APPENDIX B - BIOLOGICAL ASSESSMENT

BIOLOGICAL ASSESSMENT

for the

INTEGRATED LOCAL WATER SUPPLY PLAN

Submitted to the

CITY OF WICHITA

WATER & SEWER DEPARTMENT

by

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PART 1 INTRODUCTION

1.1 OVERVIEW

This biological assessment is part of the environmental studies for the Integrated Local Water Supply Plan (ILWSP) proposed for construction by the Water and Sewer Department (Department) of Wichita, Kansas. The assessment describes the federally listed species (threatened, endangered, or candidate for listing) identified by the U.S. Fish and Wildlife Service (FWS) that could be present in the project area, as required under Section 7 of the Endangered Species Act of 1973 (ESA), Public Law 93-205, and subsequent amendments. The biological assessment includes information on each species' status, life history, and the potential for impact by the Department's preferred alternative.

1.2 PURPOSE OF THE BIOLOGICAL ASSESSMENT

Construction of the ILWSP would involve the placement of fill materials in waters of the United States. This action would require a permit from the U.S. Army Corps of Engineers (Corps) pursuant to Section 404 of the Clean Water Act. Issuance of this permit is a federal action that requires compliance with the ESA. This biological assessment is submitted to the FWS in accordance with ESA Section 7. In response, FWS will provide a Biological Opinion on the anticipated project effects and measures necessary to protect or conserve potentially impacted threatened or endangered species.

1.3 PROJECT PURPOSE AND NEED

The purpose of the proposed project is to provide a reliable supply of potable water to the customers of the City of Wichita's water service area (service area) through the year 2050, which requires delivering water to a growing service area population and protection to the Equus Beds Aquifer. In developing the plans for a new supply, the Department used projections of future demands to determine the necessary expansions needed to increase water-pumping capacity. The project is intended to provide a firm or reliable water supply to meet the average and maximum day demand within the service area.

The City of Wichita's water service population is approximately 348,000, of which about 32,000 people are served outside the city limits. To meet its responsibilities, the Department initiated a water supply study in 1993. This study compared projected future water demands with existing raw water delivery capacity and found that water supply shortfalls during extended dry weather periods could begin occurring by 2016 for the average day supply shortfall, and by 2026 for the maximum day supply shortfall. Even with water supply improvements recently completed or currently underway, the projected water needs for the Department for the year 2050 are as follows:

- Average day demand of 112 MGD
- Maximum day demand of 223 MGD.

Implementation of a water supply plan to furnish these projected water needs may require up to 10 years lead time in advance of the projected year of water deficit for completion of planning, permitting, design, construction, start-up and operational activities.

In addition, one of the two principal raw water supply sources for the City of Wichita is the Equus Beds Well Field. Protection of the Equus Beds Well Field water quality is

a major concern. With dropping water levels, there is a threat to the Equus Beds' integrity by saltwater intrusion (a naturally occurring feature from the Arkansas river and a by-product of nearby oil field activities) and this, in turn, affects both agriculture and the City of Wichita's drinking water supply. Recharging the underlying aquifer would reduce or prevent water quality degradation and provide a large volume of stored groundwater for future use during drought conditions.

PART 2 ALTERNATIVES

2.1 INTRODUCTION

The City of Wichita established two goals for the new water development project. These goals are

1) to determine water supply plans capable of supplying the year 2050 projected average and maximum daily demand of 112 and 223 MGD, respectively, and
2) to protect the Equus Beds aquifer's water quality.

Alternatives were selected for evaluation based upon engineering feasibility, economics or cost of construction and operation, and water quality impacts.

2.2 IDENTIFICATION OF ALTERNATIVES

In meeting the City's first goal, 27 water supply sources were identified and evaluated. These sources consisted of 14 conventional and 13 non-conventional alternatives, throughout the regional area in and around Wichita. Conventional alternatives included existing and proposed reservoirs, groundwater and surface water flow. Non-conventional alternatives included use of reservoir overflows, excess stream flow, treated wastewater reuse, groundwater bank storage, rain harvesting and water conservation.

Of the 27 water supply sources, only 11 were considered viable for further engineering studies. From the 11 viable water supply sources, 3 water supply plans were developed, the Milford Reservoir Plan, the Integrated Local Water Supply Plan (ILWSP) with a 250 MGD Diversion Option and the ILWSP with a 150 MGD Diversion Option. Both of the ILWSPs used a combination of water supply sources to meet the 2050 water needs.

To meet the second goal of the City, the three alternatives were evaluated as to the capability to protect the aquifer. Under the Milford Reservoir alternative, no protection to the Equus Beds aquifer would be provided and the City would continue to withdraw water from the aquifer. Both of the ILWSP options include a component to recharge the aquifer. Further engineering studies were required to determine the best method for recharge. Therefore, the City completed a 6-year recharge demonstration project (1994-1999).

Refinement of these two ILWSP alternatives resulted from information learned from the demonstration project and various engineering studies. These studies included a re-evaluation of the water demand needs for Wichita, hydrogeologic field tests, soil borings, groundwater modeling, system operation modeling, and surface water treatment investigations. Based on the modifications to the plans, they were renamed ILWSP 150 MGD Diversion and ILWSP 100 MGD Diversion.

2.3 ALTERNATIVES CONSIDERED

The basic strategy of the ILWSPs is to shift the priority of use and primary makeup of the City's raw water supply from groundwater to surface water. This will allow water to be conserved in the aquifer to satisfy both for growing water demands and water needs during extended dry weather conditions. Both ILWSPs contain the same components; however, the Equus Bed recharge component and the Local Well Field component includes several options. The ILWSPs components are:

1. **Water conservation** - rates and public education to influence water demands by all customer classes.
2. **Cheney Reservoir** -greater use of reservoir spillage and flood pool water when available.
3. **Bentley Reserve Well Field** - Redevelopment of an existing site along the Arkansas River for use in meeting short-term peak water demands.
4. **Local Well Field Expansion** to capture "above-base" flow water from the Little Arkansas River and "leakage" water from the upstream, recharged Equus Beds Well Field.
5. **Equus Beds Aquifer** –
   - Capture of "above-base" flow water from the Little Arkansas River to be used for recharge of the Equus Beds Aquifer or direct supply to water treatment facilities in the City.
   - Recovery of stored water in the Equus Beds Aquifer during extended dry weather conditions for conveyance to the city's water treatment plants.

The two ILWSP alternatives are based on an optimized priority of water use on an "as available" basis from several sources to meet demand from storage during dry periods.

The physical features of each of the alternatives are discussed below.

2.3.1 Water Conservation Component

Conservation activities associated with the two water supply plans would involve the following:

- Review and modification of the inverted water rate structure on an annual basis to help achieve and maintain conservation goals.
- Maintenance of watering restrictions (twice per week by address) during drought periods.
- Encouragement of domestic consumers to use flow-restricting faucets and showerheads, reduce toilet tank capacity, and restrict lawn watering or car washing activities.
- Continuation of public awareness and education programs.
- Continuation of leak detection surveys to reduce water distribution system losses.
- Continuation of meter repair and replacement programs to increase the accuracy of water quantity monitoring. All meters would be tested, repaired or replaced on an eight-year cycle.
- Continuation of cooperative efforts with industries to encourage conservation of cooling, process and irrigation water.
- Operation of surface water and groundwater supplies to minimize water losses or yield reductions. Groundwater supplies would be managed to reduce aquifer declines and deterioration due to over-pumping.
- Continuation of operating water treatment facilities to minimize water losses through recycling of water used to clean filters in water treatment processes.

2.3.2 Redevelopment of the Bentley Reserve Component

The Bentley Reserve Well Field is located adjacent to the Arkansas River, south of the town of Bentley and along the right-of-

way for the 66-inch Equus Beds well field pipeline. The original wells have been abandoned and the water rights have been terminated. Redevelopment of the abandoned Bentley Reserve Well Field could supply up to 10 MGD of relatively high chloride water to meet peak demands. The high chloride water would be blended with water from other sources to maintain a level less than 200 mg/l to meet short-term peak water demands during dry weather conditions.

2.3.3 Local Well Field Component

The Local Well Field (LWF) lies downstream of the Equus Beds Well Field at the confluence of the Arkansas and Little Arkansas Rivers, near the City's Central Water Treatment Plant. Currently, the LWF is used only during periods of peak demand.

The existing LWF is comprised of 17 wells constructed between 1949 and 1953, plus three redrilled wells constructed in 1997.

The expanded LWF, which incorporates the City's original E & S Well Field, is expected to supply up to 39 percent of the City's raw water needs.

Expansion of the LWF would use "above base flow" water from the Little Arkansas River. In addition, any "leakage water" from the Equus Beds aquifer would also be collected by the new system. Water from both sources would be transferred directly to the Central Water Treatment Plant. New components would include:

- Four horizontal collector wells with pump houses
- Five vertical wells with pumps and motors (underground discharge configuration)
- Collecting pipelines (with easements)

Conceptually the design capacity for the collector wells is 10 MGD during high river stage conditions (2 feet above average flow). On average, approximately 25,000 acre-feet per year would be available, assuming that water can be diverted to the 20 cfs minimum desirable streamflow (MDS) limit. Actual yield would depend on how close to the river the wells can be constructed.

Water rights for the existing wells allow an average day withdrawal rate of 5.4 MGD and a maximum day withdrawal rate of 37.1 MGD. Based on 79 years of historical flow data, approximately 27 MGD would be diverted from the Little Arkansas River about 50 percent of the time and 37 MGD would be diverted about 40 percent of the time. Although the proposed expansion does not provide a firm water supply, it has the potential to divert up to 37 MGD from the Little Arkansas when it is available, saving the stored groundwater for times of low river flow.

Piping for the upper section of the LWF is common for both options and includes connections to three horizontal collector wells. These wells pump the diverted water into a dedicated pipeline routed through the floodway, which connects to an existing 48-inch raw water line for conveyance to the Central Water Treatment Plant.

Two options exist for the Lower Section of the LWF. Option 1 conveys diverted water from the wells south to Vertical Well 5 in the Central Riverside Park area (Figure 2–1). The final section of waterline to the Central Water Treatment Plant is routed through city property and is about 4,000 linear feet longer than the final pipeline section in Option 2.

Option 2 conveys water to Vertical Well 3 near the northern boundary of Oak Park. The final section of waterline connects the lower section of the well field from Vertical Well 3 to the existing 48-inch raw waterline for conveyance to the Central Water Treatment Plant (Figure 2–2).

2.3.4 Cheney Reservoir Component

When available, greater amounts of surface water (from reservoir spillage and flood pool storage) will be used to replace groundwater usage to conserve water in the Equus Beds aquifer. As a component of the ILWSP, use of water in Cheney Reservoir would be continued up to a maximum capacity of 80 MGD. New operating modifications would allow use of waters temporarily stored in the flood pool.

Should the City's need for more water arise at a time that additional water is available in the reservoir's flood storage pool, the capability would exist to pump water to the City's Central Water Treatment Plant. When water levels in the flood storage pool drop to a predetermined low level, the use of Equus Beds aquifer (water from the existing permit or recovered recharge water) would be increased. The objective is to maximize recharge water storage in the aquifer and to maximize use of available water stored in Cheney Reservoir. Use of these waters "as-available" allows the Equus Beds to be recharged for later use during drought conditions and minimizes the need for additional water supply sources from outside the region.

