Appendix F

Supplemental Detailed Descriptions of the Similar Projects

Boise Project

Summary

In the Boise Project, the Black Canyon Irrigation District receives reserved PN power rates, as shown in table 2, and appendix B. A summary of basic project comparison elements is shown in table 3. The project was authorized for construction in 1905. The project area, comprising roughly 400,000 acres, was once desert land except for small sections of river bottom. Principally through facilities provided by Reclamation, the Boise Project furnishes a full irrigation water supply to roughly 224,000 acres and a supplemental supply to about 173,000 acres under special and Warren Act contracts. The irrigable lands are in southwestern Idaho and eastern Oregon).

A major portion of the Nation's requirement for sweet corn seed is grown on the Boise Project. The project also produces large quantities of grain, alfalfa hay, pasture, sugar beets, corn, potatoes, onions, apples, and alfalfa seed. The hay and forage crops support a large number of dairy and beef cattle (Reclamation, January 2013, accessed May 2015).

Recent irrigated acreage estimates range from 325,514 to 511,123 acres. The average annual precipitation is 11.7 inches with a mean temperature of 52 degrees Fahrenheit, a growing season of 177 days and an elevation of about 2,500 feet.

Table 3—Boise Project Summary

Boise Project Summary	
Irrigated acres	325,514 – 511,123 acres*
Average Annual	11.7 in
Mean Temperature	52° F
Growing season	177 days
Elevation of irrigable areas	2,500 ft
Project Authorization	1905
Storage Dams	6
Diversion Dams	2
Canals	721 mi
Laterals	1,323 mi
Pumping Plants	7
Drains	649 mi
Power plants	3
Transmission Lines	31.8 mi
Substations	7

Source: Reclamation website and 1981 Project Data book;
*511,123 figure from current GIS information; 325,514 taken from 1992 data.

General Description

The Boise Project furnishes a full irrigation water supply to about 224,000 acres and a supplemental supply to some 173,000 acres under special and Warren Act contracts. The irrigable lands are in southwestern Idaho and eastern Oregon.

Principal facilities include five storage dams (excluding Lucky Peak Dam constructed by the Corps and Hubbard Dam a re-regulatory facility) which form reservoirs with a total capacity of 1,793,600 af (active 1,663,200 af), two diversion dams, three powerplants with a combined capacity of 50,200 kW, seven pumping plants, canals, laterals, and drains.

To facilitate organization of the administrative and operating procedures, the irrigable project lands are divided into the Arrowrock and Payette Divisions. Some of the features serve only one division; other features serve both divisions as well as other nearby projects.

Project Plan – Operation

The Arrowrock Division provides a full irrigation water supply to some 164,000 irrigable acres, and an additional 112,000 acres are furnished supplemental water. Water for the division is stored in Anderson Ranch Reservoir on the South Fork of the Boise River, in Arrowrock Reservoir on the Boise River, and in Lake Lowell, an off stream reservoir in a natural depression impounded by three low dams. Anderson Ranch Dam is 42 miles upstream of Arrowrock Dam. Boise River Diversion Dam, 16 miles downstream from Arrowrock and 7 miles southeast of the city of Boise, diverts water into the New York Canal, which delivers the water to Arrowrock Division lands.

During the non-irrigation season, the New York Canal carries a portion of the water released from Anderson Ranch and Arrowrock Dams to fill Lake Lowell for use in the division during the irrigation season. There are 5 irrigation districts within the Arrowrock Division receiving a full water supply from the project, and 11 districts receiving a supplemental water supply from the division. Power is produced at Anderson Ranch Dam and at the Boise River Diversion Dam.

Lucky Peak Dam, built by the Corps of Engineers, is about 1 mile upstream of Boise River Diversion Dam and backs water up to Arrowrock Dam. Lucky Peak Reservoir has a total storage capacity of 293,100 af (active 264,400 af) and was built for flood control and irrigation purposes. By agreement among the Corps of Engineers, the Boise Project Board of Control, and Reclamation, the Anderson Ranch, Arrowrock, and Lucky Peak storage reservoirs on the Boise River are operated jointly for the benefit of irrigation, power, and flood control. These three reservoirs have a total capacity of 1,058,500 af (active 959,800 af).

