

4.13 Turkey Peak Dam – Lake Palo Pinto Enlargement

4.13.1 Description of Option

The Lake Palo Pinto dam was initially constructed in 1963 and 1964 with a conservation pool level of 863.0 feet above mean sea level (ft-msl) and deliberate impoundment began in April 1964. In 1966 the conservation storage level was raised four feet to 867.0 ft-msl. In the early 1980s, the Palo Pinto County Municipal Water District No. 1 (District) became concerned about the capacity of Lake Palo Pinto and in 1985, a volumetric survey of Lake Palo Pinto was performed. This survey determined the reservoir's conservation capacity to be 27,650 acft or about 63 percent of its authorized storage. In 2007, an additional volumetric survey was performed by the Texas Water Development Board and this survey determined the reservoir's capacity to be 27,215 acft (about 62 percent of its authorized storage of 44,100 acft). Based on the June 2007 TWDB survey, Lake Palo Pinto's conservation pool currently inundates 2,176 acres at its conservation level and has an average depth of only 12.5 feet. The Turkey Peak Project project is currently being pursued by the District to recover the lost storage in Lake Palo Pinto as authorized under Certificate of Adjudication 12-4031.

The proposed Turkey Peak Project is located on Palo Pinto Creek immediately downstream of Lake Palo Pinto, as shown in Figure 4.13-1. The proposed reservoir is located approximately 2 miles northwest of the City of Santo, just upstream from the bridge over Palo Pinto Creek on FM4. The conservation capacity of Turkey Peak Project is 22,577 acft and covers 648 acres, resulting in an average reservoir depth of 35 ft.

The normal pool elevation of the Turkey Peak Project will be 867 ft-msl, the same as Lake Palo Pinto. A portion of the existing dam and spillway at Lake Palo Pinto will be removed and the two reservoir pools will be connected above an elevation of 863 ft-msl. Below this elevation a pipe will connect both pools as shown in Figure and the two pools can be operated either as a single reservoir or as separate reservoirs. The combined Turkey Peak/Palo Pinto Reservoir will initially contain approximately 49,792 acft of conservation storage and inundate 2,824 acres at its conservation storage level of 867 ft-msl.

Figure 4.13-1 Location of Turkey Peak Project

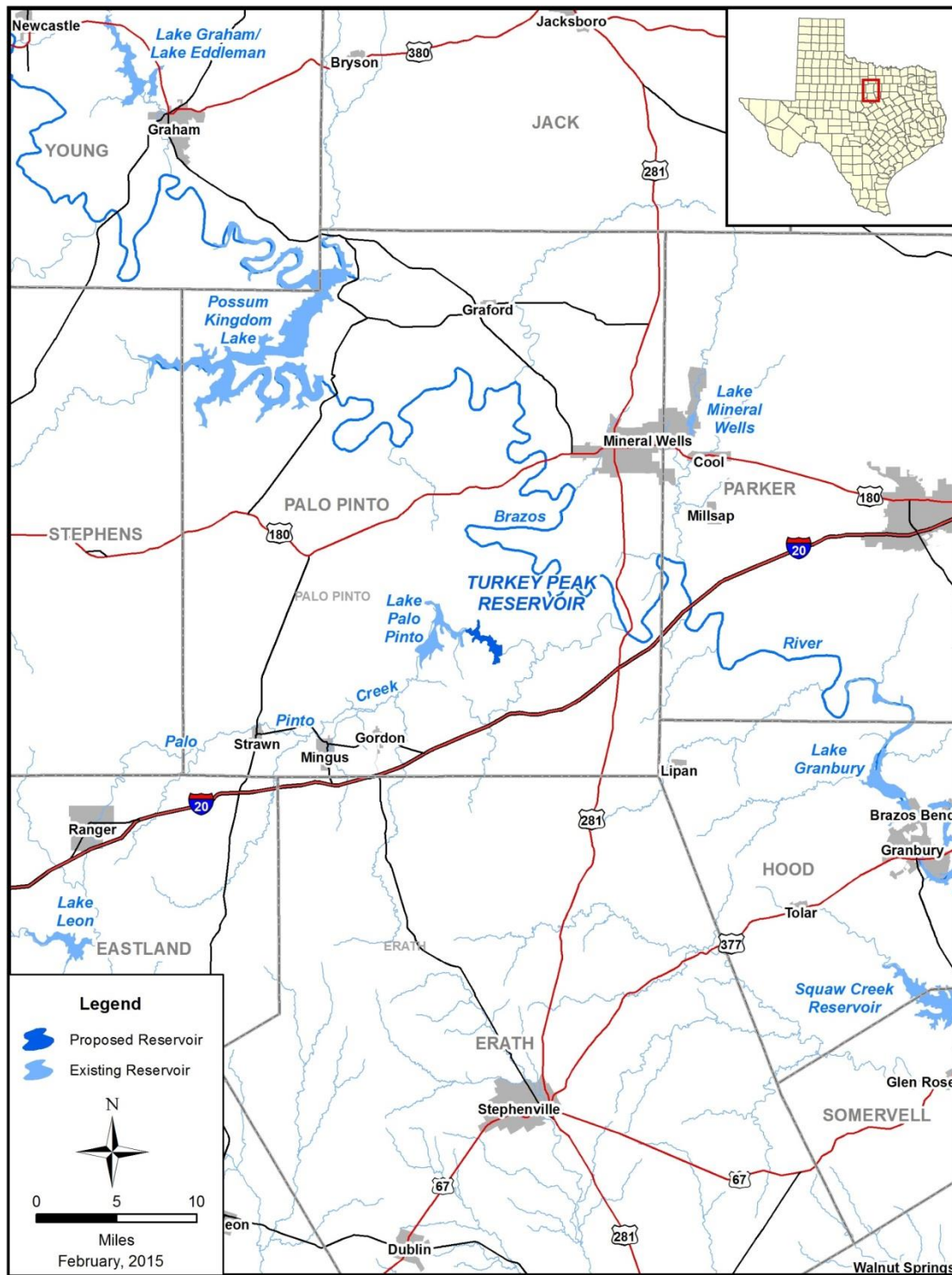
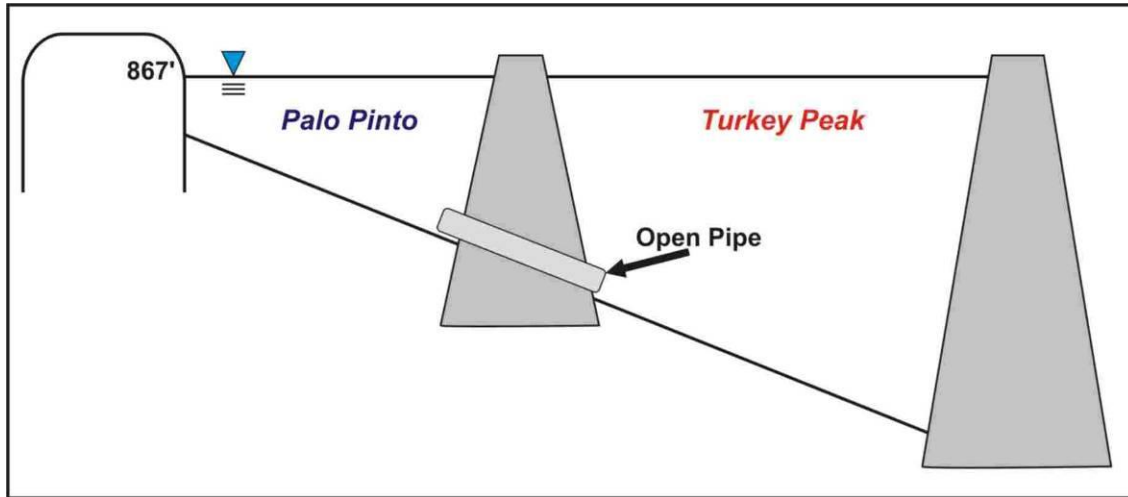


