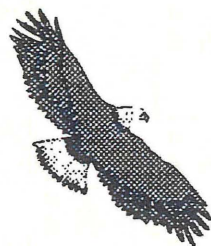


# SUMMARY

## Final Draft Water Needs Assessment



Kickapoo Tribe in Kansas



Prairie Band Potawatomi Nation



Sac and Fox Nation of Missouri

U.S. Department of the Interior  
Bureau of Reclamation

Technical Service Center  
Denver, Colorado

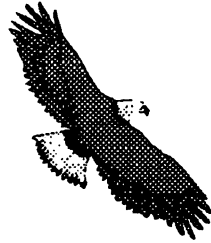


October 2002



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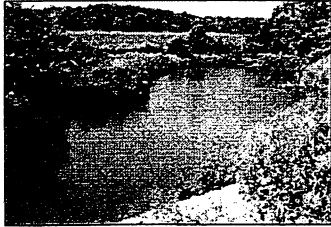
U.S. Department of the Interior  
Bureau of Reclamation

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Technical Service Center  
Denver, Colorado

October 2002





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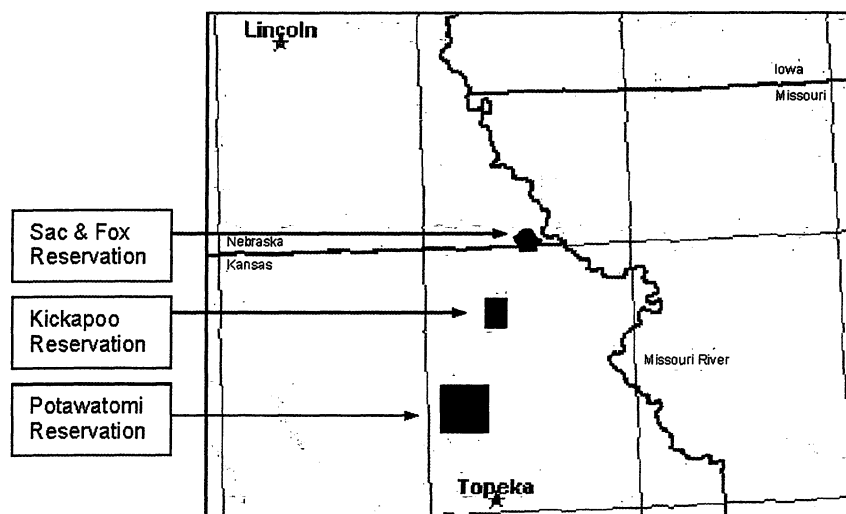


# Summary of the Final Draft Water Needs Assessment

*The Bureau of Reclamation (Reclamation) was asked to undertake a water needs assessment for the Kickapoo Tribe in Kansas, Prairie Band Potawatomi Nation, and Sac and Fox Nation of Missouri (Tribe/Nations) because of. . .*

## ● *“The Great American Desert”*

as one Tribe forced to migrate west termed the area in which the reservation lands were located. Water was scarce to sustain the Tribal populations and their development.



*The area in question.*

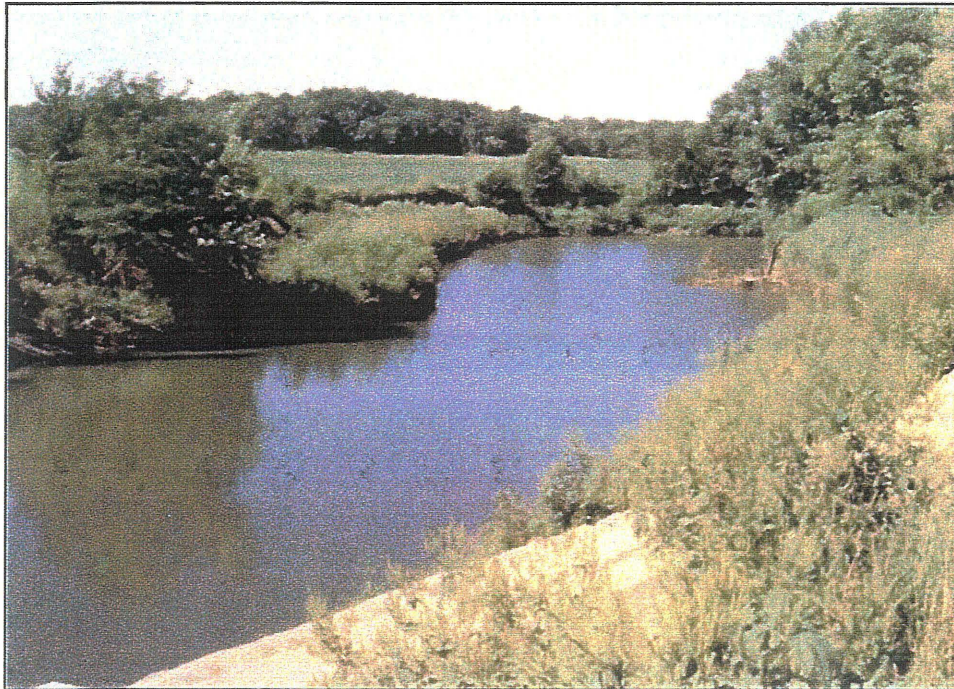
## ● *Water is still scarce*

on the reservations

- ❑ The Kickapoo Reservation, established in 1854, is in Brown County in northeastern Kansas, about 50 miles from St. Joseph, Missouri, to the east and Topoka, Kansas, to the south. Tribal headquarters are in nearby Horton. Limited surface water is from the Delaware River and tributary creeks.

- ❑ The Potawatomi Reservation, established in 1846, is in Jackson County, Kansas, about 25 miles north of Topeka. Tribal headquarters are in nearby Mayetta. Limited surface water is from creeks in the area.
  
- ❑ The Sac and Fox Reservation, established in 1837, is primarily in extreme northeastern Brown County, Kansas, with a smaller area in adjacent Nebraska. It is located about 8 miles southeast of Falls City, Nebraska. Tribal headquarters are in Reserve, Kansas. Limited surface water is from the Big Nemaha River and tributary creeks.

The general area is characterized by prairie grasslands, wooded areas along rivers and creeks, and cultivated cropland. It is, on the whole, sparsely populated; residents of non-Indian areas tend to be older than the Indian population. The population is increasing on the reservations, while nonreservation areas are declining or increasing very slightly. Per capita income in nonreservation areas is below the State median of \$20,506, but on the three reservations it is significantly (about one-third) lower. Casinos and other Tribal enterprises provide income to the reservations. The area has hot summers and cold winters, with average precipitation of about 34 inches occurring mostly between April and September. Significant droughts for periods up to 2 years are common.



*Delaware River as it runs through the Kickapoo Tribe in Kansas reservation.*



**Only the Sac and Fox Reservation has direct access to a significant surface water resource—the Big Nemaha River. The Potawatomi and Kickapoo Reservations have access only to small rivers and streams—Soldier Creek and the Delaware River, respectively. The surface water resources directly available to the Potawatomi and Kickapoo Reservations are also more susceptible to seasonal and annual variability that would reduce their reliability as water supply sources.**

Major groundwater sources—the Kansas River, Delaware River, and Missouri River Valley alluvial aquifer systems—are on the edge of the area evaluated and are not readily accessible by the Tribe/Nations. Wells in the area are generally of low yield.

