

Glen Elder Unit

Solomon Division

Pick-Sloan Missouri Basin Program

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Pick-Sloan Missouri Basin Program Glen Elder Unit, Solomon Division

Prior to the construction of the Glen Elder Unit in the 1960s, agricultural production in north central Kansas along the Solomon River was uncertain. With an average annual precipitation of under twenty-four inches, dry farming was a gamble. Stream flows depended largely upon rainfall rather than snow melt and fluctuations were wide and unpredictable. At times heavy rain storms occurred over large areas resulting in floods of short duration but often destructive proportions, while at other times, particularly during the growing season, flows dropped to an insignificant amount. After a severe drought in the 1930s, local farmers and civic leaders successfully lobbied state and federal government agencies to be included in the proposed Pick-Sloan Missouri Basin Program.

Project Location

The Glen Elder Unit is located in the Solomon River Valley in Osborne, Mitchell, Cloud, and Ottawa counties in north central Kansas. The Solomon River rises in the Great Plains in northwest Kansas and is a tributary of the Smoky Hill River which combines with the Republican River at Junction City, Kansas, to form the Kansas River. At the junction of Highways 24 and 281 in rural Osborne County is a marker in a roadside park marking the geodesic center of the lower forty-eight states of the United States. Part of the Solomon Division of the Pick-Sloan Missouri Basin Project, the Glen Elder Unit was the last of three units constructed in the Solomon River drainage basin's Solomon Division. Upstream Kirwin Dam and Reservoir of the Kirwin Unit was completed in 1955 on the North Fork of the Solomon River. The Webster Unit's Webster Dam and Reservoir in was completed in 1956 on the South Fork of the same river. The Glen Elder Unit consists of Glen Elder Dam and its reservoir,

Waconda Lake, and protective dikes and appurtenant structures.

The dam is a multipurpose structure on the river approximately seven miles below the confluence of the North and South Forks of the Solomon River in Mitchell County, Kansas, immediately above the town of Glen Elder. Glen Elder Dam is a zoned earthfill embankment with a crest length of 15,200 feet and a height approximately 115 feet above the Solomon River bed. The dam impounds water in Waconda Lake and provides a high degree of flood protection to the downstream Solomon River Valley. The Cawker City Protective Dike and the Downs Protective Dike protect two small towns, Cawker City and Downs from the water level fluctuations of Waconda Lake. Glen Elder Unit awaits future authorization to serve 21,000 acres of irrigable valley lands. Glen Elder Dam currently provides substantial municipal water supply, flood control, recreation, fish and wildlife conservation and pollution abatement benefits. The total project cost, in March of 1972, of the Glen Elder Unit was estimated at \$57,628,000.¹

Historic Setting

Geologic Setting

Sixty-five million years ago during the early and middle parts of the Tertiary period of the Cenozoic era, mountain building was taking place in the Rocky Mountains while to the east erosion in the Solomon River area was removing the upper rock layers deposited 95 million years ago during the Cretaceous period. During the Pliocene epoch of the Tertiary period, a broad alluvial plain consisting of rock particles eroded from Colorado's Rocky Mountains expanded eastward, eventually burying the Solomon River area beneath layers of sand and gravel creating the Ogallala formation. Directly overlying this formation in most places are

1. U.S. Department of the Interior, Water and Power Resource Service, *Project Data*, (Denver: U.S. Government Printing Office, 1981), 889; U.S. Department of the Interior, Bureau of Reclamation; *Glen Elder Dam*, <http://dataweb.usbr.gov/dam/ks00021.htm>, 2.

unconsolidated stream sediments, called alluvium, and aeolian, wind deposited silt, deposits laid down in the Pleistocene period beginning about two million years ago.²

The Solomon River carved down through the Ogallala formation into flat-lying Cretaceous aged sedimentary rocks to form a broad U-shaped valley at the Glen Elder Dam site. The valley wall which serves as the dam's abutments are composed of and shales and Greenhorn Limestone. The upper portion of the abutments are chalky shale and limestones of the Carlile Shale. The upper surface of these rocks are weathered to depths of twenty to thirty feet. A thin ten to twenty foot mantle of loessal silts and clays with some sand forms the upper surface of the south abutment. A near vertical bluff of limestone and shale, which was formed by down cutting of the river and the later 1879 excavation for the Solomon Valley Railroad rail line is the inner edge of the left abutment. Ten to twenty feet of aeolian, wind deposited silt and clay, also cap the Carlile Shale and Greenhorn Limestone of the right abutment. The inner portion of the right abutment is a forty to sixty foot thick terrace deposit of silt and clay with over ten feet of sand at its base lying on the Greenhorn limestone. The center section of the valley floor has a width of 7,000 feet and is underlain by thirty to sixty feet of unconsolidated alluvium of silts, clays and sand. Prior to deposition of these sediments, the down cutting and scouring action had removed weathered bedrock and as a result, these sediments rest on unweathered Graneros Shale.³

Prehistoric Setting

The available data suggests that North America could have been occupied by human groups anytime during the last 60,000 years, although evidence for possible occupations prior to 13,000 B.C. are not universally accepted. North American anthropologists and archaeologists

2. U.S. Department of the Interior, Bureau of Reclamation, *Kansas Prehistoric Archaeological Preservation Plan*, (Lawrence, Kansas: Office of Archaeological Research, Museum of Anthropology, 1987), III-18.

3. *Glen Elder Dam*, 2.

divide prehistoric Native American cultural periods into three major categories: Paleo-Indian, Archaic Indian, Proto-Historic Indian, and Historic Indian.⁴

The Paleo-Indian period on Kansas' plains is placed chronologically from 10,000 B.C. to 6,000 B.C. These people were big game hunters using spears to hunt the great game herds of the last ice age. With the end of ice age and the stabilization of the climate and the seasons the vast game herds began to disappear. Some species, such as mammoths, camels, and horses, became extinct, while others, such as pronghorn antelope, bison, and mule deer, expanded their range. Prehistoric peoples of Kansas' Solomon River Valley entered into their Archaic Indian Period, 6,000 B.C. to A.D. 1, supplementing their big game diet with small game, such as rabbits, squirrels, and water fowl, and gathering edible roots, berries, seeds, and nuts. Grinding stones became common and the Archaic hunting weapon of choice was the throwing stick, atl-atl, the precursor to the bow and arrow.⁵

The transition from the Archaic Indian Period to the Proto-Historic Indian Period, A.D. 1 to A.D. 1500, is marked by the development of the bow and arrow, pottery, and agriculture. During the early Proto-Historic Period, A.D. 1 to A.D. 1000, people in the Solomon River valley began clustering in small villages and lived in small, oval-shaped, pole frame structures made of mats of twigs or grass plastered with mud. Besides hunting and gathering, they began tending small garden plots of maize, or corn.⁶

The Native American cultural period from A.D. 900 to 1300 in the future Glen Elder Unit's site was termed the Smoky Hill Culture. These people lived on scattered farmsteads in substantial homes built of poles, grass, and clay. Game hunting continued, and small scale

4. *Kansas Prehistoric Archaeological Preservation Plan*, III-11.

5. Waldo Wedel, *Prehistoric Man on the Great Plains*. (Norman, Oklahoma: University of Oklahoma Press) 1978, 87; *Kansas Prehistoric Preservation Plan*, VIII-1.