Figure 4.13-2 Combined Turkey Peak/Palo Pinto Reservoir



The Turkey Peak Project will increase storage by 83 percent (as compared to Lake Palo Pinto), while only inundating an additional 20 percent of the surface area of the existing Lake Palo Pinto. Because Turkey Peak Project is significantly deeper than Lake Palo Pinto, there is a 695 acre reduction (20 percent) in the surface area of the combined reservoirs when compared to raising the conservation level of Lake Palo Pinto by 5.5 feet (and storing 44,100 acft, its current permit authorization). This results in a significant reduction in reservoir evaporation between the two alternative configurations. The District selected the Turkey Peak project instead of the Lake Palo Pinto Off-Channel Reservoir project because of lower unit water costs and to avoid an endangered species (Golden-cheeked Warbler).

The District has completed feasibility and preliminary design studies of the project. Efforts are currently underway for the District to secure an amendment to their surface water permit for Lake Palo Pinto (Certificate of Adjudication 12-4031A) for the impoundment of Turkey Peak Project. A draft permit was issued by the TCEQ in March of 2015. The District is moving forward with the required permitting activities associated with a Section 404 permit of the Clean Water Act.

4.13.2 Available Yield

Water potentially available for impoundment in the proposed Turkey Peak/Palo Pinto Reservoir was estimated using the TCEQ Brazos WAM which assumes no return flows and permitted storages and diversions for all water rights in the basin. The model utilizes a January 1940 through December 1997 hydrologic period of record. Estimates of water availability were derived subject to the reservoir having to pass inflows to meet environmental flow standards associated with Senate Bill 3 (SB3).

The reservoir was modeled by combining the current storage capacity of Lake Palo Pinto (27,650 acft) with the proposed storage capacity of Turkey Peak project (22,577 acft). Because this project is being pursued to recover lost storage in Lake Palo Pinto and to increase the reliability of the supply as currently authorized by the District's Certificate of Adjudication, the additional storage provided by Turkey Peak Project was modeled at the

Lake Palo Pinto priority date of July 3, 1962, which is consistent with the draft water right permit.

The District operates using a 6-month safe yield, which for the combined project is 16,900 acft/yr. The 2070 stand-alone 6-month safe yield of Lake Palo Pinto is 8,800 acft/yr. Therefore, the additional safe yield attributed to Turkey Peak Project in 2070 is 8,100 acft/yr.

Figure 4.13-3 shows simulated Turkey Peak/Palo Pinto Reservoir storage levels for the 1940 to 1997 historical period, subject to the 6-month safe yield demand of 16,900 acft/yr. Figure 4.13-3 illustrates the storage frequency of the combined reservoir under the same 6-month safe yield demand. Simulated contents remain full almost 20 percent of the time and above 80 percent full more than half of the time.