Lands in the Payette Division receive water from the Payette River and surplus drainage from the Arrowrock Division. There are 60,000 acres receiving a full water supply and 61,000 acres receiving a supplemental supply. Storage features are Deadwood Dam on the Deadwood River, a tributary of the South Fork of the Payette River, and Cascade Dam on the North Fork of the Payette River. Water is diverted into the Black Canyon Main Canal (south side) and then into the distribution system. The main canal separates into two supply lines which serve 27,000 acres by gravity flow. About 20 miles below Black Canyon Diversion Dam, a pumping plant lifts water from the main canal into a lateral system serving 26,000 acres. The 7,000-acre Notus Unit of the Payette Division obtains water from two Arrowrock Division drains south of the Boise River near Caldwell. These three acreages are in the Black Canyon Irrigation District.

The 25,000-acre Emmett Irrigation District receives a supplemental water supply partially from the Black Canyon Main Canal but primarily from the North Side Canyon Canal. Both canals divert water from the Payette River at Black Canyon Diversion Dam. Power is produced at Black Canyon Diversion Dam.

Facility Descriptions

Anderson Ranch Dam and Powerplant

Anderson Ranch Dam and Powerplant is a multiple purpose structure that provides benefits of irrigation, power, and flood and silt control. Situated on the South Fork of the Boise River 28 miles northeast of Mountain Home, the dam is 456 feet high, was the world`s highest earthfill dam at the time of its completion in 1950, and has a total storage capacity of 474,900 af (active 413,100 af). The power plant had a rated capacity of 27,000 kW with two units installed. These units were uprated in 1986, increasing the capacity to 20,000 kW each for a total of 40,000 kW.

Arrowrock Dam

Arrowrock Dam, on the Boise River, 42 miles downstream of Anderson Ranch Dam and 22 miles upstream from Boise, is a concrete thick-arch structure 350 feet high. When constructed in 1915, the dam was recorded as being the tallest concrete dam in the world. The structure was repaired and raised 5 feet during 1935-1937, increasing its storage by 9,000 af; total storage capacity 286,600 af (active 286,600 af. After 85 years of service, the Ensign valves had reached the end of their useful life. The lower set of ten Ensign valves were removed and replaced with clamshell gates between 2001 and 2004. A contract to permanently plug all five sluice gate outlet conduits was completed in January 2011. A sedimentation survey completed in 1997 estimated the total capacity of Arrowrock Reservoir at 272,200 af (active 271,700 af).

The Boise Project Board of Control completed construction of a 15 MW powerplant at Arrowrock Dam in March 2010. The powerplant penstocks tie into two of the existing 66" outlet conduits. The project also updated the transmission line to the dam.

Boise River Diversion Dam and Powerplant

The Boise River Diversion Dam, on the Boise River about 7 miles southeast of Boise, Idaho, is a rubble-concrete, weir-type structure with a hydraulic height of 39 feet. The dam diverts water into the New York Canal which serves distribution laterals and feeds Lake Lowell. A small canal known as the Penitentiary Canal, also originating at the diversion dam, distributes water on the north side of the Boise River to a small area of land east of Boise. The powerplant consists of three 500-kilowatt units that began operation in 1912. Due to the deteriorated condition of the equipment and high operating costs resulting from full-attended operation, the powerplant was placed in ready reserve status in 1982. The plant was reconstructed from 2002 to 2004 and returned to service in June 2004. The nameplate rating for the plant was increased from the original 1500 kW to 3300 kW. The existing double turbine configuration was retained, but refurbished with new materials and technology. Modern generators were installed inside the original generator housings.

Lake Lowell

Lake Lowell, originally known as Deer Flat Reservoir, is an off stream reservoir formed by three earthfill dams enclosing a natural depression southwest of Nampa, Idaho. These three dams are the Upper, Middle (Forest Dam), and Lower Embankments. A fourth embankment, called the East (Roadway Dike) is to protect farmsteads on the eastern end of the reservoir when the reservoir is full. The reservoir is filled primarily during the non-irrigation season by diversions at the Boise River Diversion Dam and conveyance through the New York Canal which discharges into the eastern (upper) end of Lake Lowell.

The Upper Embankment on the north side of the reservoir is 74 feet high and has two outlets; near the right abutment the Deer Flat Nampa Canal (100 cfs) and near the left abutment the Deer Flat Caldwell Canal (70 cfs).