● *More specifically. . .*

Principal surface waters in the region of the three Indian reservations include, most notably, the Missouri River, which forms the eastern boundary of the region; the Kansas River, which forms the southern boundary of the region; the Big Nemaha River, which forms the northern boundary of the region, and tributaries to the Kansas River, including Soldier Creek, the Big Blue River, and the Delaware River. These latter tributaries of the Kansas River have two major storage reservoirs, Tuttle Creek Lake and Perry Lake. The Big Blue River forms the western boundary of the region and is tributary to the Kansas River.

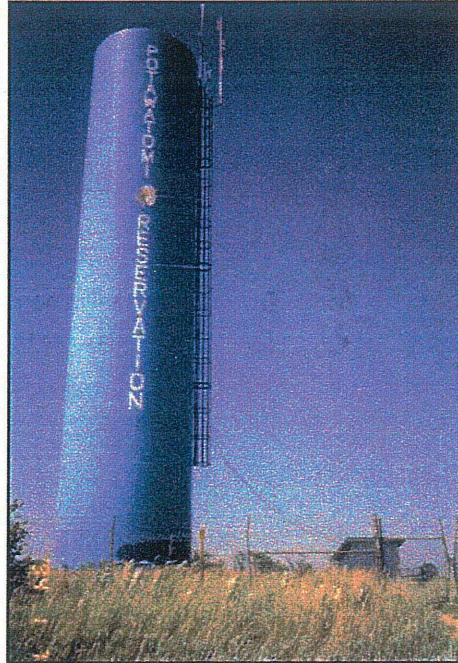
Within the boundaries of this evaluation, only the Missouri and Kansas Rivers are considered large mean annual streamflow rivers (exceeding 5,000 cubic feet per second [cfs] mean annual streamflow). The Big Nemaha River is considered a medium mean annual streamflow river (greater than 500 cfs mean annual streamflow). The remaining streams and rivers in the area are considered small mean annual streamflow systems (less than 50 cfs mean annual streamflow).

Two small-to-medium alluvial aquifer systems are within the area—the Big Nemaha River and the Delaware River systems. The Big Nemaha River borders the northern boundary of the Sac and Fox Reservation, and the Delaware River flows through the Kickapoo Reservation, and, as such, both are accessible to the respective reservations. These alluvial aquifer systems are restricted to the deposits underlying the flood plains and terraces of the rivers. Well yields are generally less than 300 gallons per minute (gpm).

Numerous small alluvial aquifer systems exist on all three reservations. These smaller systems are associated with the small streams that are tributary to the

Kansas, Missouri, Big Nemaha, and the Delaware Rivers. These smaller systems are very restricted in size and extent. Well yields are generally less than 50 gpm.

Attempts to increase supply through existing rural and municipal systems have not been fully successful. In addition, there are some water quality problems from surface water and groundwater in the area.



*View of the 100,000-gallon water storage tank and wellhouse, Prairie Band Potawatomi Nation.*

## On the Kickapoo Reservation. . .

Limitations include:

- The reservation is not located on or near a major alluvial system: smaller alluvial systems are associated with Delaware River and Gregg, Plum, and Squaw Creeks.
- Limited surface water resources exist: essentially only same-year use; limited (same-year use) off-stream storage capability.
- Surface water availability for substantial water supply development without impoundments is not promising.

- The area's aquifer system is known to be briny and more than 2,500 feet below ground surface.
- Locations, yields, and saturated thickness of minor aquifers vary greatly.

## On the Potawatomi Reservation. . .

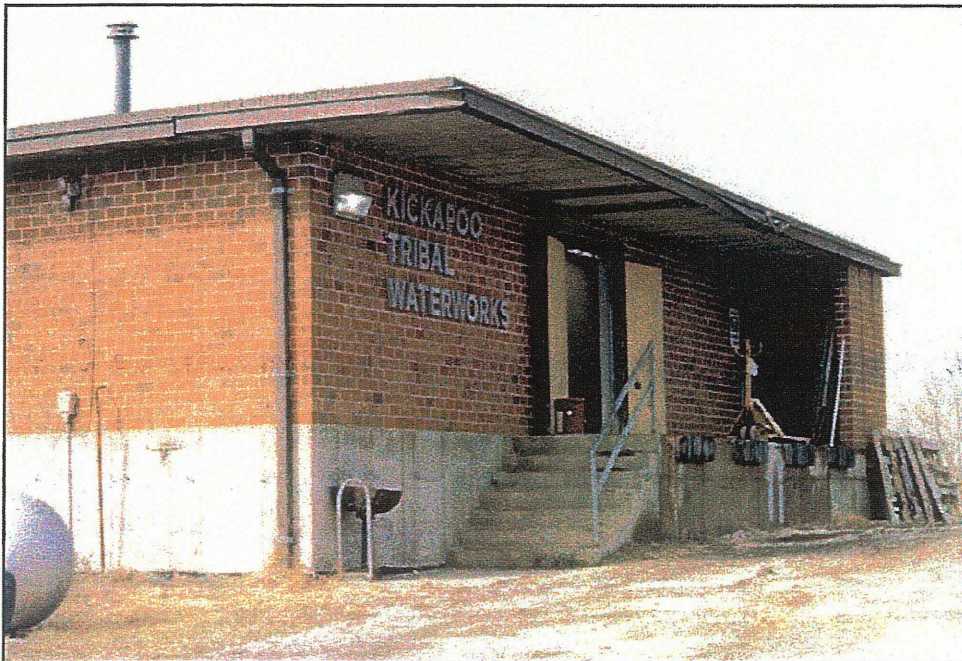
Limitations include:

- The reservation is not located on or near a major alluvial system: smaller alluvial systems are associated with Soldier, Little Soldier, and Big Elm Creeks.
- Limited surface water resources exist: essentially only same-year use: limited (same-year use) off-stream storage capability.
- Surface water availability for substantial water supply development without impoundments is not promising.
- Kansas-Republican River Basin water usage: 58 percent surface water, 42 percent groundwater: 54 percent irrigation, 30 percent municipal, 3 percent industrial.
- The area's aquifer system is known to be briny and more than 2,500 feet below ground surface.
- Minor aquifers classified as type 1 (less than 50 gpm) and type 2 (50 to 300 gpm), and the saturated thickness of minor aquifers varies greatly.
- Well yields in Jackson County: about 40 percent are less than 0.5 gpm, about 40 percent are 1 to 10 gpm, about 10 percent are 10 to 100 gpm, 1-2 percent are reported in excess of 100 gpm, and the remainder have unreported yields.

## On the Sac and Fox Reservation. . .

- The reservation is not located on a major alluvial system: a medium alluvial system is associated with Big Nemaha River in Nebraska, and smaller alluvial systems are associated with Pony, Walnut, and Roys Creeks.