Figure 4.13-2 Turkey Peak/Palo Pinto Reservoir Storage Trace

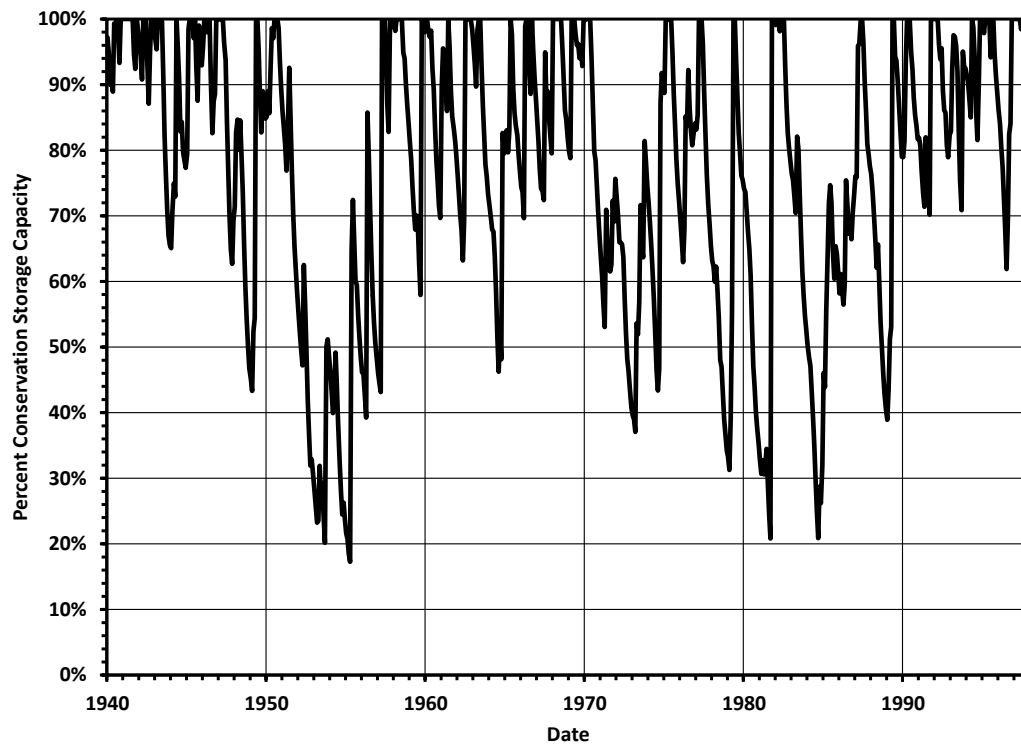
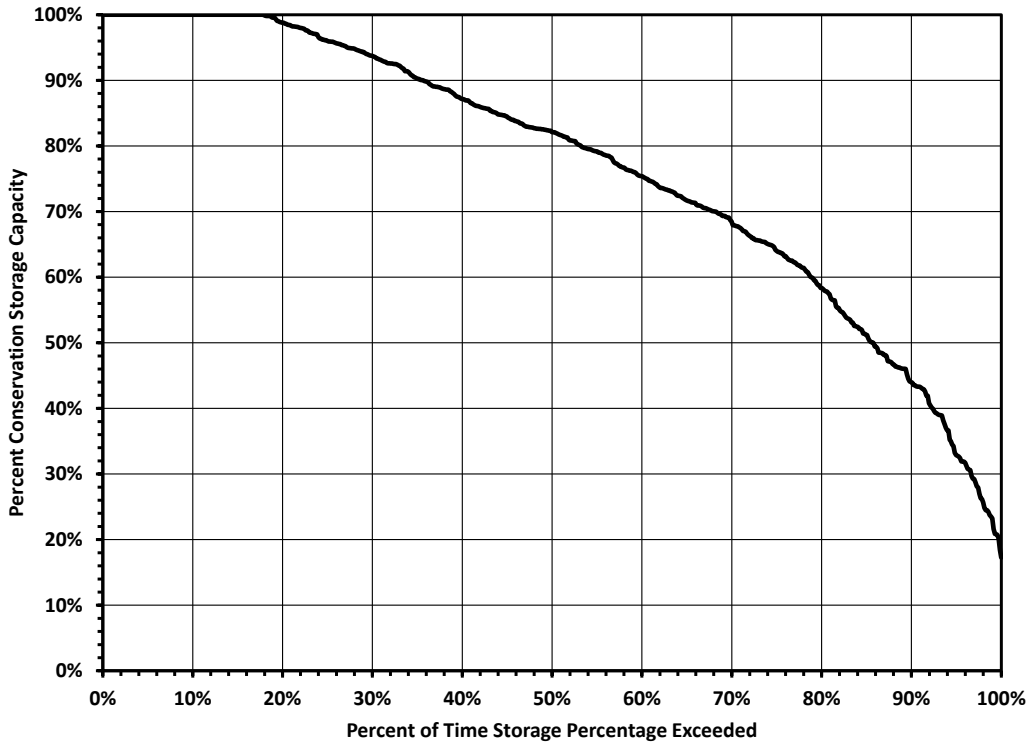


Figure 4.13-3 Turkey Peak/Palo Pinto Reservoir Storage Frequency



The draft Turkey Peak permit contains an environmental flow provision based on SB3 Brazos environmental flow standards that applies only to the diversion of water that occurs from inflows in the additional 7 square miles of drainage area captured by the new dam. However, because the District is not seeking any additional appropriation of state water in the permit, the impact of the project on the flows downstream is negligible when evaluated with the Brazos WAM.

