.

Alternative 9A and 9B FWP conditions incorporate the following measures on 2.55 forested wetland habitat and 4.48 acres of upland habitat, respectively:

- 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

2.3.7 Alternative 10: Downstream Wetlands

Implementation of Alternative 10 would involve the creation of wetlands downstream of the Mitchell Lake dam.

Alternative 10 FWP would implement the following measures on 51.32 acres of upland/shrubland habitat:

- Clearing/Excavation,
- Native Wetland Species Planting,
- Seasonal Pulses,
- Habitat Structure Augmentation,
- Installation of Bat/Nest Boxes, and
- Construction of Berms.

2.4 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 and incremental cost analysis. 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 was then conducted for each incremental measure or plan to justify the incremental cost per unit of output to arrive at a recommended plan.

2.5 Plans

Using the generated plans, their costs and benefits, a cost effective analysis was performed using the IWR (Institue Water Resources) Planning Suite II Software. Cost effective plans are defined as the least expensive plan for a given set of benefits, or environmental output. In other words, no other plan would provide the same or more benefits for a lower cost. Of the 1,728 plans (including various scales), 29 were identified as cost effective plans (including no action).

The next step in the Cost Effectiveness (CE) and Incremental Cost Analysis (ICA) analysis is to perform an incremental cost analysis on the cost effective plans. ICA compares the incremental cost per incremental benefit (output, or lift in environmental output) among the plans to identify plans that maximize the last dollar spent. Starting with the No Action plan, the incremental cost per incremental benefit is calculated from the no action for each cost effective plan. The plan with the least incremental cost per incremental output is identified as the first of the “with-project” best buy plans. Then starting with that plan, the incremental cost per incremental benefit is calculated between that plan and each remaining cost effective plan, and the one with the least incremental cost per incremental benefit is identified as the next plan in the array of best buy plans. This process continues until there are there are no remaining plans. The last plan in the best buy array, is typically the “kitchen sink” plan, or the plan that contains all of the management measures being analyzed.

From the cost effective alternatives, nine were identified as “Best Buy” plans (including the No Action Plan). The results of the analysis is shown graphically in Figure 10. The best buy plans are:

- Plan 1: No Action
- Plan 2: Polders (Alternative 6 alone)
- Plan 3: Polders + Cove 3 (Alternative 6 + 7C)
- Plan 4: Polders, Cove 3, and Downstream Wetlands (Alternatives 6 + 7C + 10)
- Plan 5: Polders, Coves 1 - 3, and Downstream Wetlands (Alternatives 6 + 7G + 10)
- Plan 6: Skip's Pond + Plan 5 (Alternatives 3+ 6 + 7G + 10)

- Plan 7: Central Wetlands (2B) + Plan 6 (Alternatives 2B + 3+ 6 + 7G + 10)
- Plan 8: Bird Pond Wetlands (1B) + Plan 7 (Alternatives 1B + 2B + 3+ 6 + 7G + 10)
- Plan 9: Forested Wetlands below the Dam + Plan 8 (Alternatives 1B + 2B + 3+ 6 + 7G + 9B + 10)

