Weber River Project

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The Weber River Project

In 1931, Reclamation finished construction on the Weber River Project, near the town of Echo, Utah, forty-two miles southeast of Ogden. Built for the purpose of supplying irrigation water to the growing agricultural region of the Salt Lake Basin, the project's use was soon expanded into supplying a portion of water for the Provo River Project in 1947. In the latter half of the 20th century, its use has increased further through recreational facilities and hydroelectric power. Although relatively small in comparison to larger, more comprehensive projects in Utah such as the Weber River Basin Project or the Central Utah Project, the Weber River Project has proven itself to be a valuable contributor to the Salt Lake Basin's economy, as a key component in the region's reclamation efforts.

Project Location

The Weber River Project was developed to supply irrigation water to 80,000 acres of land, and currently serves approximately 109,000 acres. It is located in northern Utah, northeast of Salt Lake City between the Great Salt Lake and the Wasatch Mountains. The primary feature of the project, Echo Dam and Reservoir, is located in Summit County, 42 miles southeast of Ogden, near the present-day junction of Interstates 80 and 84. The secondary feature, the Weber-Provo Diversion Canal, was enlarged from 1941-1944, as part of the Provo River Project. There is also a hydroelectric powerplant at the left toe of Echo Dam, built by the nearby city of Bountiful, which has three power generators capable of generating 4500 kilowatts of electricity each. The project itself is located along a very well-worn path that had been used by Native Americans, trappers, travelers to Oregon, California, and other points along the Pacific coast, and by the Mormons as they migrated into Utah. During the early part of the century, this series of trails was integrated into national road known as the Lincoln Highway. The portions of this

coast-to-coast highway that were in Utah became US 40 and US 530 in 1925, then became part of Interstate 80 after the Second World War.[1]

Historic Setting

The area of the Weber River Project was inhabited by Native Americans for many centuries. Until the mid-1800's, bands of Shoshone, Ute, and Paiute Indians lived a hunter-gatherer existence, following animal herds and migrating along local rivers, in accordance with their nomadic lifestyle. The first Anglos in the region came as employees of the Rocky Mountain Fur Trading Company in search of beaver pelts in 1826, and included such noteworthy mountain men as Jim Bridger. The trails that these mountain men blazed were followed by the arrival of the first Mormon pioneers in 1847. Adherents of the Church of Jesus Christ of Latter-day Saints under the leadership of their president, Brigham Young, these new settlers slowly displaced the native inhabitants of the region, as the number of religious immigrants grew and settlements became more stable.[2]

The Mormon settlers came to Utah following religious conflicts and persecutions in the Midwest during the early existence of their church. The first migrants arrived in Utah in 1847 under their leader, Brigham Young. It was thought at first that the party would push on towards California, where members of the Mormon Battalion, established during the Mexican War, were currently living. Instead, Young, upon seeing the valley of the Great Salt Lake, declared that "This is the place," and immediately set about trying to carve an existence in the arid basin.

In order to make the settlement succeed, the Mormons were forced to divert water from

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1. United States Department of the Interior, Water and Power Resources Service, *Project Data* (Denver: U.S. Government Printing Office, 1981), 1325-7; James Lin, "The End of Named Highways: 1925-Present," *History of the Lincoln Highway* [database online] (California: California Institute of Technology, October 7, 1998), available from http://www.ugcs.caltech.edu/~jlin/lincoln/history/part4.html, Internet, accessed 20 July 2000.
2. United States Department of the Interior, Bureau of Reclamation, *The Newton Project*, by Christopher J. McCune, project history, Bureau of Reclamation History Program (Denver, Colorado: Bureau of Reclamation, 2000), 3-5.

the nearby streams such as City Creek, into the valley floors; this softened the soil enough for settlers to make a few meager plantings of potatoes the first year. These irrigation efforts were reminiscent of Native American societies such as the Hohokam in Arizona, and served as a model for future irrigation in Utah and the United States. As the Mormon community grew, the new arrivals spread to nearby areas, usually designated by Brigham Young for settlement. These new communities, such as Ogden, copied the irrigation techniques developed in Salt Lake City by the first settlers. One of the early river diversions following the establishment of Salt Lake City was on the Weber River in 1852, when the city of Ogden built a seven-mile canal from the river to the lower portion of the city. The arrival of the transcontinental railroad resulted in a population and economic explosion that soon would strain the water resources needed for the area.[3]

As the population of Salt Lake City's radial communities grew, the water needs provided by the ditches and canals built by the first pioneers began to exceed their annual flows. This was especially apparent in the summer months, when water was most needed to combat the heat that could wilt the crops. In the largely agricultural communities of Utah, this was a crucial issue. The success of the first irrigation storage reservoir in Utah near the town of Newton led to widespread study of the need for similar projects in Utah following establishment of the Reclamation Service, a branch of the Department of the Interior launched in 1902. During its early years, Reclamation's programs would be heavily influenced by Mormons, experienced in the concepts of widespread irrigation in arid climates.[4]

Reclamation first gathered feasible data for the Weber River in 1904 and 1905; these