4.13.3 Environmental Issues

Existing Environment

The Turkey Peak Project site in Palo Pinto County is within the Cross Timbers Ecoregion.¹ This complex transitional area of prairie dissected by parallel timbered strips is located in north-central Texas west of the Texas Blackland Prairies Ecoregion, east of the Central Plains Ecoregion and north of the Edwards Plateau Ecoregion. The physiognomy of the Cross Timbers Ecoregion is oak and juniper woods, and mixed grass prairie. Much of the native vegetation has been displaced by agriculture and development. Range management techniques, including fire suppression, have contributed to the spread of invasive woody species and grasses within this area. Farming and grazing practices have also reduced the abundance and diversity of wildlife

¹ Griffith, G.E., Bryce, S.A., Omernik, J.M., Comstock, J.A., Rogers, A.C., Harrison, B., Hatch, S.L., and Bezanson, D., 2004, Ecoregions of Texas (color poster with map, descriptive text, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:2,300,000).

in the region.² The climate within this area is characterized as subtropical subhumid, with hot summers and dry winters. Average annual precipitation ranges between 28 and 32 inches.³ No major or minor aquifers underlie the project area, however the Trinity Aquifer, a major aquifer consisting of interbedded sandstone, sand, limestone, and shale of Cretaceous Age, lies east and south of the project area.⁴

The physiography of the region includes hard sandstone, mud, and mudstone (undifferentiated), ceramic clay and lignite/coal, terraces, and flood-prone areas. The topography ranges from flat to rolling, and from steeply to moderately sloped, with local shallow depressions in flood-prone areas along waterways.⁵ The predominant soil associations in the project area are the Bosque-Santo and Bonti-Truce-Shatruce associations. Bosque-Santo soils are deep, nearly level to gently sloping, loamy soils, typically found on flood plains. Bonti-Truce-Shatruce soils are moderately deep and deep, gently sloping to steep, loamy, stony, and bouldery upland soils.⁶

The dominant vegetation types found within the project area as mapped by the TPWD are Ashe Juniper Parks/Woods and Oak-Mesquite-Juniper Parks/Woods.⁷ Variations of these primary types occur within the region, which reflect changes in the composition of woody and herbaceous species and physiognomy. Ashe Juniper Parks/Woods, which occur principally on the slopes of hills in Palo Pinto County, usually include the following commonly associated plants: live oak (*Quercus virginiana*), Texas oak (*Q. texana*), cedar elm (*Ulmus crassifolia*), mesquite (*Prosopis glandulosa*), agarito (*Mahonia trifoliolata*), tasajillo (*Opuntia leptocaulis*), western ragweed (*Ambrosia cumanensis*), scurfpea (*Psoralea* spp.), little bluestem (*Schizachyrium scoparium*), sideoats grama (*Bouteloua curtipendula*), Texas wintergrass (*Nasella leucotricha*), silver bluestem (*Bothriochloa saccharoides*), hairy tridens (*Erioneuron pilosum*), tumblegrass (*Schedonnardus paniculatus*), and red three-awn (*Aristida purpurea* var. *longiseta*).

Oak-Mesquite-Juniper Parks/Woods, which occur as associations or as a mixture of individual (woody) species stands on uplands, generally include the following commonly associated plants: post oak (*Q. stellata*), Ashe juniper (*Juniperus ashei*), shin oak (*Q. sinuata* var. *breviloba*), Texas oak, blackjack oak (*Q. marilandica*), live oak, cedar elm, agarito, soapberry (*Sapindus saponaria*), sumac (*Rhus* spp.), hackberry (*Celtis* spp.), Texas pricklypear (*Opuntia engelmannii* var. *lindheimeri*), Mexican persimmon (*Diospyros texana*), purple three-awn (*Aristida purpurea*), hairy grama (*Bouteloua*

² Telfair, R.C., "Texas Wildlife Resources and Land Uses," University of Texas Press, Austin, Texas, 1999.

³ Larkin, T.J., and G.W. Bomar, "Climatic Atlas of Texas," Texas Department of Water Resources, Austin, Texas, 1983.

⁴ Texas Water Development Board (TWDB), Major and Minor Aquifers of Texas; Maps online at <http://www.twdb.state.tx.us/mapping/index.asp>, 2004.

⁵ Kier, R.S., L.E. Garner, and L.F. Brown, Jr., "Land Resources of Texas." Bureau of Economic Geology, University of Texas, Austin, Texas, 1977.

⁶ Moore, J.D., *Soil Survey of Palo Pinto County, Texas*, United States Department of Agriculture, Soil Conservation Service, in cooperation with Texas Agricultural Experiment Station, 1981.

⁷ McMahan, C.A., R.F. Frye, and K.L. Brown, "The Vegetation Types of Texas," Texas Parks and Wildlife Department, Wildlife Division, Austin, Texas, 1984.

hirsuta), Texas grama (*B. texana*), curly mesquite (*Hilaria belangeri*), and Texas wintergrass (*Nassella leucotricha*).

Potential Impacts

Aquatic Environments including Bays & Estuaries

Currently there is no requirement for pass throughs of environmental flows from Lake Palo Pinto. However the draft permit issued by TCEQ for the Turkey Peak project would assure base flows in Palo Pinto Creek as base flow requirements between 1 and 4 cfs are included in the draft permit in accordance with recently adopted TCEQ environmental flow requirements. Therefore only minimal differences in streamflow frequencies in Palo Pinto Creek are anticipated. This project will not have a substantial influence on total discharge in downstream locations on the Brazos River including freshwater inflows to the Brazos River estuary.

Threatened & Endangered Species

A total of 20 species could potentially occur within the vicinity of the site that are state- or federally-listed as threatened or endangered, candidates for listing, or exhibit sufficient rarity to be listed as a species of concern (Table 4.13-1). This group includes two reptiles, eleven birds, three mammals, one mollusk, and three fish species. Inclusion in this table does not mean that a species will occur within the study area but only acknowledges the potential for its occurrence in Palo Pinto County. On-site evaluations by qualified biologists are required to confirm the occurrence of sensitive species or habitats.

