

Jamestown Dam and Reservoir Unit

**Garrison Diversion Unit
Pick-Sloan Missouri Basin Program**

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Jamestown Dam and Reservoir

The James River has one of the flattest slopes of any river in North America, at points only falling ½-foot over the length of a mile. Wide and meandering, the appearance can be very deceiving. Each spring, the calm stillness gives way to raging torrents that threaten farms and towns along its course. The control and use of this river of enormous contrasts is a key to life along its banks.¹

Project Location

Jamestown Dam and Reservoir is located on the James River, a tributary of the Missouri River, in central North Dakota approximately one-quarter mile upstream from the town of Jamestown. The river drains an area of more than 21,000 square miles in North and South Dakota. Temperatures in the region range from a low of -36° to a high of 108°. Annual precipitation is just over 17-inches and the growing season is 140 days long.²

Historic Setting

The first systematic exploration of the Missouri River was undertaken by Lewis and Clark between 1804 and 1806. Their exploration of the river opened the way for settlement, and before long the river became a primary route through the region. The era of river navigation began in 1836, when the riverboat *Yellowstone* made its way up the Missouri to the mouth of the Yellowstone River. In 1862, the Homestead Act began a wave of settlement that continued unabated well into the twentieth century.

Settlement along the James River began with construction of the Northern Pacific Railroad. In 1871, railroad workers and their military guards established a camp near the confluence of the James River and Pipestem Creek. This camp later became Jamestown. The Northern Pacific connected Jamestown with Fargo in 1872, and Bismarck in 1873. Over the next decade, branch lines connected Jamestown with New Rockford to the north, and Oakes to

1. United States Department of Interior, Bureau of Reclamation, *James River Comprehensive Report, Garrison Diversion Unit*, (Missouri-Souris Projects Office, September 1989), S-3.

2. United States Department of Interior, Bureau of Reclamation, *Technical Record of Design and Construction, Jamestown Dam*, (Denver: U.S. Government Printing Office, 1957), 1; United States Department of Interior, Water and Power Resource Service, *Project Data*, (Washington: US Government Printing Office, 1981), 917.

the south.

Following the early pioneer days, Jamestown became a trading center for nearby farms and towns. Most of the farming activity in the Jamestown region consisted of raising cash crops, with the remainder devoted to cattle, poultry, and dairy production. Farming in the region was risky at best. The 160- and 320- acre farm patterns that dominated the region proved too small for the semi-arid climate, and years of sporadic production followed by the disastrous drought of the 1930s forced many to abandon their homesteads.

In the 1890s, the United States Geological Survey investigated ways of diverting the waters of the Missouri River to the James River Basin. These studies were renewed in the 1920s when several proposals were made to bring water into the region from the Missouri. In 1939, the U.S. Army Corps of Engineers completed construction of Fort Peck Dam in eastern Montana. In 1942, the Bureau of Reclamation presented a plan to irrigate more than 1,000,000 acres of lands below Fort Peck Dam and replenish Devils Lake in North Dakota, which had completely disappeared during the drought of the 1930s.

If the sporadic water years and the extended drought of the 1930s weren't bad enough, devastating floods frequently occurred along the Missouri River and its tributaries. Between 1876 and 1940, numerous major floods struck along the James River and at Jamestown. Major floods in 1942 and 1943 underscored the need for flood control on the James River and the main stem of the Missouri River. The region's need for a secure water supply and a way to control it would bring together the nation's two most prominent water resource development agencies, the Bureau of Reclamation and the U.S. Army Corps of Engineers, in what was described by some as a "... `loveless shotgun wedding' of two competing agencies."³

Project Authorization

Jamestown Dam was authorized as part of the Flood Control Act of 1944,⁴ which authorized the Pick-Sloan Missouri Basin Program (PSMBP), a comprehensive program

3. *Technical Record of Design and Construction*, 1-5; *Project Data*, 871-2, 915; William E. Warne, *The Bureau of Reclamation*, (Boulder: Praeger Publishers, Inc., 1973; reprint, Boulder: Westview Press, Inc., 1985), 164.

