

Provo River Project

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Provo River Project

Built by Reclamation, periodically between 1938 and 1958, the Provo River Project was designed to provide supplemental irrigation water for 48,156 acres of highly developed farmlands in Salt Lake, Utah, and Washatch Counties, and additionally provide a domestic water supply for American Fork, Lehi, Lindon, Orem, Pleasant Grove, Provo, and Salt Lake City, Utah.¹

Project Location

The Provo River Project is located between Provo and Salt Lake City, Utah, and encompasses lands in Salt Lake, Utah, and Wasatch Counties.² This part of the country is semiarid with a mean average rainfall of approximately fifteen inches. The growing season in the region varies from 124 days to 174 days on various parts of the project. Temperatures in the region range from -35 degrees to 110 degrees Fahrenheit. Lack of great land areas and water suited the area suited to diversified, highly productive crops. Fruits and berries are important to the region's agriculture.³

Historic Setting

Much of Utah's early history consisted of explorers and trappers passing through the region with no designs on residing there permanently. Even when later trading posts were established, they were not built with the idea of creating permanent settlements. Some of the first explorers in the region were members of Coronado's expedition in 1540. Several Franciscan Friars also traveled through the region while searching for a trail from Santa Fe, New

1. Water and Power Resources Service, *Project Data*, (Denver: Government Printing Office , 1981), 1033-6.
2. Department of the Interior, Bureau of Reclamation, "Project Histories: Provo River Project," 1947, 1952, 69 (hereafter referred to as "Project History" followed by year and page).
3. "Project History," 1937, 16; "Project History," 1940, 153; "Project History," 1951, 80; "Project History," 1941, 133.

Mexico, to Monterey, California in 1776. It is believed that the Provo River and the city of Provo were named after a trapper named Provost, who was said to have operated near Utah Lake in 1820. General William H. Ashley arrived in that same area only two years later as he led a party of fur traders from St. Louis into the West. He established a trading post on Utah Lake in 1825. However, the first written history concerning the region was made by John C. Frémont as part of the record of his expedition in 1843. It was not until the Mormons, led by Brigham Young, entered the Salt Lake Valley in 1847, however, that the region's first permanent settlement was established.⁴

In March of 1849, John S. Higbee led a party south from Salt Lake, and established a settlement on the Provo River at a place called Old Fort Field. The settlement was named Fort Utah, and is now within the city limits of Provo. The settlers built a fort, and planted crops. That first season they grew some 200 acres of wheat, rye, and corn. Soon after, population in the region grew as well. Settlements were established at American Fork, Lehi, and Pleasant Grove in August of 1850. By early October of that same year, settlers founded the towns of Springville and Payson as well.⁵ However, the region's population grew most after the first railroad came to Provo in November of 1873.⁶

Since these early settlements farmers have sought knowledge of Utah's streams in order to utilize water resources to their greatest advantage. The region's farmers realized the economic importance of utilization of all available water, and beginning in 1902, attempted to organize projects for the purpose of building storage reservoirs. Soon thereafter, private capital

4. "Project History," 1937, 66.

5. *Ibid.*, 67.

6. *Ibid.*

funded construction of several small dams. However, larger projects lacked economic support and engineering planning and were not constructed.⁷

In 1910, several individuals banded together to file appropriation applications for flood waters in the region's streams and to conduct preliminary surveys of several storage reservoirs. This group operated for several years, and by an act of the Utah State Legislature, became the Utah Water Storage Commission in 1921. The commission's duties consisted of initiating examination surveys and conducting investigations looking to both conserve and fully develop Utah's water supply. The commissioners were also directed to cooperate with any interested city, county, state, private, or federal agency conducting related work.⁸

The first investigations into the Provo River Project were initiated in 1922 through a request by the Utah Water Storage Commission. Investigations were conducted as a joint venture between the Commission and Reclamation.⁹ The Provo River Project remained in the planning stages until the lands within the project area began experiencing a severe drought which lasted from 1931-1935. Utah Lake, which supplied much of the region's irrigation water, fell from 850,000 acre-feet to 20,000 acre-feet in this time period. On the basis of a report submitted by Reclamation in the latter half of 1931, a proposal to build a storage reservoir on Provo River to be fed by diversions from other watersheds was developed. Steps were taken to obtain Congressional approval for the project. The first step involved organization of the Provo River Water Users Association in May of 1935 and organization of the Metropolitan Water District of Salt Lake City the following August. The formation of these entities was necessary

7. *Ibid.*, 18.

8. *Ibid.*

9. *Ibid.*, 19.

for the negotiation of repayment contracts between Reclamation and the water users. Following these preliminary steps, the project plan was submitted for approval.¹⁰

Project Authorization

Construction of the Provo River Project was initiated under the provisions of the National Industrial Recovery Act of June 16, 1933. President Franklin Delano Roosevelt approved the project on November 16, 1935, under the terms of subsection B of section 4 of the act of December 5, 1924 (43 Stat. 701.). Presidential approval of the Salt Lake Aqueduct came on October 24, 1938. Construction of the Deer Creek Powerplant was authorized by the Secretary of the Interior, under the Reclamation Project Act of 1939, on August 20, 1951.¹¹

Construction History

The project's main features consist of: Deer Creek Dam, which forms Deer Creek Reservoir, Deer Creek Powerplant, Salt Lake Aqueduct and Terminal Reservoir, Murdock Diversion Dam, Murdock Canal (formerly named Provo Reservoir Canal), Weber-Provo Diversion Canal, Duchesne Tunnel, Jordan Narrows Siphon and Pumping Plant, and the South Lateral. The Deer Creek Reservoir stores flood water from Provo River, Weber River surplus diverted by the Weber-Provo Diversion Canal, and surplus water diverted by the Duchesne Tunnel from the headwaters of the Duchesne River. Releases from the reservoir serve the two divisions within the project. The Aqueduct Division consists of the Salt Lake Aqueduct and Terminal Reservoir. The Deer Creek Division includes all remaining project features. Water for the Aqueduct Division is diverted into the Salt Lake Aqueduct, and is stored in the Terminal Reservoir. The water provides the main domestic water supply for Salt Lake City, Utah.¹² At

10. Water and Power, *Project Data*, 1036; "Project History," 1952, 70.

11. Water and Power, *Project Data*, 1036; "Project History," 1937, Preface; "Project History," 1977, 3.

12. Water and Power, *Project Data*, 1033; Tex Tenicks of the Provo Area Office, interview by author, 16 December 1997, telephone interview.