2.3.5 Equus Beds Aquifer Recharge, Storage and Recovery Component (ASR)

Two alternatives were investigated for the Equus Beds Recharge, Storage, and Recovery Project. Alternative 1 includes three options for capturing, pre-treating, and recharging 150 MGD of ground and surface water with an additional option to capture, pre-treat, and transfer 60 MGD of surface water direct to the City's water treatment facilities. Alternative 2 also has three options which would capture, pre-treat, and recharge approximately 100 MGD of ground and surface water with an option to capture, pre-treat, and transfer 60 MGD of surface water directly to the City's water treatment facilities.

2.3.5.1 *Alternative 1 – 150 MGD ASR*

This component consists of three options for capturing 150 MGD of surface water from the Little Arkansas River and groundwater from bank storage adjacent to the river. This includes a surface water intake, induced infiltration wells, and facilities to transfer and recharge the captured water to the Equus Bed aquifer and to recover the stored water. A presedimentation plant is proposed to treat surface water before recharging into the aquifer or piping to the City's water treatment plants. Each of the three options is considered with and without diverting 60 MGD of treated surface water to the City treatment facilities. They are:

Figure 2-3 Piping Option 1 Local Well Field Expansion

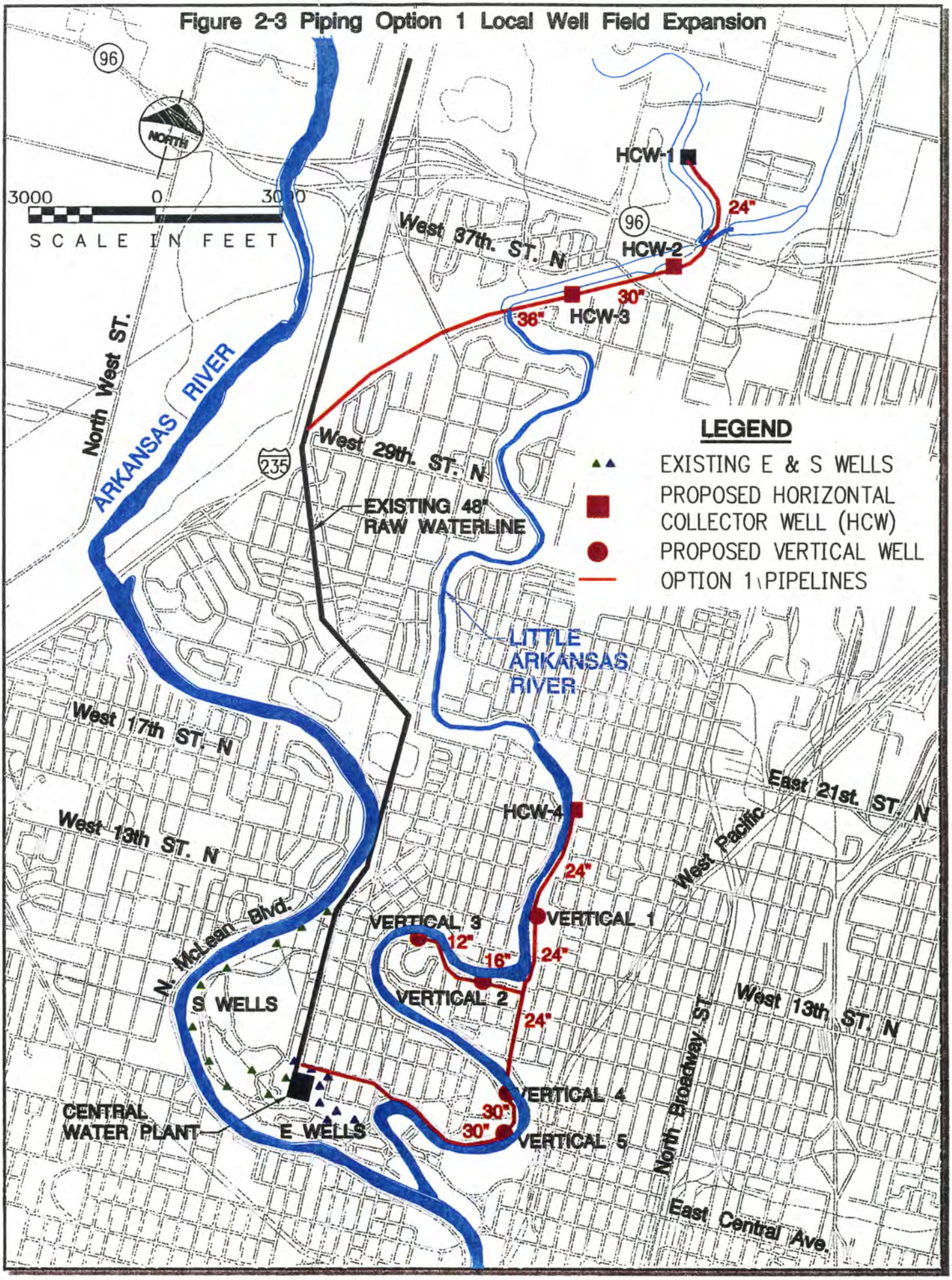
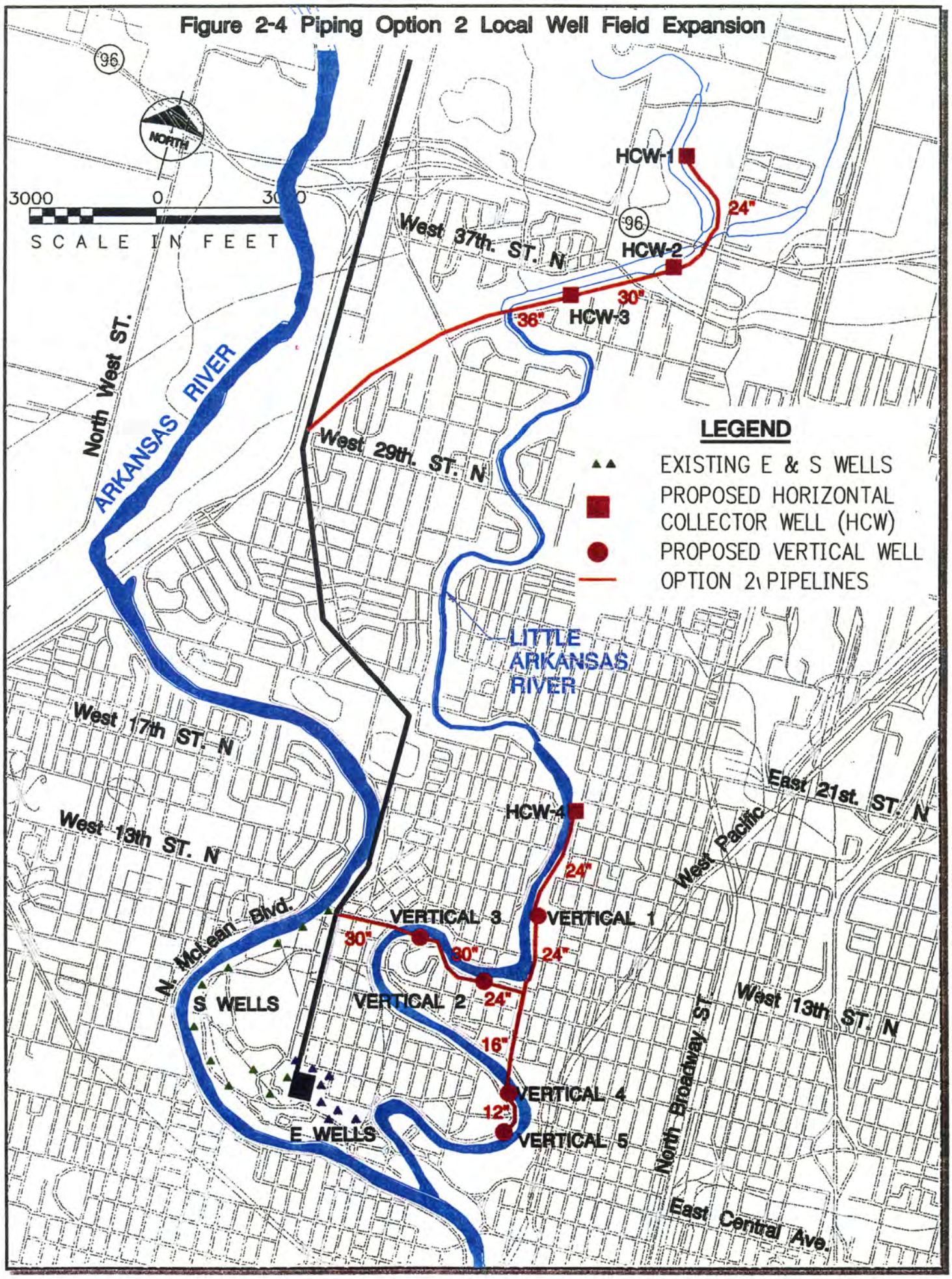


Figure 2-4 Piping Option 2 Local Well Field Expansion



- **60/90 ASR Option**: Capture of 60 MGD of induced infiltration water for recharge and 90 MGD of surface water for treatment and recharge with an additional option to capture, pre-treat and convey 60 MGD of surface water direct to the City's water treatment facilities.
- **75/75 ASR Option**: Capture of 75 MGD of induced infiltration water for recharge and 75 MGD of surface water for treatment and recharge with additional option to capture, pre-treat and convey 60 MGD of surface water direct to the City's water treatment facility.
- **100/50 ASR Option**: Capture of 100 MGD of induced infiltration water for recharge and 50 MGD of surface water for treatment and recharge with additional option to capture, pre-treat and convey 60 MGD of surface water direct to the City's water treatment facilities.

2.3.5.2 *Alternative 2 – 100 MGD ASR*

This component consists of three options for capturing 100 MGD of above base flow water from the Little Arkansas River. This includes a surface water intake, induced infiltration wells, and facilities to transfer and recharge the captured water to the aquifer and to recover the stored water. A presedimentation plant is proposed to treat surface water before recharging into the aquifer or piping to the City's water treatment plants.

Each of the three options are considered with and without capturing and diverting 60 MGD of treated surface water to the City's treatment facilities. Only 100 MGD of above base flow from the Little Arkansas River would be captured without the additional 60 MGD surface water intake. This 100 MGD of captured water would be used for recharge, storage, and recovery in the Equus Beds aquifer.

Options to Alternative 2 for a 100 MGD capture and recharge system include:

- **60/40 ASR Option**: Capture of 60 MGD of induced infiltration water for recharge and 40 MGD of surface water for treatment and recharge with additional option to capture, pre-treat and convey 60 MGD direct to the City water treatment facilities.
- **75/25 ASR Option**: Capture of 75 MGD of induced filtration water for recharge and 25 MGD of surface water for treatment and recharge with additional option to capture, pre-treat and convey 60 MGD direct to the City water treatment facilities.
- **100/0 ASR Option**: Capture of 100 MGD of induced infiltration water for recharge; no surface will be used for recharge. However, there is an additional option to capture, pre-treat and convey 60 MGD direct to the City water treatment facilities. The presedimentation plant in this plan could be located adjacent to the City's Central Water Treatment Plant.