4. 58 Stat. 887, Public Law 534, 78th Congress, 2nd session.

developed by the Bureau of Reclamation and the U.S. Army Corps of Engineers to control and develop the water resources of the Missouri River Basin. Authorized as part of the Missouri-Souris Unit of the PSMBP, Jamestown Dam was constructed early to provide much needed flood control for Jamestown and the areas downstream. The Second Supplemental Appropriation Act of Fiscal Year 1952 allocated \$500,000 for construction of the dam.⁵

Construction History

Investigations

Investigations into the development of the James River Basin began as early as 1926. In 1933, the Army Corps of Engineers reported on potential development of the basin. The first studies conducted by the Bureau of Reclamation began in 1940 and were included in Reclamation's comprehensive plan for development of the entire Missouri River Basin. In 1947, the Corp of Engineers completed a flood control study for the James River that was combined with Reclamation's study of multipurpose projects on the river. In December 1951, Reclamation issued a definite plan for construction of Jamestown Dam as a feature of the PSMBP.⁶

Construction

The initial designs and estimates for the dam were prepared in 1951. Seven alternatives investigating outlet capacity and arrangement were studied before the final design was selected. The site selected was chosen because it offered the required storage with the smallest possible dam, and satisfactory embankment materials were available nearby. One disadvantage of the site is that the foundation contains areas of unstable and pervious materials. Removal of the materials would have required excavations more than 120 feet below the existing ground surface, making the project economically infeasible. The problems related to the pervious materials were considered minor because the designed purpose of the reservoir required extended storage in only the lower 30 feet with the remainder of the reservoir reserved for temporary storage of transient flood flows. To compensate for the areas of unstable materials, Reclamation's

5. *Technical Record of Design and Construction*, 5; United States Department of Interior Bureau of Reclamation, *Repayment of Reclamation Projects*, (Washington: US Government Printing Office, 1972), 270, 290.

6. *Project Data*, 915-7; *Technical Report of Design and Construction*, 5.

designers determined that through proper embankment design and foundation excavations, the problem could be adequately overcome.⁷

Construction of the dam began in early 1952. Bids for construction of the dam and appurtenant works were opened on March 18, 1952. The low bid of \$1,868,862 was submitted by the C. F. Lytle Company of Sioux City, Iowa. The bid was accepted and the contract awarded on March 25 with notice to proceed received by the contractor on March 31. The four high pressure gates for the outlet works were supplied by the Hardie-Tynes Manufacturing Company of Birmingham, Alabama, at a cost of \$72,995. The contract was awarded on March 10, 1952, with the final shipment under the contract made in February 1953. Other contracts awarded included contracts for clearing the reservoir site, relocation of roads and construction of bridges, and relocation of powerlines.⁸

Construction work at the dam began in April 1952, with excavations for the outlet works. This was closely followed by excavations for the spillway which began in early June. Excavations for the abutment cutoff trenches were carried out in conjunction with excavations for the outlet works and spillways. Excavation of the wide foundation trench began in mid-May. The foundation trench is 215-feet wide, extending 115-feet upstream, and 100-feet downstream from the axis of the dam. The wide trench was required in order to remove as much unstable material from the foundation area as possible. Most of the materials removed from the excavations were determined to be unsuitable for use in the embankment and were wasted.⁹

Embankment placing operations began in late July with placement of zone 1 material in the abutment cutoff trench on the right abutment. The embankment was designed using two zones. Zone 1 contains impervious materials and forms the core of the dam embankment. Zone 1 material was placed in horizontal layers and compacted into 6-inch layers using a drum roller. Zone 2 material is pervious in nature and is placed atop zone 1. Zone 2 material was placed upon the embankment and rolled into 12-inch layers. About 1/3 of the embankment is zone 2

7. *Technical Record of Design and Construction*, 19, 22-3.

8. *Ibid.*, 55-6.

9. *Ibid.*, 63-5.

material. Because of the availability of materials, the orientation of the dam, and the direction of the prevailing winds, Reclamation designers determined that only minimal slope protection was required. Only the upper portion of the upstream face of the dam is protected by a layer of rip-rap. The lower section of the upstream face was extended out to a 10 to 1 slope and covered with a layer of gravel. The downstream face of the dam is protected by zone 2 material.¹⁰

Concrete placement began in late June with minor placements in the upstream cutoff collars of the outlet works. The first major placement took place in late July with placement in the downstream outlet conduit. Placement in the upstream conduit began in late August, after a steel strike caused delays in delivery of a concrete form. Concrete placement in the spillway began in early October. The final placement of the 1952 construction season was made on December 7. By the end of the 1952, work under the primary contract was 67% complete.¹¹

Work under the reservoir site clearing contract began on January 5, 1953, when the contractor, Brasel and Whitehead, of Riverton, Wyoming, began moving equipment onto the site. Brasel and Whitehead had been awarded the contract on December 9, after submitting a low bid of \$73,750. The contract was divided into three schedules calling for the removal of trees and brush from 927 acres within the reservoir site. Clearing operations began on January 6 and continued until completed. Work under the contract was accepted as complete on October 22, 1953.¹²

When construction under the primary contract resumed for the 1953 season, the work progressed at a rapid pace. By the end of April, the upstream conduit of the outlet works was completed. Installation of the four high pressure gates and gate assemblies in the outlet works began on April 1. Embankment placing operations resumed on May 14. Placement of zone 1 material around the outlet works was completed by the end of June, with placement about the spillway conduit completed in late July. The final placement of zone 1 materials took place in

10. *Ibid.*, 24-5, 67.