6. *Kansas Prehistoric Preservation Plan*, XII-23.

agriculture expanded to include maize cultivation, beans, and squash -- the “three sisters of agriculture.” Native American semi-horticultural societies harvesting the “three sisters” guaranteed themselves the basic balanced diet of nutrients to maintain good health. For reasons unclear to archaeologists, in the time period A.D. 1300 to 1500, termed the White Rock Culture, the people of the Solomon River valley shifted to a heavier dependence on bison hunting and became more mobile with less permanent structures. Some archaeologists have speculated the White Rock Culture group may have been related to later inhabitants of the Solomon River valley, the Kansa.⁷

Historic Setting

The Kansa, or Kaw, tribe belongs to the southern Siouan or Dhegiha Sioux group. The name “Kansa” is a Sioux word meaning “people of the south wind.” At one time the Kansa, Osage, Ponca, Omaha, and Quapaw were one tribe living east of the Mississippi River along the lower reaches of the Ohio River valley. The tribe moved west of the Mississippi River in the mid-seventeenth century. The various tribes broke away and migrated along several rivers with the Kansa settling on the Missouri River. In the early eighteenth century the Kansa moved into present day Kansas and settled along the Kansas River and some of its tributaries, including the Solomon River and the future site of the Glen Elder Unit. The Kansa tribe’s lands stretched roughly from west of present day Salina, Kansas, eastward to Lawrence, Kansas.⁸

The Kansa were a semi-sedentary corn growing people living in large unfortified villages of long ridged or domed houses of poles covered with rush matting or bark. Each structure was

7. United States Department of the Interior, National Park Service, Missouri River Basin Recreation Survey, “Outline of the Prehistoric and Historic Indian Cultures of Central Nebraska and Kansas,” (U.S. Government Printing Office: 1947), 8; Brad Logan, *Phasing in White Rock: Archaeological Investigations of the White Rock and Warner Sites, Lovewell Reservoir, Jewell County, Kansas*, (Lawrence, Kansas: University of Kansas Museum of Archaeology, 1995), 15; Wedel, 80.

8. Berlin B. Chapman, “Charles Curtis and the Kaw Reservation,” *Kansas Historical Quarterly*, 1947, 337-40.

large enough to accommodate several families. Agriculture and hunting were both important, with seasonal tribal bison hunts made to the west. Movement into central Kansas found the Kansa immediately at war with the Pawnee living along the Republican and Platte Rivers.⁹

West of Beloit, Kansas, was Waconda Springs before it was inundated with the construction of Glen Elder Dam and the subsequent filling of its reservoir, Waconda Lake. Future proposals for the Glen Elder State Park include a fullscale replica of a sacred Indian meeting place called Waconda Springs. Waconda is a Dhegiha Sioux word meaning “running water.” There are several Native American legends surrounding Waconda Springs, also called by Native Americans, the “Great Spirit Spring.” Wakonda, with a ‘k’, was the beautiful daughter of a Kansa chief. From the beginning, the elders of the tribe believed it unwise for the chief to name his daughter after a god, which is what they considered the spring to be. As Wakonda grew older, she enjoyed wandering the countryside. One day she came upon an injured warrior. After a short conversation, they realized they were from enemy tribes, but that did not stop Wakonda from nursing him back to health. The warrior’s name was Takota and he was the son of the opposing chief. Eventually, he regained his strength and went to Wakonda’s father to ask her hand in marriage. Harsh words were exchanged and a battle was fought around Waconda Springs. Takota was standing near the edge of the spring when one of Wakonda’s father’s warriors shot an arrow and struck him in the chest. Mortally wounded, Takota fell into the springs. Wakonda dove in after him, calling to the gods to give back her lover. The opposing warriors drew back in awe as neither of the love struck-couple ever surfaced again. Afterwards, it was believed her spirit was still in the spring. Later legends tell that when an evil warrior steps close to the waters, the spring sends out a great geyser to swallow him up and

9. Wedel, 121, 126.

drown him.¹⁰

During the 17th century Europeans made inroads into the trans-Mississippi west. The French explorer Robert Chevalier de La Salle traveled from the Great Lakes down the Mississippi River to its mouth in 1682 and claimed all of the lands, including Kansas, whose waters drained into it as French territory. La Salle named this new land Louisiana in recognition of his monarch, Louis XIV. During the early eighteenth century French fur traders began making inroads up the tributaries of the Missouri River, including the Solomon River. After establishing amiable relations with the Kansa, the French began trading muskets and other manufactured goods for furs.¹¹

In the aftermath of France's 1762 defeat by Great Britain in the Seven Years War, or French and Indian War, the French signed over their land claims west of the Mississippi River to their Spanish allies rather than lose their territory, as well as Canada, to the British. In 1799, Napoleonic France coerced the Spanish into returning the title to the Louisiana territory. Napoleon possessed grandiose ideas about resurrecting a North American French colony to supply agricultural goods to feed his burgeoning armies. But, the British Navy ruled the seas and it became apparent to Napoleon that Louisiana's contribution to France's war effort would be minimal.

In 1803, an American delegation sent by U.S. President Thomas Jefferson approached the French about purchasing New Orleans. Napoleon offered the incredulous delegation all of the Louisiana territory, from the Mississippi River west to the Rocky Mountains, for a paltry \$15 million, three cents an acre, to double the geographical size of the young American republic.

10. "The Waconda Legend," (*The Solomon Valley Post*, June 15, 1989), 1.

11. Kenneth S. Davis, *Kansas: A Bicentennial History*, (New York: W. W. Norton & Company, 1976), 36; "Republican City History," <http://www.ci.republican-city.ne.us/history.htm>

The delegation quickly consummated the deal and the Solomon River basin officially became American territory.

Also, at this time there was an ethnographic southward shift on the Great Plains in western Kansas. After acquiring horses in the 18th century, the linguistically related Cheyenne and Arapahoe left their traditional homeland west of the Great Lakes and migrated south into the Great Plains. The Kansa retained possession of the future Glen Elder Unit's site, but now they were perpetually at constant war with their new aggressive neighbors to the west as well as the Pawnee to the north.¹²

The first American military expedition to cross north central Kansas was led by Zebulon Montgomery Pike in 1806. Other American expeditions came through the area en route to the West. The 1819-1820 Stephen Long expedition used the erroneous term the "Great American Desert" in its to describe the Great Plains. Primarily because of this image, the region was considered an unlikely environment for Euro-American agricultural settlement.¹³

During the nineteenth century the Kansa tribe was generally on friendly relations with the United States government and the ever encroaching wave of settlers. Their reserve stretched from Topeka westward to the future Glen Elder Unit site on the Solomon River. In 1846, the Kansa ceded their two million acre reserve to the U.S. government for a much smaller reservation in the upper Neosho River valley, near Council Grove in southeast Kansas. Immediately, there was trouble with Euro-Americans on the new reserve because it bordered the Santa Fe Trail. Whiskey traders and squatters moved in, and railroads wanted the Kansa' lands to build track westward. Shady collusion between a corrupt Kansas governor and unscrupulous

12. Wedel, 123.

13. James R. Shortridge, "Kansas," *Lexicon Universal Encyclopedia*, (New York: Lexicon Publications, Inc., 1985), 21.

land speculators led to the tribe being removed in 1873 to Indian Territory, today Kay County, Oklahoma.¹⁴