2.3.6 No Federal Action

No federal action means that no federal permits (e.g., Section 404 Dredge and Fill, National Pollution Discharge Elimination System) would be issued, therefore, no new water supply facilities to provide additional drinking water which would require Federal approval could be constructed. If no action is taken, the existing water supply sources would be unable to meet the maximum daily needs for the expected future growth of Wichita.

Without additional capacity, the Department would be required to limit new customers to those within the Department's current service area. This action would reduce, but not stop, increases in demand for water because the Department is required by law to supply all customers within its service area. Eventually, the system would be unable to maintain pressure during maximum use periods. Currently, the Department is dependent on the Cheney Reservoir, the Local Well Field and the Equus Bed aquifer to meet average daily demand. Without any additional sources of water and recharge to the Equus Bed aquifer, contamination to the aquifer from salt water would force the Department to limit water use from the source. This contamination would ultimately reduce the City's current water supply. The impact of no-action would be a deterioration of system water pressure with possible repercussions on public health and safety.

2.4 PREFERRED ALTERNATIVE

The City of Wichita's preferred alternative is the Integrated Local Water Supply Plan with 100 MGD ASR with the75/25 ASR Option. The Integrated Local Water Supply Plan would help to preserve the Equus Beds aquifer for use by future generations. Recharging the aquifer would protect the ground water from chloride plumes migrating towards the well field and provide a large volume of stored groundwater for future use, not only by the City of Wichita, but also by local farmland irrigators.

PART 3 POTENTIALLY IMPACTED SPECIES

The FWS identified nine federally listed (threatened, endangered, or candidate) species which could be impacted by the proposed project (Table 3–1). Since contacting FWS, the peregrine falcon (*Falco peregrinus*) has been delisted (FWS 1999a) and therefore is not included in the discussion that follows. All of these species occur in other parts of the United States and could exist in the project area. The following discussion provides both general information on each species and more specific information related to each species' usage of the project area.

3.1 BALD EAGLE

The bald eagle (*Haliaeetus leucocephalus*) is a large bird of prey. It occurs throughout North America and once maintained breeding populations in Canada, Alaska, and 45 of the lower 48 states. During the late 1800's and continuing into the 1970's, the population size and breeding range of the species declined considerably. This decline prompted the species to be listed as federally endangered in 1978. Through research, conservation, management, and protection, the species population within the lower 48 states is increasing, as is its breeding range. Improvements in the species status led to it being down-listed to federally threatened in July 1995 (FWS 1995). The bald eagle is currently proposed for delisting from the federal list of endangered and threatened wildlife (FWS 1999b).

3.1.1 General Life History

The bald eagle is approximately three feet in length with a wingspan of 7 to 8 feet (Robbins et al. 1983). Adults are easily distinguished by their large size, white head and tail contrasting with a dark brown to black body. Juveniles are uniformly dark and may resemble the golden eagle (*Aquila chrysaetos*), only smaller in size.

Bald eagles may live as long as 30 years (Grier et al. 1983) with sexual maturity being obtained at 4 to 6 years of age. Mortality of juvenile birds is thought to be high and dependent on winter habitat and the severity of winter weather. After surviving one or two winters, survivorship

Table 3-1 Species of Concern

Common Name	Scientific Name	Federal Status
Bald Eagle	*Haliaeetus leucocephalus*	Threatened
Peregrine Falcon	*Falco peregrinus*	Delisted
Interior Least Tern	*Sterna antillarum athalossos*	Endangered
Piping Plover	*Charadrius melodus circumcintus*	Threatened
Arkansas Darter	**Etheostoma cragini**	Federal Candidate, State Listed Threatened
Arkansas River Shiner	*Notropis girardi*	Threatened
Topeka Shiner	*Notropis topeka*	Endangered
Eskimo Curlew	*Numenius borealis*	Endangered
Whooping Crane	*Grus americana*	Endangered

of immature eagles increases (Sherrod et al. 1977).

Once sexually mature, bald eagles may still not breed for several years. Reproductively active eagles are described as mating for life; however, this is not extensively supported (Grier et al. 1983). Bald eagles tend to use the same area for nesting in successive years and often use the same nest. Reused nests will be repaired and added to each successive year such that nests may reach considerable size, measuring several feet in diameter and depth and weighing several hundred pounds. Bald eagles generally nest in large trees with strong branches. However, where present, rock cliffs may be used.

A minimum of one square mile of essential habitat around a nest is considered necessary to successfully raise young (Grier et al. 1983). Essential habitats are geographical areas, which contain the ecological qualities necessary for survival and recovery of a species. These qualities include space for individual and population growth and normal behavior, food, water, air, light, minerals, cover and shelter, sites for breeding and raising young, and protection from disturbance.

Nesting activities begin in late winter or early spring, depending on the latitude. Nesting occurs earlier in warmer, southern portions of the range and later further north. One, two, or occasionally three eggs are laid. Fledging of chicks occurs approximately four months after eggs are laid.

The bald eagles' primary food source is fish (Grier et al. 1983). Both live and dead fish are utilized (Ehrlich et al. 1988). Because of their reliance on fish, nesting occurs in proximity to large water bodies, including lakes, rivers, and oceans.

While some bald eagles in southern latitudes remain in their nesting areas year-round, the majority of North American bald eagles migrate to coastal or more southerly climates during the winter. Migration depends partly on the severity of the winter, with eagles moving as far south as necessary to find open-water feeding areas. Wintering bald eagles are found throughout the United States but are most abundant in the midwest and west. Each year, thousands of eagles winter in Utah, Colorado, South Dakota, Nebraska, Kansas, Oklahoma, and Missouri. These states account for over 90 percent of the bald eagles recorded during midwinter surveys in the midwest and west and nearly half the eagles counted nationwide.

Suitable wintering areas require an abundant and easily available food supply and cover for protection from the cold and short periods of severe weather. During winter, eagles continue to rely on fish for food but may also feed on waterfowl, scavenge for carrion, or catch small mammals. Thus, wintering eagles may spend considerable time away from water in search of food. At night, bald eagles will select areas offering protection from the wind and severe weather. These areas are often dense stands of trees in areas where the topography affords protection from the elements. Roost sites may be communal, with large numbers of eagles using a single roost site. However, estimates are that only about 50 percent of the eagles in an area will congregate in a communal roost. Additionally, roost sites may be used for many years. Disturbance to a roost may lead to abandonment of the

site (Steenhof 1976, Hansen et al. 1981, Keister 1981).

For a variety of reasons, bald eagle populations declined significantly during the 19th and 20th centuries. In the 19th century, population declines were attributed to hunting, trapping, and loss of habitat from human development and intrusion. Population declines continued into the 20th century. During the mid 1900's, reproductive success and survivorship of adults was dramatically reduced by organochlorine insecticides (Grier et al. 1983), including DDE and DDT. Direct poisoning of birds occurred and reproductive failure increased as a result of reduced calcium metabolism resulting in egg shell thinning caused by sub-lethal levels of these chemicals. Additionally, some mortality has been reportedly caused by mercury poisoning from industrial and other wastes and by lead poisoning from ingesting lead shot when feeding on dead or crippled waterfowl (Grier et al. 1983). In some areas of the historic breeding and nesting range, disturbance caused by human development may prevent current and future eagle nesting (Murphy 1965, Retfalvi 1965, Juenemann 1973, Weekes 1974, Grubb1976, Anthony and Isaacs 1989), as well as result in abandonment of wintering areas (Stalmaster and Newman 1978, Russell 1980, Skagen 1980, Knight and Knight 1984, Smith 1988). Lastly, reduction of water quality leading to reduced aquatic productivity resulting from acid rain is under evaluation as a current threat to nesting eagle populations.

3.1.2 Kansas and the Project Area

The bald eagle has become an increasingly more common nester and winter visitor in the State of Kansas. This species has also been increasingly observed in the state, mostly between October and March. These raptors are now seen regularly throughout Kansas, with most winter concentrations occurring in the eastern half of the state in larger reservoirs and rivers. Bald eagle inventories for midwinter have averaged between 800 and 1,000 birds during the 1990's (Collins et al. 1995).

Bald eagle sightings have occurred within the project area. At Cheney Reservoir, approximately five bald eagles have been sited in recent years and these sightings have been of migratory individuals, not of nesting pairs (Ryan Stucky, personal communication).

Eight separate areas in Kansas are currently considered as critical habitat for the bald eagle. One of the eight critical areas falls within the project area; this includes all lands and waters within a corridor along the main stem of the Arkansas River from it's point of entry in Sumner County, at Sec. 1, T30S, R1E, to the Kansas-Oklahoma border in Cowley County. The bald eagle has been recorded in all counties in the project area (Collins et al. 1995).

3.2 INTERIOR LEAST TERN

The interior least tern (*Sterna antillarum athalassos*) is one of three subspecies of New World least terns. The species was first described by Lesson in 1847 (Ridgway 1895, American Ornithologists' Union (AOU) 1957, 1983). However, the first recorded observation of the interior subspecies was noted by the Lewis and Clark expedition in 1804 (Ducey 1985). Originally described as races of the Old World least tern (*Sterna albifrons*), the New World populations are now recognized as a separate species (AOU 1983). Three subspecies are recognized based on

breeding distribution: the interior least tern, the eastern or coastal least tern (*Sterna antillarum antillarum*), and the California least tern (*Sterna antillarum browni*) (AOU 1957, 1983). The interior least tern was formally listed as federally endangered on June 27, 1985 (FWS 1985).

The federally endangered status of the interior least tern applies to populations in Arkansas, Colorado, Illinois, Indiana, Iowa, Kansas, Kentucky, Mississippi River populations in Louisiana and Mississippi, Missouri, Montana, Nebraska, New Mexico, North Dakota, South Dakota, Oklahoma, Tennessee, and those populations over 80 kilometers (50 miles) from the Gulf Coast in Texas (FWS 1990). In addition, the interior subspecies is listed as state endangered in Arkansas, Illinois, Indiana, Iowa, Missouri, Nebraska, Tennessee, Texas, Kansas, Kentucky, New Mexico, Oklahoma, and South Dakota. It is also regarded as endangered in North Dakota; however, it is afforded no legislative protection.

3.2.1 General Life History

The least tern is the smallest member of the subfamily Sterninae, within the family Laridae of the order Charadriiformes. The sexes are nearly identical. Least terns are characterized by a black crown, white forehead, grayish back and dorsal wing surface, snow white underside, and legs varying from orange to yellow. Bill color varies slightly, depending on the sex, but is always black-tipped. Population size of the interior least tern is estimated at 5,000 individuals (FWS 1990).

The least tern is a migratory species, breeding along large rivers within the interior of the United States during the summer months and retreating to more southerly areas during the winter. Historically, breeding habitat included the Mississippi, Red, and Rio Grande rivers and their major tributaries. Breeding and nesting range include the area from Texas north to Montana and from eastern Colorado and New Mexico westward to southern Indiana. Currently, the least tern is still known to nest in all these areas. However, nesting areas are confined primarily to river stretches that are relatively unaltered by human activities.