11. *Ibid.*, 87; Denver: National Archive and Records Administration, Rocky Mountain Region. Records of the Bureau of Reclamation, Record Group 115. "Project Histories: Jamestown Unit, Pick-Sloan Missouri Basin Program." Vol. I, 1952, 7 (hereafter cited as "Project History" followed by volume number, year, and page).

12. Technical Record of Design and Construction, 56, 93.

late August. The spillway and outlet works were completed on August 31, and the embankment topped out on September 11. The final placement of concrete took place on September 28, and all work under the primary contract was completed on September 30, 1953, 251 days ahead of schedule.¹³

Jamestown Dam is a 1,418-foot long, rolled-earthfill dam. The crest of the dam is 85-feet above the streambed and 110-feet above the deepest point of excavation. The maximum width of the dam from upstream toe to downstream toe is 730-feet. The embankment contains 963,000 cubic yards of material. The spillway consists of a morning-glory type intake with a concrete cut and cover conduit through the right abutment of the dam. The maximum capacity of the spillway is 2,930 cubic feet per second (cfs). The outlet works are a cut and cover conduit through the left abutment. Flows are controlled by four, 5-foot by 6-foot high-pressure gates, two for regulation and two for emergency control. The maximum capacity of the outlet works is 2,990 cfs. The outlet works have been designed for possible future installation of power penstocks. The design of the outlet works also allows for the future supply of municipal water for Jamestown.

Jamestown Reservoir has a maximum capacity of 230,000 acre feet (a/f), of which 200,000 a/f is for flood control. The normal storage capacity is just under 30,000 a/f. At normal capacity, the surface area of the reservoir is 2,095 acres. When filled to its maximum depth, the reservoir covers 13,250 acres.¹⁴

Post-Construction History

Jamestown Dam was transferred to operation and maintenance on September 30, 1953. In August 1954, Reclamation signed a contract with the Stutsman County Board of Park Commissioners for the development of recreational facilities at the reservoir. This resulted in the construction of roads, a swimming beach, picnic and camping facilities, and a park.¹⁵

In 1957, the Missouri-Souris Unit was redesignated the Garrison Diversion Unit. The

13. *Ibid.*, 67, 71, 87, 89, 91: "Project History: Jamestown Unit" Vol. II, 1953, iv-v, 2.

14. *Technical Record of Design and Construction*, frontispiece; *Project Data*, 917.

15. *Project Data*, 917.

original plan for the Missouri-Souris Unit called for diversion of water from the reservoir behind Fort Peck Dam in Montana to irrigate over 1,000,000 acres in Montana and North Dakota. Because Reclamation was unable to find suitable lands in Montana, the plan was modified. Water would be diverted from Garrison Reservoir in North Dakota to irrigate lands in the north-central and eastern parts of the state. Jamestown Reservoir would be used to control and regulate water for irrigation of project lands downstream along the James River. Because of changes in the original plan and provisions in the 1964 Appropriations Act requiring reauthorization of all unconstructed units of the PSMBP, it was necessary to seek a new authorization for the Garrison Diversion Unit. In August 1965, construction of the unit was authorized by Congress.¹⁶

It was more than ten years following its completion before Jamestown Dam began to provide the flood control benefits for which it had been constructed. The first releases for flood control purposes were made in April 1965. The following April, the reservoir reached its highest level since its completion, holding back more than 70,000 a/f. In April 1969, high runoff raised the level of the reservoir to its record high level, impounding just over 105,000 a/f, a level not approached again for almost 25 years.¹⁷

In 1984, a commission was appointed to look into a number of issues relating to the Garrison Diversion Unit. These issues included concerns over economic and environmental impacts, and possible violations of international water rights agreements. The commission made numerous recommendations, including the reduction of the project from 250,000 acres to just over 130,000 acres. The Garrison Diversion Unit Reformulation Act of 1986 authorized implementation of the commission's recommendations. Under the act, Jamestown Dam and Reservoir remain as features of the unit.¹⁸

When Jamestown Dam was constructed, Reclamation engineers recognized that certain

16. "Project History: Garrison Diversion Unit", Vol. I, 1965-8, 2; *James River Comprehensive Report, Garrison Diversion Unit*, S-1.