The first settler's cabin on the Solomon River was built in 1855. In June of 1855, an Ohio party explored the Solomon River valley seeking a colony site. A Sioux war party on the Smoky Hill River to the south scared them off. Nonetheless, a few hardy frontiersmen began entering the Solomon River valley and erecting cabins. Beginning in 1858, gold seekers traversed Kansas on their way to Colorado. For the most part the Solomon River valley was bypassed with traffic concentrated on the Smoky Hill Trail to the south. As tens of thousands of prospectors rushed for riches in the Rockies, Native Americans on the Great Plains saw the bison herds scatter and the river valleys' grass consumed by the wagon teams of mules, horses, and oxen. The swarms of gold seekers en route to Colorado inevitably led to conflict with the Cheyenne and the Arapahoe, and their allies, the Sioux.¹⁵

In 1860, a great drought descended on the Great Plains causing great hardship for the Solomon River valley's settlers. With the outbreak of the Civil War the following year emigration to the valley came to a halt. Events to the west in Colorado shattered a tenuous, but peaceful, coexistence between Native Americans and the settlers. On November 29, 1864, Major John Chivington led the 3rd Colorado Volunteers into a massacre of peaceful Cheyenne and Arapahoe on the Sand Creek reservation in southeastern Colorado, igniting a major Indian war on the Great Plains. Solomon River Valley settlers in future Ottawa County barricaded themselves in a hastily constructed stockade in late 1864, while the rest of the valley's settlers fled east in the spring of 1865. Cheyenne, Arapahoe, and Sioux war parties attacked settlers and

14. Chapman, 345-8.

15. William G. Cutler, "Ottawa County," *Andrea's History of the State of Kansas* (Chicago, Illinois: The Western Historical Company, 1882), 3.

harassed emigrant trail traffic from the Platte River in Nebraska to the Arkansas River in Kansas, including in the Solomon River valley.

In 1867, another wave of settlers began moving into the Solomon River valley, fueled by an influx of discharged soldiers from the Civil War taking advantage of their soldier claims. The Indian war was not over, though, and in 1868 rampaging war parties of Cheyenne attacked the Solomon River valley killing over two dozen settlers. In August of that year, where the town of Beloit is today, the Bell family was attacked and two men and a woman were killed and two children abducted. A column of soldiers in the area gave prompt pursuit, rescuing the six and eight year old from their abductors.¹⁶

In northeastern Colorado companies of Pawnee scouts under the command of William F. “Buffalo Bill” Cody slaughtered fleeing Cheyenne and Sioux men, women, and children in the aftermath of the decisive 1869 Battle of Summit Springs. After this crushing defeat, the Indian war generally moved to the north into Wyoming, Montana, and the Dakotas, away from the Solomon River valley. The last Indian attack in the Solomon River valley was a horse stealing raid in 1870.¹⁷

With the end of the Indian threat settlers poured into the Solomon River valley. Some settlers tilled the soil of the river valley, while others raised cattle on the rolling prairie rising out of the valley. The absence of building timber was offset by the abundance of outcrops of Cretaceous limestone, almost white in color. Many of the valley’s early business buildings and farm houses were constructed from it. The four counties comprising the future Glen Elder Unit were all established by 1871. From east to west they are Cloud, Ottawa, Mitchell, and Osborne Counties. Like a closing chapter on an era in the West, a lone buffalo straggler in 1871 strayed

16. Cutler, “Ottawa County,” 2.

17. Cutler, “Ottawa County,” 4.

on to the Main Street of Cawker City, population 250, and was promptly shot. By the following year the bison had largely vanished from Kansas.¹⁸

Drought, coupled with a plague of grasshoppers, devastated agriculture in the Solomon River valley in 1874. Osborne County's *Osborne Times* chronicled the infestation on July 30, 1874. "The grasshoppers made their advent into our county the latter part of last week, and are devouring everything before them. We noticed several fields of corn literally alive with them, being almost unable to see, either the corn or the ground."¹⁹

Good crops in 1875 and 1876 brought increased growth and renewed interest in the development of land resources. The population of Cloud, Mitchell, and Ottawa counties surged from a combined population of 4,935 in 1870 to 40,567 in 1880. The Central Branch Railroad and the Solomon Valley Branch Railroad, the latter a branch of the Kansas Pacific Railroad, were built through the region in 1879. With the introduction of the railroads, the milling industry grew rapidly and became the major industry in the Solomon River valley in the late nineteenth century.²⁰

Previous strains of domestic wheat on the Great Plains fared poorly due to the lack of precipitation and the searing summer heat. German-Russian Mennonite immigrants introduced hard winter wheat from Russia's semi-arid plains that transformed Kansan agriculture. Planted in the fall, wheat seeds lie dormant throughout the winter. The spring snows and rains nourish the hardy sprouts, which mature for harvest in June, before the onset of the scorching summer

18. William G. Cutler, "Osborne County," *Andrea's History of the State of Kansas* (Chicago, Illinois: The Western Historical Company, 1882), 4.

19. Cutler, "Osborne County," 5.

20. Denver, Colorado, National Archives and Records Administration: Rocky Mountain Region, Records of Bureau of Reclamation, Record Group 115, "Annual Project History, Glen Elder Unit, Solomon Division, Pick-Sloan Missouri Basin Program, 1947," 7, 8.

heat.²¹

With the elimination of the great bison herds on the plains, cattlemen grazed their stock on the vast pasturage stretching from the Dakotas to Texas. Winter blizzards of 1885-1886 and 1886-1887, devastated the Great Plains cattle industry, including Kansas. The ensuing onset of a severe drought caught the settlers of the Solomon River valley unprepared. Eight of the next ten years of the drought saw crop failures. Combined with the collapse of agricultural prices during the Depression of 1893, some farmers gave up and moved away.²²

Times did get better for a while. After the turn of the century the rains came back and farmers' optimism soared. High agricultural prices and readily available credit during World War I encouraged farmers to put more land into cultivation. Farmers became aware during the postwar boom era that the bubble of the agriculture boom was going to burst. In the 1920s, agriculture prices plummeted and many farmers could not make their loan payments and bank foreclosures on farms soared. Another severe drought began and wide spread winds blowing across thousands of acres of nearly unprotected soil produced the infamous Dust Bowl. The economic downturn of the 1930s Depression, coupled with a plague of grasshoppers, compounded the misery and nearly a quarter of the population left the region by 1940.²³

Elected president in 1932, Franklin Delano Roosevelt believed the government had an obligation to ease the economic duress the nation's citizenry experienced during the Depression. Previous administrations believed market forces should not be tampered with and relief efforts were best left to private charitable organizations. The severity of the economic depression overwhelmed the relief efforts of the private sector and Roosevelt implemented "New Deal"

21. Shortridge, 22.

22. Davis, 127.

23. *Project Data*, 889.

programs of relief, recovery, and reform. Within the U.S. Department of Agriculture, New Deal programs taught farmers dry land farming techniques, crop rotation, and planting of trees as wind breaks for erosion prevention.²⁴

Extreme drought in western Kansas throughout the 1930s focused the attention of local and state interests on the need for irrigation, flood control, and other possible water utilization. Requests for investigations were made to the Bureau of Reclamation by the Kansas Reclamation Association, Division of Water Resources of the Kansas State Board of Agriculture, various local organizations, and individuals, for the purpose of determining the extent Kansas agriculture could be stabilized by storing flood waters for irrigation.

Investigations, in connection with the Glen Elder Unit, were initiated in August of 1940, as part of the field reconnaissance of the Solomon River basin. The first investigations were made at the Cawker Dam site, four miles west of the Glen Elder Dam site. No field surveys of the Glen Elder dam site or reservoir area were made during this initial investigation.