Least tern wintering areas are largely undetermined but are believed to include the Gulf Coast of Texas and extend southward to Central America and parts of northern South America.

The least tern feeds primarily on small fish, which it plucks from the surface of large rivers or other water bodies. Occasionally, crustaceans, insects, mollusks, and annelids may be taken (Whitman 1988). Foraging areas are usually near nesting sites. However, terns may travel several miles to fish (Talent and Hill 1985).

Least terns return to breeding and nesting areas from late April to early June (Faanes 1983, Hardy 1957, FWS 1987, Wilson 1984, Wycoff 1960, Youngworth 1930). Courtship occurs in the vicinity of the nest site and includes aerial pursuit, ground display, ritual feeding, scraping out a nest, various posturing, calling, and copulation (Ducey 1981, Hardy 1957, Wolk 1974).

Nests are constructed on unvegetated or sparsely vegetated sand or gravel bars within wide river channels, along salt flats, or on artificial habitats such as sand pits (FWS 1990, Dryer and Dryer 1985, Haddon and Knight 1983, Kirsch 1987, 1988, 1989, Larkins 1984, Morris 1980). The nest is a shallow depression in the

substrate, scratched out by the adults. It is inconspicuous and located out in the open. Because terns are colonial nesters, several nests may be located in the same area. Nests may be from several feet to several hundred feet apart (Ducey 1988, Anderson 1983, Hardy 1957, Kirsch 1990, Smith and Renken 1990, Stiles 1939). Adult birds do not travel far from their nest colony, however they may re-nest in a totally new colony if their first nest is lost (Lingle 1988). Terns will defend their nest as well as the nests of others within the same colony (FWS 1990).

Least terns begin laying eggs around the end of May. If a nest of eggs or chicks is lost, the pair may nest a second time. The second nesting may occur as late as mid to late July (Lingle 1988). Average clutch size is approximately 2.5 eggs per nest (Lingle 1988). The eggs are generally pale to olive buff with dark purple-brown, chocolate, or blue grey speckles or streaks (Hardy 1957, Whitman 1988) which effectively camouflage the eggs while in the nest. Eggs are incubated by both parents for 17 to 31 days, but generally 20 to 25 days (Faanes 1983, Hardy 1957, Moser 1940, Schwalbach 1988, Cairns 1977). Chicks are precocial, but depend on their parents for food and care until fall migration (Massey 1972). Chicks fledge at approximately 21 days of age (Kirsch 1990). Parents and chicks will remain in the area of nesting colonies until departing for the winter. By early September, terns have usually left the colonies for the southern wintering areas (Bent 1921, Hardy 1957, Stiles 1939).

Sandbar habitats used by least terns for nesting are ephemeral; thus terns are highly susceptible to loss of nests, eggs, or chicks because of high water. Although nesting usually is initiated during high flow periods causing terns to nest on higher areas of sandbars, Lingle (1988) found flooding to be the main cause of nest loss in riverine habitats. In some areas and during abnormally high or late spring flows, artificial habitats such as gravel and sand pits may provide the only suitable nesting habitat in an area (Lingle 1988). While these areas provide suitable nesting habitat, they require adult birds to fly greater distances to forage and may subject nests and chicks to a greater likelihood of loss from predators or human disturbance (Lingle 1988, Lackey 1994).

3.2.2 Kansas and the Project Area

The least tern is an uncommon migrant in the state of Kansas and a local summer resident in the central and western parts of the state. Nesting habitat for the least tern has been lost along southwestern Kansas rivers by the lowering of river flows due to use for irrigation. Lower river flows have reduced or eliminated the scouring process that cleans vegetation from sandbars and riverbanks (Collins et al. 1995).

Breeding areas for the least tern include areas along the flats of the Quivira National Wildlife Refuge (QNWR) and sandbars along the Cimarron River. The breeding range formerly extended along other rivers in central and western Kansas. The least tern arrives at breeding sites from late April to early June and typically spends 4 to 5 months at the locale. These birds nest in small colonies, creating nests out of small scrapes in the sand. Incubation lasts about 20 days, with chicks fledging about 20 days after hatching (Collins et al. 1995).

Collins et al. (1995) describes the critical habitat designated for Kansas. Habitat falling within the project area includes all

wetlands and waters within the QNWR in Reno County. The least tern has been recorded in all counties in the project area.

3.3 PIPING PLOVER

The piping plover is one of six belted plovers found in North America. It was first considered a distinct species in 1824 and was designated *Charadrius melodus*, in reference to its mating call, in 1931 (AOU 1931). Two subspecies of piping plovers are recognized (AOU 1957) even though no consensus currently exists on their distinctness. *Charadrius melodus melodus* is found on the Atlantic Coast and *Charadrius melodus circumcintus* inhabits the Great Lakes and Great Plains regions. For purposes of this biological assessment, only the Great Plains portion of the Great Lakes/Great Plains subspecies is considered, although characteristics of the Atlantic Coast and Great Lakes piping plovers are similar. Piping plover populations have declined dramatically since the early 1900's (FWS 1994a). The causes of the decline have included over-hunting and habitat loss. Although members of the inland population continue to breed throughout the Great Plains region of Canada and the United States, breeding populations of piping plovers have all but disappeared from the Great Lakes region (Haig and Plissmer 1993). These population declines prompted FWS to list the piping plover under the ESA in January 1986. Piping plovers breeding on the Great Lakes were listed as endangered, while those breeding on the Great Plains were listed as threatened. Modeling of piping plover population dynamics, based on a variety of observed and theoretical reproductive and survivorship rates, predicted the extirpation of piping plovers within 44 years (Ryan et al. 1993).

3.3.1 General Life History

Piping plovers winter along the Gulf of Mexico. They occur on the coastal beaches and use beaches, sand flats, and sand dunes. It is unclear whether or not piping plovers return to previous breeding areas. Cairns (1977) found only 15 percent of piping plovers returned to former breeding sites. However, over 90 percent returned to previous breeding sites in Minnesota (Haig and Oring 1988). Return rates for fledglings varied from less than 5 percent in New York to over 20 percent in Minnesota (Wilcox 1959, Wiens 1986). Return rates did not appear to be based on reproductive success (Wiens 1986, Haig and Oring 1988).

Piping plovers arrive on the breeding grounds between mid-April and mid-May (Prindiville- Gaines and Ryan 1988; Haig and Oring 1985; Wiens 1986). Males and females begin courtship, which includes aerial flights, stone tossing, and construction of several nest scrapes (Cairns 1982; Haig 1992). Only one of the nest scrapes is used. It consists of a shallow depression scratched in the sand or gravel and is frequently lined with small pebbles or shells (FWS 1994a). Nests are constructed on bare sand or gravel. During the breeding season, mated pairs establish a territory during courtship and defend that territory until chicks are fledged. Both adults will participate in territory defense. Defended territories generally only include those established around a nest site. Nest sites and foraging areas may be together or separate (Whyte 1985, Cairns 1977, Haig 1992). Piping plovers may nest in small colonies or alone.

Eggs are laid beginning in May. One egg is laid per day for four days. Incubation

lasts for 25 to 31 days, with both parents sharing the incubation duties (Wilcox 1959, Cairns 1977, Prindiville 1986, Wiens 1986, Haig and Oring 1988). Eggs hatch from late May to mid-June. Chicks are precocial and able to leave the nest and begin feeding themselves within several hours (FWS 1994a). Males and females share the brooding duties, although females sometimes desert their broods shortly after hatching (Haig 1992). Broods generally remain within the parents' territory but may expand the territory as they mature or if disturbed. Chicks fledge between 21 and 35 days (Haig and Oring 1988, Wilcox 1959). Plovers generally start departing the breeding grounds in mid-July and are gone by the end of August (Wiens 1986). Yearlings generally depart later than the adults.

Piping plovers feed on a variety of invertebrates, which they capture by picking and gleaning. Foraging activity generally occurs within a few inches of either side of the water's edge. Juveniles may initially forage farther away. Food taken includes worms, insects, crustaceans, mollusks, beetles, and grasshoppers (Bent 1929, Lingle 1988).

3.3.2 Kansas and the Project Area

Collins et al. (1995) describes the piping plover as a rare migrant through Kansas. Piping plovers are most likely to be seen between April and May and July through September. The piping plover has been observed in Kansas, mostly in the central part of the state around Cheyenne Bottoms Wildlife Area (CBWA) and QNWR. This bird uses open sandy habitat and saline flats in this area. The piping plover has been greatly reduced because of the loss or modification of beach habitat due to dewatering, channelization, and damming of rivers. This has resulted in the elimination of flooding, which permits growth of vegetation and inhibits the formation of sandbar habitat, areas critical for the piping plover.

There is no record of the piping plover breeding in Kansas (Collins et al. 1995). Currently, no critical habitat has been designated in Kansas. The piping plover has been recorded in the project area in Harvey County (Collins et al. 1995).

3.4 ARKANSAS DARTER

The Arkansas darter (*Etheostoma cragini*) is a federal candidate species and is considered threatened in Kansas. Historically, the sensitive habitat requirements of the Arkansas darter left the species susceptible to population decline due to habitat loss through the damming of rivers and natural drought (Blair 1959). Currently, extensive water use appears to be the greatest cause of habitat depletion. The loss of spring-fed marshes may have caused at least local extirpations and may have forced the species to occupy lower quality habitats (Pigg 1987). Agricultural development has also contributed to the decline in Arkansas darter populations due to increasing water demands and general decline in water quality caused by crop farming and livestock production (Harris and Smith 1985, Pigg et al. 1985, Moss 1981). The construction of reservoirs, especially in headwater areas, also has contributed to the decline in Arkansas darter populations (Robison et al. 1974, Moss 1981, Skeen 1989).

3.4.1 General Life History

Collins et al. (1995) describes the Arkansas darter as having a stout body that is mottled brown. Its head is short and blunt and usually without scales. The

snout is shorter than the eye diameter. Breeding males of the Arkansas darter are orange along the entire ventral surface. The dorsal fins have a diffuse orange band, but otherwise the body is plain brown. The Arkansas darter lacks the blue or green pigment that is usually prevalent in males of other darter species. The maximum length for an Arkansas Darter is 2 ¼ inches.

The Arkansas darter is composed of two main groups. The first group, the Great Plains group, is located in the Arkansas River tributaries from southeastern Colorado through south-central Kansas and north-central Oklahoma (Eberle and Stark 1998; Gilbert 1885). This group is generally associated with habitats that are found near spring sources in high plains streams with sandy bottom substrates (Miller 1984). The second group, the Ozark Plateau group, is located in the Spring, Neosho (Grand), and Illinois river drainages of southwestern Missouri, southeastern Kansas, northeastern Oklahoma, and northwestern Arkansas (Eberle and Stark 1998; Meek 1981). This group is associated with rubble and gravel bottom habitats that contain detritus (Miller 1984).

For both of these groups, typical Arkansas darter habitat is located in smaller streams with clear, cool water (< 25°C) near springs or groundwater seeps, usually where broad-leafed aquatic vegetation is abundant (Moss 1981) or exposed willow roots are present for cover (Collins et al. 1995). This habitat is typically located in pools or near-shore areas with little flow and a sand or gravel substrate, often overlain with silt, leaves, or other organic debris. The Arkansas darter feeds by perching above the stream bottom within the aquatic vegetation. Larger adults have been found near undercut banks where terrestrial vegetation extends into flowing water (Taber et al. 1986) and other specimens have been observed in atypical habitats including main stem river reaches with high turbidity, swift current, and little or no vegetation (Matthews and McDaniel 1981).