The Migratory Bird Treaty Act protects most bird species, including, but not limited to, cranes, ducks, geese, shorebirds, hawks, and songbirds. Migratory bird pathways, stopover habitats, wintering areas, and breeding areas may occur within and adjacent to the project area, and may be associated with wetlands, ponds, shorelines, riparian corridors, fallow fields and grasslands, and woodland and forested areas. Although reservoir construction would remove some habitats utilized by certain migratory bird species, it would create more habitats for others. It is anticipated that the reservoir would reach its full capacity in one to three years. This transition from terrestrial to aquatic habitat would allow time for migratory species to acclimate to the altered condition within the project area and movement of non-aquatic species to similar areas nearby.

Four bird species federally listed as threatened or endangered may occur in the project vicinity. These include the black-capped vireo (*Vireo atricapillus*), golden-cheeked warbler (*Dendroica chrysoparia*), interior least tern (*Sterna antillarum athalassos*), and whooping crane (*Grus americana*). These bird species are all seasonal migrants that could pass through the project area. The black-capped vireo only nests in dense underbrush in semi-open woodlands having distinct upper and lower stories. The interior least tern typically nests on bare or sparsely vegetated areas associated with streams or lakes, such as sand and gravel bars, beaches, islands, and salt flats. Unvegetated bars within wide river channels or open flats along lake or reservoir shorelines are preferred and provide nesting habitat and access to adjacent open water for foraging for this tern. The main whooping crane flock nests in Canada and migrates annually to their wintering grounds in and around the Aransas National Wildlife Refuge near Rockport on

the Texas coast. Whooping cranes occasionally utilize wetlands as an incidental rest stop during this migration. Habitat elements particularly attractive to the black-capped vireo, interior least tern, and whooping crane do not appear to be present on or adjacent to the proposed reservoir site, although migrants are possible.

The golden-cheeked warbler is the only federally-listed avian species with potential to utilize the proposed reservoir site for nesting. Juniper-oak woodlands found on canyon slopes may provide the isolated woodland habitat of deciduous oaks and mature junipers required by this migratory songbird. A detailed field survey for this species was conducted by qualified personnel in March–May 2006, and no sightings or detections of the warbler were documented.⁸ This survey and habitat assessment concluded that the Turkey Peak study area lacked the appropriate habitat for the golden-cheeked warbler, and that the Turkey Peak Project area was not likely to support this species.⁹

Avian species listed by the State of Texas as endangered or threatened include the peregrine falcon (*Falco peregrinus*) and bald eagle (*Haliaeetus leucocephalus*). The peregrine falcon includes two subspecies which migrate across the state from more northern breeding areas in the U.S. and Canada to winter along the coast. Bald eagles are listed as threatened in Texas and occur as winter migrants. The majority of nesting bald eagle pairs currently reported are found along major rivers and near reservoirs in eastern Texas. Bald eagles are opportunistic predators, feeding primarily on fish captured in the shallow water of both lakes and streams or scavenged food sources. These birds may utilize tall trees near perennial water as roosting or nesting sites. Although the bald eagle could use either Lake Palo Pinto or Possum Kingdom Reservoir for foraging or nesting, the species has not been reported in the region. It is not expected that either bird species would be directly affected by the proposed reservoir construction at the Turkey Peak site.

The Texas horned lizard (*Phrynosoma cornutum*), Texas fawnsfoot mussel (*Truncilla macrodon*), and Brazos water snake (*Nerodia harteri*), all state threatened species, and the plains spotted skunk (*Spilogale putorius interrupta*), a species of concern, are possible inhabitants of the reservoir site or its adjacent upland pastures. Texas horned lizards inhabit deserts and grasslands in semi-arid to arid landscapes with sparse vegetation and gravelly soils. Their habitat must contain a stable population of harvester ants, the primary prey of the horned lizard, which make up the majority of its diet. Patchy environments that contain bare areas mixed with patches of vegetation are ideal to attract harvester ants and Texas horned lizards. This species could be displaced within the areas that will be gradually inundated. Relocation would then be possible into similar and acceptable habitat available adjacent to the project area.

Several species of freshwater mussels including the Texas fawnsfoot (*Truncilla macrodon*) have been listed as threatened by the state of Texas. This species is currently considered a candidate by the USFWS. The Texas fawnsfoot has been documented within the Brazos River Basin although it is generally thought to prefer large to medium streams or rivers which are not representative of Palo Pinto Creek. No Texas

⁸ Ladd, Clifton and Amanda Aurora. Endangered Species Survey Summary for the Golden-Cheeked Warbler. Loomis Austin, 2006.

⁹ Ibid.

fawnsfoot specimens (live or dead) were identified during mussel surveys conducted in 2009 of the project reach downstream of the existing Lake Palo Pinto dam.

The Brazos water snake (*Nerodia harteri*) is limited in range to the Brazos River drainage, and is usually found in riffle areas along the riverbank. Possible suitable habitat for this species occurs along Palo Pinto Creek within the reservoir area; however, comparable habitat occurs downstream of the proposed dam site. Occurrences of the endemic Brazos water snake have been documented by TPWD near Palo Pinto Creek. Surveys for the Brazos water snake along Palo Pinto Creek within the Turkey Peak Project site and downstream were undertaken in 2009 and there were no sightings of this species. Adverse impacts to this snake are not anticipated as it has been documented to persist along rocky shorelines in reservoirs, such as in Possum Kingdom.