the Murdock Diversion Dam, approximately seven miles downstream from the storage reservoir, the Murdock Canal takes water from the Provo River. The twenty-three miles long canal serves the 46,609 acres of the Deer Creek Division. The Murdock Canal and the Jordan River provide water to the Jordan Narrows Siphon and Pumping Plant, which in turn supplies water to the project lands on the west side of the Jordan River and Utah Lake. The Jordan Narrows pump provides water to the South Lateral, which delivers its water supply to the area south of the pump and west of the Jordan River.¹³

Deer Creek Dam

Deer Creek Dam, the key structure of the Provo River Project, is located approximately sixteen miles northeast of Provo, Utah, on the Provo River. The dam is a 235 foot high, zoned earthfill structure, with a crest length of 1,304 feet. The dam's spillway is located at the right abutment. The spillway is a concrete chute controlled by two radial gates, and has a capacity of 12,000 cubic feet per second. The outlet works, located through the left abutment, is a concrete-line tunnel running from the trashrack to the gate chamber, where two steel pipes lead to the Deer Creek Powerplant. The outlet works has a capacity totaling 1,500 cfs. Releases from the dam are controlled by two tube valves. Additionally, the dam forms the 152,700 acre-foot Deer Creek Reservoir.¹⁴

Much of the preliminary work conducted at the Deer Creek damsite was accomplished by the Civilian Conservation Corps, beginning in 1938. Between 1938 and 1941, CCC forces cleared the damsite; provided preliminary excavation for the relocation of the Round Valley

13. Water and Power, *Project Data*, 1033.

14. *Ibid.*; "Project History," 1977, 4.

Highway; removed and reconstructed the Western Union Telegraph line which ran through the reservoir area; as well as conducted earth embankment work and constructed minor features.¹⁵

The first contract issued for work on Deer Creek Dam called for construction of the dam and the relocation of a portion of railroad and the Round Valley Highway. Reclamation awarded this contract to Rohl-Connolly Company on April 11, 1938. The contractor began work at the site prior to receiving notice to proceed on July 16, 1938. The first week of June, the contractor began excavation of the outlet tunnel. By the first week of August, the tunnel had been holed through. Concrete lining of the outlet works began August 18, 1938, and at year's end, lining of all regular tunnel sections, and the concrete placement in the valve house was completed. Work on the relocation of the highway and railroad had begun during the summer months.¹⁶

Work progressed smoothly throughout 1939. By May 30, 1939, the contractor completed the outlet works, including the trashrack, gate chamber, flume section, and powerhouse structure. Excavation operations were conducted throughout the summer. All work on the highway relocation concluded on August 14, 1939. The contractor conducted most of the construction work from the spillway stilling basin in October, November, and December of 1939.¹⁷

Construction efforts during 1940 also proceeded well. The contractor resumed construction of the dam embankment at the end of March and continued with this work until adverse weather conditions suspended construction in the middle of November. The dam's height was increased by 85 feet during the construction season, bringing it up to 60 feet below top elevation. During the year, the contractor completed the embankment cut-offs, finished stripping and grouting the dam foundation, and completed 76 percent of the spillway work.¹⁸

15. "Project History," 1938, 71, 73; "Project History," 1939, 30; "Project History", 1941, 38, 40.

16. "Project History," 1938, 20, 22.

17. "Project History," 1939, 24, 27.

18. "Project History, 1940, 32, 34.

The remainder of construction went swiftly during 1941. By October 20, 1941, all contract work was essentially finished, except for some electrical installations for which the contractor could not obtain the proper conductors and fixtures. As a result, the contractor was relieved of responsibility for the installations, and the contract was completed five months ahead of schedule.¹⁹

Salt Lake Aqueduct

Construction of the Salt Lake Aqueduct also commenced in 1938. The aqueduct is approximately 42 miles long, and has a capacity of 150 cfs. The structure begins at the Deer Creek Dam and is able to release water at several points along the line, as well as into a 40 million gallon Terminal Reservoir at the end of the line, near Salt Lake City, Utah. This aqueduct provides the city with a large portion of its domestic water. The aqueduct consists mostly of 69 inch diameter steel-reinforced concrete pipeline. The sections of pipe are joined by special joints sealed with heavy rubber gaskets sealed inside and out with cement mortar. This was done because the rough terrain through which the aqueduct was constructed puts a great amount of stress on the joints. Portions of the structure are made of 70 inch diameter plate steel to provide protection against the high pressures at points where the pipeline dips dangerously below hydraulic gradient.²⁰

The pipeline follows the river in Provo Canyon, traveling through two large tunnels at the mouth of the canyon, and four smaller tunnels at various point within the canyon. The Olmsted Tunnel, through which the aqueduct flows first, is a 3,614 foot long, 78 inch diameter,

19. "Project History," 1941, 36; "Project History," 1952, 72.

20. "Project History," 1977, 5; "Project History," 1952, 75.

horseshoe-shaped structure. The water is then carried a short distance into the Alpine-Draper Tunnel, which is identical in cross-section with the Olmsted Tunnel, but is 15,000 feet long.²¹

The initial construction contract for the Salt Lake Aqueduct called for construction of the Olmsted and Alpine-Draper Tunnels. Bids were first opened on October 27, 1938; however, all bids were too high, and consequently rejected. Reclamation reissued a request for bids for the contract November 22, 1938. On December 3, 1938, the Government awarded the contract to George K. Thomson and Company. The contractor began construction prior to receipt of notice to proceed on December thirtieth of the same year.²²

The contractor began excavation at the outlet portals of both tunnels in early January of 1939. By the end of June, workers holed through the Olmsted Tunnel; and the contractor completed lining the tunnel with concrete by mid-November. Work on the Alpine-Draper Tunnel also went well, with 60 percent of the tunnel being excavated by the end of 1939. However, excavation operations during 1940 encountered delays due to pending study of alternative types of tunnel supports, the six inch steel ribs used initially proved inadequate. The tunnel was not holed through until December 17, 1940; and concrete lining operations had just begun by year's end. The contractor spent the first part of 1941 replacing deformed tunnel supports, and realigning supports forced out of place during the course of construction. Concrete lining of the tunnel progressed smoothly, and the last of the concrete was placed on November twenty-seventh. All items under the contract were completed by the contractor on December 13, 1941.²³

21. "Project History," 1977, 5; "Project History," 1938, 73-4.