3. "Utah–Cradle of American Irrigation." *Reclamation Era* 32, no.9 (September 1946): 198; Stephen A. Merrill, "Reclamation and Economic Development of Northern Utah: The Weber River Project," *Utah Historical Quarterly* 39, no.3 (Summer 1971): 255-6; Marc Reisner, *Cadillac Desert: The American West and Its Disappearing Water* (New York: Viking 1986, reprint New York: Viking Penguin Books 1993), 42-3, 255-7.
4. *The Newton Project*, 6; Reisner, *Cadillac Desert*, 2-3.

surveys led to installation of stream gaging stations in 1905. In 1907, Frank C. Kelsey and Willard Young, Salt Lake City engineers consulting in the interests of Weber and Davis Counties, proposed a comprehensive irrigation project for the Weber River. This plan called for a private company to construct storage dams, canals, and reservoirs, and to purchase of land which would be subdivided and sold as tracts with a water right attached. It also proposed a canal that would divert the river 5 miles below the town of Morgan to deliver water southwest to the Sand Ridge and Bountiful regions near Salt Lake City. This latter canal, including some of the dams proposed, would eventually be included in the Weber Basin Project in the 1950's.[5]

Project Authorization

Further investigations for a project on the Weber River were conducted for Reclamation in 1922 by William M. Green, in concert with the Utah Water Storage Commission. Green gathered data on water supply, water rights, testing at dam and diversion canal sites, topographic surveys, and surveys and negotiations on rights-of-way. The report suggested a rough layout and design of the facilities, at an estimated cost of $3 million. Green's reports allowed Reclamation to make a final decision on the project site in 1924, leading to appropriations for $375,000 in 1925 and $900,000 in 1926. Further surveys would be conducted by Mr. Green until 1927, when the project was authorized by President Calvin Coolidge on January 8 under section four of the 1910 Advances to the Reclamation Fund Act, and subsection B, section 4 of the 1924 Fact Finder's Act.[6]

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5. Denver, Colorado, National Archives and Records Administration: Rocky Mountain Region, Records of the Bureau of Reclamation, Record Group 115, "Annual Project History, Weber River Project, Utah" Volume 2, 1928-60, 4-5; Robert W. Sadler and Richard C. Roberts, *The Weber River Basin: Grass Roots Democracy and Water Development* (Logan, Utah: Utah State University Press 1994), 125.

6. "Annual Project History, Weber River Project, Utah" Volume 2, 1928-60, 4-5; "Annual Project History, Salt Lake Basin Project, Utah" Volume 1, 1928, 6-7; *Project Data*,1325; United States Department of the Interior, *Federal Reclamation and Related Laws Annotated* (Washington, D.C.: US Government Printing Office 1972), 151-2, 316-7.

Construction History

The construction of the project was held up for a short time because of the difficulty in acquiring security through share purchases in the proposed reservoir capacity, which was to be 74,000 acre-feet, or one share per acre-foot . The federal government and the Bureau of Reclamation had decided not to proceed with construction of the project until 80% of the shares had been sold. The largely Mormon communities had earned a reputation as being "chary about buying water,"during the process of authorizing the nearby Strawberry Valley Project. This reluctance to buy water was highlighted when it was discovered that by January 11, 1927, 79.55% of the shares, or 58, 869 acre-feet, had been purchased. In spite of the organization of the Weber River Water Users Association(WRWUA) on January 15, 1926, an intense three-year marketing blitz, and a great deal of noise from Salt Lake City interests about buying into the water allocation, Reclamation and WRWUA officials still had a great deal of difficulty convincing people to purchase shares in the project. These concerns were exacerbated when Provo River interests reduced their purchase of shares from 7,000 to 5,400– the lower the percentage of shares for project water, the higher the proportionate costs would be for construction payments by the current shareholders. Fortunately, the fulfillment of the share purchase percentage was accomplished by March 19, 1927, when construction contracts were filed.[7]

A contract was initiated between the United States and the WRWUA on January 17, 1927, for the "First Division of the Salt Lake Basin Irrigation Project;" it would soon become known as the Weber River Project. The contract stipulated that the project would deliver 74,000

7. Denver, Colorado, National Archives and Records Administration: Rocky Mountain Region, Records of the Bureau of Reclamation, Entry 7, "Salt Lake Basin Project," Memo from RMP to Mr. Dent, January 11, 1927; Entry 7, "Salt Lake Basin Project," Memo from Assistant Engineer E. O. Larson & District Counsel J. R. Alexander to Commissioner Elwood Mead, January 6, 1927; Merrill, "The Weber River Project," 258.

acre-feet of water per year between the dates of April 1 and October 31, with a daily cap of 2,000 acre-feet a day, and would benefit 80,000 acres in Summit, Morgan, Weber, Davis, Wasatch, Utah, and Salt Lake counties. The Weber River Project was planned as an earthfill structure on the Weber River, approximately 42 miles southeast of Ogden. The dam would be 158 ft. high, 1,887 ft. long along the crest, and have a capacity of 74,000 acre-feet. The concrete spillway at the left abutment would handle flows of 15,000 cubic feet per second(cfs), with an outlet capacity of 2,100 cfs, sent through 14-foot horseshoe-shaped pressure tunnel. The Weber-Provo diversion canal would be nine miles long, and handle up to 210 cfs in its original form. When the canal was enlarged to deliver water from the Weber River to the Provo River as part of the Provo River Project, the flow capacity would be increased to 1,000 cfs.[8] Repayments of the appropriations for construction would be made in twenty equal installments, with security payments for the construction costs coming from the stock purchases in distribution canals for investing water companies. The right-of-way acquisitions were purchased from April to June of 1927, at a cost of $150,133.52 for 1,825.05 acres. , and the final appropriation of $1.75 million was granted for 1928.[9]