Preliminary fly-line canals were surveyed from the Cawker and Glen Elder Dam sites to the project area prior to making the reconnaissance land classification in March of 1941. This included approximately 20,000 acres, extending from the Cawker Dam site to Simpson, Kansas. Other surveys consisted of a seismic survey made by the Bureau of Reclamation and thirteen core holes drilled by the Corps of Engineers at the Glen Elder Dam site.²⁵

After a devastating flood in July of 1951 on the Kansas River, to which the Solomon River was a large contributor, it was determined the reservoir should have a capacity of about 900,000 acre feet. Glen Elder Dam and Waconda Lake would contribute nearly two-thirds of the

24. "Annual Project History, Glen Elder Unit, Solomon Division, Pick-Sloan Missouri Basin Program, 1948,"

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25. "Annual Project History, Glen Elder Unit, Solomon Division, Pick-Sloan Missouri Basin Program, 1947,"

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flood control capacity required on the Solomon River. Flood control benefits alone were sufficient to justify the entire cost of the lake and dam.

The droughts experienced in the Great Plains area during the mid-1950s fully demonstrated the need for conservation, regulation, and beneficial use of the Solomon River basin's water resources. These conclusions were based on the review of data obtained during foundation and materials exploration programs. These factors plus the perceived impact of the potential dam and reservoir on local communities and land areas led to the final site selection of the Glen Elder Dam.

Another benefit arose when the city of Beloit, Kansas, expressed interest in obtaining its municipal water from the project. The city had formerly obtained its municipal water supply from the Solomon River's surface flows. This proved inadequate, and, at times, restrictions on use were imposed. The city of Beloit had a vested water right and an appropriative water right, application No. 2269, with a priority date of March 5, 1954. The city therefore requested that a municipal water supply be included as a project purpose of the Glen Elder Unit, which has resulted in the unit providing water to that city as well as to three rural water districts. Under the provisions of a long term contract, No. 14-06-700-3212 dated May 24, 1962, the city would receive up to 2,000 acre feet of water annually from Waconda Lake for forty years after the initial date of delivery.²⁶

Project Authorization

The overall development plan for the Glen Elder Unit of the Solomon Division of the Pick-Sloan Missouri Basin Program, as revised and coordinated with the Corps of Engineers

26. "Annual Project History, Glen Elder Unit, Solomon Division, Pick-Sloan Missouri Basin Program, 1963," iii, 1; "Annual Project History, Glen Elder Unit, Solomon Division, Pick-Sloan Missouri Basin Program, 1964," 7; *Project Data*, 891.

plan by Senate document 247, was approved by the Flood Control Act of 1944 (Public Law 534, 78th Congress, 2d session). The Glen Elder Unit was authorized and funds appropriated for construction by the Flood Control Act of 1946 (Public Law 526, 79th Congress, 2d session). The Army Corps of Engineers had prepared a plan for the Missouri River basin emphasizing flood control and navigation, designated the “Pick Plan” after Colonel Lewis A. Pick. The Bureau of Reclamation’s William G. Sloan headed a study that stressed irrigation and hydroelectric power. The two proposals were reconciled, hence the name “Pick-Sloan.”²⁷

Construction History

Glen Elder Dam is located on the Solomon River immediately southwest of the town of Glen Elder in north-central Kansas. The dam, completed in January of 1969, is a zoned, rolled earthfill embankment with a crest of thirty feet. It has structural and hydraulic heights of 142 and 108 feet, respectively, and a crest length of 15,275 feet at elevation 1,500 feet. Also, a long low dike with a crest length of 1,825 feet is attached at the left end of the dam. The spillway is located at the right abutment and consists of a 644 foot wide overflow crest, controlled by twelve fifty by twenty-one and three-quarter foot radial gates. Spillway structures include an excavated approach channel, a concrete gate structure, a concrete chute, a concrete stilling basin, and an outlet channel. The spillway’s discharge capacity at maximum water surface (elevation 1,492.9) is 264,500 cubic feet per second, with all twelve radial gates fully open. The outlet works is located near the left abutment. A twelve and a half foot-diameter concrete conduit leads from the intake structure to the gate chamber under the dam, which contains a nine by twelve foot emergency high-pressure slide gate. A twelve and a quarter foot diameter steel penstock, enclosed in a seventeen and a half foot diameter concrete horseshoe conduit, leads from the gate

27. *Project Data*, 892.

chamber to a bifurcation structure. At the bifurcation structure, the twelve and a quarter foot diameter steel pipe has a lateral branch to the left and divides into a wye branch ahead. The wye branch is controlled by two six and a half by eight foot high-pressure slide gates which discharge water into the upper end of the outlet works stilling basin, and then into the river.²⁸

There are two dikes on the north edge of the reservoir to protect the towns of Cawker City and Downs, Kansas. Each of these dikes has an outlet works with a pumping plant. Downs Protective Dike, located just north of Waconda Lake, forms a protective barrier along the west, south, and east sides of the town of Downs. The dike is a three and a half mile-long, zoned earthfill embankment with a maximum height of fifty feet above the stream bed. The crest width is twenty feet, except at the road ramp where the crest widens.²⁹

Cawker City Protective Dike, also located just north of Waconda Lake, forms a protective barrier along the west, south, and east sides of Cawker City. The dike is a 15,600 foot-long, homogeneous earthfill embankment with a maximum height of forty-eight feet above stream bed, and a crest width of twenty feet. The dike's appurtenant structures include the outlet works to evacuate surface runoff and treated sewage from the city's sewage system.³⁰

Waconda Lake has a capacity of about 964,000 acre feet at the top of flood control elevation 1,488.3, and a surface area of about 34,000 acres. The reservoir area provides flood control, irrigation for 21,000 acres of land, municipal water supply, recreation, fish and wildlife conservation, and pollution abatement.³¹

On October 31, 1961, the Definite Plan Report for the unit was approved by the

28. United States Department of the Interior, Bureau of Reclamation. *SEED (Safety Evaluation of Existing Dams) Report on Glen Elder Dam, Pick-Sloan Missouri Basin Program, Kansas, Missouri Basin Program*, (Denver:1987), 1-2.

29. *Ibid.*

30. *Ibid.*

31. *Ibid.*

commissioner for Glen Elder Dam and Reservoir. In 1962, Reclamation began purchasing land for the dam and reservoir. By 1963, a total of 1,901 acres of fee simple land was acquired for the dam and reservoir.

As the project began to get underway, construction facilities were built. A notice to proceed to build a Construction and Maintenance Facilities Building was given on October 14, 1963, to Kenneth Van Tilborg of Cawker City, Kansas, for the low bid of \$26,381 on Contract No. 14-06-700-4548.³²

Cawker City Diversion Dam, Drain, Protective Dike and Water Supply Facilities

On March 2, 1964, Contract No. 14-06-D-5059, to construct the Cawker City Diversion Drain, was awarded to Van Buskirk Construction Company of Sioux City, Iowa, for the low bid of \$350,956. The notice to proceed given on March 4, 1964, allowed 300 days for project completion. Change order No. 1 covering fencing, additional corrugated metal pipe, and removal of an additional old concrete box culvert from a previous private irrigation project increased the estimated value of the contract to \$353,956. The construction of 4,340 feet of fill east of Oak Creek was completed for the drain on July 24, 1964. On December 14, 1964, all work was completed with a total cost overrun of nearly \$25,000 over the amended estimate. The Cawker City Diversion Drain was transferred to city operations and maintenance status on August 4, 1968.

