Lower Marias Unit

Pick-Sloan Missouri Basin Program

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Lower Marias Unit

In his April 1930 article, "Irrigation Problems of Montana," H. H. Johnson, superintendent of the nearby Milk River Project, noted some of the successes and failures of Reclamation endeavors. Johnson paid tribute to the Bureau of Reclamation for its remarkable technical successes bringing water supply to formerly dry lands. "Yet," he warned, "the human problem still remains." He believed some of the lands now being authorized for irrigation would have a difficult time paying off their irrigation costs. Specifically for this reason, the Reclamation Service extended its repayment period from ten to forty years. With the benefit of hindsight, it's not difficult to see the prophecy in Johnson's words. Ultimately, it was not the technical challenges or problems that obscured the Lower Marias Project. Rather, it was the people of the Marias River Valley with a little help from Mother Nature—that would deflate the project's main goal of irrigating the 127,000 acres in the Marias River Basin.

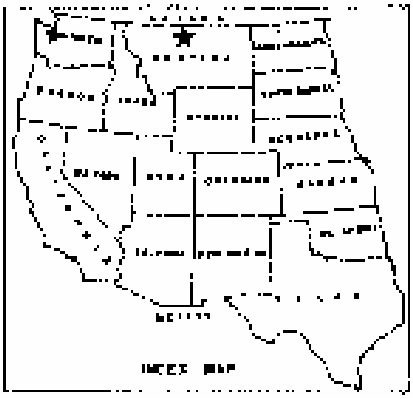
Landowners, poverty stricken from drought and economic decline, clamored for government help with irrigation during the lean 1930s. The Bureau of Reclamation heeded this call, producing a comprehensive plan to build a reservoir that would irrigate 127,000 acres of land through a vast network of canals. However, improved rain and economic conditions caused land owners to lose interest in irrigation. By the time Reclamation realized that landowner interest in paying for the project had fizzled, construction of the 23,000,000 Tiber Dam was nearly finished. The Marias River now filled a reservoir serving only a fraction of the lands the project originally intended.[1]

Project Location

The Marias River Basin is in north central Montana along the Marias River in Chouteau,

1. H. H. Johnson, "Irrigation Problems of Montana," *The Reclamation Era*. (April 1930): 58, 123; http://www.usbr.gov/dataweb/projects/idaho/boise/history.html - Location#Location

Hill and Liberty counties. The Marias River is located between the Missouri River to the south and the Milk River to the north. Fort Benton lies twenty-five miles to the south of the Marias River; Chester is twenty miles to the north. The project area is sparsely populated, as is the state of Montana generally; at the time of the project's authorization, Havre was the only urban city within a fifty-mile radius. The irrigable lands on the Lower Maria Project lie to the south of US highway 2, which runs through Chester eastward to Havre. The eastern part of the unit is traversed by highway 87. Tiber Dam, the principle structure of the unit, lies about thirteen miles south and six miles to the west of Chester and is about sixty miles north of Great Falls. The land is semi arid, averaging around 8-10 inches of rain per year.[2]



Historic Setting

The American Indian population of Montana was diverse and strong prior to European contact. The tribes of Montana gave the encroaching non-Indians plenty of difficulties. Independent fur traders established forts with difficulty; the Blackfeet repeatedly drove trappers and missionaries from their country before signing their first peace treaty. In 1851, the Treaty of Fort Laramie slowly helped pacify the western plains. On October 17, 1855, the Federal Government negotiated a treaty with Blackfeet who received land westward from the mouth of the Milk River to the main range of the Rocky Mountains, and northward from the Musselshell to the Canadian border. By 1869, they agreed to give up their hunting grounds south of the Teton River. Nevertheless, continued difficulties with tribes led to the establishment of larger

2. United States Department of Interior, Water and Power Resources Service. *Project Data* (Denver: United States Government Printing Office, 1981).

forts like Missoula, Assiniboine, and Manginnis.[3]

The economy of north central Montana shifted from fur trading to mining and ranching during the nineteenth century. Enterprising men established the fur trade in the 1820s and 1830s. Steamboat and railroad travel on the Missouri River led, in time, to increased development in the Montana Territory. As the fur trade dwindled, the discovery of rich gold deposits reinvigorated interest and settlement in Montana. As mining shifted from easy placer gold to lode claims with deposits of gold and silver, many individuals found it easier to make a profit by providing support services. Hotels, shores and toll roads developed along with farms and ranches to provide food to the miners. Montana's mining camps produced more than ten million dollars in precious metals annually through the 1860s.[4]

Montana's lively mining industry contributed to the rise of ranching in Montana. The livestock industry satiated the demand for food in mining camps and towns. By the 1870s the valleys of Montana had been stocked with cattle and sheep. The robust industry led to high profits, but it also led to overgrazing, which along with several years of drought and the harsh winter of 1886-7 depleted the range and ultimately contributed to the decline of livestock. Ranching continued to be a viable industry in Montana, but mostly large livestock companies owned the cattle and dominated the industry.[5]

Though the first settlers of the region were largely English and Scottish, later settlers arriving from the Midwest were predominantly of Norwegian and German extraction. Many migrated because of the 1862 Homestead Act, which gave lots of 160 and 320 acres, essentially for free. The arrival of the homesteader spelled the end of Montana's traditional open grazing