In September, 1927, Reclamation made arrangements for the relocation of the Lincoln Highway (US 40) with the Utah State Road Commission, and for relocation of the Union Pacific Park City and Grass Creek raillines, with the Union Pacific Railroad. This allowed Reclamation to contract with the Utah Construction Co., and A. Guthrie and Co., for construction of these relocations and for Echo Dam in November, 1927. Utah Construction Company began construction on Echo Dam that same month, while the contract for clearing the reservoir was awarded to the Heiselt Construction Co. in April of 1928. Reclamation did not award the

8. *Project Data*, 1325-7.
9. "Annual Project History, Salt Lake Basin Project, Utah" Volume 1, 1928, 7-8.

contract for the Weber-Provo Diversion Canal until October 21, 1929, when it was given to the S. H. Newell Company of Portland Oregon, for a bid of $250, 000.[10]

Prior to construction of Echo Dam, foundation and material tests were conducted along the Echo Dam site. It was found that the base of what would be Echo Dam consisted of an impervious natural layer of clay, sand, and gravel atop a pervious layer of sand and gravel, down to a depth of 26 feet. These layers rest atop a layer of Wasatch conglomerate bedrock. A mechanical analysis of soil samples was conducted, followed by a testing of the clay, sand and gravel materials for their potential for seepage and volumetric shrinkage. This step was particularly important, as these materials would be used in the earthfill portion of the dam. The results determined that the maximum compaction of materials was obtained with ten percent moisture; this figure would be the standard on compacted materials throughout the construction process.[11]

A gravel screening plant was also erected about one-quarter mile from the site, in the early stages of dam building, in order to remove concrete aggregates from the river bottom area below the dam. This plant made use of a bucket on a slack line of a double drum hoist. The material was fed into a set of vibrating screens of various meshes; the material sifted would be either discarded, or used for the thin reinforced and mass sections of the dam.[12]

Relocation of Lincoln Highway and Union Pacific Transportation Lines

The relocation of these major railroad and automobile transportation arteries took place in 1927 and 1928. Installation of all major and minor box, arch, and pipe culverts, as well as a

10. "Annual Project History, Salt Lake Basin Project, Utah" Volume 1, 1928, 3; "Echo Dam, Weber River, Utah: Bureau of Reclamation Constructing Earthfill Dam for Salt Lake Basin Project," Western Construction News, Volume 14, no.22 (December 10, 1929): 640.
11. Kenneth B. Keener, "Construction of the Echo Dam on the Salt Lake Basin Project, Utah," *Reclamation Era*, Volume 22, no.10 (October 1931): 214.
12. "Annual Project History, Salt Lake Basin Project, Utah" Volume 1, 1928, 25.

four span bridge overpass, took place from January to September of 1928. Fill and grading took place from November 26, 1927, to August 30, 1928, with the use of two steam shovels, and teams and trucks to haul the material. Ties from the old Grass Creek Line railroad spur were transferred to the new spur; work on this line was finished in September 1928. While relocating the 0.6 miles of the Grass Creek branch of the railroad went smoothly, the Park City Branch proved to be a more serious problem. Due to the short distance from the mainline at Echo Junction to the dam, a 56-foot earthfill over Echo Creek and a steep 2% grade from the creek to the dam was required in order to locate the railroad around the right abutment. The final length of the Park City relocation was 4.66 miles, and the cost of the entire relocation project was $174,900.[13]

The Lincoln Highway relocation had problems, as well, when Reclamation discovered that the relocation would eventually encroach upon the railroad rights of way further away from the site. Reclamation resolved the issue with a 99-year lease, arranged by the Union Pacific to Summit County and the state of Utah, granting right-of-way to the highway. This portion of the transcontinental Lincoln Highway (present-day Interstate 80 in Wyoming and Utah) was altered between the towns of Coalville and Echo, with a change in the roadbed from 18 to 24 feet at the overhead crossing width. The total payments for the relocation, dispensed by the Utah State Road Commission, was $35,700. Other required relocations included replacement of four miles of telephone line above the reservoir by Mountain States Telephone and Telegraph, between December 1, 1927, and February 21, 1928, and installation of 10,347 feet of 44 KV line by the Utah Power and Light Company. The electrical line was carried around the end of the dam to

13. "Annual Project History, Salt Lake Basin Project, Utah" Volume 1, 1928, 9-11.

allow removal of material above the left abutment and the spillway channel.[14]

Echo Dam and Reservoir

The A. Guthrie Construction Co. started work on Echo Dam on December 12, 1927. Construction of the buildings for the construction camp, including machine and blacksmith shops, mess hall, bunkhouses, cottages, store, office, and bathhouse, took place during the first month. To provide a water supply, the contractor dug a shallow well near the old river channel, and set up a water tank was set up near the mess hall.