22. "Project History," 1938, 22, 24.

23. "Project History," 1939, 31; "Project History," 1940, 11, 36; "Project History," 1941, 42, 44.

The first contract for construction of pipeline and structures along the aqueduct was issued in 1939. Bids for a contract calling for construction of approximately eight miles of pipeline, and the structures lying between the Olmsted and Alpine-Draper tunnels, were opened on June 24, 1939. Out of twelve bids received, Reclamation granted the contract to Utah Concrete Pipe Company on August 29, 1939. The contractor received notice to proceed on October 25, 1939, setting the completion date for November 3, 1941.²⁴

Much progress was made during 1940. In that year the contractor placed 24,700 linear feet of pipe in the trench, and backfilled and completed two miles of pipeline. However, the contractor did face some difficulties that year as well. The problems stemmed from a rift which formed between several of the company's partners, and resulted in the suspension of work under the contract. After much negotiation some members of the company relinquished their claims under the contract in favor of Carl B. Warren, who assumed management of the work on February 16, 1940. This resolved the problem, and work resumed shortly thereafter. No further difficulties or delays arose during construction; and by August 24, 1941, the contractor had completed pipe laying operations. Leakage tests began on the pipeline on September fourteenth; with all work under the contract being completed by September 25, 1941, 39 days ahead of schedule.²⁵

In April of 1942, Government forces began excavation operations for a 414 foot long tunnel for the aqueduct at Station 452+72. Work progressed swiftly, and by May 30, 1942, excavation operations were completed and the tunnel holed through. Concrete lining operations began at the beginning of June, and were completed as of June 25, 1942.²⁶

24. "Project History," 1939, 31, "Project History," 1941, 44.

25. "Project History," 1940, 38, 11; "Project History," 1941, 44.

26. "Project History," 1942, 12.

Another pipeline contract was issued in 1943. The contract was divided into two schedules; Schedule 1 calling for construction and placement of 13,300 feet of pipeline; and Schedule 2 calling for construction and placement of 39,250 feet of pipeline for the Salt Lake Aqueduct. Bids for this contract opened on December 6, 1943. Carl B. Warren received the contract on February 5, 1944²⁷.

The contractor began work on Schedule 1 on April 1, 1944. Work during the year included manufacturing pipe, and the excavation of the pipe trench called for in Schedule 1. The contractor encountered no delays during construction, and completed Schedule 1 in August of 1944. From September of 1944 through the first part of January, 1945, the contractor worked on the sections of Schedule 2 in both Provo Canyon and Salt Lake County, simultaneously. However, in the middle of the month, the contractor moved all equipment to Salt Lake County to complete work there. In July, the contractor resumed work in Provo Canyon, and continued until all work in that section had been completed. Additionally, the contractor manufactured pipe from January through September of 1945 with only minor delays. Work continued at a steady rate, and all work under the contract was completed on May 24, 1946.²⁸

Carl B. Warren received another contract from Reclamation approximately one year after receiving the first contract. On February 16, 1945 Reclamation awarded Warren a contract for construction of four and one-half miles of steel pipeline and construction of associated structures for the Salt Lake Aqueduct. The contractor began work on May 7, 1945, twenty days prior to receipt of notice to proceed. Completion of the contract was set for December 27, 1946.

Work went well in 1945, and by year's end the contractor had laid much of the high-head plate-steel pipeline. During 1946 the contractor's forces were engaged in completing the

27. "Project History," 1943, 29.

28. "Project History," 1944, 24; "Project History," 1945, 57; "Project History," 1946, 54.

pipeline and structures called for in the contract. However, a shortage of reinforcement steel caused unavoidable delays in construction; and therefore, the contractor was unable to complete work by the specified deadline. Due to a steel shortage, Reclamation granted the contractor an 82 day extension to complete construction. Once deliveries of the proper materials were made, the contractor resumed work, and completed the contract on March 19, 1947.²⁹

Bids for another two-schedule pipeline and structures contract opened May 28, 1947. Schedule 1 covered construction of three tunnels and approximately five miles of pipeline and structures in Provo Canyon. Schedule 2 called for construction of slightly more than seven miles of pipeline and structures in the Salt Lake County section of the aqueduct. All bids received for Schedule 1 were too high and were rejected. However, the contract for Schedule 2 was awarded to United Concrete Pipe Corporation on June 30, 1947. The contractor received notice to proceed on August 18, 1947, setting the completion date for December 15, 1949. By year's end the contractor completed all necessary preparatory construction work.³⁰

During 1948 the contractor completed half of the pipeline and structures called for under the contract. On December 23, 1948, the contractor was forced to halt all construction operations due to extremely severe weather conditions. Subsequent winter weather did not prove much better; and as a result, construction operations were not resumed until April 15, 1949. Despite the delay of construction, the contractor was able to complete all features of the contract by the scheduled completion date of December 15, 1949.³¹

Bids for Schedule 2, construction of Tunnels 1, 2, and 3, were reopened on May 19, 1948. The contract provided for the excavation and concrete lining of an accumulated length of

29. "Project History," 1945, 7-8; "Project History," 1947, 55, 57, 7.

30. "Project History," 1947, 20, 57.

31. "Project History," 1949, 43.

4,097 linear feet of tunnel. United Concrete Pipe Corporation received this contract as well. The contract was awarded June 28, 1948; and the contractor acknowledged notice to proceed on August 13, 1948. By mid-November, however, workers had only holed through on Tunnel 2. Progress was slow. Approximately 50 percent of the contracted work had been completed by the scheduled completion date of May 15, 1949. Due to the contractor's slow progress, Order for Changes 1, issued at the beginning of March extended the completion date to June 14, 1949. However, the contractor did not complete work until December 14, 1949.³²

August 20, 1948, bids opened for construction of two sections of high-head pipeline for the Salt Lake Aqueduct. Reclamation awarded the contract to Provo Foundry and Machine Company on September 13, 1948. Although the contractor acknowledged notice to proceed on October 22, 1948, construction did not begin until March 14, 1949, when the first phases of pipe fabrication were initiated. The primary contractor subcontracted with Ross Construction Company to conduct the field construction work. The subcontractor began work on June 4, 1949. Order for Changes 1 extended the contract completion date from October 17 to November 16, 1949. Work accomplished during the construction period consisted of excavation for the pipeline and structures, fabrication of the plate-steel pipe units, installation of the pipeline, construction of necessary structures, and placement of backfill. However, construction was not completed until two days into the penalty period.³³

The final construction bids for the Salt Lake Aqueduct were opened on August 27, 1948. The contract provided for excavation for bench, pipe trench, and structures; revision of four sections of river channel; manufacture and placement of concrete pipe; construction of major and minor structures; and placement of backfill for the last section of the aqueduct going through

32. "Project History," 1948, 9-10; "Project History," 1949, 52, 54.