- Surface water resources are not limited to same-year use: limited (same-year use) off-stream storage capability.
- Surface water availability for substantial water supply development without impoundments is not promising.
- The area's aquifer system is known to be briny and more than 2,500 feet below ground surface.
- Minor aquifers and buried sand and gravel in glacial drift may yield as much as 900 gpm, (wells north of Hiawatha) but less than 500 gpm is more common; locations, yields, and saturated thickness of minor aquifers vary greatly.
- Well yields in Brown County: about 30 percent are less than 0.5 gpm, about 17 percent are 1 to 10 gpm, and about 28 percent are 50 to 100 gpm; only about 6 percent are greater than 100 gpm. Well yields decrease to the west; there are few wells in Doniphan County, but of those few, several have yields greater than 100 gpm and yields for the remaining wells are less than 0.5 gpm.



*Front view of the Kickapoo Tribe in Kansas water treatment plant.*

● *Water needs are growing*

These tables summarize total demand for the Tribe/Nations to 2040:

Kickapoo Tribal water demands (current and future)

Period	Population	Use rate (gpcd) <sup>1</sup>	Average daily demand (gpd <sup>2</sup> )	Commercial/casino demand (gpd) <sup>3</sup>	Total demand (gpd)
Current	1,115	115	128,225	14,500	142,725
2020	1,210	115	139,150	218,400	357,550
2040	1,310	115	150,650	218,400	369,050

<sup>1</sup> Gallons per capita per day – includes institutional, commercial, and industrial needs except the casino and other large commercial water users. The municipal and industrial per capita use rate of 115 gpcd is reported in the 1999 Water Use Report of the Kansas Water Office as the average per capita use rate for medium water utilities in Region 7. This use rate includes water supplied for residential and commercial sales, free use, and unaccounted-for water.

<sup>2</sup> Gallons per day.

<sup>3</sup> This column represents the needs of large commercial water users. For the current period, the demand is for the existing casino.

Potawatomi Nation water needs (current and future)

Period	Population	Use rate (gpcd) <sup>1</sup>	Average daily demand (gpd <sup>2</sup> )	Commercial/casino demand (gpd) <sup>3</sup>	Total demand (gpd)
Current	1,625	115	186,875	50,250	237,125
2020	2,250	115	258,750	94,750	353,500
2040	2,935	115	337,525	94,750	432,275

<sup>1</sup> Gallons per capita per day – includes institutional, commercial, and industrial water supply needs except the casino and other large commercial water users.

<sup>2</sup> Gallons per day.

<sup>3</sup> This column represents the needs of large commercial water users. For the current period, the demand shown is for the existing casino.

Sac and Fox Nation water needs (current and future)

North area					
Period	Population	Use rate (gpcd) <sup>1</sup>	Average daily demand (gpd <sup>2</sup> )	Commercial/casino demand (gpd) <sup>3</sup>	Total demand (gpd)
Current	150	115	17,250	0	17,250
2020	195	115	22,425	0	22,425
2040	225	115	25,875	0	25,875
South area					
Period	Population	Use rate (gpcd) <sup>1</sup>	Average daily demand (gpd <sup>2</sup> )	Commercial/casino demand (gpd) <sup>3</sup>	Total demand (gpd)
Current	50	115	5,750	19,900	25,650
2020	65	115	7,475	56,470	63,945
2040	75	115	8,625	56,470	65,095

<sup>1</sup> Gallons per capita per day – includes institutional, commercial, and industrial water supply needs except the casino and other large commercial water users.

<sup>2</sup> Gallons per day.

<sup>3</sup> This column represents the needs of large commercial water users. For the current period, the demand shown is for the existing casino. Under the existing contract with BCWD No. 2 (which supplies water to the casino), the casino can use up to 27,400 gpd without improvements to the piping and the execution of a new contract.

● *Storage needs also exist*

For the Kickapoo, there currently exists a shortage of about 600,000 gallons. For 2020, additional storage required would be about 276,000 gallons, and for 2040 an additional 40,000 gallons above the 2020 need would be required.

On the Potawatomi Reservation, about 600,000 gallons are needed to meet current water storage needs. For 2020, additional storage required would be 872,527 gallons (275,883 gallons if 2000 storage is added). For 2040, an additional 362,168 gallons above the 2020 need would be required.

For the Sac and Fox, about 551,000 gallons are needed to meet current water storage needs. For 2020, additional storage required would be 11,000 gallons (561,953 minus 550,903 gallons) if 2000 storage is added prior to the time 2020 facilities are constructed. For 2040, an additional 1,169 gallons would be required. Based on these tank sizes, and the small difference in added storage associated between years, the Sac and Fox Nation is urged to obtain the entire additional required storage, 551,000 gallons, as soon as possible.

● *Self-determination and development*

Recent and current emphasis on Tribal sovereignty and the development of a Tribal land/enterprise base accompanies the need for an adequate and reliable water supply.

**The Tribe/Nations are seeking additional water supplies to augment existing systems that are inadequate to meet water needs for economic development and community/ Tribal infrastructure. Data gathered show a need for increased economic opportunity on the three reservations. Relatively low income and high unemployment exist together with the potential for increased population and growth. In addition, significant droughts for periods up to 2 years are common.**



*Home in the Red Earth housing area of the Sac and Fox Nation of Missouri.*

The estimated current and future population of each reservation is presented below.

Estimated current reservation population and  
population projections

Reservation	Estimated current population	2010	2020	2030	2040
Kickapoo	1,115	1,160	1,210	1,260	1,310
Potawatomi	1,625	1,935	2,255	2,585	2,935
Sac and Fox	220	240	260	280	300

## Kickapoo Reservation

The economy of the Kickapoo Reservation is based primarily on agricultural production and revenues from the Tribally owned Golden Eagle Casino located on the Kickapoo Reservation. Other enterprises are the Kickapoo Tribal Plaza and Kickapoo Trading Post. Significant revenues are derived from leasing agricultural lands and from Tribal farm operations. Major crops grown in the area include wheat, corn, soybeans, and milo. The Tribal farm operated by the Kickapoo currently has about 1,200 acres, and the Tribe typically leases 500 to 600 acres of pasture. Tribal enrollment is currently 1,611 members.

Median household income on the reservation in 1999 was estimated to be \$26,515, and per capita income was an estimated \$13,212. The percentage of reservation population below poverty level was 15.7 percent. According to the 2000 Census, 60.7 percent of all persons on the reservation 16 years of age or older were in the labor force. Of those considered to be part of the labor force, an estimated 6.1 percent were unemployed.

## Potawatomi Reservation

The economy of the Potawatomi Reservation is most influenced by the casino located on the Reservation in Mayetta, Kansas, and by agricultural activities. The single greatest source of economic activity on the reservation is the casino and hotel complex jointly operated by the Prairie Band Potawatomi Nation and Harrah's Entertainment. Approximately 3,000 acres of Tribal land are presently under cultivation, primarily in hay and pasture. Other economic activities on the reservation include a hunting club/preserve, a county-operated landfill, service stations, a nursery, and a bingo hall.



The 2000 Census estimated median household income on the reservation to be \$42,232 in 1999, and per capita income was an estimated \$15,372. The percentage of reservation population below poverty level was 7.8 percent. An estimated 70 percent of all persons on the reservation 16 years of age or older were in the labor force. Of those considered to be part of the labor force, an estimated 3 percent were unemployed.