Contract No. 14-06-700-4563 was awarded on December 6, 1963, to Missouri Pacific Railroad for construction of their relocated section on the Cawker City Diversion Drain under Specifications No. DC-6045. Excess excavated materials from the drain construction were used to construct an additional fill for the Missouri Pacific Railroad relocation.

32. *Ibid.*, iii, 2, 3.

On August 1, 1967, Contract No.14-06-D-6222, for the construction of the Cawker City Protective Dike and Water Supply Facilities, was awarded to Bushman Construction Company of St. Joseph, Missouri, for the low bid of \$2,442,620. The work involved construction of: the earthfill dike embankment; the outlet works structure; a water collection basin (sump borrow area); a sanitary sewer drain; the municipal water supply system; pumping plant electrical systems; miscellaneous roadwork involving a portion of relocated Mitchell County Highway No. C-705, south of Cawker City; a detour connection back to the existing highway; a ramp to the sewage lagoon; a service road to the outlet works; and bituminous surfacing of existing road north of Cawker City to Saints Peter and Paul Cemetery. The work was situated on the east, south, and west perimeter of Cawker City.

In September of 1967, earthwork subcontractors Wentz Construction Company of Concordia, Kansas, and BOC Construction Company, Inc. of Hartington, Nebraska, started earthwork operations on the embankment for relocated Mitchell County Highway No. C-705. Before shutting down in December due to cold weather, the subcontractors had excavated 1,384,000 cubic yards of material from borrow areas, dike embankment foundation, and structures. For the dike and relocated road from Station 5+00 to Station 26+18, 564,000 cubic yards of Zone 1 and 1A and Zone 2 materials were placed and 466,000 cubic yards of material was placed from Station 26+18 to Station 53+19 including a vibratory roller test section. Beginning in October of 1967, the prime contractor initiated construction of fifteen-inch perforated pipe drains and completed a number of vertical drains. In early November, concrete operations were started for the outlet works structure following dewatering of the site. By the end of the year, 3,200 linear feet of twelve-inch and fifteen-inch diameter No. 14 gauge perforated pipe was installed. Throughout December, the contractor made good progress placing

361 cubic yards of concrete for the outlet works intake, conduit, and stilling basin structures, and the triple box culvert on the 12th Street improvement.

One earthwork subcontractor worked intermittently throughout January, February, and March of 1969, dressing and shaping the sump borrow area. On April 15, 1969, soil-cement placement operation resumed and was completed on June 11, 1969. Principal items of work on the project included: excavation of 2,864,454 cubic yards of material for structure sites and from sump and reservoir borrow areas; placement of 1,817,639 cubic yards of zoned materials for the dike embankment and toe drain system; placement of 512,320 cubic yards of material for the vibratory roller roadway embankment test section; placement of 58,202 tons of bedding for riprap and 82,860 cubic yards of soil-cement for slope protection; placing 982 cubic yards of concrete for the outlet works and other structures; construction of a sanitary sewer drain; construction of a municipal water supply system; construction of a pumping plant system; and associated roadwork. The Cawker City Protective Dike and Water Facilities were officially transferred to the city operations and maintenance on March 15, 1970.³³

Downs Protective Dike and Diversion Drain

The Downs Protective Dike, Contract No. 14-06-D-5263, for construction of the dike from Station 11+64 to Station 44+15, was awarded on September 25, 1964, to Alexander Construction Company, Inc., of Littleton, Colorado, for the low bid of \$414,580. October 8, 1965, was set as the completion date. On November 13, 1964, Contract No. 14-06-D-5286 for the Downs Diversion Drain, was awarded to Walters, Kershaw and Morgan, Inc., of Manhattan, Kansas, for the low bid of \$227,470. Notice to proceed was given the same day with a targeted

33. "Annual Project History, Glen Elder Unit, Solomon Division, Pick-Sloan Missouri Basin Program, 1964," 2-5; "Annual Project History, Glen Elder Unit, Solomon Division, Pick-Sloan Missouri Basin Program, 1967," 15, 16; "Annual Project History, Glen Elder Unit, Solomon Division, Pick-Sloan Missouri Basin Program, 1969," 13; "Annual Project History, Glen Elder Unit, Solomon Division, Pick-Sloan Missouri Basin Program, 1972," 2.

completion date of July 11, 1965. Due to the unavailability of rights-of-way the notice to proceed concerned only that portion of the drain through Station 90+00. By the end of the year, The contractor completed earthwork operations and initiated work on the baffled apron drop structure at Station 26+00.

An amendatory agreement with the contractor on April 30, 1965, increased the estimated value of the contract to \$239,390. The revisions/additions/charges included fencing, construction of a low water crossing, daylighting the baffled apron drop at Station 26+00, construction of additional compacted embankment in the relocated left bank, placing of waste materials, and installation of a culvert.

The contract for Downs Protective Dike from Station 44+15 to Station 190+60 provided for construction of an earthfill dike to serve as protective works for the city of Downs, Kansas. Its features included: a dike approximately 14,650 feet in length with a maximum height of ninety feet above the bottom of the cutoff trench; a drain system; an outlet works structure; interior and exterior drainage ditches; extension of the existing city of Downs sanitary sewer through an outlet works structure; river channel realignment and bank protection for the Solomon River; closure of the existing gap in the dike embankment crossing for U.S. Highway 24; construction of a water collection basin (sump borrow area); drop structures; the pumping plant electrical system; and miscellaneous roadwork.

On March 13, 1967, the Downs Protective Dike contractor resumed excavation for the core trench, and placement of the dike's embankment from Station 50+00 through Station 171+00. Riprap and bedding placement for Solomon River bank protection was completed early in the year. Dewatering operations from Station 51+00 to 65+00 started and continued until

August. Inclement weather from April to September resulted in the contractor falling twenty-eight percent behind schedule. Also, twelve working days in June were lost when portions of the south drop structure and outlet works were inundated by heavy runoff. The core trench from Station 107+00 to 111+00, and from 120+00 to 128+00, and the sump area were also flooded, but no major damage was sustained. In the latter part of July, advance notice of a thunderstorm from the Weather Bureau prevented damage to critical structure sites by flood waters on the Solomon River. From August to September, another eight inches of rain fell, but the contractor made good progress, excavating one-half million cubic yards of material from borrow pits and placing on the embankment. By October, all earthwork on the dike was complete. A total of 3,400,000 cubic yards of excavation from borrow areas and the dike foundation was required. Furnishing and placing bedding and riprap materials, including stockpiling, amounted to 19,021 tons. Protective materials for roadway structures totaled 286 cubic yards.

Concrete operations started in May, with concrete placements for the footing of the outlet works conduit section, the south drop structure, transitions for the culvert at Station 3+72 on the sewage disposal plant, and the dike access road. Good progress was made throughout the summer on the north and south drop structures, manholes, and storm sewer facilities. Concrete placements amounted to 1,051 cubic yards for the outlet works structure, 608 cubic yards for drop structures, forty-seven cubic yards for manholes and the sewer outlet, 318 cubic yards for roadway drainage structures, and 388 cubic yards for highway pavement.