33. "Project History," 1948, 9-10; "Project History," 1949, 48.

Provo Canyon. United Concrete Pipe Corporation received the contract on October 22, 1948; and acknowledged notice to proceed on November 22, 1948; setting completion for July 4, 1950. The contractor began preliminary work soon after receipt of notice to proceed, but major construction was not begun until April 26, 1949. Work advanced on schedule in 1949, but was halted in mid-December due to adverse weather conditions. As a result, Order for Changes 1, moved the completion date to August 14, 1950, providing the contractor with an additional 40 days to finish construction. However, 40 additional days did not prove to be sufficient for the contractor to complete work, which was not finished until October 4, 1950. This marked the completion of the Salt Lake Aqueduct, twelve years after construction first began.³⁴

Duchesne Tunnel

The Duchesne Tunnel penetrates the westernmost rim of the Uinta Mountains. The structure taps the Duchesne River, a tributary of the Green River, which flows into the Colorado River, and diverts water into the Deer Creek Reservoir. The six mile long, 600 cfs tunnel is a horseshoe shaped, concrete lined, nine and one-quarter foot diameter, tunnel which conveys one-third of the project water from the Colorado River Basin to the Provo River Drainage Basin. Diversion begins at the North Fork of the Duchesne River, at the Duchesne Diversion Dam, approximately 30 miles east of Heber City, Utah. The dam is a twenty-three foot high, 270 foot diameter (weir crest length), rockfill weir, concrete core-wall structure that diverts water into the Duchesne Tunnel.³⁵

Bids for construction of the first three miles of the Duchesne Tunnel opened August 21, 1940. Reclamation granted the contract to Utah Construction Company, which received notice

34. "Project History," 1948, 9-10; "Project History," 1949, 54, "Project History," 1950, 49, 53; "Project History," 1952, 75.

35. "Project History," 1952, 72; "Project History," 1977, 5; Water and Power, *Project Data*, 1033.

to proceed on November 9, 1940, thus only nineteen linear feet of tunnel had been excavated by the end of the year.³⁶ Excavation during 1941 was extremely erratic due to problems with faulty equipment and labor trouble. Although breakdowns of old equipment caused several delays in construction, the most detrimental problem in 1941 stemmed from a jurisdictional dispute between the Congress of Industrial Organizations and the American Federation of Labor. Together these problems caused many shut downs, and slowed progress in general. Only 42 percent of the contract had been completed by the end of the year.³⁷

From January to mid-October, 1942, the contractor fared better with construction progress than in the previous year; however, operations were still hampered by equipment and labor difficulties. Additionally, the contractor had to overcome seepage problems during construction. By October the contractor excavated a total of 12,227 feet of tunnel. However, on October 16, 1942, the contractor's compressor house and much equipment were destroyed by fire. Before work could be resumed, World War II put a halt to operations when the War Production Board ordered of construction of the Duchesne Tunnel stopped.³⁸

Construction on the tunnel did not resume until the latter part of 1949, when Reclamation awarded a contract calling for reconditioning of the existing portion of the tunnel; completion of the remainder of the six mile long structure; lining the tunnel with concrete; and construction of a rockfill concrete cut-off diversion dam at the north fork of the Duchesne River. The contract was issued to Grafe-Callahan Construction Company and Rhoades Brothers and Shofner on September 15, 1949. Preliminary work began October 1, 1949. In 1947 and 1948, the

36. "Project History," 1940, 34.

37. "Project History," 1941, 38.

38. "Project History," 1942, 26.

Government had attempted to get work on the tunnel underway, but both times all bids were rejected as being excessive.³⁹

The contractor finished reconditioning the completed section of the tunnel in the first part of May, 1950. During that time the contractor reinforced several supports within the tunnel. The rock in small portions of the tunnel initially appeared quite sound, but after a few months of work all the unsupported sections developed loose rock in the sides and arch. Because the Duchesne Tunnel was excavated through unstable rock, in some locations the tunnel developed rock bursts, some of which exploded violently, throwing as much as several cubic yards of material from the tunnel's face and arch. As a result, the contractor had to support all sections of the tunnel. After clearing all rock debris and supporting the entire length of the tunnel, the contractor set about excavating the new portion of tunnel. At the end of 1950 a total of 5,982 linear feet of new tunnel had been excavated.⁴⁰ Work during 1951 progressed with no problems. Construction of the diversion works and dam at the inlet end of the tunnel was completed by mid-October; and the tunnel was holed through by December 10, 1951.⁴¹

Concrete placement began March 1, 1952, and was completed November 7, 1952. The original plan called only for a partial lining of the tunnel; however, as lining work was occurring it was thought advisable to include the whole length of the tunnel to insure that future maintenance work would remain within reasonable levels. In November and December of 1952, the contractor finished final construction details, and fulfilled all aspects of the contract on December 30, 1952, thirty-seven days ahead of schedule.⁴²

Murdock Canal

39. "Project History," 1947, 18; "Project History," 1948, 9-10; "Project History," 1949, 16, 23; "Project History," 1952, 73.

40. "Project History," 1950, 43, 49.

41. "Project History," 1951, 19, 10.

42. "Project History," 1952, 27, 40.