*Newly constructed Prairie Band Potawatomi Nation Senior Center.*

## Sac and Fox Reservation

The Sac and Fox Reservation economy depends in large part on agriculture-related activities. Approximately 450 acres of Tribal lands on the reservation are currently under lease for agricultural use, which provides a significant amount of income to the reservation. Commercial establishments on or near the reservation include a casino, truck stop, five small establishments and a community building. The Sac and Fox Casino is located in on Highway 75 south of Powhattan, Kansas, and opened in 1997. The casino has slot machines, table games, and a restaurant. Revenues from the Sac and Fox Casino provide a significant positive impact on reservation employment and income. Sac and Fox Tribal enrollment is currently 429 members.

Based on the 2000 Census data, median household income on the reservation in 1999 was \$31,500, and per capita income was an estimated \$13,356. The percentage of reservation population below poverty level was 7.9 percent. Approximately

88.4 percent of all persons on the reservation 16 years of age or older were in the labor force. Of those considered to be part of the labor force, all were considered to be employed as defined in the U.S. Census.

● *Overall . . .*

Household and per capita income are lower on the Kickapoo and Sac and Fox Reservations than for the two surrounding counties and all of Kansas. Per capita income is lower on all three reservations than for Jackson County and Kansas as a whole. Median household income on the Potawatomi Reservation is higher than for all of Kansas. The percentage of the population below poverty is much higher on the Kickapoo Reservation than for the two counties and all of Kansas.

The percentage of the population in the labor force varies greatly, depending on the reservation. In decreasing order, comparing each reservation's labor force older than 16 years of age to the State average of 67.5 percent, the Sac and Fox are at 88.4 percent, the Potawatomi at 70 percent, and the Kickapoo at 60.7 percent. A relatively low percentage of people considered to be a part of the labor force on the Kickapoo Reservation compared to the rest of the State may be an indication that there is chronic, long-term unemployment on the Kickapoo Reservation that is not reflected through traditional unemployment rates. The unemployment rate on the Kickapoo and Potawatomi Reservations is higher than for the counties and for all of Kansas.

Households are somewhat larger, and the average age is lower on two of the three reservations than for the two counties and the State as a whole. In addition, the fertility rate (measured as children ever born per 1,000 women) is generally higher than average for the three reservations. Educational attainment on the three reservations is lower than for the State. The lower-than-average high school graduate rate could be a limitation on employment opportunities.

**The relatively young population and high fertility rates indicate the high potential for future population growth and continued large households.**

● *Reclamation's role*

Reclamation conducted this study at appraisal level under the authority of the Federal Reclamation Act for the Tribe/Nations under Tribal Council resolutions. Funding was provided through Reclamation's Technical Assistance to States Program.

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Technical and other assistance was through Tribal task forces, the Mni Sose Intertribal Water Coalition, rural water districts, local municipalities, the Kansas Water Office, and Kansas and Nebraska Departments of Environment.

● *Possibilities (and some potential problems)* . . .

## Kickapoo Tribe in Kansas

### Groundwater

Groundwater resources around the Kickapoo Reservation may be developed along the Delaware River alluvium. Yield may be between 50 and 300 gpm, but no specific pump yields within the reservation have been determined.

### Surface water

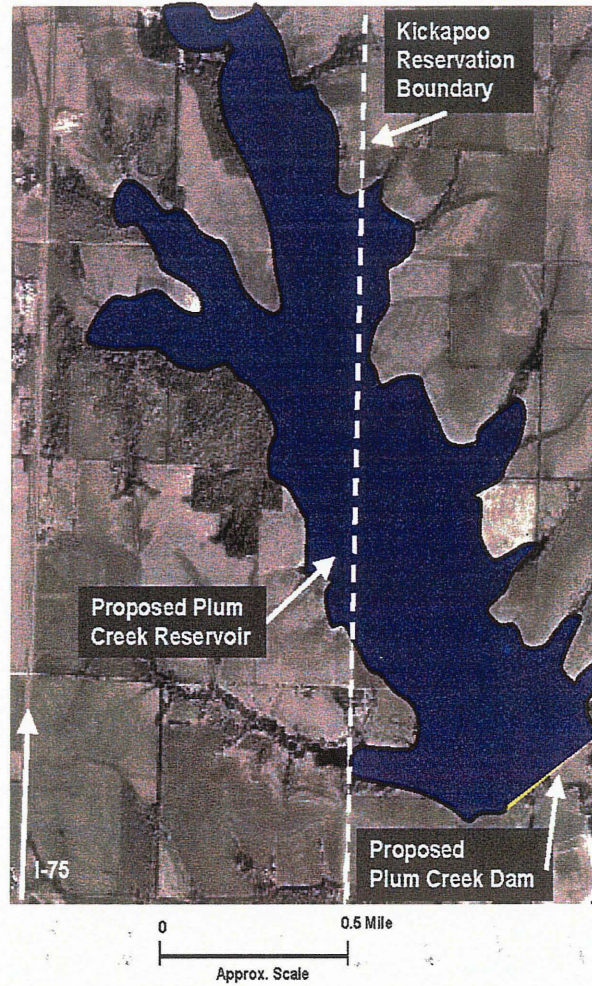
The Delaware River has been studied by the U.S. Department of Agriculture (USDA) and appears to have sufficient flow and area to satisfy the Kickapoo water demands. (USDA-Soil Conservation Service [SCS – now the Natural Resource Conservation Service] Kansas report, *Watershed Plan and Environmental Impact Statement*, January 1994). The existing Delaware River impoundment has proven to be insufficient in size to retain the required volume for current water demands for the Kickapoo Tribe.

One option available to the Kickapoo Tribe for on-site water supply to meet 2040 demands is to construct a surface water reservoir at the Plum Creek dam site (depicted on the following page).

## Prairie Band Potawatomi Nation

### Groundwater

Developing groundwater within the Potawatomi Reservation is problematic from both a quantitative and qualitative aspect. Reclamation and the U.S. Geological Survey were unsuccessful at locating test wells with high yields along Big Soldier Creek, and historic water quality problems would warrant complex water treatment processes which would be costly both for construction as well as for operation and maintenance (O&M) (Reclamation, October 2001).



Plum Creek Reservoir aerial view.  
(Notes: (1) Prepared by Reclamation from data supplied by Terraserver [Microsoft®], USGS, and SCS; (2) Reservoir boundaries are approximate).

If pursued, the following would be necessary to develop a groundwater supply, treatment, and distribution system on the Potawatomi Reservation:

- (1) Design and construct water treatment facilities at the sites of the groundwater supply wells along Big Elm Creek and/or other sites if exploratory test wells find higher yields.
- (2) Acquire the water distribution system components from Jackson County RWD No. 3, including all existing distribution piping, water storage tanks, pumps, and associated equipment.
- (3) Add storage and distribution piping.
- (4) Design and construct necessary pumping facilities and piping to transport raw water from the wells to the new water treatment facilities and then to the existing water distribution system.