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3. Howard R. Lamar, ed., *The New Encyclopedia of the American West* (New Haven: Yale University Press, 1998), 729; "Project Histories," 1948-73, Volume II, 12, Records of the Bureau of Reclamation, Record Group 115 (RG 115), National Archives and Records Administration–Rocky Mountain Region, Denver, Colorado (NARA).
4. Lamar, *New Encyclopedia of the American West*, 729-30.
5. Lamar, *New Encyclopedia of the American West*, 731.

economy, as branding and barbed wire became common along the landscape.[6]

The same factors that encouraged territorial expansion continued after Montana became a state in 1889. In 1893, James J. Hill completed the Great Northern Railway, the 1,700 mile rail line connecting St. Paul, Minnesota to Seattle, Washington. Railroads were hardly the only giant industry in the state during the turn of the century. After the gold rush, continued discoveries of copper and silver in Montana kept mining as the key industry of the state. The president of the colossal Anaconda Mining Company, John D. Ryan, consolidated a number of small electric power companies in the vicinity of Butte and formed the Montana Power Company, which skyrocketed in wealth.[7]

Around 1910, dry land farming became prevalent in the region. Much of the rangeland was homesteaded and plowed for cultivation. Land rushes in 1910 and 1914 accelerated the process. The 1920s witnessed good harvests, as agriculture in the region continued to expand. However, in the years that followed, dwindling farm prices and recurring droughts limited production and many farmers abandoned their land. By the 1930s, Montana's agricultural economy plummeted. The Federal Government heeded calls for assistance from those who had stayed on their parched farms. Surveys disclosed that a potential irrigation project could use the Marias River water for irrigation of lands lying between that river and Big Sandy Creek.[8]

Project Authorization

Congress voiced its concern with protecting property along the tumultuous and chaotic Missouri River Basin after the severe flooding of 1943. However, the flood control region was under the auspices of the U.S. Army Corp of Engineers. Therefore, it was left to Colonel Lewis A. Pick to conduct a study on how to control flooding in the region. The release of the Pick

6. "Project Histories," 1948-73, Volume II,
7. Lamar, *New Encyclopedia of the American West*, 730-2.
8. "Project Histories," 1948-73, Volume II, 13

Report pressured Reclamation to instigate its own study, conducted by William Glenn Sloan as principal investigator, which was released May 1, 1944. The Sloan Report included a broader range of topics, including hydroelectric power, irrigation, and even wildlife and recreation. Rather than compete for dominance over each project along the Missouri River Basin, the two different organizations divided the Missouri, with the Bureau of Reclamation taking the upper basin, and the Army Corp of Engineers taking the lower.[9]

The Lower Marias Unit was authorized by the Flood Control Act of December 22, 1944, Public Law 534, which approved the general comprehensive plan set forth in Senate Document 191 and House Document 475, as revised and coordinated by Senate Document 247, 78th Congress, 2d session. Additional appropriations were approved August 10, 1972, by Public Law 92-371, 86 Stat. 525.[10]

The Plan

The Marias River Basin seemed to be an ideal fit for all the goals of the Pick Sloan Missouri Basin Project. Project planners of the nearby Milk River Unit, constructed in the early twentieth century, first noted the potential for irrigation in the Marias River Basin. Not only did the project tout vast irrigation potential, it also promised flood control of a major tributary of the tumultuous and destructive Missouri River. Preliminary investigators also noted that water was not readily available to farmers in the Lower Marias Unit. With no major springs, and only one intermittent stream, the Sandy, farmers relied on deep wells. They concluded that the present water supply was, "with no exception, in need of expansion." They found the whole economy of the Lower Marias area precarious. Though farmers in the region were doing well because of good precipitation and high wartime prices, it was nonetheless a one-crop system. Moreover,

9. William D. Rowley, *The Bureau of Reclamation: Origins and Growth to 1945* (Denver: Bureau of Reclamation, 2006), 392-4.
10. *Project Data*, 935.

precipitation in each of the years since 1945 had been low, indicating the start of a dry cycle which they believed would be "disastrous for dry-land agriculture."[11]

Perhaps most importantly, farmers from the region seemed interested. In the 1930s, a local delegation of eight went to Washington, D.C., to report drought conditions. They later formed the Toole County Irrigation District and hired an engineering firm to conduct a feasibility report. The Montana State Water Conservation Board reviewed the previous studies and issued a report in 1935. In 1937, the Marias Improvement Committee was formed to promote development of Marias water resources. As a result of the committee's actions and previous investigations, the Bureau of Reclamation made an exhaustive survey of the project possibilities and released a report in 1939.[12]

The main feature of the plan was a dam in between Liberty and Hill counties. Initial reports discussed numerous potential sites for dams, but they finally settled on Tiber Dam because it could provide irrigation to the district more economically. The dam would be designed for a reservoir capacity of 362,000 acre feet, with no flood control provided in the design. Tiber Dam was to be an earth fill structure, totaling 182 feet high and 4200 feet long. The reservoir would also feature an earth fill dike, about 30 feet high and 7000 feet long at the abutment. The main features of Tiber Dam would be a spillway releasing water at 71,200 cubic feet per second (cfs), a 2450 cfs outlet to the Marias Canal, and a diversion tunnel. Tiber Dam was to retain 971,000 acre feet of water, 352,000 of active storage for irrigation, 575,000 of dead storage, and 34,000 of superstorage (the storage between max normal and max is the superstorage). Releases would be made into the Marias River through the spillway and through an 18 inch pipe to be installed at the diversion tunnel. The reservoir would be 25 miles up the