The plains spotted skunk (*Spilogale putorius interrupta*) is generally found in open fields, prairies, and croplands. Vegetation within the project area generally consists of moderately dense mixed deciduous woodlands in the canyons, with pastures or pecan orchards in the floodplains. It is expected that if the plains spotted skunk is present in the project area, the gradual transition to an aquatic system could displace these species. However, the project area is rural, and similar suitable habitats exist adjacent to the project area; therefore, it is anticipated that the spotted skunk could relocate to those areas if necessary.

The gray wolf (*Canis lupus*) and red wolf (*Canis rufus*) are two state and federally listed endangered mammals which historically lived in Palo Pinto County. These two species are now considered to be extinct within this region of the state.

The sharpnose shiner (*Notropis oxyrhynchus*) and the smalleye shiner (*Notropis buccula*) are two small, slender minnows endemic to the Brazos River Basin that are federally listed as endangered. Historically, these sympatric fish existed throughout the Brazos River and several of its major tributaries. The population of each species within the Upper Brazos River drainage which occurs upstream of Possum Kingdom Reservoir is apparently stable, while the population within the middle and lower segments of the Brazos River Basin may exist only in remnant areas of suitable habitat. General habitat associations for both species include relatively shallow water of moderate currents flowing through broad and open sandy channels. Typical habitat is similar for both species and includes the often saline and turbid water of the Upper Brazos River. The last documented occurrence of the smalleye shiner within the lower segment of the Brazos River was recorded near the confluence of Palo Pinto Creek and the Brazos River in 1953. The stored water released from the existing Lake Palo Pinto is fresh and does not provide the saline water quality conditions needed by both species. Additionally, the existing channel dam constructed in the mid 1960's would likely restrict upstream movement of these minnows. The study area lies downstream of any recently recorded occurrences for these species; therefore the occurrence of either cyprinid species is unlikely.

Information received from the TPWD Texas Natural Diversity Database¹⁰ revealed no documented occurrences of endangered or threatened species within or near the

¹⁰ Texas Parks and Wildlife Department (TPWD), Texas Natural Diversity Database, Received 10/04/2014.

proposed Turkey Peak Project. Although based on the best information available to TPWD, these data do not provide a definitive statement as to the presence, absence, or condition of special species, natural communities, or other significant features in the project area.

Based on the lack of suitable habitat for listed endangered or threatened species, the degree of previous land modification, and the anticipated gradual transition of the area into an aquatic system, this project is unlikely to have an adverse effect on any listed threatened or endangered species.

Wildlife Habitat

Palo Pinto County is included in the Texan Biotic Province as delineated by Blair and modified by TPWD.¹¹ This province includes bands of prairie and woodland that begin in South Central Texas and run north to Kansas. The Texan Biotic Province constitutes a broad ecotone between the forests in the eastern portion of this region and the western grasslands. Although varied, the vertebrate community within the area of the proposed reservoir includes no true endemic species. The wildlife habitat types of the study area coincide closely with the major plant community types present. The mountains and associated vegetation areas within Palo Pinto County are similar to that of the Edwards Plateau; therefore the wildlife habitats and species of the study area represent a mixture of those typical of the surrounding areas.

Within this province, western species tend to encroach into open habitats, and eastern species intrude along the many wooded drainageways extending through the landscape. Mammals typical of this province include the Virginia opossum (*Didelphis virginiana*), eastern mole (*Scalopus aquaticus*), fox squirrel (*Sciurus niger*), Louisiana pocket gopher (*Geomys breviceps*), fulvous harvest mouse (*Reithrodontomys fulvescens*), white-footed mouse (*Peromyscus leucopus*) and swamp rabbit (*S. aquaticus*). Animals typical of grasslands of this province include the thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*), hispid pocket mouse (*Chaetodipus hispidus*), and black-tailed jackrabbit (*Lepus californicus*).

Typical anuran species to the Texan Biotic Province include the Hurter's spadefoot (*Scaphiopus holbrookii hurteri*), Gulf Coast toad (*Bufo valliceps*), green treefrog (*Hyla cinerea*), bullfrog (*Rana catesbeiana*), southern leopard frog (*Rana sphenoccephala*) and eastern narrowmouth toad (*Microhylla carolinensis*).

According to TPWD geographic information system (GIS) data, 84 percent of the habitat which will be inundated by the project includes forest or woodland areas, 6 percent is grassland, approximately 4 percent is shrubland, and the remaining 6 percent includes herbaceous vegetation, open water and urban areas.¹²

Cultural Resources

Cultural resources protection on public lands in Texas is afforded by the Antiquities Code of Texas (Title 9, Chapter 191, Texas Natural Resource Code of 1977), the National

¹¹ Blair, W. Frank. 1950. "The Biotic Provinces of Texas," Texas Journal of Science 2 (1):93-117, modified by TPWD GIS lab.

¹² TPWD. 2014. Texas Ecological Systems GIS mapping layers.

Historic Preservation Act (PI96-515), and the Archeological and Historic Preservation Act (PL93-291). Based on the review of available GIS datasets provided by the Texas Historical Commission (THC), there are no National Register Properties, National Register Districts, State Historic Sites, cemeteries or historical markers located within or near the reservoir project area. The owner or controller of the project would be required to coordinate with the Texas Historical Commission regarding potential impacts to cultural resources.

The Texas Archeological Sites Atlas online database of the Texas Historical Commission (THC) was also consulted and background research was conducted to determine any previous cultural resources survey efforts as well as the locations of previously recorded historic and archaeological resources in the project area. Records indicate that eight previously recorded prehistoric archaeological sites were located within a 1-mile radius of the reservoir area.