Clearing of the dam site began in January of 1928, which consisted of stripping by a gas shovel. Using material excavated from the outlet channel, placement of earthfill into the embankment began in March, starting with the left side of the river at the downstream toe, all the way to the river's edge. The river was then diverted to the cut bank at the right side of the river bottom, and placement of earthfill continued to the upstream toe. The earthfill material consisted of a Zone 1 core, containing clay, sand, gravel, and cobbles, sprinkled to a ten percent moisture content, and rolled in eight-inch layers. The contractor covered the downstream face of the dam with a layer of gravel and cobbles, while the upstream portion was layered with conglomerate riprap four feet thick. To provide drainage, eight and twelve-inch tile was laid in trenches at the downstream toe of the dam in 1930, then backfilled with gravel and cobbles. After the base of the dam was raised to 20 feet, a dry earth blanket was placed at the downstream toe, increasing the distance by 30 feet and providing extra protection from seepage. By the end of the summer, the excavation of the concrete corewall trench between Stations 8 and 13 was also completed and the placement of concrete in the structure had begun. The corewall trench was backfilled during the fall months of 1928. During this period, the main corewall was completed across the

14. *Ibid*.

entire river bottom section, as well as a 57-foot long portion of the wall up the dam's left abutment. Due to frost conditions at elevation 5,444, the backfilling process had to be discontinued beyond that point. Placing of embankment and riprap would continue until the dam had reached a height of 158 feet, after which workers placed a concrete parapet wall along the top length of the dam.[15]

Excavation of the cut-off trench was begun in mid-April of 1928, while further excavation and placement of earthfill continued through the summer. The trench was excavated through sand and gravel to the conglomerate underlying these layers, then was backfilled with clay and rolled in eight-inch layers in the same manner as the dam. By December of 1929, a concrete cutoff wall, keyed to the underlying conglomerate, extended 12 feet into the earthfill of the cutoff trench. Beginning in 1930, the areas of the trench not laid with concrete were filled with puddled clay.[16]

The contractor began excavation of the diversion tunnel March 9, 1928, and finished on June 16, when the tunnels for the upstream and outlet ends were finally joined. Concrete lining of the tunnel was finished by October 1928. The tunnel itself was built 12 feet wide by 18 feet high, with the horseshoe section at the upstream reach of the tunnel being 14 feet in diameter. After 1928, two hydraulically operated emergency slide gates were installed for the tunnel, along with two riveted steel pipes that would serve as the means for discharge through the tunnel. Workers then installed two 60-inch internal differential needle valves at the downstream ends of the pipes to control the flow and discharge into the stilling basin.[17]

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15. "Annual Project History, Salt Lake Basin , Utah" Volume 1, 1928, 16-7, 24-5; "Echo Dam, Weber River, Utah, Western Construction News, 639; Keener, "Construction of the Echo Dam," 214-5.
16. "Annual Project History, Salt Lake Basin , Utah" Volume 1, 1928, 17; Keener, "Construction of the Echo Dam," 214.
17. "Annual Project History, Salt Lake Basin , Utah" Volume 1, 1928, 18-20; Keener, "Construction of the Echo Dam," 216.

After completion of concrete placement in the diversion tunnel, grouting was injected in the rock around the diversion tunnel and the gate chamber, and in other areas where needed. To facilitate drainage, an eight-inch drain to the stilling basin was placed below the gate chamber and the invert floor at the outlet portal. Excavation and installation of the trashracks at the upstream end of the outlet works began in July 1928, and was completed in September 1928.[18]

Work began on the spillway in 1930, at the left abutment. The channel was excavated thirty feet wide at the bottom, and concrete was placed to a thickness of one foot. Four motor-operated spillway gates were installed at the channel's intake. A gasoline engine was installed in case of a breakdown with this system. At the foot of the spillway, a stilling basin was excavated and lined with concrete to a width of 40 feet and a depth of 31 feet, with the bottom being 17 feet below the river channel's elevation. The contractor excavated the river channel to a base width of 30 feet, but left it unlined. By October 7, 1930, the dam was complete and the reservoir area had been cleared.[19]

Weber-Provo Diversion Canal

Work began on the Weber-Provo Diversion Canal in 1930, and completed by April of 1931. Reclamation placed the head of the canal on the Weber River, 25 miles upstream from Echo Dam, near Kamas, Utah. Because of the upcoming enlargement, the canal was presumably kept in earth-lined form along its entire length. The canal itself diverted water from the Weber River to the Provo River, in accordance with plans for the upcoming Provo River Project, a larger Reclamation project that began construction in 1938. The water from Weber River, however, would only be diverted after those holding priority on the Weber River had received

18. "Annual Project History, Salt Lake Basin , Utah" Volume 1, 1928, 20-3; Keener, "Construction of the Echo Dam," 216.
19. "Echo Dam, Weber River, Utah, Western Construction News, 639; Keener, "Construction of the Echo Dam," 215-6; Merrill, "The Weber River Project," 259.

their designated share. The United States held onto the title of the canal, and the right to dispose of its water capacity in preparation for the Provo River Project. Reclamation completed the entire Weber River Project in 1931, while an enlargement on the Weber-Provo Diversion Canal to a 1,000 cfs flow capacity would be carried out from 1941-1947.[20]