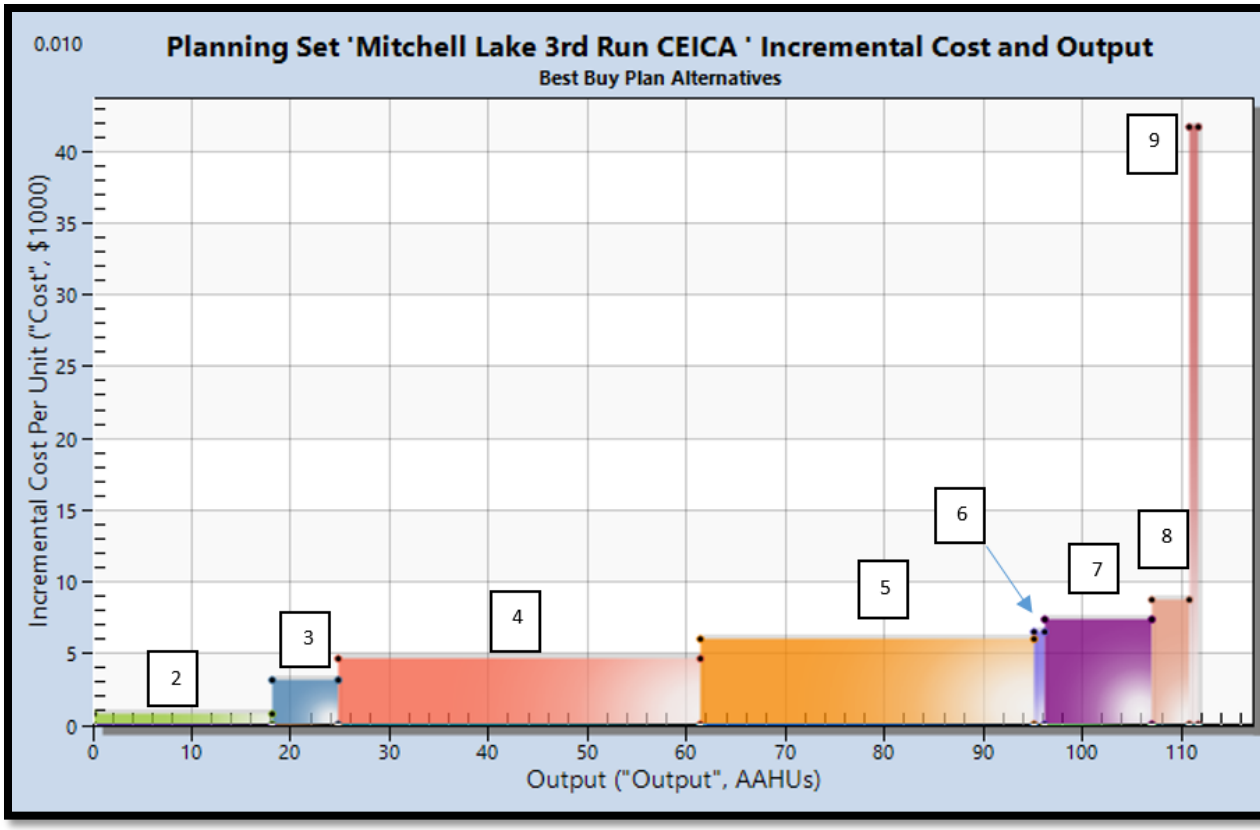

Figure 10. CE/ICA Best Buy Plans

2.6 Impacts to Jurisdictional Wetlands/Waters of the U.S. Department of Defense

As part of the alternatives evaluation process, a semi-quantitative assessment of permanent impacts to jurisdictional wetlands and water of the U.S. was conducted for the No Action and eight 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. For the purposes of the analysis, jurisdictional features were defined as any aquatic resource within the study area which included open water and wetland habitat.

The specific type and quality of specific habitat impacts were not evaluated 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 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).

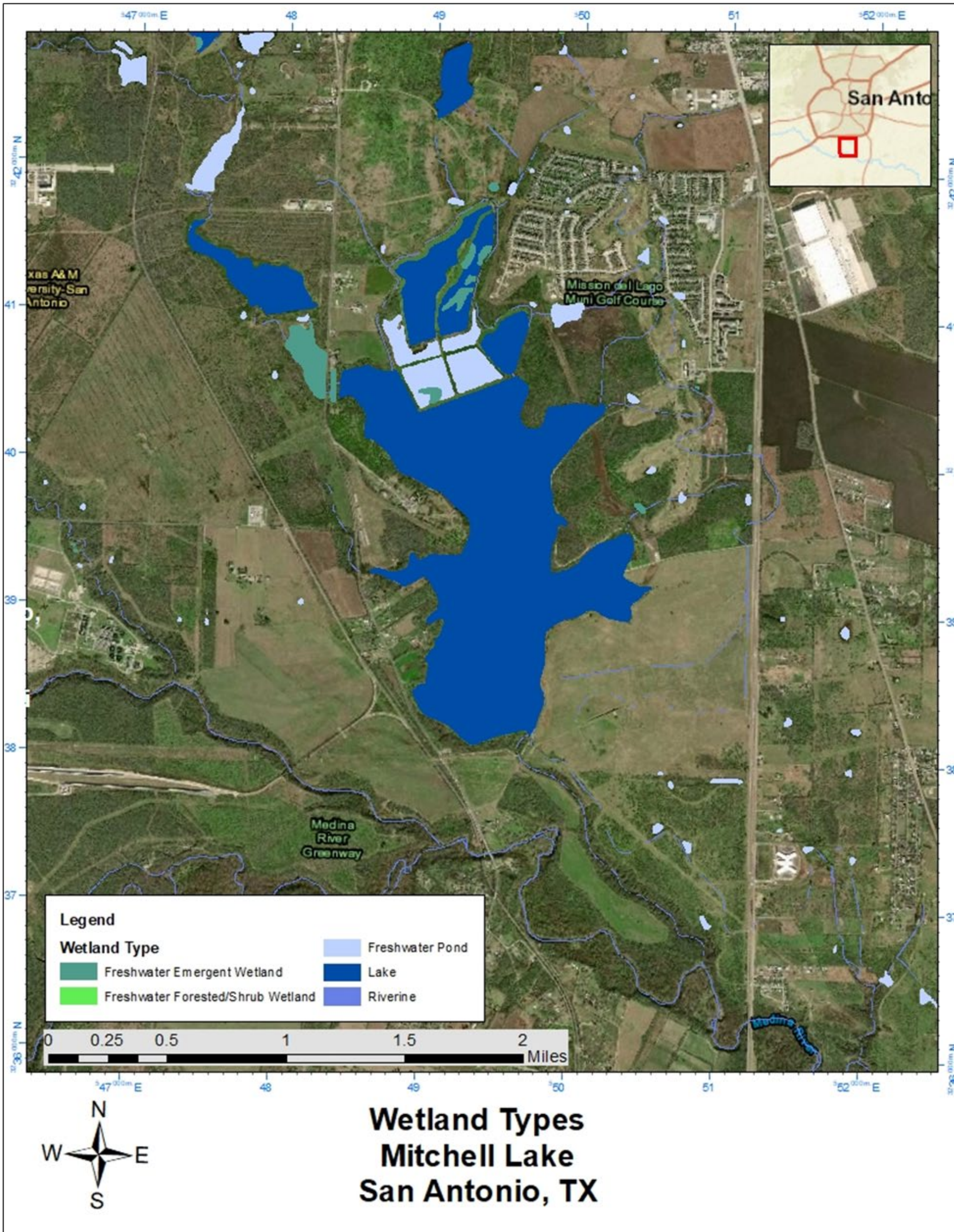

Figure 11. National Wetlands Inventory of Wetland Types within the Study Area (USFWS 2019)