In addition a Phase IA cultural resource assessment was conducted for the proposed development of the Turkey Peak Project site in January 2009. This research revealed that there were no previously documented archeological sites found within the proposed reservoir area. Phase 1B surveys, including trenching at selected alluvial terrace locations, were initiated in 2010. The findings of the Phase 1B surveys were provided to the USACE and THC in support of Section 404 Permit coordination in accordance with the requirements of Section 106 of the National Historic Preservation Act (NHPA). The District will also coordinate the findings of the archeological surveys with the THC and TCEQ in conjunction with the review of the project under the Antiquities Code of Texas.

The Phase 1B investigations recorded two prehistoric localities, 13 prehistoric sites, and one historic site. Nine sites are recommended for further testing to determine eligibility for listing in the National Register of Historic Places (NRHP) and designation as a State Archeological Landmark (SAL). Five sites are recommended as not eligible for NRHP listing or SAL designation. The evaluation of the pre-historic and historic resources in the area of potential effect of the reservoir will be conducted and documented in accordance with standard practices for determination of NRHP and SAL eligibility and mitigation measures will be implemented, if necessary.

Threats to Natural Resources

The Turkey Peak Project will have little adverse effect on stream flow below the reservoir site and will meet TCEQ environmental flow requirements included in the water rights permit. In addition the reservoir would trap and/or dilute pollutants, providing some positive benefits to water quality immediately downstream. Dissolved oxygen levels on Palo Pinto Creek are expected to be slightly improved as the project includes plans to construct a multi-level outlet tower which will always release water to Palo Pinto Creek from the top 10 to 15 feet of the reservoir pool. Current conditions include an existing outlet pipe at Lake Palo Pinto at a fixed elevation of 835 ft-msl which is 32 feet below conservation level. The project is expected to have negligible impacts to total discharge downstream and overall water quality in the Brazos River or Brazos River estuary.

Table 4.13-1 Endangered, Threatened, Candidate and Species of Concern Listed for Palo Pinto County

Common Name	Scientific Name	Summary of Habitat Preference	USFWS Listing	TPWD Listing	Potential Occurrence in County
BIRDS					
American peregrine falcon	<i>Falco peregrinus anatum</i>	Migrant and local breeder in West Texas.	DL	T	Possible Migrant
Arctic peregrine falcon	<i>Falco peregrinus tundrius</i>	Migrant throughout the state.	DL	--	Possible Migrant
Bald eagle	<i>Haliaeetus leucocephalus</i>	Primarily found near waterbodies.	DL	T	Nesting/ Migrant
Black-capped vireo	<i>Vireo atricapilla</i>	Prefers oak-juniper woodlands with distinctive patchy, two-layered aspect; shrub and tree layer with open, grassy spaces.	LE	E	Possible Migrant
Golden-cheeked warbler	<i>Setophaga chrysoparia</i>	Prefers juniper-oak woodlands with Ashe juniper for nesting.	LE	E	Possible Migrant
Interior least tern	<i>Sterna antillarum athalassos</i>	Nests along sand and gravel bars in braided streams	LE	E	Possible Migrant
Mountain plover	<i>Charadrius montanus</i>	Non-breeding, shortgrass plains and fields	--	--	Nesting/ Migrant
Piping plover	<i>Charadrius melodus</i>	A small pale shorebird of open sandy beaches and alkali flats, the Piping Plover is found along the Atlantic and Gulf coasts.	LT	T	Possible Migrant
Sprague's pipit	<i>Anthus spragueii</i>	Migrant in Texas in winter mid Sept. to early April. Strongly tied to native upland prairie.	C	--	Possible Migrant
Western burrowing owl	<i>Athene cunicularia hypugaea</i>	Open grasslands, especially prairie, plains and savanna	--	--	Resident



Common Name	Scientific Name	Summary of Habitat Preference	USFWS Listing	TPWD Listing	Potential Occurrence in County
Whooping crane	<i>Grus americana</i>	Potential migrant	LE	E	Potential Migrant
FISHES					
Guadalupe bass	<i>Micropterus treculii</i>	Endemic to perennial streams of the Edward's Plateau region.	--	--	Resident
Sharpnose shiner	<i>Notropis oxyrinchus</i>	Endemic to Brazos River drainage. Found in large rivers.	LE	--	Resident
Smalleye shiner	<i>Notropis buccula</i>	Endemic to upper Brazos River system and its tributaries. Found in medium to large prairie streams with sandy substrate.	LE	--	Resident
MAMMALS					
Gray wolf	<i>Canis lupus</i>	Extirpated formerly known in western two-thirds of the state.	LE	E	Historic Resident
Plains spotted skunk	<i>Spilogale putorius interrupta</i>	Prefers wooded, brushy areas.	--	--	Resident
Red wolf	<i>Canis rufus</i>	Extirpated.	LE	E	Historic Resident
MOLLUSKS					
Texas fawnsfoot	<i>Truncilla macrodon</i>	Found in rivers and larger streams, intolerant of impoundment.	C	T	Resident
REPTILES					
Brazos water snake	<i>Nerodia harteri</i>	Found in upper Brazos River drainage in shallow water with rocky bottoms.	--	T	Resident
Texas Horned Lizard	<i>Phrynosoma cornutum</i>	Varied, sparsely vegetated uplands.	--	T	Resident

Common Name	Scientific Name	Summary of Habitat Preference	USFWS Listing	TPWD Listing	Potential Occurrence in County
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LE/LT=Federally Listed Endangered/Threatened
 DL=Federally Delisted
 C=Candidate for Federal Listing
 PT=Proposed Threatened
 E, T=State Listed Endangered/Threatened
 Blank = Considered rare, but no regulatory listing status

TPWD, 2015. Annotated County List of Rare Species –Palo Pinto County 9/4/2014.