The Murdock Canal diverts water from the Provo River beginning at the Murdock Diversion Dam near the mouth of Provo Canyon. The twenty-three mile canal runs northeast of Orem, Lindon and Pleasant Grove, Utah. There it turns west between American Fork and Alpine, then continues past Lehi to the point of the mountain where it siphons under the interstate highway and the Jordan River, and flows into the Jordan Aqueduct. The canal, originally built by private interests, was purchased by the Government and enlarged from a capacity of 230 cfs to 550 cfs. The enlarged canal permits delivery of 350 cfs of water at the Jordan Narrows for irrigation of bench lands west of the Jordan River in Salt Lake and Utah Counties. The canal consists of alternating concrete lined and unlined sections. Although the original plans for enlargement called for completely lining the canal, fiscal shortages at the time of construction prevented the completion of that aspect of the project.⁴³

The first step in enlarging the Murdock Canal required the purchase of the canal from the Provo Reservoir Company beginning in February of 1940.⁴⁴ The legal process surrounding the purchase took until January 5, 1942, to complete. Initial work on the enlargement was conducted by Government forces starting on January 15, 1942. On April 16, 1942, Government workers finished excavating a tunnel on the canal at Station 18+75, and water from the Provo River was diverted into the canal.⁴⁵

During 1943, the raging war in Europe resulted in the halting of most of Reclamation's projects, including construction of the Murdock Canal. Consequently no work was accomplished in 1943. However, late in the year developing conditions indicated the need to forestall an impending food production shortage. In November of 1943 the War Production

43. "Project History," 1952, 73; "Project History," 1977, 55c; Water and Power, *Project Data*, 1035.

44. "Project History," 1940, 11.

45. "Project History," 1942, 10, 12.

Board gave authorization to proceed with construction of the canal. The approved construction plan called for the immediate removal of several bottlenecks impeding flow in the canal. The idea being, that removal of the offending material would greatly increase the canal's capacity, and therefore increase the amount of water for irrigation of food crops. The program also called for issuance of a contract for construction of three siphons and one flume totaling just under one and one-half miles in length. The War Production Board agreed that these major structures could proceed to completion without interruption.⁴⁶

The bids for construction of the American Fork Creek Siphon and wasteway, Dry Creek Siphon, Highland Draw Flume, and Olmsted Siphon on the Murdock Canal opened March 15, 1944. J. B. and R. E. Walker, Incorporated, received the contract on April 12, 1944. The contractor acknowledged notice to proceed on June seventh, and began work June 13, 1944; the completion date being set for April 3, 1945. By year's end the contractor completed the Highland Draw Flume, nearly completed the American Fork Siphon and wasteway, and had a good start on the Olmsted Siphon. However, this was not enough to allow the contractor to finish work by the completion date.⁴⁷

The delays experienced by the contractor in 1944 carried over into 1945. The problems with construction stemmed from a lack of proper supervision on the work site, a shortage of qualified workmen, and the difficulty in obtaining proper materials for the job. As a result, the contractor submitted a request for an extension, and was allowed an additional 147 days to complete the contract.⁴⁸

46. "Project History," 1944, 47.

47. *Ibid.*, 19; "Project History," 1945, 40, 43.

48. "Project History," 1945, 18.

The work conducted by the contractor in 1945 consisted of alternating construction on the Olmsted Siphon and the Dry Creek Siphon. From January to May the contractor worked on the Olmsted Siphon. Spring brought about weather favorable enough for work to be conducted on the Dry Creek Siphon; therefore all work was concentrated on the Dry Creek Siphon until the first part of August. At that point work was again conducted on both structures simultaneously, until the end of the year.⁴⁹ The contractor completed work on the Olmsted Siphon in March of 1946. Work continued on the Dry Creek Siphon until May, at which time the contractor suspended work for the summer months. Construction resumed in October, and all work under the contract was completed by the end of November in 1946.⁵⁰

The remainder of work on the Murdock Canal was conducted under a number of small contracts. Reclamation opened bids for the first of these contracts with a contract calling for construction of canal lining and structure for a portion of the Murdock Canal enlargement, on June 2, 1948. The contract was awarded to Young and Smith Construction Company on July 30, 1948. The contractor acknowledged notice to proceed on September 7, 1948. Construction was conducted with no delays, and all work under the contract was completed November 30, 1948.⁵¹ Young and Smith Construction Company received another of these contracts on January, 6, 1949. This contract involved lining approximately 7,015 linear feet of the various reaches of the canal. The contractor began work in late January, and completed construction on May 1, 1949.⁵² Bids for a contract calling for lining 1,295 linear feet of the Murdock Canal with four inch reinforced concrete, in addition to lining the tunnel along the canal with concrete, were opened January 12, 1949. Reclamation awarded this contract to Young and Smith Construction

49. *Ibid.*, 40, 43.

50. "Project History," 1946, 19.

51. "Project History," 1947, 9-10.

52. "Project History," 1949, 32, 36.

Company as well. The contractor received notice to proceed on January 20, 1949, and began work immediately. This contract was also completed on May 1, 1949.⁵³

Bids opened September 13, 1949, for construction of the Murdock Canal's South Lateral. The contract went to Sevier Excavating and Construction Company on October 13, 1949. The contract provided for construction of eight and one-half miles of canal, 840 linear feet of which were to be lined with concrete. The contractor received notice to proceed on October 22, 1949, and began work four days later. Work advanced until December sixteenth, when winter weather halted construction for the remainder of 1949. The contractor was able to resume construction on February 27, 1950. The work during that year consisted mainly of earthwork and construction of structures. However, the principal contractor subcontracted with Pritchett Brothers Construction Company and the American Gunitite Company to complete structures and canal lining. The American Gunitite Company substituted gunitite lining for cement lining, as it was deemed as a satisfactory substitute, and the installation of the gunitite was much more simple and less time consuming. All work under the contract was completed May 27, 1950, twelve days after the date specified in the contract.⁵⁴

The last contract calling for lining of the Murdock Canal was granted to Wootton Construction Company on October 13, 1949. The contract provided for lining the final 2,236 linear feet of the canal, revision of an existing flume along the canal, and installation of protective fencing along the section of canal to be lined. The contractor acknowledged notice to proceed on October 22, 1949, and began construction within three days. Good progress was made during the year. Work ceased late in the year, and resumed February 27, 1950. The work during 1950 mainly consisted of excavating portions of the canal, providing trimming earth

53. *Ibid.*, 36.