Post-Construction History

On June 30, 1931, the United States sent a notice to the Weber River Water Users Association that the project was virtually complete, save for work on the parapet wall atop the dam, and other minor work. The notice also informed the WRWUA that after July 5, operation and maintenance of the project, as well as responsibility for the project's recreational facilities, would be turned over to the association. The final cost of the project came in under budget, at $2,869,974.63, which was below the original $3 million estimate of William Green in 1922. Due to low stream flow in 1931-1932, and the financial hardships that resulted from the Great Depression, a total of $650,203 was deferred from 1932 to 1936 via moratorium acts of Congress. The United States and the WRWUA renegotiated and signed the repayment contract on December 20, 1938, increasing the number of annual payments from 20 to 30. Operation and maintenance of the Weber-Provo Diversion Canal was transferred to the Provo River Water Users Association that same day.[21]

Weber-Provo Diversion Canal Enlargement

The diversion canal is the principal source for the water supply for Deer Creek Dam and Reservoir, the first of the dams built for the Provo River Project. Construction on Deer Creek Dam began in 1938. The Provo River Project, at the time of its authorization in 1937, was the

20. Merrill, "The Weber River Project," 259-60.
21. "Annual Project History, Weber River Project, Utah" Volume 2, 1928-60, 6-7; Merrill, "The Weber River Project," 260-1.

largest reclamation project in Utah in terms of irrigable area. Reclamation designed the project to augment irrigation in Utah, and Salt Lake counties, and provide municipal supplies to Provo, Orem, American Fork, and Salt Lake City, as well as storage water for Utah Lake. The area was included in the same investigations of the Salt Lake Basin by William Green that eventually brought the Weber River Project into existence. Green himself concluded in 1923, that the existing Provo River systems were inadequate for the development of what would potentially be a very large-scale project. The feasibility of such an endeavor depended upon the purchase of hydroelectric power rights and the increase of diversions from the Weber River, presumably to help pay for the construction costs as well as serve the very large area the Provo River Project would be covering. Thus, the construction of the Weber River Project was crucial to the ultimate success of the Provo River Project. The enlargement of the Weber-Provo Diversion Canal in the 1940's came about largely because of Green's conclusions.[22]

At the beginning of the Provo River Project, the canal enlargement became part of the project's Deer Creek Division, which included Deer Creek Dam, the Duchesne Tunnel, and the relocation of a portion of the Denver & Rio Grande rail line, as well as US Highway 40. Enlargement of the canal, from 210 cubic feet a second to 1,000 cfs, was particularly important because 65% of the water stored in Deer Creek Reservoir had to come from the Weber River via this canal; most of the rest would come from the Duchesne River. The issue of water for future hydroelectric power generation was settled in a contract between the WRWUA, Provo River Water Users Association, Utah Light and Traction Co., Utah Power and Light Company, and the United States. Signed on February 15, 1939, this contract allowed for the transfer of hydropower

22. "Annual Project History, Provo River Project, Utah" Volume 1, 1937, 16-21.

water from the Weber River to the Provo River via the canal.[23]

Surveys for enlargement of the canal began in mid-1941, after which laborers from the Civilian Conservation Corps(CCC) and other government forces assigned to the project began site preparations for the coming enlargement. The CCC forces were withdrawn on December 23, 1941. On December 19, 1941, a contract was awarded to Norman I. Fadel of Hollywood, California, with a total bid of $97,345.75, and construction began on April 4, 1942; the construction company worked in concert with government forces. During 1942, the contractor completed a portion of the excavation. Other work completed by the contractor included the measuring control and chute, placement of the concrete drop, and installation of the siphon cross drain. In the meantime, government forces had their worked in one reach of the canal. The government workers completed 40 minor structures consisting of siphons, flumes, timber bridges and a concrete highway bridge, and excavation of the canal prism (the canal's cross-section).[24]

On November 1, 1943, the contract with Norman I. Fadel was terminated on account of no work being done during the course of the year. This was not due to negligence on the part of the contractor, but occurred because of a lack of manpower due to World War II. The remainder of the contract was taken up by government forces which, during 1944, placed the remaining 4,000 linear feet of concrete not undertaken by the contractor. They also placed nearly 1,000 linear feet of the canal's clay lining, including dumping clay and earth material in earth-lined portions to seal leaks and prevent excess seepage loss. The remainder of the canal prism was enlarged, while the canal itself was excavated to full size, and the timber highway bridge

23. "Annual Project History, Provo River Project, Utah" Volume 2, 1938, 18; "Annual Project History, Provo River Project, Utah" Volume 3, 1939, 10, 16; "Annual Project History, Provo River Project, Utah" Volume 6, 1942, 23.
24. "Annual Project History, Provo River Project, Utah" Volume 5, 1941, 40-2; "Annual Project History, Provo River Project, Utah" Volume 6, 1942, 29.

constructed.[25]

During the final stages of construction, from 1945-1947, the crew repaired and cleaned the stilling basin, built bridge approaches, and placed backfill in the embankment where shrinkage of the material had occurred. They also built Parshall flume at the outlet end of the canal. A trashrack was installed at the canal inlet to catch debris during diversion periods. The final work, consisting of minor repairing and cleaning, was completed in October of 1948.[26]