Moss (1981) observed Arkansas darter reproductive processes in the field. Female Arkansas darters were located in dense vegetation, while the males were located on the edges of the vegetation or in open areas. Spawning occurred in open silty-bottomed areas with eggs deposited in the top 2 cm of ooze. Spawning probably does not occur within the vegetation (Moss 1981). Distler (1972) observed Arkansas darters in an aquarium spawning in gravel away from rock or vegetative cover. Arkansas darters usually spawn from March through May (Cross and Collins 1995).

The Arkansas darter feeds primarily on aquatic insects and other arthropods (Moss 1981, Taber et al. 1986). Snails, fish eggs, and plant materials have also been found to compose a portion of the Arkansas darters diet (Distler 1972, Moss 1981).

3.4.2 Kansas and the Project Area

The Arkansas darter occurs in Kansas in the Arkansas River basin and in streams along the western Ozark Border. This species is endemic to the Arkansas River system and most of the surviving populations are concentrated in small streams south of the “big bend” of the Arkansas River in south-central Kansas. These streams are small, sandy streams that are continuously fed by seepage from the high water table. The species has been able to survive by using other habitats in streams overlying the Ogallala

and Great Bend aquifers (Cross and Collins 1995).

Collins et al. (1995) describes critical habitat for the Arkansas darter in Kansas. Critical habitat falling within or near the project area includes the main stem of the North Fork of the Ninnescah River at the Stafford-Reno County line to its confluence with the South Fork of the Ninnescah River in Sedgwick County and numerous perennial spring-fed reaches of named and unnamed streams south of the Arkansas River in Kingman, Reno, and Sedgwick Counties. The Arkansas darter has been recorded in the project area in Sedgwick, Kingman, and Reno Counties.

3.5 ARKANSAS RIVER SHINER

The Arkansas River shiner (*Notropis girardi*) is currently found in the Canadian River in New Mexico, Oklahoma, and Texas and the Cimarron River in Kansas and Oklahoma. Both of these rivers are tributaries to the Arkansas River basin. A non-native introduced population of the Arkansas River shiner occurs in the Pecos River in New Mexico, but is not included in the listing. The populations in the Arkansas River basin are threatened mainly through habitat destruction and modification caused by stream dewatering or depletion due to surface water diversions or groundwater pumping, the construction of impoundments, and water quality degradation. Competition with the Red River shiner (*Notropis bairdi*), a non-indigenous species, has contributed to the reduced distribution and abundance of the Arkansas River shiner in the Cimarron River. Other concerns include incidental capture during commercial bait fishing operations, agriculture and livestock production, drought, and other natural factors (FWS 1998a).

3.5.1 General Life History

Collins et al. (1995) describes the Arkansas River shiner as very small, with a very small head and eyes. The fish is straw colored and has silvery sides with scattered brown flecks on the sides behind the head. The pectoral and dorsal fins are high and have pointed tips. The maximum length for an adult Arkansas River shiner is 3 1/4 inches.

The Arkansas River shiner historically inhabited the main channels of the Arkansas River basin, which are typified by rivers and streams that are wide, shallow, and sandy- bottomed (Gilbert 1980). The Arkansas River shiner was wide spread and abundant throughout the western portion of the Arkansas River basin in Kansas, New Mexico, Oklahoma, and Texas. Although the Arkansas River shiner does not use certain habitats, such as quiet pools, backwaters, and deepwater with mud or stone substrate, it will utilize a broad spectrum of microhabitat features (Cross 1967, Polivka and Matthews 1997). Adult Arkansas River shiners will use habitats based on water depth, sand ridge and mid-channel habitats, dissolved oxygen and current. The juvenile stage of this species is mostly associated with current, conductivity, and backwater and island habitat types (Polivka and Matthews 1997).

The Arkansas River shiner feeds by facing into the stream current and capturing organisms being washed down stream or organisms uncovered by movement of the sand substrate (Cross and Collins 1995). The specific feeding preferences and diets of the Arkansas River shiner have only recently been investigated. A study by Polivka and Matthews (1997) found that

sand/sediment and detritus dominate the diet of the Arkansas River shiner. Invertebrates were determined to have been ingested incidentally, with no particular invertebrate type dominating the diet. Polvika and Matthews concluded that the Arkansas River shiner is a generalist. Bonner et al. (1997) also concluded that the Arkansas River shiner was a generalist. They found that the diet of the Arkansas River shiner was composed of detritus, invertebrates, sand and silt. With the exception of the winter season when larval flies were consumed with a greater frequency than other invertebrates, no specific invertebrate taxa dominated the diet.

The Arkansas River shiner spawns from June to August when streams approach the floodstage level. The eggs drift near the surface of the open channel. The eggs develop quickly and the hatchlings swim to sheltered areas within three to four days after the eggs are deposited (Collins et al. 1995). Arkansas River shiner eggs are non-adhesive and drift with the swift current during the high flows. It is believed that the Arkansas River shiner will not spawn unless the conditions are favorable for the survival of the larvae (Moore 1944, Cross 1967).

3.5.2 Kansas and the Project Area

The Arkansas River shiner was listed as threatened on November 23, 1998. Since the 1960's, the Arkansas River shiner has disappeared from the Arkansas River mainstream as well as from most of its original range (Cross and Collins 1995). The species may be extirpated from Kansas (Collins et al. 1995).

The Arkansas River shiner historically inhabited the broad, sandy channels of major streams in the Arkansas River system in southwestern Kansas. This species was most commonly found on the "lee side" of sand ridges that were formed by steady shallow water flow. One of the major causes for the decline in the Arkansas River shiner has been the reduction in stream flows. In addition, competition with other fish species, most specifically non-native species, may also have contributed to the disappearance of the Arkansas River shiner from its former range (Collins et al 1995).

The Arkansas River shiner has been recorded in the project area in Sedgwick and Kingman Counties. Critical habitat in Kansas within the project area includes the main stem of the Arkansas River from its junction with U.S. Route 281 in Barton County to the Kansas-Oklahoma border in Cowley County, and the main stems of the South Fork Ninnescah River and main stem Ninnescah River from Pratt County Lake to the confluence of the Ninnescah and Arkansas Rivers in Sumner County (Collins et al. 1995). The Arkansas River shiner has been recorded in the project area in Sedgwick and Kingman Counties (Cross et al. 1995).

3.6 TOPEKA SHINER

The Topeka shiner (*Notropis topeka*) presently occurs in small tributary streams in the Kansas and Cottonwood river basins in Kansas; the Missouri, Grand, Lamine, Chariton, and Des Moines river basins in Iowa; the James, Big Sioux and Vermillion river basins in South Dakota; and the Rock and Big Sioux river basins in Minnesota. Topeka shiner populations have been threatened due to habitat destruction, degradation, modification, and fragmentation. The habitat for the Topeka shiner has been altered over time through siltation, poor water quality,

impoundments, stream channelization, and stream dewatering (FWS 1998b).

3.6.1 General Life History

Cross and Collins (1995) describe the Topeka shiner as a stout, slightly compressed fish that is nearly as wide as it is high. The dorsal fin is high and acutely pointed, and often reddish. The eye is small and nearly as long as the snout. The tail fin has a small chevron like spot at its base. The Topeka shiner has dusky streaks along its sides and red fins in the summer spawning months. The maximum length for an adult Topeka shiner is 3 inches.

The Topeka shiner typically occurs in small headwater prairie streams with good water quality and cool temperatures. These streams are usually perennial, but some streams can be intermittent during summer months. The Topeka shiner prefers stream substrates composed of clean gravel, cobble, sand and lacking any type of sedimentation (FWS 1998). This species also prefers open water habitats (pools) that maintain stable water levels due to weak springs or water percolation through riffles. The water in these pools is usually clear (Cross and Collins 1995).

The Topeka shiner spawns from late June to August and the young mature in one year. The maximum life span is two or three years (Cross and Collins 1995). There is little information available on the diet of the Topeka shiner, although Cross and Collins (1995) indicate that the diet is composed mainly of midge larvae and other benthic aquatic invertebrates.

3.6.2 Kansas and the Project Area

The Topeka shiner was once wide-spread throughout the State of Kansas. The species is now restricted to small streams in the Flint Hills (both Kansas and Neosho drainages), as well as a few streams elsewhere, such as Willow Creek in Wallace County, Cherry Creek in Cheyenne County, and single streams in Jefferson and Johnson counties. Most of the remaining populations of the Topeka shiner are in Kansas and formerly occurred in at least twelve counties in central and western Kansas, but has not been found recently. The Topeka shiner has been recorded within the project area in Sedgwick and Harvey counties (Cross and Collins 1995). No critical habitat has been designated for the Topeka shiner.

3.7 ESKIMO CURLEW

Historically, around 150 years ago, the Eskimo curlew (*Numenius borealis)* may have been the second most abundant shorebird, to the lesser golden-plover (*Pluvialis dominica*), among nearly 50 shorebirds in North America. Since the beginning of this century, the Eskimo curlew has been an endangered species. Since 1916, sightings of the species have been of 25 birds or less at a time, usually only 1 or 2 birds. The Eskimo curlew once occurred in the “millions” (Gollop et al. 1986).

Eskimo curlew observations have been reported in 25 of the years from 1945 to 1986. All of these observations have been made in North America, except for a 1963 specimen in Barbados and a sighting in Guatemala in 1977. Of these observations, usually one or two birds have been sighted and never more than six at a time, with the exception of 23 in Texas in 1981 (Gollop et al. 1986).

The Migratory Bird Treaty of 1916, between Canada and the United States,

protected Eskimo curlews throughout the year in North America. The species has also come under protection elsewhere through the Convention between the United States and Mexico Protection of Migratory Birds and Game Animals in 1936, the Convention on Natural Protection and Wildlife Preservation in the Western Hemisphere in 1940, and the Convention on the International Trade in Endangered Species of Wild Fauna and Flora in 1974 (Gollop et al. 1986). The Anderson River Migratory Bird Sanctuary, established in 1961, also protects a portion of the Eskimo curlew's breeding range. In 1980, the Eskimo curlew was listed as an endangered species in Canada (Fraser 1980). This species was designated as endangered in the United States in 1967 (50 CFR 17.11).

3.7.1 General Life History

The life history information available relies heavily on the accounts documented by hunters and, to a smaller extent, collectors. Eskimo curlew nests have only been found in the Northwest Territories in Canada and North America and might possibly have also bred in Alaska, eastern Siberia, and some of the Canadian Arctic Islands (Gollop et al. 1986). The species has been recorded outside the breeding season in Uruguay, Argentina, Chile, and on passage in Central America. The Eskimo curlew migrates south through the North American prairies to over-winter in the pampas and grasslands in Argentina. (Texas Parks and Wildlife Department 1997).