Figure 12. Existing Wetlands within the Study Area Surveyed by the USACE Team

Based on the analysis, the estimated impact to jurisdictional areas from the permanent placement of fill materials is 3,309 acres for Plan 8.

Table 1. Amount of Material Required for Excavation, Ditches, Trenches, and Berms

Alternatives		Total Area of Alternative (Acres)	Wetland Cell Excavation (Cubic Yards)	Ditch and Trench Excavation (Cubic Yards)	Berm Creation (Cubic Yards)
Bird Pond Wetlands	1B: Expansion/Enhancement of Existing Wetlands and Enhancement of Additional Wetlands	6.42	1,570	876	0
Central Wetlands	2B: Expansion/Enhancement of Existing Wetlands and Enhancement of Additional Wetlands	18.37	4,826	1,046	0
Skip's Pond	3: Enhancement of Existing Wetlands	2.18	432	177	0
Polders	6: Management/Modification of Existing Polders/Basins	49.52	0	0	3,309

2.7 Least Environmentally Damaging Practicable Alternative (LEDPA) Analysis

Although there were eight plans that could be considered economically and environmentally justifiable, Plan 8 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 could be considered as LEDPA, but Plan 8 better meets the Project's purpose and need.

Plan 8 increases the synergistic water quality benefits of the previous Plans by adding the nutrient filtering function of the Bird Pond Wetlands with the channel to the Central Wetland/Skip's Pond/Linear Wetland/Cove 1 system. Plan 8 is worth the Federal and local investment because of:

- The increased diversity of bird species benefiting from the restoration;
- Increased water quality function resulting from adding the Bird Pond Wetland to the Plan;
- Three distinct habitat types (emergent wetlands, submergent/emergent wetlands, and mudflats) will be restored out of the four targeted habitat types;

- Provides resilient habitat for migratory birds;
- Creates a complex of wetlands that can be managed to improve water quality as an ancillary benefit; and
- Restores of 97.8% of the proposed restoration areas.

Migratory birds are the primary resource of national significance identified within the study area. Based on historical descriptions of the study area, the large wetland complex that occupied the study area prior to the impoundment of Mitchell Lake would have acted as extremely valuable stopover habitats for migrating birds. The recreation of the emergent, submergent, and forested wetlands along with the associated mudflat habitats are critical to improving vital migratory habitat for migratory birds and help stem the systemic decline in population sizes for these species.

Plans were screened and compared based on how well an 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).

2.7.1 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.

2.7.2 Effectiveness

Plan 8 contributes to the achievement of the planning objectives and avoids all constraints.

Table 2. Comparison of Alternative Benefits and Acreages

Alternatives		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 Wetland	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	36.73	36.73	51.32

2.7.3 Acceptability

Plan 8 is acceptable in terms of all known applicable laws, regulations, and public policies by the USACE and SAWS.

2.7.4 Efficiency

Plan 8 is the LEDPA plan and the most cost effective means of achieving the objectives of all of this study's alternatives, plans, and scales of plans.

Table 3. Comparison of Alternative Benefits and Costs

Alternatives		**Annual Benefits AAHU**	**Annual Cost ($1,000) October 2018 Prices**
Bird Pond Wetlands	1A: Enhancement of Existing Wetlands	1.53	$29.98
	1B: Expansion/Enhancement of Existing Wetlands and Enhancement of Additional Wetlands	3.85	$40.57
Central Wetlands	2A: Enhancement of Existing Wetlands	5.03	$47.28
	2B: Expansion/Enhancement of Existing Wetlands and Enhancement of Additional Wetlands	10.69	$72.48
Skip's Pond	3: Enhancement of Existing Wetlands	1.05	$6.90

Polders	6: Management/Modification of Existing Polders/Basins	18.14	$13.68
Fringe Wetlands	7A: Enhancement of Cove 1 (Wetland/Riparian Plantings)	29.9	$164.94
	7B: Enhancement of Cove 2 (Wetland/Riparian Plantings)	6.6	$36.38
	7C: Enhancement of Cove 3 (Wetland/Riparian Plantings)	3.81	$21.02
	7D: Combination of Coves 1 & 2	36.5	$201.36
	7E: Combination of Coves 1 & 3	33.71	$186
	7F: Combination of Coves 2 & 3	10.41	$57.40
	7G: Combination of Coves 1, 2 & 3	40.31	$222.38
Dam Forested Wetlands	9A: Enhancement of Existing Wet Riparian Habitat	0.47	$28.73
	9B: Expansion/Enhancement of Existing Wet Riparian Habitat and Enhancement of Additional Riparian Habitat	0.83	$34.59
Downstream Wetlands	10: Creation of Wetlands Downstream of Mitchell Lake	36.73	$173.07