The Lower Embankment at the west end of the reservoir is 44 feet high. The Deer Flat Low Line Canal (1,200 cfs) outlets on the left abutment and the Deer Flat North Canal (70 cfs) outlets on the right abutment.

The Middle Embankment, which has no outlets, is 16 feet high and helps to close the reservoir near the Lower Embankment. It has been referred to as an emergency spillway; however, no slope protection is provided for this purpose.

Because of safety concerns at the Upper and Lower Embankments, the maximum water level was reduced by 5 feet in 1989 while plans were prepared to address remedial actions. Major modifications were made to the Upper and Lower Embankments from 1991 to 1993. Further, in 1996 an upstream seepage blanket was constructed at the right abutment of the Upper Embankment to address seepage in this area. These activities were accomplished under Reclamation's Safety of Dams Program. A Safety of Dams modification was also performed in 2008-2009. The modifications involved the complete replacement of the Caldwell Canal outlet works structure including the intake tower and access bridge, gate and operator, the entire length of the conduit, and the placement of a circumferential filter around the downstream section of new conduit. In addition, the downstream section of the Nampa Canal outlet works conduit was replaced with a new section of conduit incorporating a downstream circumferential filter.

The original total storage capacity of Lake Lowell was 190,000 af (active 169,000 af). A sedimentation survey conducted in 1994, estimated the reservoir's total storage capacity at 173,000 af (active 159,400 af).

Hubbard Dam

Hubbard Dam, located about 12 miles southwest of Boise, Idaho, was originally constructed in 1902 by private interests. Reclamation purchased the facility in 1911 as part of the Boise Project. This is an earthfill structure 23 feet high creating a reservoir area of 450 acres with an active capacity of about 4,000 af. Due to Safety of Dams concerns, Hubbard Dam has a reservoir operating restriction to elevation 2765 feet (570 af) to reduce static loading on dam. Water is delivered to the reservoir by the New York Canal. The dam and reservoir are operated and maintained by the Boise Project Board of Control as a reregulating facility for irrigation water deliveries in the adjacent area. It also provides emergency short-term storage for dewatering the New York Canal should a failure in the canal occur downstream.

Arrowrock Diversion Canal System

The New York Canal is about 40 miles long and has a diversion capacity of 2,800 cfs. It consists of the enlarged old New York Canal, a section of new canal, and a part of the channel of Indian Creek. Diversions are made from the New York Canal into various canals such as the Mora Canal and the Deer Flat High Line Canal and into numerous distribution systems. Water delivered by the New York Canal to Lake Lowell is diverted into the four canals outletting the reservoir.

Hungry Horse Dam and Powerplant

Hungry Horse Dam and Powerplant is located near the town of Kalispell Montana in northwestern Montana. The dam contributes to hydroelectric power generation not only at Hungry Horse Dam, but by storing and releasing water for use by downriver hydroelectric dams on the Flathead River, Clark Fork, Pend Oreille River, and Columbia River. About a billion kilowatt–hours are generated annually at Hungry Horse Dam.

Power generating facilities at Hungry Horse Dam are housed in a building constructed across the river channel at the downstream toe of the dam. The original design included four 71,250 kW generators—a total of 285 MW installed capacity. The generator capacity was uprated in the 1990s to 107,000 kW each for a total capacity of 428 MW.

Energy production at Hungry Horse dam contributes to overall energy production of the Federal Columbia River Power System and thus contributes to the general Pacific Northwest power rate.

Deadwood Dam

Deadwood Dam is located in west-central Idaho on the Deadwood River about 25 miles above its confluence with the South Fork of the Payette River and about 90 miles above Black Canyon Diversion Dam. The dam site is located in a narrow canyon where the Deadwood River has cut into granite bedrock, approximately 53 miles northeast of Boise, Idaho. The dam lies on the western slope of the Sawtooth Mountains with elevations in the basin varying from 5311 feet by the dam to about 8,696 feet at Price Peak. Deadwood Reservoir is three and one half miles long and covers 3,180 acres. Deadwood Dam is a concrete-arch structure with a structural height of 165 feet and a total capacity of 154,000 af, providing a regulated flow for the powerplant at Black Canyon Diversion Dam and for irrigation in the Payette Division and Emmett Irrigation District.