17. "Project History: Jamestown Unit", Vol. XV, 1966, 2; "Project History: Garrison Diversion Unit", Vol II, 1969, 2; Memorandum, Neil Stessman, Regional Director, Great Plains Region, to Assistant Commissioner - Resources Management. "1993 Flood Control Operations and Benefits - Great Plains Region". 31, January, 1994. Current files: Bureau of Reclamation - Water, Land, and Cultural Resources.

18. *James River Comprehensive Report, Garrison Diversion Unit*, S-2 - S-4.

deficiencies existed in the foundation, but were confident that potential problems could be corrected in the future. The primary problem is seepage of water through pervious material in the old river channel and water pressure within the dam embankment. Reclamation designers recognized that when the level of the reservoir increased, seepage and water pressure within the dam embankment might rise, threatening the structural integrity of the embankment. The designers recommended installation of relief wells downstream from the dam should this occur. In May 1969, when the reservoir surface reached its record level, water pressure and seepage increased, but the recommendations of the designers were overlooked and relief wells were not installed.

In 1993 and again in 1995, high inflows pushed the level of the reservoir to within one foot of the 1969 level, causing increased pressure and seepage. A recent inspection by Reclamation's Dam Safety Office indicated that the dam could fail if the deficiencies were not corrected. Their report indicated that when the reservoir's surface was at normal operating levels, the potential for failure was small, but as the water level increased, the potential for failure rose dramatically. In a memo to the Commissioner of Reclamation, the head of Reclamation's Dam Safety Office recommended the immediate installation of relief wells and the installation of a heavy gravel filter blanket to prevent the loss of embankment materials through seepage. Eight relief wells were installed in the downstream toe of the dam in late 1995. Installation of the filter blanket is scheduled for the spring of 1996.¹⁹

Settlement of Project Lands

Because Jamestown Dam and Reservoir were constructed primarily as a flood control unit, no lands were withdrawn for settlement in conjunction with construction of the unit.

Project Benefits and Uses of Project Water

The primary use of water from Jamestown Reservoir is recreation. Although the Garrison Diversion Unit Reformulation Act of 1986 authorized irrigation development of

19. Memorandum, David Achterberg, Chief, Dam Safety Office, to Commissioner [Reclamation], "Request for Approval of Transfer of Safety of Dams Funds for Modifications at Jamestown Dam, Garrison Unit, Pick-Sloan Missouri Basin Program," [1995], Current files: Bureau of Reclamation - Dam Safety Office; Darrell Ahlers, Ecological Planning and Assessment Office, Interview by author, 16 February 1996.

130,000 acres within the Garrison Diversion Unit, the only irrigation development has taken place at the Oakes Test Area, downstream from Jamestown Reservoir near the town of Oakes. There is just over 7,000 acres available for irrigation within the test area. Currently, only 6 farm units totaling just under 1,000 acres receive water from the Garrison Diversion Unit.

Recreational activities at Jamestown Reservoir are administered by the Stutsman County Park Board. Activities available at the reservoir include camping, boating, fishing, and hunting. In 1992, more than 54,000 visitor days were recorded at Jamestown Reservoir.²⁰

In addition to providing water for recreational uses, Jamestown Reservoir provides a significant degree of flood control along the lower reaches of the James River. Since its completion in the early 1950s, the Jamestown Dam and Reservoir has prevented almost \$36,000,000 in damage due to flooding, including more than \$7,500,000 in 1993 when record floods ravaged the Missouri River Basin.²¹

Conclusion

Although yet to realized its full potential as a multi-purpose unit, the importance of Jamestown Dam as a flood control unit can not be underestimated. As downstream development encroaches further and further into the historical flood path of the James River, flood control operations at Jamestown will become increasingly critical and complicated, placing great demands on officials of the Bureau of Reclamation and Army Corps of Engineers. If development of the Garrison Diversion Unit ever reaches its full potential, the benefits provided by Jamestown Dam will increase significantly. But even if there is no further development, the benefits provided by Jamestown Dam and Reservoir are far greater than the small size of the unit might indicate.

About the Author

William Joe Simonds was born and raised in Colorado and has a clear understanding of the importance of water in the American West and its influence

20. 1992 Summary Statistics, Water, Land, and Related Data, 62, 109, 114; James River Comprehensive Report, Garrison Diversion Unit, S-5.

21. "1993 Flood Control Operations and Benefits - Great Plains Region"; Memorandum, J.(Jim) L. Wedeward, Manager, RMSG, to Director, Water, Land, and Cultural Resources. "1994 Flood Control Operations and Benefits - Great Plains Region". 31, January 1995. Current files: Bureau of Reclamation - Water, land, and Cultural Resources.

on the development of that region. He attended Colorado State University where he received a BA in History in 1992 and a Masters in Public History in 1995. He lives with his wife and two children in Fort Collins, Colorado.

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