3 Recommended Plan

3.1 Project Description

The Recommended Plan will be a combination of Alternatives 1B, 2B, 3, 6, 7, and 10 which will include the construction/implementation of the following measures described in Chapter 2.1:

- Native Aquatic Plantings
- Pipeline and Pump Installation
- Low Quality Vegetation Removal
- Habitat Structure Augmentation
- Installation of Bat and Bird Nest Boxes
- Invasive Animal Management
- Invasive Vegetation Management
- Berm Construction
- Clearing / Excavation
- Polder Operations Management
- Water Control Structures
- Seasonal Water Pulses

The measures that will induce changes to Waters of the U.S. include: excavation, berm construction (fill needed), pipeline and pump installation, polder operational management, and seasonal water pulses.

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 Recommended Plan.

3.2.2 Quantity of Material

Based on conceptual designs approximately 3,309 cubic yards (CYs) would be placed within the polders for berm creation for Alternative 6. The Bird Pond Wetlands, Central Wetlands, and Skip's Pond would require 6,828 CYs of material to be excavated in and around existing wetlands and 2,513 CYs would be excavated for ditches and trenches. Light grading of the existing wetlands at these sites would also be implemented in addition to full-scale excavation of the expanded limits.

3.2.3 Source of Material

The source of material for the Alternative 6 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 to verify it meets the specifications as required by the design specifications in the construction contract prior to it being used in the construction of berm features. It is anticipated that the materials would be free of any contaminants. In the event that the materials are not suitable to be placed within the polders, off-site material will be purchased. This material would also be verified and tested before placement.

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).

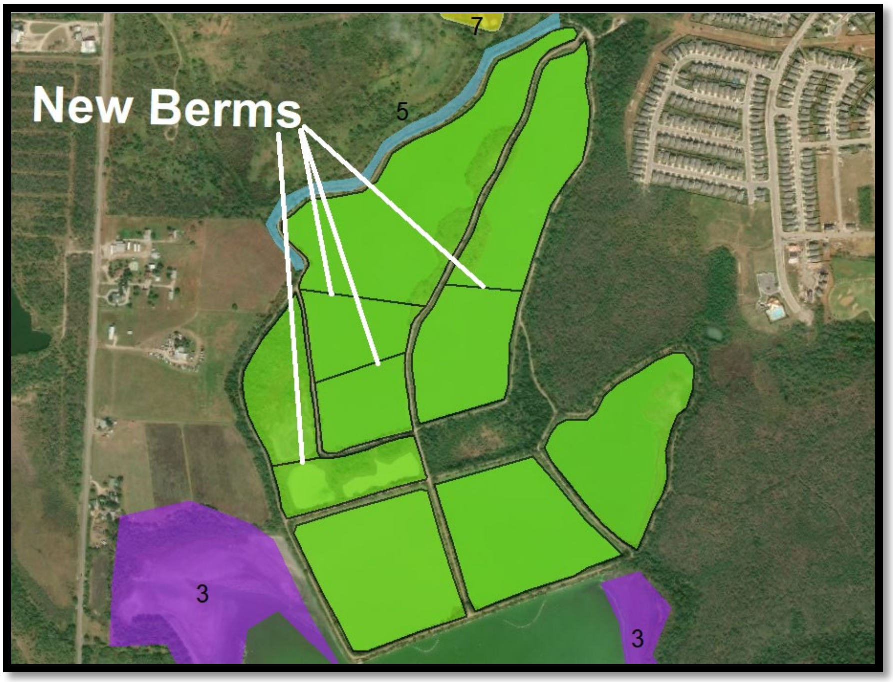

Figure 13. Newly Created Berms within East and West Polders and Basin 5

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 TSP 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 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

The Bird Pond Wetlands, Central Wetlands, and Skip's Pond are not considered jurisdictional wetlands, but based on field surveys they were determined to be wetland habitat. The polders are considered Waters of the U.S., but is severely degraded with 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 onsite 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 sited 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 jurisdictional 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 within the Bird Pond Wetlands, Central Wetlands, and 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 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 to act 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 impacts to aquatic and wetland habitats, these will be temporarily negative and lead to long-term positive impacts.

3.5.1.5 Other Effects

Temporary impacts to aquatic organisms and fish could occur during construction from the earthmoving activities with the potential for temporary sedimentation and water quality degradation of 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.

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 affected during construction and expected to then recover and improve post construction.

3.5.2 Water Circulation, Fluctuation, and Salinity Determinations

3.5.2.1 Salinity

The project would not impact the salinity of Mitchell Lake. The design and operation of the areas would not concentrate sediment, nutrient, or minerals.

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 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 positive changes in water color over several hundred years.

3.5.2.5 Odor

The filtering of Mitchell Lake water through Bird Pond Wetlands, Central Wetlands, Skip's Pond, and Cove 1 will yield positive changes in odor over several hundred years.

3.5.2.6 Taste

Implementation of the Recommended Plan would not affect the water's taste following the completion of construction.

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.

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.

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 and outflow of 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.