## **Surface water**

The volume of flow in Big Soldier Creek appears to be inadequate to meet the Potawatomi Nation's water demands. Big Soldier Creek has also had water quality problems with atrazine, a synthetic organic chemical used in herbicides. For these reasons, developing a surface water source on the Potawatomi Reservation appears infeasible.

## **Sac and Fox Nation of Missouri**

### **Groundwater**

There are no known groundwater resources within the Sac and Fox area.

### **Surface water**

Along the northern border of the Sac and Fox Reservation is the Big Nemaha River, with average annual streamflow of 454,000 acre-feet. The water quality of the Big Nemaha River appears to be generally acceptable, assuming standard surface water treatment. Based upon existing water quality data, only iron and manganese are parameters that exceed primary or secondary drinking water standards.

For the Sac and Fox Nation to pursue obtaining water from the Big Nemaha River, the following would be required:

- (1) Install a proposed river diversion located in the southeast corner of Section 26, Township 1 North, Range 17 East and on the Sac and Fox Reservation.
- (2) Install a surface water filtration treatment plant near the point of diversion, about 1 mile north and 2 miles east of the Red Earth housing area.
- (3) Since the Red Earth area is presently being served by Richardson County RWD No. 2, the existing water distribution infrastructure would have to be purchased from the district or new distribution piping installed.
- (4) Construct and operate the water storage facilities.

2040 water needs and current available water are shown below:

2040 yearly and average day water demands and current available water		
2040 demands		
Demand	Acre-feet/year	Million gallons/day
Potawatomi	485	0.43
Kickapoo	414	0.37
Sac and Fox (south area)	73	0.07
Sac and Fox (north area)	29	0.03
<b>Total all Tribe/Nations</b>	<b>1,001</b>	<b>0.90</b>
Current available water		
Source	Acre-feet/year	Million gallons/day
Plum Creek (projected) <sup>1</sup>	1,792	1.60
Perry Lake <sup>2</sup>	84,000	75.00
Kansas River/Shawnee Reservoir <sup>3</sup>		Available
Banner Creek <sup>4</sup>		Available
Hiawatha Well <sup>5</sup>		Available

<sup>1</sup> Obtained from *Watershed Plan and Environmental Impact Statement, Upper Delaware and Tributaries Watershed in Atchison, Brown, Jackson, and Nemaha Counties, Kansas*, page 30, January 1994 – SCS.

<sup>2</sup> Obtained from the State of Kansas Water Office.

<sup>3</sup> Water is available via verbal contact with the U.S. Army Corps of Engineers.

<sup>4</sup> The treatment plant can provide 1.5 million gallons per day, expandable to 2.5 million gallons per day. Sufficient water is available via verbal contact with Jackson Co. RWD No. 3.

<sup>5</sup> Water available via verbal contact with city of Hiawatha. Currently at 70 percent capacity at highest demand day per year. Currently researching new water sources.



*Raising the height of the reservoir on the Delaware River located near the water treatment plant, Kickapoo Tribe in Kansas.*

### ● *Multi-Tribal alternatives*

Five multi-Tribal alternatives were analyzed—Plum Creek Reservoir, Perry Lake, Kansas River/Shawnee Reservoir, Banner Creek, and Hiawatha Wells. Only Hiawatha Wells would provide water to all the Tribe/Nations, and Banner Creek would exclude Sac and Fox (north) because of the long distance involved.

Facilities that serve more than one Tribe/Nation, such as a pipeline, water treatment plant, or pump station, are defined as shared facilities. The cost of a shared facility is assumed to be proportional to each Tribe/Nation based on the amount of flow each Tribe needs. To clarify, the respective flows for the Kickapoo, Potawatomi, and Sac and Fox south are 513 gpm, 600 gpm, and 90 gpm, respectively. Costs for all three would be apportioned 42.6 percent to Kickapoo, 49.9 percent to Potawatomi, and 7.5 percent to the Sac and Fox based on these flows.

A water treatment plant, a shared facility, is sized for the maximum day water demand from all three Tribes of 1.7 mgd. Shared pump stations are assumed for each alternative to pump raw water from its source to the water treatment plant. Pump stations which pump treated water from the plant to each Tribe/Nation may or may not be shared.

Information is summarized below.

Multi-Tribal alternatives source waters, treatment facilities, and end points

Alternative	Tribe/Nation	Source	Treatment	Destination
Proposed Plum Creek Reservoir	Potawatomi Kickapoo Sac and Fox (casino only)	Proposed Plum Creek Reservoir	Proposed joint Tribal Plum Creek water treatment plant	North Booster Station Distribution System Connection Sac and Fox casino
Perry Lake	Potawatomi Kickapoo Sac and Fox (casino only)	Perry Lake	Proposed south Cedar Creek water treatment plant	North Booster Station Distribution System Connection Sac and Fox casino
Kansas River	Potawatomi Kickapoo Sac and Fox (casino only)	Kansas River/Shawnee River	Proposed south Cedar Creek water treatment plant	North Booster Station Distribution System Connection Sac and Fox casino
Banner Creek	Potawatomi Kickapoo Sac and Fox (casino only)	Jackson County RWD No. 3/City of Holton Banner Creek Reservoir	Banner Creek water treatment plant	North Booster Station Distribution System Connection Sac and Fox casino
Hiawatha Wells	Potawatomi Kickapoo Sac and Fox (casino only)	Hiawatha Wells	Chlorination by city of Hiawatha	North Booster Station Distribution System Connection Sac and Fox casino
	Sac and Fox (Red Earth)		Proposed chlorination facility	Red Earth subdivision

<sup>1</sup> Supply alternative color code for site plan maps of supply alternative layouts, figure 5.



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## Plum Creek Reservoir

A multi-purpose reservoir would be constructed on Plum Creek, a tributary to the Delaware River. The Plum Creek dam and reservoir project was 1 of 20 flood-retarding dams with a multipurpose structure proposed by the SCS in a Watershed Plan and Environmental Impact Statement (January, 1994).

The Plum Creek dam would be located on the Kickapoo Reservation, and about 50 percent of the land inundated by the reservoir would be on the reservation. About 90 percent of the drainage area above the dam is outside the 1862 Reservation Boundary. SCS expressed concerns relative to the quality of the water that would be captured by the reservoir. Nitrates and phosphates from irrigation runoff, fecal material from livestock, and pesticide runoff from irrigated lands, all existing problems in Perry Lake Reservoir, may presumably be in Plum Creek since it intercepts waters that would normally have gone to Perry Lake.

A water treatment plant could be located by the dam, sized to meet 2040 water demands for the Tribe/Nations. This plant would provide filtered and chlorinated water to all end users. The operation and maintenance of the plant is assumed to be a joint effort of the three Tribe/Nations, and other shared facilities would be required.

## Perry Lake

This alternative assumes the Tribe/Nations arrange for the acquisition of 972 acre-feet per year of raw water from Perry Lake. Shared facilities would be required, and additional infrastructure requirements would have to be undertaken by the Tribe/Nations individually.