54. "Project History," 1950, 27, 32.

foundations for the concrete lining, compacting the embankments, placement of reinforcement bars and concrete for canal lining, and installing the protective fencing. The contractor completed work on April 30, 1950.⁵⁵

The final contract for the Murdock Canal expansion program was issued on March 7, 1950. The contract called for construction of Sublaterals 1, 2, 2A, 3, and 4, and the wasteway for the South Lateral. Reclamation awarded this contract to Emmet D. Ford, Contractor, Incorporated. The contractor received notice to proceed on March 7, 1950, and began work on March 9, 1950. Construction started with excavation for the pipeline and various structures. All construction work was completed prior to the close of the year. In that time the contractor excavated 5,370 linear feet of pipe trench and placed an equal amount of precast concrete pipe, and asbestos cement pipe. Additionally the contractor completed six diversion boxes, as well as the wasteway structure, a roadway crossing, a parshall flume, two turnouts, a stilling pool, and 1,005 feet of concrete lined channel.⁵⁶

Weber-Provo Diversion Dam and Canal

The Weber-Provo Diversion Dam and Canal, located on the Weber River one mile east of Oakley, Utah, and above Deer Creek Reservoir, were originally built as part of the Weber River Project, and divert Weber River surplus water into the Deer Creek Reservoir. The diversion dam is a concrete ogee overflow weir with embankment wings, and a hydraulic height of nineteen feet. The canal, with an original capacity of 210 cfs, was enlarged as part of the Provo River Project to supply Deer Creek Reservoir with Weber River water. The enlarged canal, consisting

55. "Project History," 1949, 38; "Project History," 1950, 35.

56. "Project History," 1950, 33, 35.

of unlined, earth-lined, and concrete-lined sections is nine miles long, and has a capacity of 1,000 cfs.⁵⁷

Work on the enlargement of the Weber-Provo Diversion Canal began with the initiation of construction surveys in the middle of 1941. In August of 1941, the CCC and other Government forces began dismantling obsolete structures in preparation for enlarging the canal. A contract providing for reconstruction of the lower mile of the canal was granted to Norman I. Fadel, on December 19, 1941. The contractor received notice to proceed March 17, 1942, however, preliminary work was actually initiated in January. During the year the contractor excavated the canal prism, completed the measuring control and chute, a concrete drop, a siphon cross drain, excavation of the canal, and related miscellaneous work. However, construction of some of the required structures was delayed due to the late arrival of materials.⁵⁸

During 1943, the contractor had labor difficulties because he was unable to secure enough workmen to continue construction efforts. As a result, the contractor performed no construction work during 1943, and Reclamation terminated his contract. All construction not completed by Fadel, was taken over by Government forces in addition to their efforts to enlarge the canal. These forces completed all required structures between Stations 325+ and 14+, as well as the canal section between Stations 300+00 and 14+00.⁵⁹ During 1944, Government forces constructed two major structures, nine minor structures, nearly all the clay lining for the canal, and approximately 1,600 linear feet of concrete lining.⁶⁰ The majority of work performed in 1945 consisted of making minor repairs and installations on the canal, installing fencing, and painting bridges as needed. Construction was terminated at the end of the year and not resumed

57. Water and Power, Project Data, 1033; "Project History," 1977, 5; "Project History," 1952, 73.

58. "Project History," 1941, 40, 42; "Project History," 1942, 10, 12-3.

59. "Project History," 1943, 21, 41.

60. "Project History," 1944, 19.

until July of 1946.⁶¹ The last major item of the enlargement work on the Weber-Provo Diversion Canal was conducted by Government forces during July, August, September, and October of 1946. This work consisted of lining 4,400 linear feet of the canal.⁶² Little work on the project was accomplished during 1947. Workers placed some clay lining during the year, and concluded construction at the end of the year with work being 99 percent complete. Work resumed during the summer of 1948, and the enlargement program was considered complete as of October of 1948.⁶³

Provo River Channel

The Provo River Channel was revised in order to provide additional carrying capacity in the Provo River and to prevent flooding along farm lands adjacent to the river banks. The channel runs from Weber-Provo Diversion Dam to the Deer Creek Reservoir. Revision work included conducting bank protective work along the sixteen mile channel.⁶⁴

Government forces initiated the betterment of the Provo River Channel in November of 1944, by diverting water from the channel. The Government continued work intermittently throughout 1945 and 1946. During that time workers cleared four and one-half miles of channel, constructed two protective dikes, excavated secondary channels, completed revision of 10,444 linear feet of channel, constructed three timber bridges, constructed four timber sills, and completed other minor items incidental to the revision work. Construction work was conducted throughout 1947, except when adverse weather conditions prevented doing so. During that year, workers improved approximately one and one-half miles of channel, including the construction

61. "Project History," 1945, 18.

62. "Project History," 1946, 18.

63. "Project History," 1947, 18; "Project History," 1948, 14.

64. "Project History," 1952, 73; "Project History," 1947, 18-9.

of seven channel sills and providing protection to the timber bridges constructed the prior year.⁶⁵ Work was carried on during 1948 until the latter part of November, when a personal services limitation imposed by Congress stopped construction operations. Some operation and maintenance work was conducted during the spring of 1949 to stave off excessive flood damage, but major construction work did not resume until August 11, 1949.⁶⁶

Government work on the channel was continued periodically through the end of November of 1951. At that point it was planned that all remaining work be accomplished under contract.⁶⁷ However, in the spring of 1952, Government workers had to perform emergency repairs on the Provo River Channel; the result of heavy spring runoffs eroding several sections along the channel. The emergency work consisted of removing log jams, reinforcing banks at weak spots, and placing rock jetties at specific locations in order to deflect the current away from where the bank erosion had begun.⁶⁸

September 30, 1952, bids opened for completion of revision work on the remaining ten miles of the channel. Reclamation granted the contract to Gibbons and Reed Construction Company, the first part of October. The contractor acknowledged notice to proceed on October 20, 1952, and began construction within a week. Work on the channel progressed with no problems, and the contractor completed all contracted work on March 20, 1953, a full 69 days ahead of schedule.⁶⁹

Jordan Narrows Siphon and Pumping Plant

The Jordan Narrows Siphon, and the 65 cfs capacity, Jordan Narrows Pumping Plant work in conjunction with the Murdock Canal to supply project lands with water. The siphon and

65. "Project History," 1947, 18-9.

66. "Project History," 1949, 16.

67. "Project History," 1951, 11.

68. "Project History," 1952, 23, 27.