Recreation

In addition to providing water for western regions, Reclamation projects have often reflected national cultural trends. Such is the case for the Weber River Project, in regards to recreational use of the project facilities. Prior to the 1950's, the opportunities for the type of recreational activities in the United States enjoyed today were much more limited. This began to change following World War II, as national incomes rose and the transportation infrastructure was modified around the increased use of the automobile. In a manager's report submitted at the WRWUA annual meeting, D. Earl Harris remarked that "the American public is gradually finding themselves with more time and money to spend for this type of activity. Also the highways from the populated areas to the Echo Reservoir are being greatly improved."[27]

In 1960, when the project first opened its recreational facilities under control of the WRWUA, it received 11,800 visitors, a number that climbed to 33,450 by 1976. Recently, the recreation area has had relatively few visitors during the summer weeks, seeing almost no crowds, although the weekends are quite busy. Most of the activity on the lake consists of boating or water skiing, rather than other available activities such as camping and fishing. The

25. "Annual Project History, Provo River Project, Utah" Volume 7, 1943, 21; "Annual Project History, Provo River Project, Utah" Volume 8, 1944, 19, 42-4.
26. "Annual Project History, Provo River Project, Utah" Volume 9, 1945, 18, 39; "Annual Project History, Provo River Project, Utah" Volume 11, 1947, 33.
27. "Annual Project History, Weber River Project, Utah" Volume 3, 1961-1965, 10.

reservoir is the site for a number of water events, including corporately sponsored boating and jet-ski races, and an annual fishing derby which takes place the first week of June. In 1992, a rail-trail for pedestrians, Utah's first, was built by the Utah National Guard along the old Union Pacific rail line that led from Park City through the Echo Dam site. This trail provides bikers and hikers with a direct link from Park City to Echo Reservoir.[28]

Controversy, 1966-1972

In the time since completion of the Weber Basin Project, it has proven an important component of the entire Salt Lake Basin area. Because of this, the issue of its control and place within the framework of Utah's infrastructure has often been the center of a great deal of controversy. Most of these conflicts have been centered around the issues of control of the project and land-transportation. Conflicts over project control can be attributed to struggles resulting from misunderstandings of the construction contracts; the latter is due to the location of the dam, which is right next to a road, I-80, which has served as a major land route stretching back to the days when the area was largely occupied by Native Americans.

It had been the desire of the WRWUA to take over not just the operations and maintenance of Echo Dam and Reservoir, but title to the facilities, as well. The WRWUA first made this request in June 1966, shortly after the final project repayment was made. The minutes of WRWUA meetings from the 1960's onward reveal that, in spite of aggressively attempting to assert its authority over the project, the organization could make very little headway. This was largely because the contract that had been signed with Reclamation, prior to the project's

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28. *Ibid*.; "Annual Project History, Weber River Project, Utah Volume 6, 1976-8, 12; Dave Holt, "Echo Lake," *Utah Lakes* [web site online] (September 25, 1996), available from http://members.aol.com/_ht_a/h2oskiholt/utlakes.htm, Internet, accessed 18 July 2000; telephone conversation with Joye Raye, Echo Reservoir manager, 21 July 2000; Craig Hansell, "Utah's First Rail-Trail Close to Being Open," *The Salt Lake Tribune* [database on-line] (Utah: The Salt Lake Tribune 1992), available from http://archive1,sltrib.com/cgi-bin...oftpage=Document&wordsaroundhits=3, Internet, accessed 20 July 2000.

construction, required the action of Congress on questions of title transfer and changes in fund settlements. The stockholders, as they understood the situation, felt that the US government would transfer the title to the association after the project was paid for. That, however, is not the policy of the U.S. government, so the repayment contract, like all the others Reclamation had written up, did not provide for transfer upon full payment. Any transfers of title had to be authorized by Congress.[29]

In a letter to Utah Senator Frank E. Moss, Reclamation's N. B. Bennett affirmed that there was no legislative precedent for the title of a reclamation project to change hands to a private organization following the payout. Furthermore, Bennett argued, transfer of title would cause the loss of eligibility for federally funded rehabilitation and betterment programs, as well as muddle the question of state and local tax liability. In 1972, Commissioner Ellis Armstrong solidified Reclamation's opposition to title transfer on the grounds that Reclamation desired to reserve any mineral, oil, and gas rights to the land for the United States. In addition, a proposal to investigate public interest in the flood control benefits of the Salt Lake and Weber Basin projects had been recently introduced, and the transfer of title to the WRWUA would hamper those investigations. Armstrong cautioned that if the project was not coordinated with Weber Basin, the risk of flood damage would increase. Thus, the title of the project was never transferred over to the WRWUA.[30]

Conflicts over land settlement was another controversy that marked the years immediately following the last payment on the project in 1966. The highway building that began during the Eisenhower administration, had a direct effect on the Weber River Project. In 1964,

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29. "Annual Project History, Weber River Project, Utah," Volume 4, 1966-70, 6, 24.
30. "Annual Project History, Weber River Project, Utah," Volume 4, 1966-70, 25, 109; "Annual Project History, Weber River Project, Utah," Volume 5 1971-5, 94.

plans were drawn up for the construction of a highway alongside the project that would become Interstate 80. On December 15, 1964, D. Earl Harris reported to the WRWUA that the construction of the highway would result in the relocation and construction of a new gaging station, as well as relocation of the Weber River channel and Echo Creek to accommodate an interchange, one half-mile from the base of the dam along the west side.[31]