## Kansas River/Shawnee Reservoir

This alternative assumes the Tribe/Nations arrange for the acquisition of 972 acre-feet per year of raw water from Kansas River (or possibly Shawnee Reservoir). Costs are based on withdrawing water directly from the Kansas River at a point directly below Highway 75. Shared and individual infrastructure requirements are involved.

## Banner Creek Reservoir

This alternative assumes that the Tribe/Nations arrange for the acquisition of 972 acre-feet per year of water from Banner Creek Reservoir, with shared and individual treatment plant/infrastructure requirements.

## Hiawatha Wells

This alternative assumes that the Tribe/Nations arrange for the acquisition of 1,001 acre-feet of water per year from Brown Co. RWD No. 2 and 58 acre-feet of water per year from the city of Hiawatha, Kansas.

The source for water for all areas south of the Hiawatha wells was chosen to be the distribution system connection for Brown Co. RWD No. 2 near their water tank. This saves the 14 miles of water pipeline that would be needed to connect directly to the Hiawatha Wells or the 10 miles of pipeline to connect to the city center. The source of water for all areas north of the Hiawatha Wells (the Sac and Fox Reservation) was chosen to be the Hiawatha well field. The city of Hiawatha treats its water 2 miles south of the well field.

Common and additional Tribal infrastructure would be required under this plan.

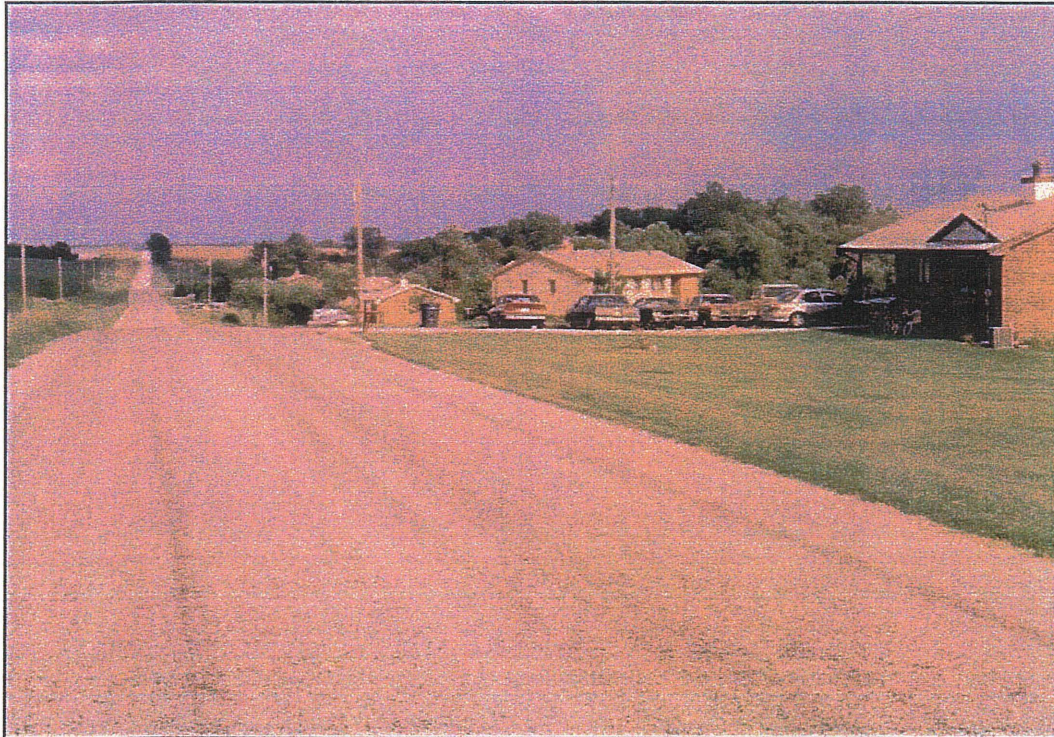
Costs of the alternative plans are shown below.

Summary of total construction cost by alternative

	Joint Tribal alternatives	Plum Creek Reservoir	Perry Lake	Kansas River/ Shawnee Reservoir	Banner Creek Reservoir	Hiawatha Wells
Item	Cost (\$)	Cost (\$)	Cost (\$)	Cost (\$)	Cost (\$)	Cost (\$)
Water treatment	1,178,739	1,178,739	1,178,739	1,178,739	1,178,739	3,427,504
Pumping plants	679,846	1,652,491	1,629,191	766,512	388,998	
Pipelines	3,856,889	7,650,518	7,326,170	4,397,685	5,988,295	
Storage	3,425,000	3,425,000	3,425,000	3,425,000	3,425,000	
Mobilization	457,024	695,337	677,955	488,397	661,490	
Unlisted items	1,371,071	2,086,012	2,033,865	1,465,190	1,984,470	
<b>Contract cost<sup>1</sup></b>	<b>10,968,569</b>	<b>16,688,097</b>	<b>16,270,920</b>	<b>11,721,523</b>	<b>15,875,757</b>	
Contingencies	2,742,142	4,172,024	4,067,730	2,930,381	3,968,939	
<b>Field cost<sup>2</sup></b>	<b>13,710,711</b>	<b>20,860,121</b>	<b>20,338,650</b>	<b>14,651,904</b>	<b>19,844,696</b>	
Noncontract cost	4,113,213	6,258,036	6,101,595	4,395,571	5,953,409	
<b>Construction cost</b>	<b>17,823,924</b>	<b>27,118,157</b>	<b>26,440,245</b>	<b>19,047,475</b>	<b>25,798,105</b>	

<sup>1</sup> Subtotal of items above.

<sup>2</sup> Subtotal of contract cost plus contingencies.



*Approaching the Red Earth housing area of the Sac and Fox Nation of Missouri.*

● *Some findings. . .*

Multi-Tribal

- ❑ The Plum Creek Reservoir alternative, at \$17.8 M dollars, is the least costly alternative, while the Perry Lake alternative, at \$27.1M dollars, had the highest construction costs.
- ❑ High cost estimates for all five multi-Tribal water supply options reflect long lengths of water transmission lines. The most economical solution for each Tribe may not involve a single water source serving all the Tribe/Nations.
- ❑ None of the reservation communities have a formalized water conservation plan. It has been demonstrated that 10 to 20 percent water savings can accrue from a properly conceived water conservation program.

- If criteria used to assess water quality are predicated on compliance with the Surface Water Treatment Rule of the Clean Water Act, the four surface water alternative solutions would include a water treatment plant using filtration and disinfection.

## Kickapoo Tribe in Kansas

- The least costly multi-Tribal option of water supply for this Tribe is the Plum Creek Reservoir at \$4.03 M dollars +/- 40 percent.
- The current source of water supply, the Delaware River, and the existing river impoundment, are unreliable and undersized, respectively, to provide adequate water supplies for current water demands.
- The current water treatment plant has sufficient capacity to meet the maximum day water demands of the Tribe to 2010. However, operational procedures paid to some of the water treatment plant equipment, the attention being given to routine O&M procedures, and the resources available to the O&M staff, all the subject of an earlier Reclamation report, were found to require increased attention in order to lower costs and provide efficient and reliable safe drinking water.
- Storage of potable water is currently inadequate by 285,000 gallons. This deficit increases to an additional 625,000 gallons by 2040.
- Either the per capita water use is excessive or the water distribution system has a high amount of leakage. The ability of the water distribution system for firefighting is inconclusive.