USFWS, 2015. Endangered Species List for Palo Pinto County, Texas. At http://ecos.fws.gov/tess_public/countySearch!speciesByCountyReport.action, February 19, 2015.

4.13.4 Engineering and Costing

Cost estimates for the Turkey Peak/Palo Pinto Reservoir were originally prepared by HDR, Inc. in 2013 as part of a preliminary design study and those costs were updated for this study to reflect current September 2013 costs. The capital cost, approximately \$48.3 million, are associated with the relocation of FM 4, the construction of a new bridge and road at the existing dam and spillway at Lake Palo Pinto and the construction of the new dam and spillways along with modifications to the existing dam and spillway. The total project cost is approximately \$91.4 million (Table 4.13-2). This includes the costs for construction, land acquisition, resolution of conflicts, environmental permitting and mitigation, engineering, mapping and surveying, utility relocations, design, TxDOT plan review, and construction phase services. However, the District has already financed approximately \$8 million in preliminary engineering studies and legal assistance associated with permit acquisitions. Therefore, the total remaining project costs are estimated to be \$83.4 million. The 6-month safe yield of 8,100 acft/yr from the project would provide raw water to the District at a unit cost of \$749 per acft or \$2.30 per 1,000 gallons.



Table 4.13-2 Cost Estimate for Turkey Peak Project

Item	Estimated Costs for Facilities
Capital Cost	
Dam and Reservoir	\$48,257,000
Integration, Relocation, & Other	\$8,622,000
Total Cost Of Facilities	\$48,256,000
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	\$16,890,000
Environmental & Archaeological Studies and Mitigation	\$8,767,000
Fees Paid by District for Completed Studies and Legal Assistance	(\$8,000,000)
Land Acquisition and Surveying (9,978 acres)	\$8,767,000
Interest During Construction (4% for 3 years with a 1% ROI)	\$8,683,000
Total Remaining Cost Of Project	\$83,363,000
Debt Service (5.5 percent, 20 years)	\$1,076,000
Reservoir Debt Service (5.5 percent, 40 years)	\$4,394,000
Operation and Maintenance	
Dam and Reservoir	\$595,000
Pumping Energy Costs (\$0.09 kwh)	\$0
Total Annual Cost	\$6,065,000
Available Project Yield (acft/yr), based on a Peaking Factor of 1	8,100
Annual Cost of Water (\$ per acft)	\$749
Annual Cost of Water (\$ per 1,000 gallons)	\$2.30

4.13.5 Implementation Issues

This water supply option has been compared to the plan development criteria, as shown in Table 4.13-3, and the option meets each criterion.

The District is actively implementing this project with plans showing construction beginning in 2017-2018. A summary of the planned implementation steps for the project follows.

- Complete on going geotechnical investigations required for final design.
- Complete final design of the project.
- Initiate and complete land acquisition for the project.
- Receive all necessary permits required for construction.

- Secure additional state funding to implement the project.
- Begin construction of the project.

Potential Regulatory Requirements:

- Finalize the Texas Commission on Environmental Quality Water Right and Storage permits;
- Finalize the U.S. Army Corps of Engineers Permit for discharges of dredge or fill into wetlands and waters of the U.S. for dam construction, and other activities (Section 404 of the Clean Water Act);
- Texas Commission on Environmental Quality administered Texas Pollutant Discharge Elimination System Storm Water Pollution Prevention Plan;
- Texas General Land Office Easement if State-owned land or water is involved; and
- Texas Parks and Wildlife Department Sand, Shell, Gravel and Marl permit if state-owned streambed is involved.

State and Federal Permits may require the following studies and plans:

- Environmental impact or assessment studies;
- Wildlife habitat mitigation plan that may require acquisition and management of additional land;
- Flow releases downstream to maintain aquatic ecosystems;
- Assessment of impacts on Federal- and State-listed endangered and threatened species; and
- Cultural resources studies to determine resources impacts and appropriate mitigation plan that may include cultural resource recovery and cataloging; requires coordination with the Texas Historical Commission.

Land Acquisition Issues:

- Land acquired for reservoir and/or mitigation plans could include market transactions or other local landowner agreements;
- Additional acquisition of rights-of-way and/or easements may be required; and
- Possible relocations or removal of residences, utilities, roads, or other structures.



Table 4.13-3 Comparison of Turkey Peak Project to Plan Development Criteria

Impact Category	Comment(s)
A. Water Supply	
1. Quantity	1. Sufficient to meet needs
2. Reliability	2. High reliability
3. Cost	3. Reasonable
B. Environmental factors	
1. Environmental Water Needs	1. Low impact
2. Habitat	2. Low impact
3. Cultural Resources	3. Low impact
4. Bays and Estuaries	4. Low impact due to distance from coast
5. Threatened and Endangered Species	5. Low impact
6. Wetlands	6. Low impact
C. Impact on Other State Water Resources	Low to none
D. Threats to Agriculture and Natural Resources	Low to none
E. Equitable Comparison of Strategies Deemed Feasible	Option is considered to meet municipal and industrial shortages
F. Requirements for Interbasin Transfers	None
G. Third Party Social and Economic Impacts from Voluntary Redistribution	None

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