11. *Lower Marias Unit: Definite Plan Report*, Volume I, General Plan: Supplemental Appendix, September 1952. 20, 49, 23.
12. *Lower Marias Unit: Definite Plan Report*, 37.

main river valley and would have a surface area of 17,500 acres. Investigators noted that the flooded land would be grazing land with few physical improvements.[13]

The proposed irrigation of the 127,000 acres of dry land presented an entirely different set of problems. Investigators proposed that the water from Tiber Reservoir be released into the Marias Canal through an outlet adjacent to the left abutment of the dam. This would discharge into tunnel number 1 which would extend for 1.1 miles. Water would then come from the canal into a coulee, which would then divert the flow into a section of the Marias earth canal. After 39.9 miles, the Marias canal would reach the turnout to the Kenilfeeder Canal and continue to mile 77.1, irrigating lands along the way.

The Kenilfeeder Canal would extend in a southwesterly direction, following the Marias Milk River Divide, and continue to follow the divide section for part of the way. At mile 6.5, a turnout would feed the Kenil gravity canal, complete with a siphon spillway at mile eight. The canal would discharge into the forebay at the Kenil pump plant, which would require the construction of a small dam.[14]

The Kenilgravity Canal was to extend from mile 6.5 of the Kenilfeeder Canal in a southeastern direction for 35 miles. Kenilhigh and Kenilow were to both extend from the Kenilpump plant. Kenilow was to stop just north of Big Sandy while Kenilhigh was to run roughly parallel to the low canal, ending six miles west of Big Sandy. Finally, waste water would be discharged into Lonesome Lake from the irrigated land. Lonesome Lake was to be situated with a small dam to impound the water. This water would be discharged from the lake into a 12 mile coulee and then diverted into the Sandy Gravity canal at a diversion dam.[15] (See Appendix A).

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13. *Lower Marias Unit: Definite Plan Report*, 38; *Project Histories, 1948-1973*, Volume I, 47.
14. *Lower Marias Unit: Definite Plan Report*, 31, 38.
15. *Lower Marias Unit: Definite Plan Report*, 31.

Planners knew that there were going to be some challenges presented by the project. As one investigator noted, "Most of the easily subjugated lands in the West are already under irrigation, therefore future irrigation developments are likely to present problems of engineering and soils which are more complex than those encountered in the past." They didn't seem especially surprised to find that underground drainage might hinder return flow water from reaching Lonesome Lake Reservoir for several years. To this, they reasoned that only 17% come from deep drainage, and 83% come from surface drainage facilities. Early reports from the Montana State Board of Health in the 1930s showed the presence of numerous bacteria and dissolved salts. Another sample was sent out to determine whether Marias water was suitable for use as an alternate source of supply. Though an agreement had not been made, reports show little concern that irrigators would agree to repay the amount of $21,380,000 approved by the Commissioner of Reclamation as total contribution of irrigators towards construction costs of irrigation facilities.[16]

At the close of 1948, the beginning of work on Tiber Dam was still contingent on landowners within the district producing "tangible proof" that they would pay their obligated debt back. Because of this, preconstruction phases lasted longer than first intended, from 1945 until June 30, 1948.[17] Construction was authorized by November 25, 1949, when the Marias Improvement Association finally obtained the minimum number of signatures. Still, due to the delays, there were no further surveys for the construction of the Tiber Dam, other than a construction material investigation that year. Moreover, Reclamation did little topographic study on the project. Still, project planners remained hopeful. The irrigation district made plans to file a petition for irrigation on January 3, making a hearing on the petitions to start by February 20,

16. *Lower Marias Unit: Definite Plan Report*, 31.
17. *Lower Marias Unit: Definite Plan Report*, 3.

1950. Mother Nature also gave some encouragement for farmers to irrigate, providing a dearth of precipitation. That year, farmers on the Lower Marias produced 6.8 bushels of wheat per acre, far below the 21.5 bushels in 1948 and the long time average of 11.8 bushels per acre.[18]

The year 1951 seemed bleaker. No proposals were approved during calendar year 1951 that brought the construction of the Tiber Dam any closer to reality. In all, no new funds were allocated in the 1952 fiscal plan. Surveys on the potential canal routes were virtually stopped, except for a small amount of work on the Marias. Construction was limited to establishment of a construction office in the town of Chester on January 1, 1950. This time, precipitation was much better, allowing for a relatively good crop year.[19]

Adding insult to injury, Edmund Christopherson wrote an article entitled "The Big Water Gyp in Montana" in the heavily circulated *Saturday Evening Post*. Though the article is heavily biased toward the "ruggedly individualistic" and "rebellious" dissenters against the project, it nevertheless better demonstrates the internal dynamics of the irrigation district. It seems the main dissenters were a group of large wheat growers in the Lonesome Prairie Valley. Though initially in favor of the project, they became disillusioned when they found that they would not be able to own more than 160 acres if they received irrigation. The Bureau brought in famed engineer W. G. Sloan to address the irrigation district. According to the article, Sloan addressed the group in such a condescending manner, the Lonesome Valley ranchers became assured they were correct in their decision to take on the Bureau of Reclamation. In court, dissenting growers testified that "if the project goes through we'll be forced to change from American mechanized farming to peasant style grubbing with hoes and shovels on smaller acreages with a fraction of our present income." They further stated that in recent years, the adoption of summer fallow