## Prairie Band Potawatomi Nation

- The least costly multi-Tribal option of water supply for the Nation is the Banner Creek Reservoir at \$7.2 M dollars +/- 40 percent.
- Surface and groundwater resources within the reservation appear inadequate in terms of quantity and quality to meet current and future water demands.

- Storage of potable water is currently inadequate by 597,000 gallons. This deficit increases to an additional 635,000 gallons by 2040.
- The water distribution system is inadequately sized for firefighting.

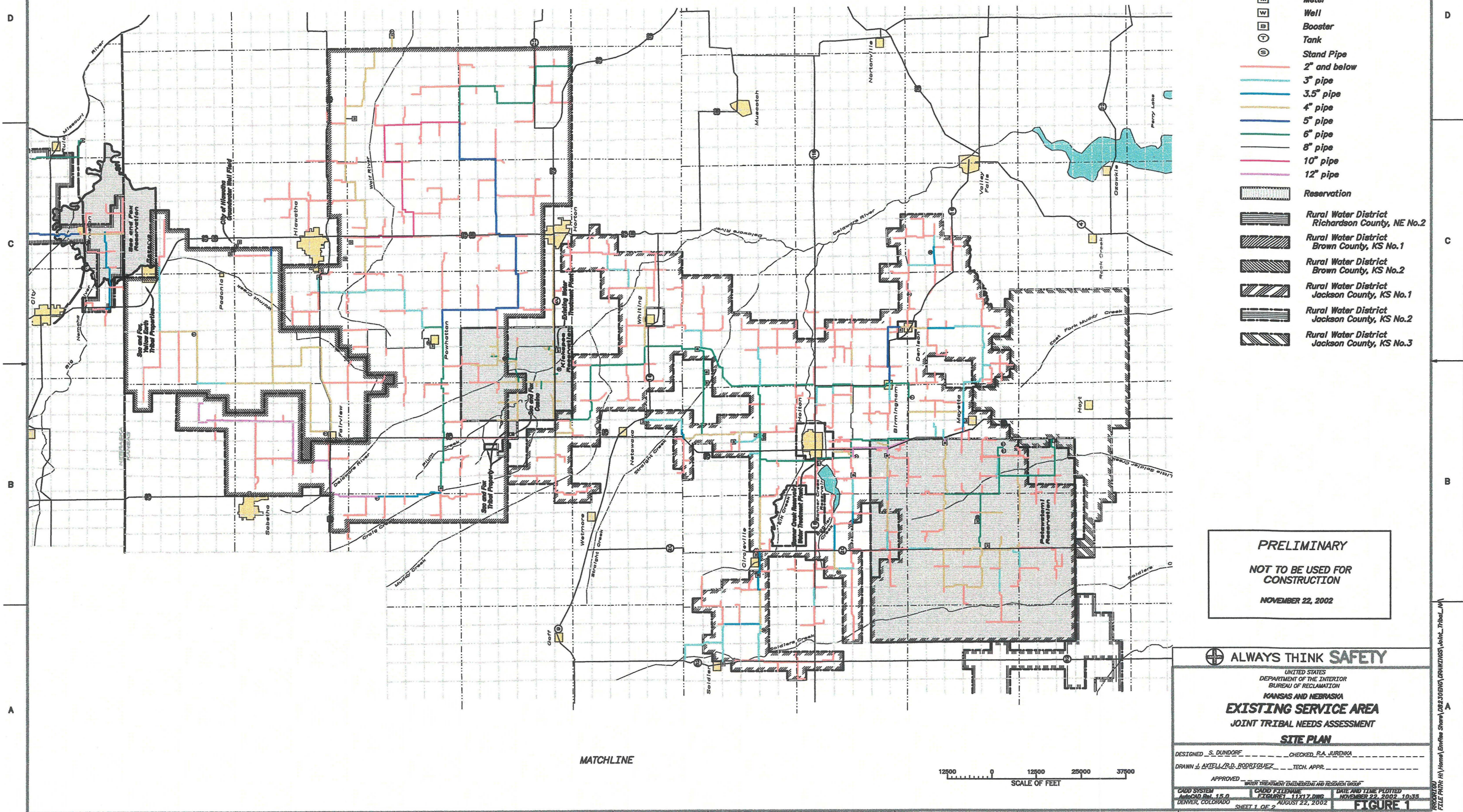
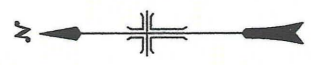
## Sac and Fox Nation of Missouri

- The least costly multi-Tribal option of water supply for the Nation is the Plum Creek Reservoir at \$1.7 M dollars +/- 40 percent.
- For the Sac and Fox north area, storage of potable water is currently inadequate by 184,384 gallons. This deficit increases by an additional 2,200 gallons by 2040. The small increase in storage needs from today to 2040 reflects the population increase over the same time period.
- For the Sac and Fox south area, storage of potable water is currently inadequate by 546,519 gallons. This deficit increases by an additional 10,000 gallons by 2040.
- The Sac and Fox Nation of Missouri borders the Big Nemaha River and therefore may pursue development for its own water supply from that source.

### ● *Recommendations are that . . .*

- Each Tribal Council review the findings and conclusions noted in Reclamation's report, with consideration given to the total cost of delivered water for the multi-Tribal solutions identified versus other, nonmulti-Tribal solutions.
- The Kickapoo Tribe in Kansas, the Prairie Band Potawatomi Nation, and the Sac and Fox Nation of Missouri adopt water conservation and reuse plans to reduce potable water demands.
- The water distribution system serving the Kickapoo Tribe in Kansas be evaluated for its capability to deliver fire flow and to quantify and possibly reduce leakage.
- Collaboration with the State of Kansas be undertaken, since some of the suggested water supply alternatives may also be sources of raw water for other communities in the region.





**LEGEND**

- Water Treatment Plant
- Meter
- Well
- Booster
- Tank
- Stand Pipe
- 2" and below
- 3" pipe
- 3.5" pipe
- 4" pipe
- 5" pipe
- 6" pipe
- 8" pipe
- 10" pipe
- 12" pipe
- Reservoir
- Rural Water District Richardson County, NE No.2
- Rural Water District Brown County, KS No.1
- Rural Water District Brown County, KS No.2
- Rural Water District Jackson County, KS No.1
- Rural Water District Jackson County, KS No.2
- Rural Water District Jackson County, KS No.3

**PRELIMINARY**  
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 CONSTRUCTION  
 NOVEMBER 22, 2002

**ALWAYS THINK SAFETY**

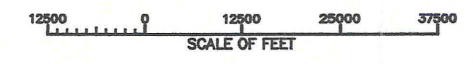
UNITED STATES  
 DEPARTMENT OF THE INTERIOR  
 BUREAU OF RECLAMATION  
 KANSAS AND NEBRASKA  
**EXISTING SERVICE AREA**  
 JOINT TRIBAL NEEDS ASSESSMENT  
**SITE PLAN**