On September 5, 1967, the contractor started placing soil-cement between Station 69+80 and 98+00. Silty sand material was excavated and stockpiled downstream. Material from the stockpile was fed into a hammer mill and pulverized into an acceptable size. Then cement and soil entered a pug mill simultaneously where the required water was added. A pug mill is a

machine in which materials, such as clay and water, are mixed, blended, or kneaded into a desired consistency. Some difficulties were encountered at the batch plant regarding the flow of materials, but plant modifications eventually minimized these problems. After mixing, the soil-cement was transported to the dike by twelve cubic yard dump trucks. The material was spread as it was dumped from the trucks, then rolled and compacted to the required density with a sheepfoot roller and a rubber-tired roller. Water curing was accomplished with a water tank truck equipped with a fog sprayer. Test loads were weighed and titration tests were run to determine the percent of cement in the material. The cement finishing brooming operations between lifts were performed in accordance with specifications. By November 12, 1967, soil-cement protection was complete.

Other principal features of work completed during the year were: the dike foundation drain system which included three inspection wells and about 8,300 linear feet of twelve and eighteen inch diameter asbestos bonded, perforated and non perforated, corrugated metal pipe drains; the sanitary sewer system including the connection to, rehabilitation, and modification of the existing diversion manhole; and construction of seven manholes. Also, accomplished was the installation of 1,500 linear feet of fifteen-inch diameter vitrified clay pipe; 170 linear-feet of sixteen inch cast iron pipe; the pump chamber; a chlorination building; and chlorination chamber and associated piping.

On May 22, 1968, the contractor completed work at the Downs protective dike. Throughout the remainder of 1968, numerous adjustments in equipment and automatic controls were needed to make the sanitary facilities operational. Work included installation of a replacement motor and pump for the chlorination system, modification of the ejector system to prevent discharge of sewage through the air exhaust system during ejection cycles, and cleaning

and repair of building facing discolored by discharge of sewage through air exhaust system. The Downs Protective Dike and Diversion Drain were both transferred to city operations and maintenance status on August 4, 1970.

To enclose the Downs Protective Dike, Mosbarger and Ems Construction was awarded on October 22, 1968, Contract No. 14-06-D-6641 for the low bid of \$14,305. By February 7, 1969, 1,031 linear feet of wire cable-guard fencing was installed. Later in 1969, Kansas Wesleyan University as an engineering project for its students constructed three drop structures to convey irrigation tail-water from a field located immediately west of Downs Dike sump area into an access road drainage ditch and ultimately into the Downs Dike sump.³⁴

Glen Elder Dam

For the construction of Glen Elder Dam, Contract No. 14-06-D-5270, Schedule A and C, was awarded on October 1, 1964, to Bushmen Construction Company of St. Joseph, Missouri, for the low bid of \$13,647,291. On November 14, 1964, notice to proceed was given with December 13, 1968, as the targeted completion date. The contractor immediately began stripping operations, and construction of the coffer dam to protect the core trench area from flooding. Also, clearing and sand production operations were initiated.

Tragedy struck in June of 1965, when a subcontractor on the Glen Elder Dam, Cofferdam Dewatering Corporation, had one employee killed and two others seriously injured when struck by a scraper. Other than this mishap the contractor made excellent progress due to extended fine weather conditions in the fall. Clearing operations and core trench excavations were completed by the end of the summer. By the end of the year the concrete had substantially backfilled from

34. "Annual Project History, Glen Elder Unit, Solomon Division, Pick-Sloan Missouri Basin Program, 1964," 3-6; "Annual Project History, Glen Elder Unit, Solomon Division, Pick-Sloan Missouri Basin Program, 1965," 3; "Annual Project History, Glen Elder Unit, Solomon Division, Pick-Sloan Missouri Basin Program, 1967," 4-7; "Annual Project History, Glen Elder Unit, Solomon Division, Pick-Sloan Missouri Basin Program, 1969," 4, 5; "Annual Project History, Glen Elder Unit, Pick-Sloan Missouri Basin Program, 1972," 2.

Station 20+50 to Station 132+00, and fifty percent of the spillway structure's concrete was placed.

Throughout 1966 and into 1967, Bushmen Construction Company made good progress on Glen Elder Dam. In March of 1967, the contractor completed three required stockpiles placing 4,925 tons of bedding and 10,004 tons of riprap. On March 13, 1967, the earthwork subcontractor resumed full scale operations placing materials excavated from the spillway borrow area and borrow area "A" of the dam embankment. Dam embankment was essentially completed in July from Station No. 0+00 to Station 110+00 and evacuation of the spillway area outlet channel completed. Progress on outlet works throughout August and September allowed placement of embankment over the spillway structure.

Inclement weather, with twenty-seven inches of rain from April to September of 1967, resulted in a loss of forty working days. Torrential rains in June caused surface runoff to fill construction sites at the outlet works stilling basin to a depth of twenty feet, and also inundated the spillway stilling basin and borrow areas. From July 28 to July 30, heavy upstream rains caused flooding on the Solomon River at the construction site. Even though peak flow was measured at 6,640 cubic feet per second, advance warning from the Weather Bureau prevented flooding of critical structures. Flooding on the Solomon River on September 18, destroyed the contractor's onsite heavy equipment operating bridge.

During the summer the contractor erected equipment and the batching plant for processing soil cement at Station 94+00 on the upstream toe of the dam and proceeded to stockpile materials at this location. Due to weather conditions, soil-cement operations were delayed until September. One-third of the required slope protection, 51,237 cubic yards of soil-cement, was placed before operations discontinued for the winter on November 11, 1967.

On October 9, hydrostatic testing of the pressure exerted by the water on the completed outlet works conduit was successfully performed. The closure section for Glen Elder Dam was commenced on October 16, 1967, and topped out on November 22. The first storage of water in Waconda Lake began October 17, 1967. The Solomon River was diverted through the outlet works structure on November 1, 1967.

By November 25, 1967, earthwork embankment for the dam, comprising 9,761,684 cubic yards of embankment materials, was essentially completed. By the end of the year, all twelve spillway structure radial gates had been assembled and bolted into place, and all perforated drains for structures and connecting roads to the dam completed. Spillway concrete placements amounted to 17,703 cubic yards, and the 7,242 cubic yards for the outlet works was completed.

McGowan Clearing and Sodding Company of Perham, Minnesota, was awarded Contract No. 14-06-700-6247 on October 19, 1966, for the low bid of \$115,914. Principal components of the work included: clearing 700 acres of trees and brush; removing and disposing of buildings on seventy-five farmsteads; constructing nearly four miles of boundary fence; demolishing foundations, filling basements, storm cellars, capping wells, removing fences, and windmills; and removing and salvaging 2,500 native stone fence posts. On April 25, 1967, Order for Changes No.1 provided for construction of four and a half miles of additional reservoir boundary fencing, and filling Waconda Springs with fill dirt, increasing the original contract amount by \$6,327.

In early 1967, the contractor made excellent progress clearing, piling, and burning trees for four miles along the north side of Solomon River. By the end of April, sixty percent of the work was done in forty percent of the allotted contract time. The contractor's progress slowed significantly from May to October of 1967, due to labor shortages and inclement weather. By

the end of the summer clearing was accomplished south and east of Cawker City, and in the area along the north shoreline of the reservoir from one to three miles west of Glen Elder, Kansas. Tragedy struck on September 22, 1967, when the contractor's employee James Bogart was fatally injured by a falling tree. The clearing was completed at the end of the year in the Walnut Creek and Mill Creek areas, and work was proceeding on the North and South Forks of the Solomon River west of Mitchell County Highway C-705. Initial water storage began at Waconda Lake on October 17, 1967, and official storage began on July 24, 1968.