Gaining the right of way for the lands proved to be a long, arduous process, and again demonstrated the WRWUA's lack of power in directing the affairs of the project. The title to the lands required for the highway construction belonged to the United States, and it was understood that any settlements regarding sale of land title would be submitted to the WRWUA for approval prior to accepting the settlement. Any money received for lands purchased for I-80 could go to either the association directly, or to the Treasury in the name of the association. Reclamation preferred the latter method, for future support of with a rehabilitation program to be implemented at a later date. This way, any future use of funds would require Congressional action. In 1968, the Utah State Road Commission pressed for a settlement on right of way lands for the interstate. Commissioner Armstrong later approved the collection of funds for this easement from the State of Utah on April 28, 1970, with the funds to go into the Treasury.[32]

The issue came to a head at the 1971 convention of the National Water Resources Association in Dallas, when members of the WRWUA confronted Armstrong regarding the monies collected for lands lost to construction of I-80. Not only were they none too pleased with the amount of the settlement, but they contended Reclamation attempted to settle without prior approval from the association. In an effort to placate the WRWUA, Armstrong promised to make an effort to organize a fair settlement. The Utah Department of Highways paid $16,450 to

31. "Annual Project History, Weber River Project, Utah," Volume 3, 1961-5, 30.
32. "Annual Project History, Weber River Project, Utah," Volume 4, 1966-70, 6, 55, 63.

the Reclamation fund on July 31, 1972, for freeway right of way on the west shore of Echo Reservoir.[33]

Project Payment and Maintenance

Although Echo Reservoir has filled consistently since its completion, occasional drought years, coupled with the Depression in the 1930's, forced the WRWUA to request deferments of their annual payment. In 1961, the area was struck by such harsh drought that the reservoir only filled to 39% of its capacity, and forced the association to consider requesting a 60% deferred payment. However, it was decided by September of 1961 to levy assessments against outstanding stocks of project water instead, to pay the full $88,192 annual amount that was due.[34]

The last payment on the project took place in February of 1966, five years over the contractual thirty-year deadline. In June of that year, a ceremony was held at the dam marking the final payment. At this ceremony, Commissioner Floyd Dominy remarked, "In 1965, the reported gross crop return was $12,570,000...nearly 4 ½ times the cost of building Echo Dam...I am re-convinced by examples like this Weber River Project that today's so-called high-cost projects will be tomorrow's bargains."[35]

Of course, this bargain came with some costs, namely in the area of project maintenance. The first major maintenance problem with the project occurred in 1961, when it was discovered that the needle valves would not work properly when the reservoir dropped below 10,000-11,000 feet. To alleviate this, a booster pump in the supply line was installed from the reservoir to the valves in July of 1961, to keep water flowing properly.

There was also a serious maintenance problem which prompted the WRWUA Board of

33. "Annual Project History, Weber River Project, Utah," Volume 5, 1971-5, 6, 10-1.
34. "Annual Project History, Weber River Project, Utah," Volume 3, 1961-5, 9, 48.
35. "Annual Project History, Weber River Project, Utah," Volume 4, 1966-70, 6, 88.

Directors to call a special meeting in September of 1968. It was discovered that large sections of the concrete floor and sidewalls of the stilling basin had completely washed out. The stilling basin is the focal point for the dissipation of energy caused by moving water, thus damage to the basin could endanger the dam itself, as well as the outlet works. The WRWUA contracted with Peter Kiewet and Sons, Company, to repair the cracks and holes in the basin. This work was accomplished from October to December of 1968, at a cost of $57,581. Further studies were undertaken the following year, and wear on the new concrete was found. Rocks and gravel were removed from the stilling basin, and a program for keeping the basin clear was suggested.[36]

In 1974, the stilling basin again required repairs. D. Earl Harris of WRWUA suggested installing a pump to move water from the basin, or a pipe in the river bed which would drain by gravity. An inspection by skin divers from Colorado in 1975, discovered severe cavitation and erosion over a large area, to the point that steel reinforcement bars were exposed and/or displaced. These inspections led to an extensive repair and maintenance program beginning in 1976, when a contract was awarded to Geary Construction Company to repair the stilling basin. A permanent pumping system would also be installed to facilitate the repairs. In 1977 and 1978, the basin was pumped out and debris removed. The two electric pumps that had been installed proved to be immensely useful, capable of draining the basin in two days with one man supervision.[37]

In 1981, cross-sections taken of Echo Dam revealed that riprap needed to be replaced in several areas, particularly on the upstream face. The riprap had become displaced significantly, although there was no serious settlement, bulging, benching, or erosion. In 1983 and 1984,

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36. "Annual Project History, Weber River Project, Utah," Volume 2, 1928-60, 9; "Annual Project History, Weber River Project, Utah," Volume 4, 1966-70, 37-43, 56.
37. "Annual Project History, Weber River Project, Utah," Volume 5, 1971-5, 43, 47; "Annual Project History, Weber River Project, Utah,' Volume 7, 1976-8, 24, 28, 75.