18. "Project Histories," 1948-73, Volume II, 45.
19. Edmund Christopherson, "The Great Water Gyp in Montana," *The Saturday Evening Post* (Aug 1952) 45-51; "Project Histories," 1948-73, Volume IV, 32.

methods had improved their average output beyond comparable irrigated projects, even during relatively dry years. Finally, they testified that in the lands in the lower Marias district, drainage problems would make irrigation potentially destructive to the land due to the salt content. The judge ruled that the Lonesome Prairie Valley be removed from the irrigation project, reducing the total project to 89,000 acres irrigated. According to Christopherson, the argument was persuasive enough to lead "dozens" of farmers to demand their names be stricken from the petition to proceed with irrigation. This appears to be a major turning point for the worse in Bureau/district negotiations.[20]

Construction History

Though the Lonesome Prairie Valley ranchers backed out of the irrigation project, Reclamation still had enough signatures from the rest of the district announcing their intention to enter a repayment contract that the construction was finally approved for the contract. Construction of Tiber Dam began September 15, 1952, and was completed March 6, 1956. Progress improved in 1952, though not without setbacks. The Bureau accepted bids for two contracts for building temporary housing at the dam and the building the Tiber Dam, and awarded the lowest bidders for each one, the McCann Construction Company for the prime contract of building the dam and the Continental Casualty Company for the temporary housing. However, both companies defaulted on their contracts and advertisements for accepting new bids were placed. The Greer Construction Company was the lowest bidder for the temporary housing project and Guy H James Company won the prime contract September 12. By August of 1952, Greer Construction Company had completed 74.6% of the contract in 122% of the time. Surveys were continued on a definite route for the first fourteen miles of the Marias canal. Work was fast

20. "Project Histories," 1948-73, Volume IV, 32.

enough that planners surmised that construction of the entire project would be done by 1970, with water being provided to many users by 1967. As preliminary studies indicated, portions of the Lower Marias Unit lands were not susceptible to normal deep drainage. More detailed studies found that deep drainage could not continue in 80% of the land. Comparisons with a similar Canadian irrigation project were made to form a General Plan of Irrigation. Planners used canal lining to minimize seepage damage to irrigable lands where necessary. They also recommended a system of shallow project drains that were estimated to cost $58.50 for every acre they installed. Project planners remained confident that with technical vigilance, land leveling, and farm-water methods, such problems could be solved without debilitating costs or challenges. Despite the optimism from Bureau officials, such problems certainly worried the newly formed irrigation district.[21]

The project continued steadily in 1953. Construction generally went year round, with only rare intermittent stops in the winter due to freezing. Homes were completed for the construction of the dam and the work for the first placement of a concrete tunnel was completed by July 17, 1953. Progress toward a repayment contract seemed to be coming as well. Officials estimated that negotiations with the district would be completed in 1955, thus deferring construction of canals to begin in 1957.[22]

By 1954, progress came along slowly on the erection of the Tiber Dam. By March 2, the contractor started hauling in field stone for riprap and the river was diverted through the River Outlet Works Tunnel. After the diversion, workers began draining water and began cleanup of dam foundation cutoff trench in the river channel. By April 13, the first embankment materials of the season were placed on the dam in the river channel area. By July 20, full scale

21. "Project Histories," 1948-73, Volume V, 3, 18, 52, 55.
22. "Project Histories," 1948-73, Volume VI, 57, 63.

embankment placing on the dam began and by November 12, the last bucket of concrete placed on the spillway. Although progress was not as great as desired, the prime contract was 73% complete in 69.7% of the time with the total feature being 66% complete[23]

That same year however, problems with the Marias irrigation district slowly became evident. The first Repayment schedule was rejected in 1953 and the Revised Repayment was denied by the Secretary on June 30. To reinvigorate interest in the waning project, managers put on four education meetings by December of 1954. Many in the Marias Irrigation District seemed to be concerned the preliminary reports that suggested drainage problems. Seepage and salt occurrences on similar soils near Highwood provoked questions concerning the permanence of the Marias soils under irrigation. Project planners reassured farmers that "the proposed plans require enough deep drains, cut off drains, and relief drains so that accumulation and rise of ground water is not expected." Still, planners began to clamor for a development farm to test how well irrigation would take in the region. Accordingly, the Bureau of Reclamation changed that year's appropriation request to be based on a three year development farm prior to serving the initial block of land. Recognizing the importance of the farm in assessing the drainage ability of the soil, the Commissioner advised that the additional cost of the project would be well worth it.[24]

The irrigation district certainly agreed. They encouraged the Regional Director to advise the Commissioner to start as rapidly as possible. Ultimately, the rapid placement of a construction farm was out of the hands of both the Bureau and the irrigation district, as both the house and the senate balked at the idea. Both legislative branches questioned whether this was really within the authority of the Bureau of Reclamation. Rather, Congress recommended that

23. "Project Histories," 1948-73, Volume VII, 4-6.
24. "Project Histories," 1948-73, Volume VII, 4.