69. *Ibid.*, 27; "Project History," 1953, 6.

pumping plant were constructed by the same contractor under two separate contracts. The contract for construction of the pipeline, tunnels, and structures for the Jordan Narrows Siphons was awarded to Carl B. Warren on July 24, 1946. The contractor received notice to proceed on September 24, 1946. Even though the contractor did not begin work until the beginning of 1947, all construction work was completed by the specified date of September 9, 1947.⁷⁰

Carl B. Warren received the contract for construction of the Jordan Narrows Pumping Plant and related structures on August 14, 1947. He acknowledged notice to proceed, September 23, 1947. The contract provided for construction of the pumping plant, discharge lines, placement of the 69 inch diameter steel siphon, placement of a 48 inch diameter steel penstock, and construction of a wasteway and other pertinent concrete structures.⁷¹ The contractor made good progress during 1948; however, he did experience some delays due to the unavoidable delay in delivery of many Government-furnished materials. As a result, work extended beyond the specified completion date. However, once the proper materials were delivered, the remainder of construction went quickly; and the contractor completed the contract on April 15, 1949.⁷²

Murdock Diversion Dam

The Murdock Diversion Dam is a twenty-two foot high concrete ogee weir structure located on the Provo River near the mouth of Provo Canyon. The dam diverts water from the Provo River into the Murdock Canal which delivers water to project lands west of the Jordan River.⁷³ Bids for construction of the dam opened August 23, 1949, after much of the canal was already complete. On September 19, 1949, Reclamation awarded the contract to Vinnell

70. "Project History," 1946, 7-8; "Project History," 1947, 8.

71. "Project History," 1947, 7-8, 45.

72. "Project History," 1948, 30; "Project History," 1949, 31.

73. Water and Power, *Project Data*, 1035; "Project History," 1952, 73.

Company, Incorporated, who received notice to proceed on October 24, 1949. Much progress was made during the remainder of the year. The contractor completed most of the required structure excavation, conducted work on the downstream cutoff wall, and placed reinforcement steel for the sluiceway.⁷⁴ Due to winter weather, the contractor halted work at the end of 1949, and did not resume construction until the first part of March in 1950. The work accomplished during the year mainly consisted of completion of excavation, placing embankment, placing concrete in lining and structures, and installing miscellaneous metal work and a variety of other functional and electrical parts. The contractor completed construction on September 10, 1950, which was 51 days past the scheduled completion date. However, the contractor was granted an extension because of an unavoidable stoppage of work during June as a result of problems caused by high water in the Provo River.⁷⁵

Terminal Reservoir

The Terminal Reservoir is the storage facility into which the Salt Lake Aqueduct empties, and is used to regulate the water delivered to Salt Lake City, Utah. The reservoir is a concrete structure with a capacity of 122.8 acre-feet. It was built with two compartments to permit alternate draining and cleaning to provide maximum sanitation. The two compartments can be emptied and filled completely independently of each other.⁷⁶ Construction of the Terminal Reservoir began in 1950 when Reclamation granted a construction contract to Peter Kiewit Sons' Company on September 20, 1950. The contractor initiated work on October 4, 1950, and continued construction on an intermittent basis through the end of the year. The

74. "Project History," 1949, 41.

75. "Project History," 1950, 37, 43.

76. Water and Power, *Project Data*, 1035; "Project History," 1952, 75.

majority of construction work was conducted in 1951. The contractor faced no problems or delays with construction, and completed the contract on December 31, 1951.⁷⁷

Deer Creek Powerplant

Deer Creek Powerplant is located at the Deer Creek Dam, and was built on a substructure provided during construction of the dam. The powerplant has two, 2,474 Kilowatt generators, and provides power for the project and surrounding area.⁷⁸ Although authorization for construction of the Deer Creek Powerplant occurred in 1951, construction efforts were not initiated until the end of 1955.⁷⁹

Jacobsen Construction Company received the contract to built the Deer Creek Powerplant on December 12, 1955. Work on the powerplant began January 31, 1956. Work progressed at a satisfactory rate during the year, the contract or encountering no delays in construction. In October of 1956, an Order for Changes added the moving of high pressure gate controls from the access tunnel to the control room of the powerplant, added construction of a concrete apron in front of the generator room door, and added to the existing construction contract the placing of overhead preassembled cable and poles from the powerplant to the switchyard.⁸⁰ Progress was satisfactory in 1957, except when late delivery of Government materials caused delays. Government delivery of materials, including the turbines for Units 1 and 2 at the powerplant occurred intermittently during the year, and were installed accordingly. As a result, the contractor was granted an extension from the original completion date of September 25, 1957. Operational testing began at the plant on December 5, 1957. Final work

77. "Project History," 1950, 55; "Project History," 1951, 11.

78. "Project History," 1977, 6.

79. Water and Power, *Project Data*, 1036.

80. "Project History," 1955, 4; "Project History," 1956, 1a, 4.

occurred after the first of the year, and the contract was completed on March 31, 1958, bringing construction of the Provo River Project to an end.⁸¹

Post-Construction History

At completion of construction of the Provo River Project, the irrigation districts instituted a maintenance program to keep the project facilities in good working order. These maintenance programs include activities such as: painting structures as needed, cleaning of channels, reinforcement of banks prone to erosion problems, replacement of riprap as needed, repair of damaged concrete, lining canal and lateral sections prone to seepage, cleaning of siphons, removal of trees detrimental to project facilities, maintenance of all pumping facilities, and institution of chemical weed control programs.⁸² However, over the years in addition to regular maintenance work, the irrigation districts have had to perform modifications and repairs on some of the project features.

The first of these revisions occurred from 1959 to 1965. The problem stemmed from the fact that the project's entire water supply was diverted into the Provo River Channel for storage in the Deer Creek Reservoir, and at times the river's natural flow combined with the influx of imported water exceeded the channel's carrying capacity, causing flooding of property along the channel. The problem grew as more and more recreational developments appeared along the river. These conditions resulted in Reclamation granting a supplemental repayment contract to the Provo River Water Users' Association and the Metropolitan Water District at the end of 1959 in return for needed work, revising the Provo River Channel.⁸³ Construction of the channel

81. "Project History," 1957, 3-4, 9-10; "Project History," 1958, 2.

82. "Project History," 1956, 5a; "Project History," 1957, 11; "Project History," 1958, 2, 9; "Project History," 1959, 8; "Project History," 1960, 7, 88; "Project History," 1968, 25-54; "Project History," 1969, Appendix, 5; "Project History," 1971, 14; "Project History," 1947, 20; "Project History," 1985, 26; "Project History," 1987-90, 79.