A majority of the information on breeding comes from a collector named MacFarlane during the late 1800's and early 1900's (Gollop et al. 1986). The Eskimo curlew was noted to breed in the "barren grounds" area, near the Arctic Ocean in North America, and avoided wooded tracts. In general, the curlew utilizes open tundra and tidal marsh areas. Of the curlew nests MacFarlane observed, most contained four eggs or four young. Nests were simple holes in the ground lined with decaying leaves and various grasses. It is uncertain which sex incubates the clutch. However, both sexes incubate clutches in two species closely related to Eskimo curlew, the little curlew (*Numenius minutus*) and the whimbrel (*Numenius phaeopus*) (Labutin et al. 1982 and Skeel 1978).

The incubation period of the Eskimo curlew is probably about two weeks and most likely peaks in the last week of June and the first two weeks of July. The Eskimo curlew was examined by MacFarlane on the breeding grounds near Fort Anderson between 27 May 1865 and 2 August 1865. Sightings have been made in recent years from as early as 18 May 1964 and as late as 15 August 1982.

Eskimo curlews used a variety of habitats through breeding, migration, and over-wintering. All habitats are open, and when open habitats such as mud flats and sandbars are not available, then headlands and hills within a few kilometers of the seas are preferred. Old fields, closely grazed pastures, and broad dry or marshy pampas are also utilized. Burned-over prairies and marshes have been noted as attractive habitats for migrating curlews, as well as plowed wheat and corn fields (Gollop et al. 1986).

In coastal habitats, a curlew's diet consists of snails, worms and other invertebrates. Nearby upland areas in these coastal regions contained the crowberry or curlew-berry (*Empetrum nigrum*), which also

composes a large portion of the curlew's diet. In the curlew's southern range, the diet is composed mainly of insects. Grasshoppers and crickets are important food items along the Atlantic coast of the United States. Curlews also eat beetles, moths, ants, spiders, seeds, and other berries, grubs, and freshwater insects (Gollop et al. 1986).

Curlews will often nest in the company of other shore birds, such as the lesser golden-plover. Curlews will also occasionally be found migrating in the company of lesser golden-plovers and whimbrels. Flock sizes historically varied from three to thousands of curlews, with 30 to 50 individuals being the average flock size (Gollop et al. 1986).

The main reason for the decline of the Eskimo curlew was unrestricted hunting between 1870 and 1890. Curlews were easy to hunt due to the species' abundance and tame nature and were killed by the thousands. The curlew was valued as a food and sport item and at one time the demand for curlew meat was large and wide spread as it was considered a desirable food item.

The Eskimo curlew began to decline noticeably between 1885 and 1890 and has been declining ever since. This species is now quite rare, difficult to locate, and little is known about it (Gollop et al. 1986). The Eskimo curlew did not recover after non-game bird hunting ceased in the United States with the passage of the Migratory Bird Treaty Act. The lack of recovery of the curlew population might be attributable to the conversion of native grasslands to cropland both in South American wintering areas and along migration routes through tall grass prairies in North America. Currently, no approved recovery plan is in place for the Eskimo curlew.

3.7.2 Kansas and the Project Area

The Eskimo curlew was once an abundant migrant throughout Kansas, but is now on the verge of extinction. However, recorded sightings in North and South America are numerous enough to extend the possibility of a breeding population still existing. There are five known counties from which curlew specimens have been taken: Russell, Ellis, Lyon, Woodson, and Douglas. The species may also have occurred in Dickinson and Riley counties. None of these counties are in the project area. The Eskimo curlew has historically been seen from April 13 through June 15 to September 5 and 28 (Thompson and Ely 1989). There is no record of the Eskimo curlew breeding in Kansas. No critical habitat has been designated in Kansas for this species. The last reported sighting was in1902 (Collins et al. 1995).

3.8 WHOOPING CRANE

The whooping crane (*Grus americana*) is perhaps the best known endangered species in North America. It is also a symbol of international efforts to protect and restore endangered wildlife. The annual travels of this endangered species are well documented.

In the mid-1800's, the principal breeding range extended from central Illinois northwestward through northern Iowa, western Minnesota, northeastern North Dakota, southern Manitoba and Saskatchewan, into central Alberta. A non-migratory breeding population occurred along the coast of Louisiana until the mid-1940's. The whooping crane disappeared from the heart of its breeding range in the north-central United States by the 1890's. Historically, the whooping crane wintered

along the coast of the Gulf of Mexico from Florida to central Mexico. There were two important migration routes, one between Louisiana and Manitoba and the other from Texas and the Rio Grande delta region to the Canadian provinces (Allen 1952, FWS 1994b).

Although widely distributed, the whooping crane was never common. According to one estimate, the total population in the mid 1800's may have been 1,300 to 1,400 (Allen 1952).

The species declined dramatically as human settlement and development spread westward. By 1942, only 16 birds remained in the migratory population. The remnant Louisiana non-migratory population was reduced from 13 to six birds following a hurricane in 1940 and the last individual was taken into captivity in 1950 (FWS 1994b).

As a result of an enormous conservation effort since 1940, the whooping crane population has slowly increased. Although numbers have fluctuated from year to year, by March 1990 the Aransas/Wood Buffalo population had climbed to 146. In March 1993, this population numbered 136. In 1993, 45 pairs nested, an all-time high. In 1985, an experimental flock of 33 migrated from Idaho to New Mexico. Only eight individuals remained in this flock in 1993 and there has been no reproduction. In late 1993, a third wild flock in Florida consisted of 10 captive-reared birds remaining from experimental releases. In May 1993, 112 whooping cranes were held in captivity (FWS 1994b).

The current breeding distribution of wild whooping cranes is restricted to a small area in the northern part of Wood Buffalo National Park near Fort Smith, Northwest Territories. The population is migratory and winters in and around the Aransas National Wildlife Refuge (NWR) on the coast of the Gulf of Mexico in Texas.

3.8.1 General Life History

The whooping crane is the tallest North American bird. The males approach five feet when standing erect and average 16 pounds. Females average 14 pounds. The whooping crane is snowy white with black wingtips (visible only when the wings are extended) and has a wingspan that may reach eight feet. The neck is long, the bill is long, dark and pointed, and the legs are long, thin and black. There is a patch of reddish-black bristly feathers on the top and back of the head. Black feathers on the side of the head below the yellow eye look like a long, dark moustache. The whooping crane is the only large white bird with black wingtips that flies with its neck straight out in front, the legs trailing far behind. It also is the only one that walks or stands on long thin legs and does not swim.

Plumage of the juvenile whooping crane is a rusty or cinnamon brown color. At about four months of age, white feathers begin to appear on the neck and back. Young in their first fall migration usually have a brown head and neck and a mixture of brown and white on the body. The plumage is predominantly white by the following spring (FWS 1994b).

3.8.2 Habits

Birds arrive on the wintering grounds located on Aransas NWR or in its vicinity between late October and mid-November. Occasionally, stragglers may not arrive until late December. Non-breeders and unsuccessful breeders usually initiate and complete the fall migration sooner than family groups (FWS 1994b).

As spring approaches, dancing, calling and flying increase in frequency, indicative of pre-migratory restlessness (Allen 1952, Blankinship 1976). Family groups and pairs are usually among the first to depart the wintering grounds. First departure dates usually are between March 25 and April 15, with the last birds usually leaving by May 1 (FWS 1994b).

Occasionally, one to four birds have remained at the Aransas NWR throughout the summer. Some of those birds were ill or crippled or mates of crippled birds. Parents and the young of the previous year separate upon departure from Aransas NWR while enroute to the breeding grounds or soon after arrival on the breeding grounds (FWS 1994b).

The 2,400-mile migration route generally cuts across northeastern Alberta and southwestern Saskatchewan, through northeastern Montana, the western half of North Dakota, central South Dakota, Nebraska and Oklahoma and east-central Texas (FWS 1994b).

The primary migration route through Nebraska is a narrow swath approximately 140 miles wide. Migration may take two to six weeks. Whooping cranes migrate in the daytime and make regular stops for the night to feed and rest. Some stopovers last only one night, others up to four weeks. Whooping cranes migrate as individuals, pairs, family groups or small flocks of up to 11 birds (FWS 1994b).

Whooping cranes may live up to 24 years in the wild. Captive birds can live 35 to 40 years. A 29-year-old captive male was still reproductively active in 1993 (FWS 1994b).

3.8.3 Reproduction

Whooping cranes mate for life but will accept a new mate if one of the pair dies (Blankinship 1976, Stehn 1992). Birds reach sexual maturity in three to five years. Courtship displays, involving dancing, begin in early spring on the wintering grounds. On the nesting ground, adults carry out an elaborate courtship display, bobbing, weaving, jumping and calling with their mates (FWS 1994b).

Breeding pairs show considerable fidelity to their breeding territories, returning to the same nesting area each year. Individual nests are often used for three or four years. Whooping cranes may re-nest if their first clutch is destroyed or lost before mid-incubation (Erickson and Derrickson 1981, Derrickson and Carpenter 1981, Kuyt 1981). Although they usually nest annually, breeding pairs will occasionally skip a nesting season, particularly when nesting habitat conditions are unsuitable (FWS 1994b).

Nests are large mounds of dried bulrushes about four feet wide with the flat-topped central mound up to five inches above the water. Usually two eggs are laid, occasionally one or three. Eggs are light brown or olive-buff overlaid with dark, purplish-brown blotches. Each egg is about four inches long, about two-and-a-half inches wide and weighs about seven ounces (Bent 1926, Allen 1952, Stephenson and Smart 1972, and FWS 1994b).

Both adults are involved in incubating the eggs for 29 to 31 days. The eggs hatch in late April to mid May. The eggs in each nest hatch at different times, and the second egg or chick often is pushed out of the nest or starves to death. Young birds are able to fly 80 to 90 days after hatching.

3.8.4 Habitat

The current nesting area in Wood Buffalo National Park lies near the headwaters of the Little Buffalo, Klewi, Sass and Nyarling rivers. The area is interspersed with potholes and is poorly drained. Wetlands vary considerably in size, shape and depth, and most have soft marl bottoms (FWS 1994b).

Approximately 22,500 acres of salt flats and marshes on Aransas NWR and adjacent areas comprise the principal wintering grounds. Interior portions of the refuge that are periodically used by foraging whooping cranes are gently rolling and sandy grasslands with swells and ponds (FWS 1994b).

Although a variety of habitats are used during migration, a wetland is always used for night roosting and frequently for foraging. While migrating, whooping cranes roost standing in the shallow water of marshes, flooded crop fields, artificial ponds, reservoirs and rivers. Wetlands surrounded by tall trees or other visual obstructions, or marked with dense vegetation are not used. The birds select sites with wide, open panoramas. Sites must also be isolated from human disturbances. The preference for isolation and the birds' rarity result in relatively few confirmed sightings during migration each year.

Although the whooping crane is considered an omnivorous feeder, it subsists primarily on an aquatic animal diet (Walkinshaw 1973). In summer they eat snails, minnows, frogs, larval insects and leeches. If given the opportunity, they may also take small rodents such as voles, lemmings or shrews. During migration, cranes eat aquatic animals, plant tubers, roots and waste grain in crop fields. Wintering whooping cranes eat crabs, clams, crayfish and small fish in the tidal marshes and sandflats and acorns and wild fruits in the uplands (FWS 1994b).