the Secretary of the Interior and the Department of Agriculture be notified. The landowners grew increasingly disappointed that a development farm had been deferred, and insisted that this would be an important factor in accepting a repayment contract. In one irrigation meeting, Bureau officials noted the attendees "were very emphatic in their remarks about the delay and indecision on the Bureau's part regarding the entire contract negotiation procedure." Yet the bureau remained confident in their relationship with the irrigation district since meetings were "exceptionally well attended" and no dissatisfaction or criticism of the contract had been voiced. Due to these stalled negotiations, field surveys of lateral and drains for design data and selection of route for Marias Canal were delayed.[25]

By 1955, things seemed to be improving. Construction of Tiber Dam was going well. The dam and reservoir were 92% complete at the close of the year and dam construction progressed from 73.5% to 98% by December 31. Earth embankment placement was completed on December 31 1955. For the first time the Tiber Reservoir could now store a limited supply of water. Storage in the newly-formed Tiber Reservoir began on October 27, 1955, upon the closure of the outlet works. Storage in the 1,393,000 acre feet reservoir was at 36,600 acre feet on December 31, or seven feet above the outlet level. Though no surveys planning or construction on canals had begun, the project touted an earthen dam with a crest height of 211 feet, and 4,300 ft crest length. The dike was a homogenous earthen structure of impervious materials, 1650 feet long and 65 feet high.[26]

Optimism generated from construction progress faded as irrigation negotiations came to a standstill in April 1955. Only forty two resident owners of 10,277 acres signed the petitions out of a total of 206 residents, owning a total of 49,664 acres. This fell well short of the 60% of

25. "Project Histories," 1948-73, Volume VII, 83, 87.
26. "Project Histories," 1948-73, Volume VIII, 7.

signatures that Montana law required. Local proponents and bureau officials knew that the difference between the number of signatures obtained and those needed was far too great to be amended. Though there was no criticism of the contract itself, in several meetings there were some outspoken comments made in opposition to the entire program. Most detrimental to the project, several members of the board of commissioners simply lost enthusiasm for the project and refused to circulate the petitions to landowners in their districts. The failure to procure a repayment plan was disastrous since construction of the Tiber Dam was approved solely on the basis of approving an irrigation contract. The few proponents remaining from the irrigation district wanted to explore the possibility of a block of the district continuing forward, but that plan was scrapped. They agreed that "as long as wheat price and moisture conditions continue, interest would continue to be low." They further concluded that a "minimum of two years of protracted drought would undoubtedly result in the revival of sufficient interest. . . ." Though the impetus behind the project was gone, the construction of the Tiber Dam was too far advanced to be jettisoned. Irrigation was shelved pending further interest.[27]

By 1956, the project seemed a shadow of its former potential. That year three different construction engineers headed the waning project. The Tiber Dam and Reservoir was completed at the close of the year. Riprap placement was the only thing remaining at year's end. The years continued to be good to the farmers, with higher temperatures in 1958 leading to a record average of 28 bushels of wheat per acre. All that remained in 1957 was completion of contracts and cleanup of construction work. The Lower Marias Unit was transferred to operation and maintenance status in May 1957. The irrigation district held no meetings and no definite plan report was drafted to procure new monies from Congress.[28]

27. "Project Histories," 1948-73, Volume VIII, 8.
28. "Project Histories," 1948-73, Volume IX, A14.

A letter signed W. E. Cowan of Box Elder gives a good synopsis of why the project did not take with the irrigation district. In his letter to Senator Mike Mansfield, he noted complaints from the irrigation district mainly in the following areas:

1) 160 acre limitation would necessitate some to dispose of land;

2) net return of large scale dry farming compared to small scale irrigation farming;

3) undesirability of destroying a sound economy and establishing one not as healthy;

4) reluctance to encumber title of land;

5) undesirability to submit to the Bureau of Reclamation;

6) fear of greater benefits going to the city;

7) desire to avoid the delay waste and inconvenience of any government operated enterprise.[29]

Post Construction History

Though most had given up and moved on from the irrigation project, a few still tried to make use of the potential in the new reservoir. In W. E. Cowan's letter to Senator Mansfield, Cowan suggested that water should be supplied on a demand basis, much as electricity is supplied to towns, and that water be used to supplement existing economy rather than replace it. The response from the Commissioner W. A. Dexheimer of the Bureau of Reclamation showed the vast difference between the desires of the irrigation district and Reclamation law. No demand based water contracts would be awarded to private owners. Landowner curiosity about obtaining water from the reservoir seemed thoroughly quelled by 1958, encouraged in no small part, by the record breaking 31.5 bushels of wheat per acre cultivated by local farmers.

Construction problems became evident nearly immediately after filling the reservoir. Reports in 1960 noted that a sliding area in the cut above the right side of the Tiber Dam

29. "Project Histories," 1948-73, Volume IX, 9.

spillway had been a problem since 1957, when sloughing of material first appeared. This continued until the sloughing material obstructed the drainage gutter and flowed against and over the right spillway wall, exerting hazardous pressures. As early as the summer of 1956, engineers noted significant movement in the spillway crest structure. Project engineers hypothesized that the problem was a layer of clay, though drilled samples yielded no evidence. Still, the engineers determined that the overlying material and clay layer be removed as previously hypothesized. They determined this to be the remedy, and 5:1 slope was established over a 20 foot berm. While conducting these repairs, engineers discovered a layer of varve shale at the base of the glacial till.[30] By 1957 the foundation materials underlying the dam, as evidenced by "erratic settlement and seriously deteriorating concrete, and as shown by subsurface excavations, had irreparably failed." This meant reservoir water levels needed to be lowered to a minimum level each succeeding spring, even during record heavy snow and rain runoffs. Designers concluded that complete restoration of flood control and recreation benefit would require replacement of the spillway.[31]