DESIGNED S. DUNDORF CHECKED P.A. JURENKA

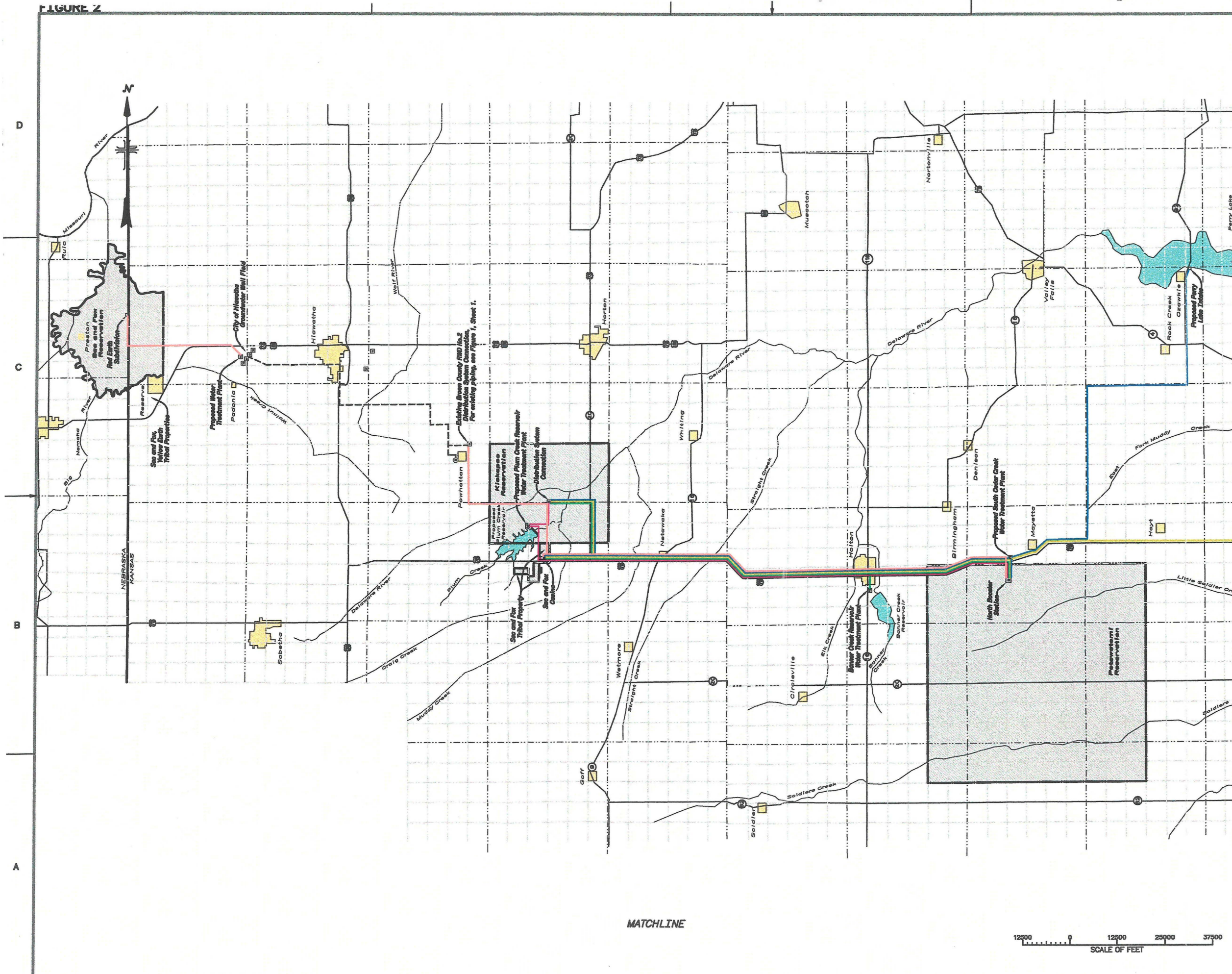
DRAWN J. AXTELL/R.D. RODRIGUEZ TECH. APPR.

APPROVED **WATER TREATMENT ENGINEERING AND RESEARCH GROUP**

CADD SYSTEM AutoCAD Rev. 15.0 DATE AND TIME PLOTTED NOVEMBER 22, 2002 10:35  
 FIGURE 1 11x17 DWG  
 SHEET 1 OF 2 AUGUST 22, 2002



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- LEGEND**
- Water Treatment Plant
  - Well - Groundwater
  - Distribution System
  - Storage Tank
  - Alternative MT1**
  - Potawatomi - Proposed Plum Creek Reservoir to North Booster Station.*
  - Kickapoo - Proposed Plum Creek Reservoir to Distribution System Connection.*
  - Sac & Fox - Proposed Plum Creek Reservoir to Sac & Fox Casino.*
  - Alternative MT2**
  - Potawatomi - Perry Lake to North Booster Station*
  - Kickapoo - Perry Lake to Distribution System Connection.*
  - Sac & Fox - Perry Lake to Sac & Fox Casino.*
  - Alternative MT3**
  - Potawatomi - Kansas River/Shawnee Reservoir to North Booster Station.*
  - Kickapoo - Kansas River/Shawnee Reservoir to Distribution System Connection.*
  - Sac & Fox - Kansas River/Shawnee Reservoir to Sac & Fox Casino.*
  - Alternative MT4**
  - Potawatomi - Jackson County RWD No.3, City of Holton, Banner Creek Reservoir to North Booster Station*
  - Kickapoo - Jackson County RWD No.3, City of Holton, Banner Creek Reservoir to Distribution System Connection.*
  - Sac & Fox - Jackson County RWD No.3, City of Holton, Banner Creek Reservoir to Sac & Fox Casino.*
  - Alternative MT5**
  - Potawatomi - Brown County RWD No.2 Distribution System Connection to North Booster Station.*
  - Kickapoo - Brown County RWD No.2 Distribution System Connection to Distribution System Connection.*
  - Sac & Fox - City of Hiawatha Groundwater Wells to Red Earth Subdivision.*
  - Brown County RWD No.2 Distribution System Connection to Sac & Fox Casino.*

**PRELIMINARY**  
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 NOVEMBER 22, 2002

**ALWAYS THINK SAFETY**

UNITED STATES  
 DEPARTMENT OF THE INTERIOR  
 BUREAU OF RECLAMATION  
 KANSAS AND NEBRASKA  
**MULTI TRIBAL  
 WATER SUPPLY ALTERNATIVES  
 JOINT TRIBAL NEEDS ASSESSMENT**  
**SITE PLAN**

DESIGNED S. DUNDORF CHECKED P.A. JURENKA  
 DRAWN E.D. RODRIGUEZ TECH. APPR. \_\_\_\_\_

APPROVED \_\_\_\_\_  
WATER TREATMENT ENGINEERING AND RESEARCH GROUP

CADD SYSTEM: AutoCAD Rev. 15.0 DATE AND TIME PLOTTED: NOVEMBER 22, 2002 10:35  
 DENVER, COLORADO SHEET 1 OF 2 AUGUST 26, 2002 **FIGURE 2**

MATCHLINE