3.8.5 Limiting Factors

Reasons for the initial decline in the whooping crane population include habitat loss from draining and clearing wetlands and human disturbance in breeding areas and along the migration routes. Conversion of wetlands and prairie to hay and grain production made much of the original habitat unsuitable for whooping cranes. Mere human presence interfered with the continued use of prairies and wetlands by breeding and migrating whooping cranes. Birds were once shot for their feathers and as meat for the table (FWS 1994b).

Most deaths, other than those of chicks, occur during migration and in the summer. Deaths from April through November are three times greater than deaths on the wintering grounds. Whooping cranes are exposed to a variety of hazards such as collision with obstructions, predators, disease and illegal shooting. Snow and hail storms, low temperatures and drought can present navigational handicaps or reduce food availability. Collision with powerlines is the primary known cause of death for whooping cranes, accounting for the death or serious injury of at least 19 whooping cranes since 1956. The frequent stopovers necessary during migration become increasingly perilous as more land is developed for agriculture, industry or habitation, and fewer suitable resting sites remain (FWS 1994b).

The only self-sustaining wild population of whooping cranes is vulnerable to destruction through a chemical contaminant spill on the wintering grounds. Barge traffic on the Gulf International

Waterway, primarily transporting petrochemical products, is among the heaviest on any waterway in the world. Hurricanes could place the birds at risk from high winds. Drought decreases the availability and abundance of the natural food supply (FWS 1994b).

Several natural factors limit whooping cranes numbers. Although they have a long life span, sexual maturity is delayed for at least three years. A pair produces only two eggs and raises but one chick. The low number of breeding pairs further limits the number of young that can be produced. Since the current northern breeding ground has an ice-free season of only four months, there is rarely time for a second clutch of eggs if the first clutch fails. Under those conditions, even a healthy population will grow very slowly (FWS 1994b).

3.8.6 Management and Outlook

The whooping crane is protected internationally in Canada, the United States and Mexico under the Migratory Bird Treaty Act. The species is classified and protected as endangered in Canada and the United States (FWS 1994b).

Wintering habitat in the Aransas NWR and the last breeding area in the Wood Buffalo National Park are managed to protect the whooping crane. Canada and the United States work closely on all management actions affecting the winter or summer habitat of the whooping crane.

Since 1954, when the whooping crane breeding area was first located, there have been annual surveys to determine the number and location of breeding pairs and nonbreeding birds. Surveys of wintering birds also are conducted annually in and around Aransas NWR. Surveys on the wintering grounds monitor the birds' arrival at the refuge in fall and departure in spring. The number of birds in the population also is determined. Public sightings along the migration route provide state and federal wildlife agencies the opportunity to locate and protect habitat and to limit human disturbance that might be harmful (FWS 1994b).

In 1967, efforts were initiated to develop a captive flock of whooping cranes. A captive flock saves the species from extinction should it be extirpated from the wild and can be used to bolster the wild population through captive propagation and release of captive-produced stock. There are now two breeding populations of whooping cranes in captivity, one at the Patuxent Wildlife Research Center in Maryland and one at the International Crane Foundation in Wisconsin. Construction of a third facility is underway at the Calgary Zoo in Alberta (FWS 1994b).

Since the whooping cranes use only one breeding area and one wintering area, there is a high potential for the loss of this species in the wild. The goal of the U.S. Whooping Crane Recovery Plan is to establish two wild populations of at least 25 breeding pairs in addition to the existing population so that the species can be down-listed from endangered to threatened status (FWS 1994b).

Efforts to establish an additional wild population began in 1975 when whooping crane eggs from Wood Buffalo National Park were placed in the nests of sandhill cranes at Grays Lake National Wildlife Refuge in Idaho. After hatching, the chicks were adopted and raised by the foster parents. The young whooping cranes then migrated with their adoptive parents and

wintered in New Mexico. Initial results were promising, but the whooping cranes failed to form pair bonds, and breeding never occurred (FWS 1994b).

The next attempt to establish an additional population was made in January 1993, when the first group of 14 whooping cranes hatched in captivity was released in Kissimmee Prairie, Florida. The objective is to establish a non-migratory, self-sustaining population there. Studies also are underway to determine the feasibility of establishing other migratory populations in Wisconsin and Canada (FWS 1994b).

The outlook for the survival of the whooping crane is considerably brighter than it was in 1950. The population has slowly increased, but complete protection and intensive management will have to continue if desirable population levels of whooping cranes are to be attained and maintained. Preventing further human encroachment that would threaten nesting and wintering habitat is vital. Protection of suitable migratory stop-over habitat and reducing mortality, particularly along the migration route, are critical. Positive public support remains an essential ingredient in the efforts to restore the whooping crane.

3.8.7 Kansas and the Project Area

The whooping crane is a rare spring and fall migrant through the state of Kansas. The species usually spends one night in the state and then moves on. Central Kansas appears to be the principle flyway, with the CBWA and QNWR as primary stopover locations. Critical habitat for the whooping crane in the project area includes all portions of QNWR falling within Reno County (Collins et al. 1995). The species has been recorded from February 10 through April 28 in the spring and from October 5 to November 16 in the fall. In Kansas, the whooping crane mainly utilizes marsh habitat, and has occasionally been sighted near farm ponds (Thompson and Ely 1989). The whooping crane has been recorded within the project area in Kingman and Reno Counties.

PART 4 POTENTIAL IMPACTS OF THE PREFERRED ALTERNATIVE

The preferred alternative for the proposed water supply project is the 100 MGD Diversion Option and could impact the existing environment in the project area in several ways. The use of additional water from Cheney Reservoir may affect the amount of total discharge to the North Fork of the Ninnescah River and could result in the alteration of stream flow during high flow periods. The use of surface water from the Little Arkansas River may reduce flow in that river during specific periods. However, recharging the Equus Beds aquifer would benefit groundwater resources and spring-fed streams, and would ultimately increase base flow in the Little Arkansas River. Construction of the well field, pipelines, and water treatment plant could temporarily disturb wildlife in the immediate area and permanently change some land use.

From 1996-1998, Burns & McDonnell conducted an In-Stream Flow Incremental Methodology (IFIM) study on the North Fork of the Ninnescah and Little Arkansas rivers to assess the potential beneficial and adverse impacts of Wichita's ILWSP. The IFIM incorporates data on stream velocity and water depth, water surface elevation, and physical habitat to determine discharge and useable habitat for fish species. Discussions in this Part describe the likely extent to which the federally threatened, endangered, or candidate species presented in Part 3 of this Biological Assessment and might be impacted by construction and operation of the proposed project. Results of the IFIM are addressed where applicable to the species.

4.1 BALD EAGLE

The use of pesticides and DDT are the major causes for bald eagle population declines. Bald eagle populations have also suffered from habitat loss, shooting, lead poisoning, and human disturbance.

Eagles require relatively undisturbed areas around lakes, rivers, and reservoirs to feed and nest. Trees such as cottonwoods or sycamores that are at least 50 feet tall and sturdy enough to support a nest must be available near water. These trees provide a wide field of view for adults and shelter for their chicks. Nests may be very large, ranging up to eight feet in diameter and weighing several hundred pounds. Bald eagles are generally intolerant of human disturbance. Such disturbance has been attributed as the cause of nesting failure and reduced usage of wintering areas (Grier et al. 1983).

Eagles feed on fish in the open water areas created by dam tailwaters, warm water effluents from power plants and other discharges, in power plant cooling ponds, and along rivers and lakes. At night they roost in groups of trees near feeding areas that are protected from harsh weather.

The bald eagle has become an increasingly more common nester and is more commonly seen in Kansas, primarily from October to March (Collins et al. 1995). Bald eagles likely occur in the project area, especially along the Arkansas River and at Cheney Reservoir. However, no nesting pairs have been documented recently in these areas. Because nests are conspicuous, it is not likely there are any nesting eagles that may be impacted. If a nest is located during construction, the

FWS will be immediately contacted for avoidance instructions.

A loss of open water may concentrate migratory waterfowl and increase the potential for avian cholera outbreaks. Expected reservoir levels will not be altered significantly to concentrate waterfowl and increase the incidence of avian cholera. Surface withdrawals will alter, to some degree, the characteristics of tailwater flow in the North Fork, potentially altering the supply of fish available for eagles in the area. The relation between the number of eagles that may use the reservoir and associated rivers for feeding and the concentration of fish and waterfowl is not a limiting factor. If fish and waterfowl populations were slightly reduced as a result of this project, the reduction would not significantly impact eagle survivability. However, results of the IFIM showed that implementation of the ILWSP is not expected to impact peak discharges in any significant way. Therefore, there will be no effect on the available habitat that has historically been available for all the life stages of fish species since Cheney Reservoir was constructed (Burns & McDonnell 2001), and the fish available as a prey base for bald eagles should not be impacted.

Installation of infiltration wells, recharge wells, recovery wells, surface water intake structures, recharge basins, and pipelines to connect all components will occur primarily in agricultural areas outside the riparian communities associated with the rivers. Consequently, no direct impacts to potential roosting sites or nests are expected. No surveys of construction sites have been completed to document the absence of eagles or potential nesting trees in the area.

If eagles are present in the area during construction, there may be some indirect, short-term disturbances resulting from construction noise and human activity. Critical habitat along the Arkansas River is approximately 4 miles from the project area; as a result, no critical habitat will be directly impacted during construction.

4.2 INTERIOR LEAST TERN

The loss of natural nesting habitat due to river channelization, irrigation, and construction of reservoirs and pools has caused declines in populations of the interior least tern and many other shorebirds. The unpredictability of flows released from dams further impacts wetland dependent species. High flow periods may extend into the nesting season and inundate potential shorebird nesting areas, forcing birds to utilize poor quality areas for nesting. Feeding areas may also be dewatered and nests flooded from dam discharges. The storage of flows in reservoirs also allows encroachment of vegetation into areas naturally scoured by river flows and reduces channel width. Sediment loads retained in reservoirs cause further degradation of the riverbed and reduce available shoreline habitat. In addition, the least tern is sensitive to human disturbance. These birds will not nest in areas with frequent human activity; increasing recreational use of our nation’s rivers and lakes reduces available nesting areas for the interior least tern (FWS 1990).

Interior least terns are generally transients or summer visitants to Kansas and can be found on barren flats and sandbars near

large rivers. The QNWR, located 34 miles northwest of Cheney Reservoir and 57 miles northwest of the Little Arkansas River near Sedgwick, has been designated critical habitat for nesting least terns (Collins et al. 1995). Both the North Fork of the Ninnescah River and the Little Arkansas River are typical sandy bottom streams found in Kansas, and sandbar habitat can be found scattered along the length of both waterways.

Because of the proximity of QNWR, there is a possibility that least terns may occasionally use portions of either river during the summer for short periods of time. However, neither river is likely large enough or has sufficient sandbar habitat to support nesting least tern colonies. No survey for least terns has been completed on either river to document the presence or absence of terns.