With fund limitations and no significant lands being irrigated by the project, no monies were granted for spillway modification. Rather, the more affordable auxiliary outlet works was authorized. To build this, a spillway cofferdam was constructed to close off the entrance to the damaged spillway structure, and Reclamation began to construct an auxiliary outlet works utilizing an existing high level canal outlet at the left abutment of the dam. The auxiliary outlet works was controlled by a 7.25- by 9.25 foot outlet gate capable of releasing 4,240 cubic feet per

30. "Project Histories," 1948-73, Volume VIII, 7.
31. United States Department of Interior, Bureau of Reclamation. M. A. Jabara and W. E. Wagner, Engineers. Office of Chief Engineer, Denver: Bureau of Reclamation, "Tiber Dam Auxiliary Outlet Works:" A paper to be presented at the hydraulics division 17th Annual specialty conference. American Society of Engineers. Utah State. Logan, Utah. August 20-2, 1969, 1; "Project Histories," 1948-73, Volume VIII, 7.

second. Engineers concluded that the structure could not be subjected to the predicted additional settlement and remain capable of safely accommodating large releases. However, future construction activities of the irrigation features, project designers concluded, depended on securing a repayment contract with landowners.[32]

Milk River Proposal 1971

One of the most interesting components of post construction history was a detailed feasibility investigation into joining the Lower Marias Unit with the nearby Milk River Unit, a project that never came to fruition. This trans-basin transfer investigation was first conducted as field reconnaissance investigations for the purpose of selecting the best land route between the two rivers. Investigators concluded that a contiguous area in the Marias glacial lake basin was found to meet present drain ability standards. They found that a substantial land resource was available in the Milk River Valley, which did not have an assured water supply. Moreover, they found more favorable drainage there too. When engineers discovered that this would be economically feasible, the proposal was turned into a detailed study. In 1964, petitions were circulated to be included in the project from land owners in the area. The project proposed to extend to unit lands located in five counties, beginning in Chouteau, going north to Hill, then easterly along the Milk River through Blaine and Phillips. The feasibility investigation was authorized by the Congress 9-7 1966 80 Stat. 707.[33]

Under this new plan, 72,700 acres of new land would be irrigated, as well as providing supplemental water to 122,700 acres of existing development. The project would be contingent on planned modifications to the Tiber Dam, estimated at $12,730,000 in non-reimbursable funds

32. Jabara and Wagner, *Tiber Dam Auxiliary Outlet Works*, 23; "Project Histories," 1948-73, Volume XXIII, 2.; *Project Data*, 937.
33. *Feasibility Report on Marias-Milk Unit*. Appendix II. Milk division. Pick-Sloan Missouri Basin Program. Montana. U.S. Department of the Interior. August 1970. Revised July 1971.

(ii). Project designers relied extensively on previous investigations of the Lower Marias Unit to conduct the investigation. The work necessary on the dam included reconstructing the spillway and raising the dam and dike nine feet. Total construction assessment was estimated as follows:[34]

A 4732 foot long horseshoe tunnel through the left abutment of the Tiber Dam; An 80.2 mile-long canal to convey water from Tiber Dam to Fresno Reservoir and irrigate 37,200 acres in the central Marias unit; A 64 mile-long canal along Big Sandy Creek to irrigate 15,000 acres there and 600 in central Marias; A system of laterals totaling 232 miles; Project drains in Central Marias.[35]

To accomplish this, the report recommended an 80.2 mile canal to be constructed from Tiber Reservoir which would convey water to Fresno Reservoir on the Milk River. After regulation, it would be released downstream to irrigate 19,900 more acres. Enroute to Fresno, it would irrigate about 37,800 acres of new land in the Central Marias Unit. A sixty-four mile branch canal called the Big Sandy would deliver water to 15,000 acres.

The project proposal shows some fascinating differences in planning from the original project investigations. First, it needed a dam to raise the water level for an outlet canal below it to an elevation higher than previous plan called for. Planners also decided against the tunnel route the original plan called for in favor of following the Marias River route. Studies indicated that the tunnel route would cost about $3,200,000 more, and it would have required lowering the canal route about fourteen feet, which would have reduced potential irrigable area by 3500 acres. Planners decided to keep the canal route of Big Sandy Canal but called for a long siphon that could deliver water to irrigable lands as high as would be served by the pumping plant for less in

34. *Feasibility Report on Marias-Milk Unit*, ii, C2.
35. *Feasibility Report on Marias-Milk Unit*, I, ii.

operations and maintenance costs.

The original plan also called for construction of a dam below Lonesome Lake depression for storage, releasing to a Coulee Dam. However, reconnaissance indicated that this would have been susceptible to flooding. It would have required a much larger dam and a larger spillway, which project investigators judged excessive in costs. Investigators instead concluded that bypassing Lonesome Lake would be much more cost effective and could serve several thousand acres more than the original plan. In all, the plan would have cost about 84 million dollars, while the total benefits to Reclamation would have been 8.959 million in annual benefits (with only 5.9 million in direct benefits). No documents have been found that explain why the project was not selected.[36]

Spillway modifications, and Dam and Dike Raising

The auxiliary outlet works constructed in 1969 was always a stopgap solution to a more serious problem. With the auxiliary outlet, the dam could only function under reduced operating levels, which hindered its original intentions of flood control, recreation, and municipal water supply.