3.5.3.2 Velocity

Velocity in the Bird Pond Wetlands, Central Wetlands, and Skip's Pond are largely dependent on local rainfall and seepage from Bird Pond. There would not be any anticipated impacts to velocity due to the Recommended Plan.

3.5.3.3 Stratification

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 polder water levels are controlled within the FWP conditions. There will not be a 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: Temporary lowering of dissolved oxygen could occur during construction, but would be very temporary in both time and extent.

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 toxins 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. 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 at the same 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 project. 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 locations for the Recommended Plan construction 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

As described in Section 2, 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 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 the limited species at all levels of the food web would return to the same level as currently exists. Therefore, no net loss of species or negative impacts to trophic levels are anticipated as the result of the Recommended Plan.

3.5.6.4 Effects on Special Aquatic Sites

Sanctuaries and Refuges: No National fish and wildlife sanctuaries or refuges occur within the project area.

Wetlands: There will be 15.81 acres of wetland impacted by the recommended project; however, these impacts will result in beneficial effects to the wetland systems. An additional 11.16 of wetland will be created around these areas from upland/shrubland habitat. There will not be any negative impacts from the Recommended Plan. Emergent vegetation will be planted within the Bird Pond Wetlands, Central Wetlands, Skip's Pond, the Fringe Wetlands, and the Downstream Wetlands to enhance the wetlands within the project area.

Mud Flats: The goal of the Recommended Plan is to create mud flat habitat for the benefit of migratory birds and shorebirds within 49.52 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 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. 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 migrate 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, except for the Downstream Wetlands. The project would enhance these currently underused areas for the benefit of wetland habitat, mud flat 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 SHPO will ensure compliance with Section 106 of the NHPA. 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 NRHP before ground disturbing activities would be allowed to continue in the vicinity. In this way, no significant impacts for the implementation of the Proposed Action 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. 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 offsite 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. However, the goal of the measures is to improve wildlife habitat conditions by regulating and operating the polders to an appropriate standard. Sediments are likely to stay within the polders after fill is added. The polders are a closed system that will be operated in and amongst themselves. Water from Mitchell Lake will be pumped to the Bird Pond Wetlands through the recommended project. 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 removing waste. The Texas Pollutant Discharge Elimination System (TPDES) stormwater permit would establish practices to be implemented to protect water quality. As a result, the potential for adverse impacts on water quality during construction would be short-term and minor.

Installation of the recommended ecosystem restoration measures, including additional wetlands in the northern section of the project area would reduce the rate of aquatic degradation within Mitchell Lake. The wetland vegetation would provide an additional level of treatment of stormwater runoff within the Lower Median watershed before entering the Median River. 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 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.

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 150.65 acres of enhanced or created wetland habitat and 49.52 acres of mudflat habitat with essential connectivity along a critical stop-over corridor for the birds utilizing the Central Flyway (Table 4). Therefore; the cumulative effects of the recommended project will have long-term beneficial impacts.

Table 4. Increase of Mudflat and Wetland Habitat by Enhancement and Creation for the Recommended Plan

Plan	Mudflat Habitat Increase (Acres)	Emergent/Submergent Wetland Habitat (Acres)	Emergent Wetland Habitat (Acres)	Forested Wetland Habitat (Acres)
8. Polders + Coves 1-3 + Downstream Wetlands + Skip's Pond + Central Wetlands(2B) + Bird Pond Wetlands (1B)	49.52	74.54	76.11	0.00

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

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 United States 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 located 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 United States.

Under the 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 being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes. 40 CFR 230.10(a)(2).

While implementation of the Recommended Plan would involve the placement of fill material within the project footprint and would impact 1.6 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.

Implementation of the Recommended Plan meets the conditions of Nationwide Permit (NWP) 27- Aquatic Habitat Restoration, E for Ecosystem Restoration, Enhancement, and Establishment Activities. Mitigation for impacts to 1.6 acres of waters of the U.S. and wetlands is not required, as per NWP 27. In addition, the creation/enhancement of 200.08 acres of wetlands and mud flat habitat with ecosystem restoration measures would offset any adverse impacts to existing wetlands.

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.

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,

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Biologist, Compliance Section
Environmental Branch
Regional Planning and Environmental Center U.S. Army Corps of Engineers justyss.a.watson@usace.army.mil
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ATTACHMENT K

ATTACHMENT M - Monitoring and Adaptive Management Plan

This section 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. This plan will be further developed in the Preconstruction, Engineering, and Design (PED) phase as specific design details are made available.

The Mitchell Lake Aquatic Ecosystem Restoration Project adaptive management plan will describe and justify whether adaptive management is needed in relation to the alternatives identified in the Feasibility Study. The plan will outline how the results of the project-specific monitoring program would be used to adaptively manage the project, including specification of conditions that will define project success.

The primary intent of this Monitoring and Adaptive Management Plan 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.

Uncertainties remain regarding the exact project features, monitoring elements, and adaptive management opportunities. Components of the monitoring and adaptive management plan, including costs, were estimated using currently available information. Uncertainties will be addressed in PED, and a detailed monitoring and adaptive management plan, including cost breakdown, will be drafted by the project delivery team (PDT) as a component of the design document.