5,000 tons and 1,000 tons of riprap, respectively, were placed on the upstream face of the dam and along the inlet walls. While the original riprap consisted of cemented conglomerate sandstone with minor lenses of shale, the new riprap was a more eclectic mix of reddish-orange quartzose sandstone, medium rounded quartz grains cemented with silica, and clayey limestone.[38]

During 1986 Reclamation had two major construction projects at the damsite– the replacement of the needle valves with jet-flow gates, and the building of a power plant by the city of Bountiful at the foot of the dam. Attention was paid to the needle valves in the outlet works for the first time in 1976, when the first one of these devices for the project was repaired. On February 20, 1986, the WRWUA received $500,000 under the 1948 Emergency Fund Act to replace the old needle valves in the outlet works with two 60-inch jet-flow gates. Replacement was necessary because, if improperly operated or maintained. the needle valves could develop a "water hammer" condition, which would cause excess pressure, leading to a risk of explosion. Each of the jet-flow gates weighed 30,000 pounds and cost $67,000; the gates were installed separately on October 29 and December 18, 1986. The most recent examination of Echo Dam, March 29, 1999, showed that the facilities were quite well-maintained, save for the wear and tear of concrete throughout the spillway, and the slight deterioration of the spillway radial gates.[39]

On August 13, 1985, the city of Bountiful received a license from the Federal Energy Regulatory Commission to construct a hydroelectric plant at the toe of Echo Dam; a power line would be tied Bountiful's plant, at Echo Dam, to another power plant at East Canyon Dam.

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38. "Annual Project History, Weber River Project, Utah," Volume 12, 1986, 19, 46, 61.
39. *Ibid*., 29, 33, 62; United States Department of the Interior, Bureau of Reclamation, *Special Examination Report, Echo Dam, Weber Basin Project, Utah,* Upper Colorado Region, Denver Office: Waterways and Concrete Dams Group, 27 July 1999.

Construction on the powerplant by the city began in June, at the left toe of the dam, and cost $3.7 million. The City of Bountiful electric revenue bonds to cover the cost. Due to weather delays and holiday breaks, the plant was 86% complete at the end of 1986, but workers finished the plant the following year.[40]

Settlement of Project Lands

Many of the settlements in the vicinity of Echo Dam and Reservoir, and the lands they serve, were already established by the time the Weber River Project was authorized; thus, the Weber River Project was an attempt to provide adequate sources of water for presently settled lands, which had overtaxed their distribution facilities. The area is considered part of the Salt Lake Basin, which has shown population growth of approximately 12.7% in the past ten years. How much this growth can be traced to the distribution of project water is difficult to assess, because no evidence exists that lands were withdrawn by Reclamation specifically for settlement. However, the crop values of project lands, as well as the presence of the Bountiful power plant at the foot of Echo Dam, both indicate of the project's present-day contribution.[41]

Project Benefits and Uses of Water

Echo Dam and reservoir provides supplementary irrigation water for approximately 109,000 acres of farmland along the Weber River and a considerable amount of land on the west side of Ogden, Utah, as far as the Great Salt Lake. The irrigation benefits provided by the project water proved to be immensely profitable for the farmlands involved in the project's water distribution; from 1950 to 1960, the gross crop value per acre ranged from $81.34 to $129.78. Revenues received from the project lands were so high, in fact, that Reclamation's official

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40. *Ibid*., 20, 62; Bureau of Reclamation, "Weber River Project, Utah," *DataWeb* [database on-line] (Denver, Colo.: Bureau of Reclamation, date unknown), available from http://dataweb.usbr.gov/html/zweberiv.html, Internet, accessed 6 July 2000.
41. United States Bureau of the Census, *Subcounty Population Estimates, 1990-1999*, 30 June 1999.

newsletter, *Reclamation Era*, reported in 1947, that the water users of the project would produce, by the end of 1948, crops equal in value to the project's cost of $2.8 million. Crops produced by project farmers include barley, alfalfa, and sugar beets, although a number of fruits and vegetables are also grown for canning purposes. By 1992, crop values had grown to a total gross value of $46,314,442, with the value per acre at $506.73. Even when accounting for inflation, these are impressive figures for what has been, up until recently, a largely autonomous project.[42]

The Bountiful powerplant, while not controlled by the Bureau of Reclamation, provides hydroelectric power from two 1,750 kilowatt and one 1,000 kilowatt generators. As part of an inter-project flood-control program with the Weber River Water Conservancy District, which runs the Weber River Basin Project, Echo Reservoir has a dedicated 73,940 acre-feet for flood control space, and has provided nearly $12 million in flood control benefits over the past fifty years since the program was implemented. Lastly, Echo Reservoir has proven to be a popular recreational spot for boating, camping and fishing, drawing a total of 198,339 visitors in 1996.[43]

Conclusion

Because of its unique place within the framework of other reclamation projects in the Salt Lake Basin, the Weber River Project has proven an important contributor to the basin's water use, as well as the focus of tense conflicts during its history. The role of flood control in concert with the Weber River Basin Project, along with the variety of uses for the project that have been implemented over the decades, should solidify Weber River's place as a critical component of Salt Lake Basin reclamation.

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42. "Annual Project History, Weber River Project, Utah," Volume 2, 1928-60, 12; "Crops Jump in Gross Value," *Reclamation Era*, Volume 33, no.2 (February 1947): 48; United States Department of the Interior, Bureau of Reclamation, "Irrigation and Gross Crop Value by Region–1992," *1992 Summary Statistics* (Denver, Colo.: Bureau of Reclamation 1992), 44.
43. Bureau of Reclamation, "Weber River Project, Utah," *DataWeb*.

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