Two factors eventually warranted further construction; the original spillway became inoperable because of excessive crest structure settlement, and the Inflow Design Flood (IDF) was raised in 1966 to accommodate a higher probable rainfall superimposed on heavy snow pack. Accordingly, even though irrigation was still not added to the project, Reclamation still added a new spillway using the original chute and stilling basin, as well as a dam and dike

36. *Feasibility Report on Marias-Milk Unit*, C3; *Tiber Dam and Lake Elwell Recreation Management Condition and Assessment*, Pick-Sloan Missouri Basin Project, Lower Marias Unit, Montana. Great Plains Region, Montana Area Office (2005) I-9, IV-25, IV-66

embankment.[37]

Construction on the spillway began first. Beginning construction in February 1977, contractors removed the concrete spillway, inlet, and bridge structures, 400 feet of spillway chute, and the radial gates. The new concrete spillway was controlled by new radial gates. The contract also involved removing existing embankment and placing zoned embankment in the cutoff trench and walls, which was finally bonded into existing dam embankment. The project was completed in November 1979.[38]

Raising the dam involved entirely different challenges. A geological investigation found that the shale embedded in the dam had been air slaking; meaning that exposure to air had caused some of the material to deteriorate. Still, they found the shale was a relatively good quality foundation. However, excavation for the new spillway revealed gypsum-lined voids in bedrock, and settlement of these voids meant that the spillway would need to be replaced. Foundation treatment for the dam was completed by wide cutoff trenches and walls to firm the Colorado shale in the stream section most of the length of the abutments. The cutoff trench provided a positive cutoff and also ensured the removal of unsuitable material beneath the embankment.[39]

To raise the dam and dike, contractors removed the gravel surfacing and excavated the crest to a depth up to six feet to ensure removal of zone 3, or coarse, outer layer, pervious materials, and provide adequate width of the zone 1 materials, the impervious inner core in the existing embankment. They were then able to build an extended zone 1 core to elevation of

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37. United States Department of Interior, Bureau of Reclamation, "Review of Tiber Dam: Raising Dam and Dike," *Division of Technical Review Final Report*, Denver: Bureau of Reclamation, October 1982, 2.
38. U.S. Department of the Interior, Bureau of Reclamation, Upper Missouri Region. *Technical Report on Tiber Dam: Technical Report of Construction; Tiber dam, Spillway Rehabilitation and Raised Dam and Dike*. Lower Marias Unit, Montana. Pick-Sloan Missouri Basin Program. Tiber Dam Construction Office, Chester Montana: April 1982, 9-10
39. "Review of Tiber Dam: Raising Dam and Dike," *Division of Technical Review Final Report*, 4-5.

3025 feet. Zone 3 material was excavated from a nearby borrow area, along with riprap and other materials, which were used to raise the dam and dike. The project raised the crest width of dam and dike, which were now 30 and 20 feet respectively. The Division of Technical Review accepted construction as complete in October 1981.[40]

Project Benefits

The Tiber Dam and Tiber Reservoir (Lake Elwell) provide benefits in flood control, recreation, conservation, and hydropower generation. Since construction, $58,700,000 in flood damages has been prevented. Moreover, Tiber Dam provides greater flood control and 301,000 acre feet of replacement water for Fort Peck Reservoir, which enables improved recreational use. The Reservoir also provides municipal water. In 1962, the city of Chester constructed a pipeline to bring water to a number of ranchers unable to establish well water. Though it doesn't supply to a large block of irrigated land, water sales contracts have been initiated, and approximately a dozen public and private entities use water from the reservoir. It provided water to two rural water supply systems and irrigation of 3,241 acres of cropland, when Reclamation last gathered statistics in 1992. In 1997 the Chippewa-Cree Tribe on the Rocky Boy's reservation entered into a water users' compact to obtain 10,000 acre feet of water per year.[41]

Fishing and other forms of recreation might be the most successful aspects of the project. Since the Bureau of Reclamation is required to run the dam and reservoir to maintain flood control capacity, opportunities for fishing, boating, camping, hunting, and similar recreational activities have developed for Montanans and tourists in the region. In 2004, an impressive total of 69,988 visitors used the reservoir. This number seems to be increasing quickly. As of July 15, 2005, 92,567 visitors had already came to the park in 2005. A *Study of New Dollars* was

40. "Review of Tiber Dam: Raising Dam and Dike," *Division of Technical Review Final Report*, 6.
41. "Project Histories," 1948-73, Volume XXIII, 9; "Project Histories," 1948-73, Volume I, 11; *Tiber Dam and Lake Elwell Recreation Management Condition and Assessment*, IV-23

conducted to show the benefits to the region. However, the study conducted was slightly problematic. Since no data was available for Lake Elwell, it used data available from nearby Canyon Ferry and applied this data as a "benefits transfer approach" to evaluate economic impact in the Tiber Reservoir region. In other words, it assumed that the visitors to the Canyon Ferry Reservoir were socially and demographically similar to those who visited Lake Elwell. The study found that 20% of the visitors came from outside the region, bringing about $1,160,000 in recreation-related expenditures in 2004.[42]