Authority and Purpose

Ecosystem restoration feasibility studies are required to include a plan for monitoring the success of the restoration (Section 2039, WRDA 2007). "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 2039 also directs that a Contingency Plan (Adaptive Management Plan) be developed for all ecosystem restoration projects.

Project Goals and Objectives

During the initial stages of project development, the PDT developed restoration goals and objectives to be achieved by the restoration measures. The goal of the Mitchell Lake Aquatic Ecosystem Restoration Project is to restore structure and function of the aquatic 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 the Mitchell Lake is to "increase areal extent and quality of wetlands, thereby increasing floral and faunal species diversity and richness."

Management and Restoration Actions

The PDT performed a thorough plan formulation process to identify potential management measures and restoration actions that address the project objective. Numerous alternatives were considered, evaluated, and screened in producing a final array of alternatives. The PDT subsequently identified a tentatively selected plan (TSP). The TSP included the following ecosystem restoration components:

- Restore 49.52 acres of mudflat habitat for shorebirds and migratory birds by maintaining polder operational control
- Restore and enhance 74.54 acres of submergent/emergent and 76.11 acres of emergent wetland habitat by removing low quality and non-native invasive species and replanting the areas with native submergent and emergent wetland species

Implementation

Pre-construction, during construction, and post construction monitoring shall be conducted by utilizing a Monitoring and Adaptive Management Team (MAMT) consisting of representatives of the U.S. Army Corps of Engineers (USACE), San Antonio Water Systems (SAWS), and contracted personnel (if needed).

Monitoring will focus on evaluating project success and guiding adaptive management actions by determining if the project has met Performance Standards. Validation monitoring will involve various degrees of quantitative monitoring aimed at verifying that restoration objectives have been achieved for both biological and physical resources. Effectiveness monitoring will be implemented to confirm that project construction elements perform as designed. Monitoring will be carried out until the project has been determined to be successful (performance standards have been met), as required by Section 2039 of WRDA 2007. Monitoring objectives have been tied to original baseline measurements modeling that were performed during the site characterization field visits. Adaptive management measures will be considered upon first instance of failure to meet a performance standard. Metrics and specific adaptive measures triggers will be refined during PED.

Table 1: Monitoring Criteria, Performance Standards, and Adaptive Management Strategies for the Mitchell Lake Aquatic Ecosystem Restoration Project.

Measurement	**Performance Standard**	**Adaptive Management**
Wetland Vegetation	80% plant establishment	Replacement of dead plants vegetation; modifying plant species composition or location within the restoration area, modify propagation method, allowing natural succession of native vegetation, remedial planting/seeding, amending soil, modify irrigation, herbicide application, biological control, mechanical control of invasive species
Woody Vegetation	80% plant establishment	Replacement of dead woody vegetation; modifying woody species composition or location within the assigned habitat category area; allowing natural succession of native woody species

		within the assigned habitat category area.
Herbaceous Vegetation	50% canopy cover	Remedial planting/seeding; modification of plant species composition; amending the soil; increased irrigation.
Species diversity	75% of reference site	
Non-native vegetation	<25-percent canopy cover of non-native species with no area >0.25 acres in size with >25-percent non-native species	Remedial planting/seeding; modification of plant species composition; amending the soil; increased irrigation; herbicide application; biological control; mechanical removal.
Invasive Species	<25-percent canopy cover of invasive species with no area >0.25 acres in size with >25-percent invasive species	Chemical and mechanical removal.
Hydrology	>80-percent of structures functioning with minimal maintenance	Repair of structures; redesign of structures

Vegetation

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 should be able to allow the MAMT to assess the performance standards. Any planted material that has died within the warranty period shall be replaced. Post warranty period, adaptive management could include the replacement of the plants, modifying the propagation method, allow natural selection to augment the habitat. Restoration of the emergent/submergent wetland and riparian vegetation would be considered successful when the site meets the species diversity associated with the target vegetation association and when the site is generally vegetated with 80% success of plantings for wetland and riparian species with a herbaceous canopy cover of at least 50%. Adaptive management could include remedial planting/seeding, modifying species composition, modifying propagation method, amending soil, and/or modify irrigation to ensure successful establishment the vegetation.

The percent canopy cover of non-native and invasive species should be less than 25 percent at each restoration site. On an annual basis, or more frequently if needed, areas greater than or equal to 0.25 acres in size that have more than the 25 percent areal cover of non-native or invasive vegetation shall be treated per the Operations and Maintenance Manual for the Mitchell Lake Project. This typically includes the use of chemical and mechanical methods for management of non-native and invasive species.

Hydrology

The Mitchell Lake wetland cells are designed to mimic natural wetland processes such as removing water contaminants and providing wildlife habitat. The proposed water control structures, pipeline, berms, and wetland cell creation are designed to address these processes in a controlled and constrained system. In addition, the wetlands supported by these hydraulic structures assist in the formation of wetlands that provide habitat for aquatic and terrestrial organisms. Restoration of the wetland structural habitat would be considered successful when

80-percent of the structures as designed can be maintained with minimal effort over a five-year period.

Reporting

Evaluation of the success of the Mitchell Lake Ecosystem Restoration Project will be assessed annually at a maximum until all performance standards are met. Site assessments will be conducted annually by the MAMT and an annual report will be submitted to the U.S. Fish and Wildlife Service (USFWS), Texas Parks and Wildlife Department (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.