Drawdown of flows in the Little Arkansas River and reduced flows through the North Fork of the Ninnescah could reduce the scouring process that cleans vegetation from sandbars and riverbanks, thereby reducing available nesting habitat. However, IFIM studies indicated that discharges of only 100 cfs or less may be necessary to inundate sandbars along the North Fork (Burns & McDonnell 2001). Peak discharges were estimated by the IFIM to exceed 100 cfs about 73 percent of the time. These conditions are expected to remain unchanged or slightly improve with implementation of the ILWSP. If water is available to recharge the Equus Beds Aquifer, wetland areas overlying the aquifer could increase in coverage with time and create additional habitat for a variety of species over the long term. Drawdown may also expose additional habitat found along these sandy-bottomed rivers.

Any terns possibly present in the area along the Little Arkansas River will likely be displaced during construction of intake structures and wells by human activity and construction noise. These impacts, most of which will occur outside the riparian area of the river, will be short-term and temporary.

4.3 PIPING PLOVER

Threats to the piping plover are similar to those facing the interior least tern. In addition to habitat loss, piping plovers are also subject to high predation rates and nest abandonment (FWS 1988).

Like the interior least tern, piping plovers inhabit sand beaches and sandbars of inland rivers and lakes. These birds are most likely to be found at QNWR and CBWA located 34 to 57 miles northwest of the project area, though they may also be found along rivers during spring and fall migrations. No critical habitat has been designated in Kansas, and there is no record of piping plovers breeding in Kansas, making impacts of the ILWSP project on breeding plovers unlikely (Collins et al. 1995).

The proximity of the project area to QNWR and CBWA and the presence of some sandbar habitat along both rivers suggest a possibility of transient piping plovers occurring near the project area during their spring or fall migrations. Because of the similarity in habitats for the piping plover and least tern, the impacts to both species are expected to be similar. Flow and discharge reductions are not expected to significantly affect sandbar habitat occurring along the banks of the Little

Arkansas and North Fork rivers where piping plovers could be found; flows sufficient to inundate and scour the sandbars will continue to occur nearly annually. Drawdowns could also slightly increase the surface area of available sandbar habitat.

Migrating plovers, if present, could be temporarily displaced by construction noise and human activity near potential feeding areas during the installation of intake structures, wells, access roads, and pipeline. Because of the transitory nature of these stopovers, impacts to the piping plover would be minimal.

4.4 ARKANSAS DARTER

Due to intensive agricultural demands for the available water supply, natural droughts, construction of reservoirs and the resulting flow regulations, and a specialized habitat, the Arkansas darter is being considered by FWS for protection under ESA (FWS 2000). As a candidate species, it is currently afforded no legal protection under the ESA, but its designation indicates it will likely be listed in the near future. Because this is a long-term project, the Arkansas darter may be legally listed before this project is completed, so potential impacts are being considered pro-actively to avoid future complications.

The primary threat to the Arkansas darter is the loss of habitat through groundwater mining for crop irrigation. As water tables drop, the spring-fed habitats essential for this species' survival disappear. River damming, construction of reservoirs, and natural drought have also contributed to this species' decline.

The North Fork of the Ninnescah River has been designated by KDWP as critical habitat for this species (Collins et al. 1995). An Arkansas darter was collected during an aquatic survey completed to obtain baseline environmental data for this river in 1997 (Burns & McDonnell 1998). This fish is endemic to the Arkansas River system where it is concentrated in small sandy streams continuously fed by seepage from high water tables. It has also survived by occupying lower quality habitats.

One goal of this project is to recharge the Equus Beds Well Field with above-base flow surface water, which would help protect available habitat for this species by increasing the water table and potentially improving base flows in overlying streams and increasing the extent of wetlands. The removal of surface water from the Little Arkansas River and Cheney Reservoir should have little impact on downstream resources. The IFIM indicated the proposed withdrawals would not reduce flows beyond the critical threshold necessary to maintain fish species (Burns & McDonnell 2001, Burns & McDonnell 2000). Even at maximum depletion of 250 cfs on the Little Arkansas River, optimum discharges and resulting maximum available habitat will still be easily reached (Burns & McDonnell 2000). Therefore, the reduction in available discharge will not affect available habitat that has historically been present for all life stages of the fish species studied in the Little Arkansas and North Fork of the Ninnescah rivers. Based on the outcome of IFIM modeling for the indicator fish species, it is believed that the reduction of discharge during peak flow periods will also not greatly impact the other fish species for all life stages found in the Little Arkansas or the North Fork of the Ninnescah rivers.

The Arkansas darter and the other fish found within the North Fork waterway have adapted to the irregularity of flows released from Cheney Reservoir. Changes in flows resulting from this project would be insignificant compared to historic alterations following dam construction. Flows into the North Fork have been regulated since 1964.

4.5 ARKANSAS RIVER SHINER

The Arkansas River shiner is threatened primarily due to inundation and modification of stream discharge by impoundments, channel desiccation by water diversion and groundwater pumping, stream channelization, degradation in water quality, and the introduction of the non-native Red River shiner (*Notropis bairdi*). Although the Arkansas River shiner evolved in rapidly fluctuating, harsh environments, channelization of the Arkansas River has permanently altered and eliminated suitable habitat for this species. Inundation following impoundments in the Arkansas River system eliminate spawning habitat, isolate populations, and favor increased abundance of predators (FWS 1998a).

This species, which may be extirpated from Kansas, was most commonly found on the lee side of sand ridges formed by steady shallow water flow. A reduction in stream flows has severely impacted this habitat. While the proposed project calls for removing additional water for consumptive use, the amount of water to be used is not likely sufficient to significantly impact the already-altered downstream habitats. If this water were not withdrawn, there is the potential that the additional flow during wet years could increase stream flows and improve stream quality for the Arkansas River shiner and other fish. However, the recharging of the Equus Beds Well Field could offset this potential over time since base flow in the river is projected to increase with time.

4.6 TOPEKA SHINER

The Topeka shiner has suffered from habitat destruction, degradation, modification and fragmentation resulting from siltation, eutrophication, tributary impoundments, and stream channelization and dewatering. Removal of the protective vegetation within a stream's watershed from agricultural and urban development results in accelerated stream sedimentation from soil runoff. The Topeka shiner is an indicator of water quality because it is dependent upon high quality aquatic habitats. It is also threatened from introduced predaceous fishes (FWS 1998b).

The Topeka shiner typically occurs in small headwater prairie streams that are usually perennial, but may also be intermittent during the summer. In these cases, groundwater seepage must maintain water levels for the fish to survive. It prefers stream substrates, such as sand and clean gravel, like those found within the Little Arkansas and North Fork of the Ninnescah rivers. The species is primarily restricted to small streams in the Flint Hills region of Kansas (Collins et al. 1995). It is possible that no Topeka shiners occur in the Little Arkansas or North Fork of the Ninnescah rivers and thus would not be impacted by the proposed project.

If present, this species, like the Arkansas River shiner and Arkansas darter, could be impacted by an alteration in flows released from Cheney Reservoir and withdrawals from the Little Arkansas River. Again, the magnitude of this change is not significant enough to seriously affect populations of the Topeka shiner as indicated by the IFIM

(Burns & McDonnell 2001, Burns & McDonnell 2000). Some riparian vegetation along the banks of the Little Arkansas may be removed to make way for installation of project facilities or impacted by removal of alluvial bank storage water. This could result in a slight increase in siltation of the river.

Recharging the Equus Beds aquifer would certainly benefit this species by providing additional groundwater to increase the base flow and maintain the intermittent streams and Little Arkansas River in the area upon which this species depends.

4.7 ESKIMO CURLEW

The primary cause for the Eskimo curlew's decline is loss of significant grassland habitat. It is very rare throughout North America, including Kansas. The last reported sighting in Kansas was in 1902. There is also no record of the curlew breeding in Kansas, nor is there any designated critical habitat that could be affected by the project (Collins et al. 1995).

Given the extremely rare status of this bird, it is highly unlikely that any Eskimo curlews will be impacted by this project, either directly or indirectly. There is also little grassland habitat available in the project area, and most construction of wells and basins will occur in agricultural fields that are not preferred curlew habitat.

4.8 WHOOPING CRANE

Whooping cranes are endangered primarily due to hunting, specimen collection, human disturbance, conversion of their nesting habitat such as potholes and prairies to agriculture, contaminant spills along their wintering range in Texas, collisions with power transmission lines, and severe weather during migrations that may impede navigation and food availability. In addition, whooping cranes have a delayed sexual maturity and a small clutch size that prevent a rapid population recovery (FWS 1994b, Campbell 1995).

These birds may be found in Kansas during their spring and fall migration between their breeding grounds in Canada and their wintering habitat in Texas (Collins et al. 1995). Whooping cranes may be found in a variety of habitats during their migration. They typically roost in riverine habitat, on isolated submerged sandbars, and in large palustrine wetlands, such as those found in the QNWR and the CBWA. They also may be found feeding on waste grains from harvested cropland.

Because of the proximity of the project area to the QNWR and CBWA, it is possible whooping cranes may occasionally be found near the North Fork of the Ninnescah River or the Little Arkansas River during their migrations. Cropland is plentiful in the area as a potential food source. However, both rivers contain only marginal habitat for this species and there are few other wetlands in the project area; the likelihood of occurrence is remote.

Because the cranes are only occasional visitors during their migrations further reduces the likelihood of their presence during construction. If whooping cranes do occur in the construction area and construction is timed to coincide with their migration, the only probable disturbance would be a displacement from the construction area to a less disturbed area in the vicinity, such as the QNWR or CBWA. This displacement would be temporary and would likely be to equal or superior quality habitat.

PART 5 CONCLUSIONS

Nine species were identified by FWS as endangered, threatened, or candidate for listing that may potentially occur in the project area. One of these species, the peregrine falcon, has been delisted due to its recovery. The Arkansas River shiner may be extirpated from Kansas and likely no longer occurs in the project area. Also, the Topeka shiner may no longer occur in the project area. The Eskimo curlew is extremely rare, last sighted in Kansas in 1902, and has a high probability of no longer occurring in the project area. Therefore, impacts to these species are not expected due to implementation of the ILWSP. The primary source of disturbance to any of the species present in the project area will be temporary displacement due to construction activities (Table 5-1). No long-term adverse impacts to any of the species discussed are anticipated. The results of the IFIM show that implementation of the ILWSP will not affect available fish habitat and will not change the frequency of flows needed to scour and maintain sandbar habitat, which is important to the least tern and the piping plover. Recharging of the Equus Beds aquifer will improve groundwater resources, benefit spring-fed and intermittent streams, and wetlands, and increase base flow in the Little Arkansas River. This has the potential for long-term benefits to the habitats occupied by the fish species discussed in this Biological Assessment. As fish habitat and the scouring process will not be affected by the proposed project, there should be no adverse impacts to sensitive fish species due to the implementation of the 100 MGD Diversion Alternative of the ILWSP.

Table 5-1 Summary of Impacts to Threatened or Endangered Species

Common Name	Impacts	Potential to Adversely Affect
Bald Eagle	Possible temporary displacement due to construction activities	May (Temporary)
Interior Least Tern	Possible temporary displacement due to construction activities	May (Temporary)
Piping Plover	Possible temporary displacement due to construction activities	May (Temporary)
Arkansas Darter	None expected	Not likely
Arkansas River Shiner	None, not present	Not likely
Topeka Shiner	Not anticipated	Not likely
Eskimo Curlew	None, not present	Not likely
Whooping Crane	Possible temporary displacement due to construction activities	May (Temporary)

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