The Tiber Reservoir has also provided excellent fishing and hunting combined with fish and wildlife replenishment as well. Wildlife and livestock coexist on much of the rangeland, requiring active management to accommodate this dual use. In the past, overgrazing, coupled with drought, seriously depleted the wildlife habitat. By 1988, under the guidance of the Tiber Land Management Committee, a fencing program brought grazing under control and habitats improved. Presently, the "take half and leave" policy is being used, which means that half is dedicated to grazing, and half is dedicated to wildlife. "The result has been a dramatic turnaround in wildlife diversity and population."[43]

Conclusion

The major goal of large-scale irrigation never materialized. The original objective was to provide irrigation to over 110,000 acres of land in the Lower Marias River region. Without securing a landowners' agreement to repay, the driving impetus behind the project was dead, though the construction of the dam was far too advanced to abandon by this time. Accordingly, you will see no long list of irrigation benefits and crop outputs for this project. The Marias Unit irrigates only 3,496 out of a total of 325,837 acres irrigated by Reclamation in Montana.

42. "Project Histories," 1948-73, Volume IV, 23; *Tiber Dam and Lake Elwell Recreation Management Condition and Assessment*, 9.
43. "Project Histories," 1948-73, Volume IV, 65, 66.

Exhaustive investigations and reconnaissance and surveillance reports on canal and irrigation networks yielded no tangible results. The dam alone cost $22,000,000, and would not have been constructed had the designers known that the irrigation potential would not be fulfilled.[44]

However, the reservoir still provides excellent benefits, including a FERC power plant, flood control, Tribal water settlements, a source of water for a regional water system, and recreation. Perhaps most important to many of the residents of nearby counties is economic boost the sparsely inhabited region receives from recreation at Lake Elwell.

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44. *Summary Statistics* 1992, 78.

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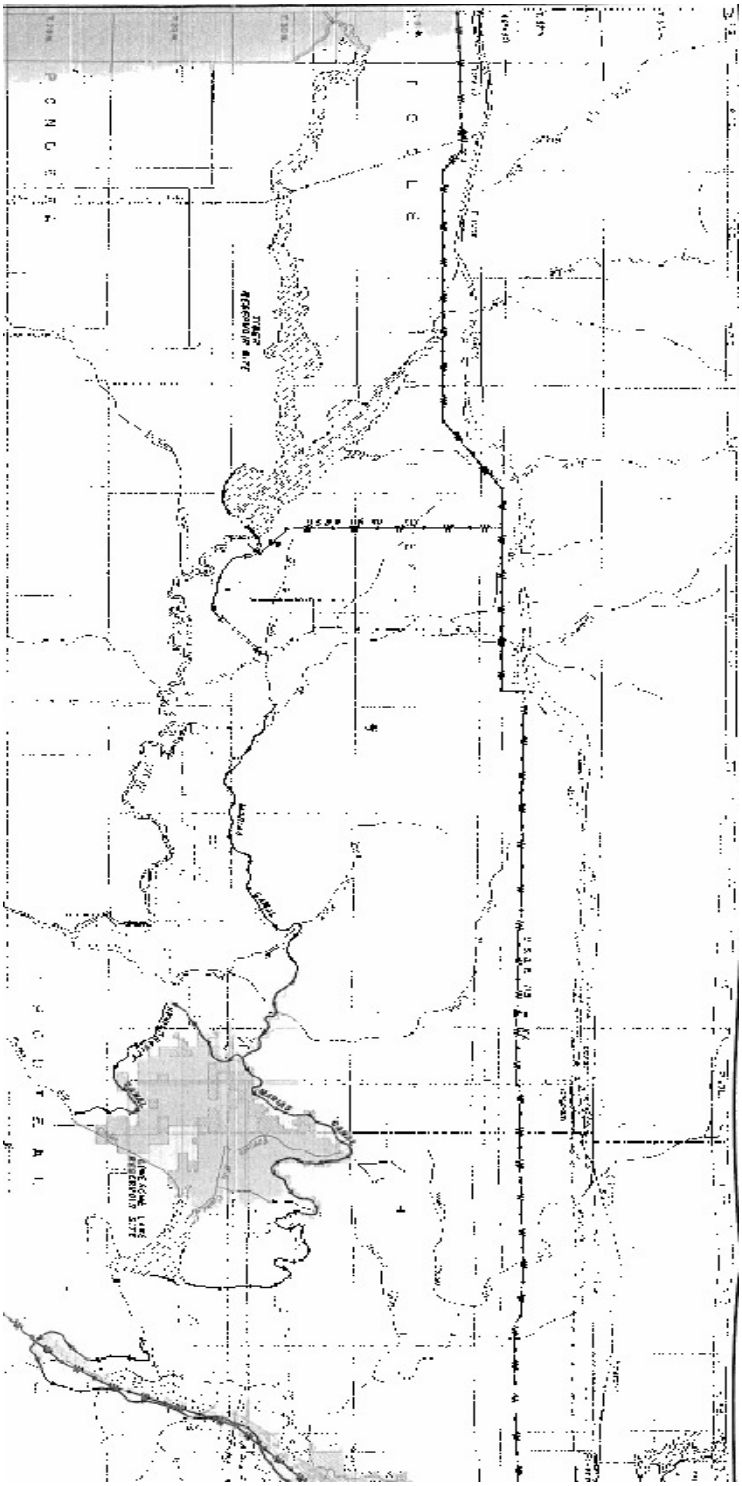
Appendix A