Monitoring and Adaptive Management Plan Costs

Costs to be incurred during PED and construction phases include drafting of the detailed monitoring and adaptive management plan. Cost calculations for post-construction monitoring are displayed for a three year monitoring period. It is intended that monitoring conducted under the Mitchell Lake Aquatic Ecosystem Restoration Project will utilize a centralized data management, data analysis, and reporting functions associated with the USACE data management structure. All data collection activities will follow consistent and standardized processes established in the detailed monitoring and adaptive management plan. Cost estimates include monitoring equipment, photo point establishment, data collection, quality assurance/quality control, data analysis, assessment, and reporting for the proposed monitoring elements (Table 2). Unless otherwise noted, costs will begin at the onset of the PED phase and will be budgeted as construction costs.

Table 2: Cost Estimates for Implementation of the Monitoring and Adaptive Management Plan for the Mitchell Lake Aquatic Ecosystem Restoration Project for Hydrology

Category **Hydrology**	**Activities**	**PED Set-up & Data Acquisition**	**Construction**	**3-Year Post Construction**	**Total**
Monitoring: Planning	Monitoring workgroup, drafting detailed monitoring plan, working with PDT on performance measures	$10,000			$10,000
Monitoring: Data Collection	Vegetation and Perimeter Assessments			$225,975	$225,975
	Hydrology Assessments		$10,000	$26,500	$36,500

Data Analysis	Assessment of Monitoring Data and Performance Standards		$8,000	$5,000	$13,000
Adaptive Management Program	Vegetation Detailed Adaptive Management Plan and Program Establishment and Management. Contingency for watering & replanting, additional field work, etc.		$225,975	$225,975	$451,950
	Hydrology Detailed Adaptive Management Plan and Program Establishment and Management. Contingency for construction, correction, monitoring		$1,445,166	$26,500	$1,471,666
Database Development, Management, and Maintenance,				$256,105	$256,105
Total					$2,465,196

ATTACHMENT L

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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Amanda M. McGuire

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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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Amanda M. McGuire

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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

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Acting Chief, Environmental Branch
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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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Amanda M. McGuire

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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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Amanda M. McGuire

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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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Sincerely,

Amanda M. McGuire

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Acting Chief, Environmental Branch
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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

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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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

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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

Casey Hanson
Terrestrial Archeologist
Texas Historical Commission
Archeology Division
P.O. Box 12276
Austin, Texas 78722-2276

Dear Mr. Hanson:

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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

Pam Wesley
Administrative Assistant
Kickapoo Tribe of Oklahoma
P.O. Box 70
McLoud, Oklahoma 74851

Dear Ms. Wesley:

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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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

Sheila Bird
Tribal Historic Preservation Officer
United Keetoowah Band of Cherokee Indians
P.O. Box 746
Tahlequah, Oklahoma 74465

Dear Ms. Bird:

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

Theodore Isham
Historic Preservation Officer
Seminole Nation of Oklahoma
P.O. Box 1498
Wewoka, Oklahoma 74884

Dear Mr. Isham:

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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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

Martina Callahan
Tribal Historic Preservation Officer
Comanche Nation
P.O. Box 908
Lawton, Oklahoma 73502

Dear Ms. Callahan:

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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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

Dr. Linda Langley
Tribal Historic Preservation Officer
Coushatta Tribe of Louisiana
P.O. Box 10
Elton, Louisiana 70532

Dear Dr. Langley:

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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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

Kim Penrod
Director, Cultural Resources/106
Delaware Nation
Archives, Library and Museum
31064 State Highway 281
P.O. Box 825
Anadarko, Oklahoma 73005

Dear Ms. Penrod:

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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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

Lauren Brown
NAGPRA Coordinator, Consultant & Cultural Clerk
Tonkawa Tribe of Oklahoma
1 Rush Buffalo Road
Tonkawa, Oklahoma 74653

Dear Ms. Lauren Brown:

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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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

Earl J. Barbry, Jr.
Tribal Historic Preservation Officer
Tunica-Biloxi Indian Tribe of Louisiana
P.O. Box 1589
Marksville, Louisiana 71351

Dear Mr. Barbry:

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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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

Kellie Lewis
Tribal Historic Preservation Officer
Kiowa Indian Tribe of Oklahoma
P.O. Box 369
Carnegie, Oklahoma 73015

Dear Ms. Lewis:

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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

Devin Oldman
Tribal Historic Preservation Officer
Northern Arapaho Tribe
P.O. Box 67
St. Stevens, Wyoming 82524

Dear Mr. Oldman:

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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

Janice Lowe
Cultural Preservation Assistant
Alabama-Quassarte Tribal Town
Cultural Preservation Department
P.O. Box 187
Wetumka, Oklahoma 74883

Dear Ms. Lowe:

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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

Holly Houghten
Tribal Historic Preservation Officer
Mescalero Apache Tribe
P.O. Box 227
Mescalero, New Mexico 88340

Dear Ms. Houghten:

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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

Bryant Celestine
Tribal Historic Preservation Officer
Alabama-Coushatta Tribe of Texas
571 State Park Road 56
Livingston, Texas 77351

Dear Mr. Celestine:

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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

Derek Hill
Cultural Preservation Department
Caddo Nation of Oklahoma
P.O. Box 487
Binger, Oklahoma 73009

Dear Mr. Hill:

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) 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.