83. "Project History," 1960, 6; "Project History," 1959, 11.

revisions and improvements occurred under seven small contracts issued between 1960 and 1963; with work extending into 1965. Work included construction of dikes, bank improvements for erosion control, and all earthwork and structures necessary for the stabilization of the channel to insure that it could operate at its full capacity. These contracts were completed by: Thorn Construction Company, Incorporated; Ashton Lumber and Hardware Company; Joe Lloyd Construction; Ford Construction Company; E. V. Chettle; Evan W. Ashby; and United Engineers, Incorporated.⁸⁴

The 1960s saw work on other project features as well. This work included modifications to the Duchesne Tunnel inlet; as well as the addition of rock drops, rock outcroppings designed to divert the flow of water away from weak banks, at Deer Creek Dam to provide erosion control. Additionally, a permanent tailwater control structure was built at the dam in order to insure the maintenance of the dam's maximum flow.⁸⁵ Finally, due to seepage problems, the Murdock Canal was modified to improve the structure's concrete canal lining, during the 1960s.⁸⁶

There was no major work done to the project during the 1970s; however, the 1980s were fraught with damaged features due to natural and man made disasters. In 1980, the Murdock Canal was damaged when a landslide just east of Pleasant Grove, Utah, filled the canal. The slide measured 50 feet diameter, and extended 150 feet up the hillside. The slide stopped water flow through the canal, and heavily damaged the canal's concrete lining. While the Provo River Water Users' Association was beginning repairs to the canal, a second slide south of the first

84. "Project History," 1960, 1, 6; "Project History," 1961, 1, 3, 8, 10-2; "Project History," 1962, 1, 8-9; "Project History," 1963, 1-2; "Project History," 1964, 1; "Project History," 1965, 3.

85. "Project History," 1961, 2-3; "Project History," 1962, 12.

86. "Project History," 1963, 11; "Project History," 1964, 1; "Project History," 1965, iii.

one, also caused extensive damage.⁸⁷ During the summer of 1980 the Provo River Channel was closed down and cleaned because a tanker truck, carrying road sealant, crashed into the channel, spilling its contents into the river.⁸⁸ The Provo River Water Users' Association spent three months of 1986 repairing damage from flooding caused by heavy spring runoff. Flood waters tore down trees damaging the Provo River Channel, washed new channels, and tore out a number of bridges and roads. Workers repaired the damage, and added five dikes along the channel in an effort to prevent future flood damage.⁸⁹ The Provo Water Users' Association also made repairs to the Murdock Canal in 1988 when the canal bank breached near Lindon, Utah. The canal was shut off at the Murdock Diversion dam, and repairs were made. However, the break caused one million dollars worth of damage.⁹⁰

Improvements by the Metropolitan Water Users Association during the 1980s relocated portions of the Salt Lake Aqueduct. Beginning in 1986, a portion of the Salt Lake Aqueduct had to be relocated in order to accommodate the State of Utah's plan to widen US Highway 189. In 1987, costly repairs to the aqueduct were required when construction crews working on the Highway 189 expansion severely damaged the aqueduct during blasting operations. The repair time was lengthy due to the fact that the Metropolitan Water District wanted repair efforts done without having to close down the aqueduct, and thus deprive Salt Lake City, Utah, of most of its domestic water supply.⁹¹

The biggest issue involving a Provo River Project feature thus far in the 1990s was controversy over the Murdock Canal beginning in 1994. Since the canal's completion a number of people, especially children, have drowned as a result of falling into the canal. Citizens living

87. "Project History," 1980, 20.

88. *Ibid.*, 27.

89. "Project History," 1986, 63.

90. "Project History," 1987-90, 9.

91. *Ibid.*, 43.

near the canal petitioned Reclamation to fence off the area surrounding the entire length of the canal. The lack of feasibility of such action prevented the requested work from being done. However, the Provo Office instituted an education program, whereby Reclamation employees agreed to visit area schools every year to warn the neighborhood children of the dangers of playing in or around the canal. Thus far, local citizens have accepted the program as a reasonable alternative to fencing off the canal.⁹²

Settlement of Project Lands

Project lands were settled by private owners prior to construction of the project works. The project provided supplemental water to the irrigation area, Consequently, no lands were withdrawn for future settlement.⁹³

Project Benefits and Uses of Project Water

Much of the Salt Lake Valley has greatly benefitted from construction of the Provo River Project. Built for the dual purpose of irrigation and as a supplemental domestic water supply, it stabilized the irrigation of highly developed farm lands in four counties, and provided Salt Lake City, Provo, and five smaller communities in Utah with a large portion of their domestic water.⁹⁴ The project provides stable supplemental irrigation water to 48,156 acres of land. It has provided its water users with plenty of water to stave off drought conditions which adversely affected many other less well supplied farm communities.⁹⁵ The growing of barley, wheat, alfalfa, potatoes, irrigated pasture, and oats provides area farmers with almost sixteen million

92. Tex Tenicks of Provo Area Office, interview by author, 16 December 1997, telephone interview.

93. "Project History," 1937, 17-25; "Project History," 1977, 1-5.

94. "Project History," 1950, 89.

95. "Project History," 1987-90, 90.

dollars worth of crops annually. This agricultural industry contributes greatly to Utah's economic well being.⁹⁶

Additionally, the project has benefits important recreation. Deer Creek Reservoir has become a very popular tourist attraction and recreational facility, with close to 400,000 recreation use visits each year. The reservoir's primary uses are boating, and fishing for perch, and native, brown, and rainbow trout. However, the lake also provides visitors with opportunities for camping, swimming, water skiing, and windsurfing. In fact, in the late 1970s, windsurfing became so popular on the lake because of its excellent wind conditions that the American Windsurfing Championships were held there in 1979.⁹⁷

The Deer Creek Powerplant also benefits the region, as it generates upwards of 19,000,000 kilowatt-hours of power, annually.⁹⁸ And even though the Provo River Project has no official flood prevention allocations, the project is credited with preventing more than twenty million dollars in flood damage since its construction.⁹⁹

Conclusion

Besides providing the Salt Lake and Utah Valleys with a reliable source of irrigation water, as many predicted, the population of Utah, especially in and around Salt Lake City, has exploded over the last several years. The Provo River Project provides most of these new residents with their domestic water supply. Utah's industrial economy is also heavily governed by the available water supply. This project has been important to Utah's industry; and water will

96. *Ibid.*, 13; "Project History," 1985, 33.

97. "Project History," 1987-90, 13; ""Project History," 1978, 6; "Project History," 1979, 40.

98. "Project History," 1987-90, 13, 79.

99. "Project History," 1985, 29.

continue to be a key factor in shaping Utah's future. The Provo River Project has not only been extremely important to the those within the project lands, but to all of Utah.¹⁰⁰

100. "Project History," 1976, 22.

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