On June 19, 1968, Contract No.14-06-700-6501 to clear the second section of Waconda Lake, was awarded to Wentz Construction Company, Inc., of Concordia, Kansas, for low the bid of \$70,530. Principal components of work involved: removing and disposing of improvements on thirty-five farmsteads and performing related work such as demolishing foundations, filling cisterns, and basements; removing windmills and filling wells; removing over eighteen miles of fence below elevation 1,460; and constructing over eleven miles of barbed wire fence.

During 1968 the last touches were put on Glen Elder Dam. Additional material was excavated to widen the right side of the outlet channel below the outlet works structure from Station 12+90 to Station 14+71. Also, furnishing and placing of bedding for riprap on the outlet channel's left bank of the outlet works structure was done from Station 12+90 to Station 14+34. Work crews removed a leaking high-pressure gate valve in the outlet works structure and installed government furnished shims, tapered pieces of metal used to adjust the fit, and reinstalled the valve.

Principal components of work on the Glen Elder Dam included: excavation of 11,726,222 cubic yards of material for spillway and outlet works structures; placing 9,887,344 cubic yards of zoned embankment and drainage materials; placing 86,028 cubic yards of

concrete for the spillway and outlet works structure; placing 98,602 tons of riprap and bedding material; and constructing 138,415 cubic yards of soil-cement slope protection. Other associated work involved in the diversion and care of the river, clearing, foundation grouting, construction of roadways, and seeding and installation of twelve fifty by twenty-one and three-quarter foot radial gates for the spillway structure and high-pressure gates for the outlet works structure along with associated electrical and mechanical systems.

On February 14, 1969, a ribbon cutting ceremony marked the opening of the county highway across Glen Elder Dam's crest. Regional Bureau of Reclamation officials participated in the ceremony with Mitchell County officials. Glen Elder Dam was officially transferred to operation and maintenance status on May 1, 1969.

Mullen Construction Company of Salina, Kansas, was awarded on June 27, 1967, Contract No.14-06-700-6639, for the low bid of \$145,734, to construct the Waconda Lake Visitor Center. On August 28, grading operations started and by September, all earthwork operations for building site sewage lagoons, a cul-de-sac, and the access road were completed. By the end of 1969, the visitor center building and terrace, along with basic electrical and mechanical systems, were completed. In 1970, the remaining work was completed, which included: constructing water and gas lines; installing lighting and plumbing fixtures; erecting chain link fence; completing retaining wall and concrete work on the terrace; rolling and sealing roadway surfacing; and installing guard posts and cleanup of the site.³⁵

Miscellaneous

35. "Annual Project History, Glen Elder Unit, Solomon Division, Pick-Sloan Missouri Basin Program, 1964," 4; "Annual Project History, Glen Elder Unit, Solomon Division, Pick-Sloan Missouri Basin Program, 1965," 2-4; "Annual Project History, Glen Elder Unit, Solomon Division, Pick-Sloan Missouri Basin Program, 1967," 8-10, 13; *Project Data*, 892; "Annual Project History, Glen Elder Unit, Solomon Division, Pick-Sloan Missouri Basin Program, 1969," 3, 6-10, 14; "Annual Project History, Glen Elder Unit, Pick-Sloan Missouri Basin Program, 1972," 2.

On December 3, 1963, Contract No. 14-06-700-3292 was negotiated with Missouri Pacific Railroad for relocation surveys and preparation of design data. After it was completed and submitted for review, the Missouri Pacific Railroad negotiated Contract No. 14-06-700-4633 for relocation of tracks through the project area, on July 17, 1964. Van Buskirk Construction Company of Sioux City, Iowa, and Graves Construction Company of Melvin, Iowa, on September 14, 1964, were jointly awarded the contract for grading of the relocated rail line with their low bid of \$2,016,398. The railroad had accepted the contractors' proposal to use riprap and bedding alternates. On October 13, 1964, work started. Several cross-drainage structures in the Granite Creek area were modified in accordance with plans for relocation of U.S. Highway 24.

Throughout the summer of 1964, local roads and utility, power, and telephone lines were relocated. The Kansas State Highway Commission on June 9, 1964, received Contract No. 14-06-700-688 for the reconstruction of Kansas State Highway 181, near the Downs Diversion Drain. No construction was performed on the state highway in 1964, due to unresolved rights-of-way claims by the city of Downs, Kansas, in the Diversion Dam area.

On June 17, 1964, Contract No. 14-06-700-4633 was negotiated with the Missouri Pacific Railroad Company for relocation of rail line through the project area. The contract for this work was awarded to Graves Construction Company of Melvin, Iowa, and Van Buskirk Construction Company of Sioux City, Iowa, on September 14, 1964, for the joint bid of \$2,016,398. Work began October 13, 1964. Subcontractor Grosshans and Petersen, Inc., of Marysville, Kansas, was awarded on August 7, 1965, the subcontract for track construction by the railroad company.

The first train was routed over the new section of track between Glen Elder and Downs on March 4, 1966. By April 25, 1966, Missouri Pacific Railroad commenced operations over the

entire relocated track and Western Union completed work on their communications system.

Supplement No. 1 was executed on May 19, 1966, to provide for a seventeen car rail siding at Cawker City. On April 6, 1966, Wentz Construction Company, Inc., of Concordia, Kansas, was awarded a \$24,505 contract for removal of the abandoned portion of the railroad line.

During 1965, three cemeteries were abandoned and their graves moved the following year because of Glen Elder Dam. The cemeteries relocated to higher ground were Saints Peter and Paul Cemetery, Granite Creek Cemetery, and Grelett Cemetery.

Bushmen Construction Company of St. Joseph, Missouri, was awarded Contract No. 14-06-D-6001 on July 25, 1966, for the low bid of \$440,795. The contract was for the construction of the Solomon River bridge, embankment, and channelization for Mitchell County Highway C-705. Principal components of work included : construction of a four-span continuous welded steel girder bridge with concrete deck slab; concrete piers; abutments incorporating steel piling; and construction of abutments for the bridge and the Solomon River diversion. The job site was located two miles south of Cawker City, Kansas, on relocated Mitchell County Highway C-705.

The contractor made good progress during the fall of 1966, completing thirty-nine percent of the work. Despite snowy and cold weather conditions which limited construction activity during January of 1967, the last concrete placement for the south abutment was made and pile driving operations for the north abutment commenced. Improved weather conditions in February allowed the contractor to make good progress. Work was completed on the north abutment by driving 900 linear feet of twelve inch steel piling and placing 900 cubic yards of concrete. The erection of structural steel commenced on February 24, and was completed on March 20. On the same day, hauling and placement of bedding and riprap on both abutments began and was completed in April.

Beginning in April, heavy rains began to fall and continued throughout the spring, hindering construction. Concrete placement for the bridge deck and curbing was initiated in April and completed in June. Throughout May, completion of compacted backfill for three piers and both abutments were accomplished. Heavy spring rains left only eighty-five percent of the work completed when the contract expired on June 28, 1967. The work that remained included completion of excavation for the channel change, diversion of the Solomon River, and placing bedding and riprap protection. Continuing rains and flooding in July delayed work being completed until August 2, 1967.

Principal items of work completed in 1967 on the Solomon River bridge and its associated features included: excavating 464,000 cubic yards of material; placing 3,000 cubic yards of backfill; and 12,000 tons of riprap and bedding. Also accomplished was the driving 3,500 linear feet of ten inch and twelve inch steel piling; erecting 324,000 pounds of structural steel; and placing 1,394 cubic yards of concrete.