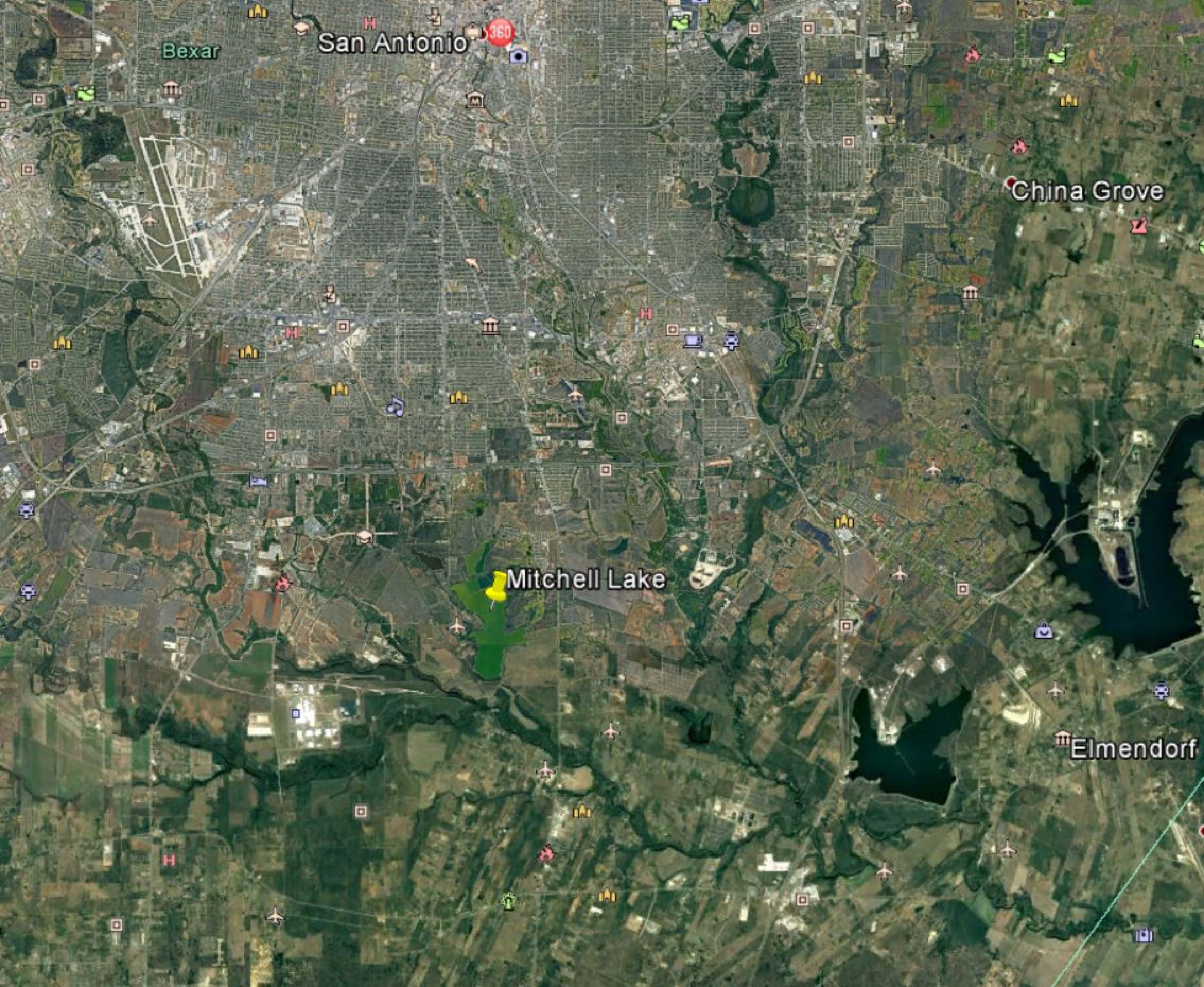
Our office would like to solicit any input you may have with respect to the Mitchell Lake Feasibility Study area in accordance with the NHPA and other applicable laws and regulations to assist us in the identification of historic properties. We look forward to receiving your comments. Please contact 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



San Antonio
Bexar
China Grove
Mitchell Lake
Elmendorf

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, FORT WORTH DISTRICT
P.O. BOX 17300
FORT WORTH, TX 76102-0300

February 12, 2019

Public Notice

Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study Public Meeting

The Fort Worth District, U.S. Army Corps of Engineers (USACE), hereby informs the public of the public scoping meeting to be held for the Mitchell Lake Aquatic Ecosystem Restoration (ER) 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 Wednesday, March 13, 2019 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.

Sincerely,

Douglas C. Sims, PMP, RPA
Chief, Environmental Branch
Regional Planning and Environmental Center

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Mitchell Lake Aquatic Ecosystem Restoration Feasibility Study Public Meeting

FORT WORTH DISTRICT

Published March 8, 2019

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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/.