On September 1, 1967, road reconstruction Contract No. 14-06-D-6375 was awarded to Reece Construction Company, Inc., Scandia, Kansas, for the low bid of \$557,295. On October 11, 1967, earthwork subcontractor William Givens Construction Company, Inc. of Phillipsburg, Kansas, started work on October 11, 1967, on Township Road No. 277. The roadway embankment was constructed from Station 14+00 to Station 72+50 with materials excavated from adjacent borrow areas. By the end of the year all grading operations were completed on Township Roads Nos. 277, 471, 28-A, 52, 56, and 58-B, including culvert structures and placement of the existing bridge at Station 5+23.3 on Township Road No. 28-A with an eighty-four inch multiplate corrugated metal pipe arch. Fencing and seeding subcontractor, R.C. Leake of Oberlin, Kansas, installed 1,774 linear feet of fence and seeded

thirty-seven acres to complete this portion of the work.

During October of 1967, the prime contractor began moving equipment and materials to the jobsite and erecting a batch plant. A delay in obtaining the batch plant's replacement screens deferred any concrete placements during the year. Pier Nos. 1 and 2 were excavated, and shaping embankments for the abutments for the bridge on the North Fork of the Solomon River was completed. Pile driving operations proceeded on Abutment No. 1 and forms were constructed for the piers. By the end of the year work was fifteen percent complete. All work was completed by the following fall.³⁶

Post Construction History

The Bureau of Reclamation operates and maintains the unit. Operations and maintenance of the Glen Elder Unit have been routine since construction.

A definite plan report was published in June 1961, in which flood control was described as a major project purpose. Irrigation was excluded from the report. Nonetheless, the Mitchell County Irrigation Demonstration Farm was selected by Reclamation's Technical Committee in May of 1962. The demonstration farm was located three-fourths of a mile south of Asherville, Kansas. The Solomon River runs through the farm and is the source of irrigated water, which is pumped from the river and conveyed to the land via portable aluminum pipe. Thirty-six acres were leveled and produced irrigated corn the following year.

On September 7, 1966, feasibility studies on the irrigation phase were authorized by Public Law 89-561. Arrangements for soil conservation practice were made with the Osborne County Soil Conservation District on August 29, 1966, and with Mitchell County Soil

36. "Annual Project History, Glen Elder Unit, Solomon Division, Pick-Sloan Missouri Basin Program, 1964," 4, 5, 7-10; "Annual Project History, Glen Elder Unit, Solomon Division, Pick-Sloan Missouri Basin Program, 1965," 13; "Annual Project History, Glen Elder Unit, Solomon Division, Pick-Sloan Missouri Basin Program, 1967," ii, iv, 11, 14, 15, 17.

Conservation District on September 7. However, Public Law 88-442 required that if an irrigation system were to be incorporated into the plan the unit must be reauthorized, and studies for this were initiated in fiscal year 1968. The preparation of a feasibility report began, but was suspended in fiscal year 1972, in anticipation of the need to complete the study under new criteria promulgated by the Water Resources Council. Studies under these the Water Resources Council's new criteria have not been authorized to date.

Glen Elder Irrigation District-No. 8 was approved by the Chief Engineer, Division of Water Resources, Kansas State Board of Agriculture, on November 16, 1976. The first board of directors was elected in February of 1977. As a result of significant changes in the available water supply for the Kirwin and Webster Units upstream of the Glen Elder Unit on the Solomon River, the Bureau of Reclamation initiated a water management study of the Solomon River in October of 1976. This study examined the factors affecting surface water supplies of the basin and helped verify the potential water supply available for the irrigation phase of the Glen Elder Unit. As of 2001, no immediate plans have been authorized.³⁷

Settlement of Project Lands

The Solomon River basin where the Glen Elder Unit is located was settled by homesteaders in the 1870s and the 1880s. Due to existing settlement, no new lands were developed in conjunction with the project.

Project Benefits

Flood Control and Water Supply

Glen Elder Dam has an exclusive flood control storage capacity of 722,315 acre-feet and an additional surcharge capacity of 164,966 acre-feet for a total flood control capacity of

37. United States Department of the Interior, Bureau of Reclamation, Nebraska/Kansas Office, "Pick-Sloan Missouri Basin Program - Glen Elder Unit," 1998, <http://dataweb.usbr.gov/html/glenelder.html>, 3.

887,281 acre-feet. As of 1998, Glen Elder Dam has prevented \$116 million dollars in flood damages. The unit provides a dependable water supply to Beloit, Kansas, as well as to three rural water districts.³⁸

Recreation

The Bureau of Reclamation signed contracts on January 6, 1969, with the Kansas Forestry, Fish and Game Commission, to administer 12,498 acres of land and 12,602 acres of water, and the Kansas State Park and Resources Authority to administer 1,391 acres of land of the Glen Elder Unit. Later that same year on May 29, 1969, Waconda Lake had a tragic first when Wayne Van Way of Cawker City drowned.

Today, the Kansas Department of Wildlife and Parks administers 23,901 acres of land and water for fish and wildlife. Hunting for quail, pheasant, waterfowl, and small and big game is available. The reservoir also provides excellent fishing for a variety of species, including walleye, crappie, white bass, striped bass, and channel and flathead catfish.

Glen Elder State Park not only offers hunting and fishing opportunities, but swimming, bicycling, horseshoes, volleyball, softball, boating, and water skiing. There are four campgrounds and a full service marina providing boat and slip rental, boating and camping supplies, and groceries. One of the park's newest features is the Waconda Heritage Village, featuring the historic Hopewell Church, storm shelter, and ecological exhibit. Future proposals include a full scale replica of the sacred Native American meeting place called Waconda Springs.³⁹

Conclusion

38. "Pick-Sloan Missouri Basin Program - Glen Elder Unit," 4.

39. "Annual Project History, Glen Elder Unit, Solomon Division, Pick-Sloan Missouri Basin Program, 1972," 2; "Pick-Sloan Missouri Basin Program - Glen Elder Unit," 4; Kansas Department of Wildlife and Parks, "Glen Elder State Park," 1998, <http://www.lasr.net/lasr/kansas/glenelder/stabody.html>, 1.

Glen Elder Dam and Waconda Lake provides flood protection to the lower Solomon River valley and to the lower Smoky Hill and Kansas Rivers. The unit provides a dependable water supply to Beloit, as well as to three rural water districts. The reservoir has the storage capacity to irrigate 30,000 acres of land after satisfying the requirements for present project purposes, if authorization is given in the future. Until then, the Glen Elder Unit is not maximizing the possible usage of its water storage.

About the Author

Kevin E. Rucker was born in Clarinda, Iowa, and raised in Colorado. Rucker received his B.S. in Marketing from Metropolitan State College of Denver in 1993, B.A. in History from the University of Colorado at Denver in 1995, and a M.A. in History from the University of Colorado at Denver in 1997. Rucker is currently enrolled in the Ph.D. program of the Graduate School of Public Affairs at the University of Colorado at Denver. He teaches European, American, and Colorado History at Metropolitan State College of Denver, Red Rocks Community College, and Arapahoe Community College. A published author with four books, Rucker has served on the Jefferson County Historical Commission since 1997. Rucker is married to Darcey, an environmental science major, and has three children and resides in Arvada, Colorado.

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