Cascade Dam

Cascade Dam, near Cascade, Idaho, on the North Fork on the Payette River, is a zoned earthfill structure 785 feet across the crest. The initial total storage capacity was 703,200 af (active 653,200 af). The spillway is located on the right abutment of the dam. The invert is 45 feet wide at the crest under the radial gates and about 330 feet long excluding the open cut channel to the reservoir. The design capacity is 12,500 cfs with the water surface at elevation 4828.0 feet. Two 21-foot wide by 20-foot high radial gates are installed on the crest of the spillway to provide means for regulating the discharge of water over the spillway and to provide protection for the dam in the event of a sudden rise in reservoir water level. A sedimentation survey completed in 1995 at Lake Cascade estimated the total capacity at 693,100 af (active 646,500 af).

Black Canyon Diversion Dam and Powerplant

Black Canyon Diversion Dam, on the Payette River near Emmett, Idaho, is a concrete gravity type dam with an ogee overflow spillway. The dam has a structural height of 183 feet and serves to divert water to the Payette Division through Black Canyon Canal. The original capacity was 44,700 af but heavy siltation has reduced the capacity. At full pool there is now a volume of 31,200 af. Water is diverted at Black Canyon Diversion Dam by gravity into the Black Canyon Main Canal on the south side of the Payette River and by two direct connected turbine-driven pumps, located in the powerhouse, to serve the Emmett Irrigation District Canal on the north side of the river. The two unit Black Canyon powerplant had an initial total capacity of 8,000 kW. The unit's electrical components were upgraded to 5,100 kW each in 1995 to provide the capability of generating 10,200 kW with further upgrade of the turbines. Present generating capacity is however limited to about 10,000 kW. The plant supplies power to the Southern Idaho Federal Power System for Reclamation project uses and for non-project purposes.

In 1998, a six-inch raise in Black Canyon Reservoir water surface was implemented by modifying the spillway drum gate and the radial gate at the Black Canyon Main Canal headworks. This was done to improve regulation of irrigation diversions from Black Canyon Reservoir to the Black Canyon Main Canal and to conserve the amount of stored water released from upstream reservoirs to meet fluctuating irrigation demands.

Pumping Plants

Shown in table 2, the pumping plants are: (1) Black Canyon at the Black Canyon Diversion Dam; (2) `C` Line Canal at station 1064 on the Black Canyon Main Canal; and (3) Willow Creek at station 1111 on `C` Line Canal East, about 4 miles northeast of Middleton, Idaho. There are also four small relift pumping plants.

The Black Canyon Pumping Plant contains two pumps directly connected to turbines; the `C` Line Canal plant has five pumps; and Willow Creek has two motor-driven pumps lifting water from the `C` Line Canal East.

Table 4—Boise Project Pumping Plant Data

Designation	Number of Units	Total Capacity (cfs)	Total Dynamic Head (ft)	Total Horsepower
C Line Canal	5	600	92	7,250
Black Canyon	2	270	27	1,250
Willow Creek	2	27	39	160
C Line Relift Plant No. 7, 8, 10 & 11		8.5	16-24	
Totals	9	905.5	174-182	8,660

Source: Reclamation website

Data matched that in the Water and Power Resources Service Project Data book, 1981.

Non Federal Powerplants

Idaho Power Company constructed a two unit 12,800 kilowatt powerplant at Cascade Dam in 1983 under a Federal Energy Regulatory Commission license. The hydraulic capacity of the powerplant is approximately 2,300 cfs at elevation 4828.0.

In 1988, four of the five irrigation districts of the Boise Project Board of Control, under a Federal Energy Regulatory Commission license, completed construction of a 3 unit powerplant at Lucky Peak Dam which includes one 11,250 kilowatt unit and two 45,000 kilowatt units for a total capacity of 101,250 kW. Generation is under contract with the Seattle Light Company.

The Boise Project Board of Control completed construction of a two unit 15,000 kilowatt powerplant at Arrowrock Dam in 2010. The powerplant penstocks tie into two of the existing 66-inch outlet conduits. The project also updated the transmission line to the dam.

Payette Division Canal System

The Black Canyon Main Canal is 29 miles long and extends from the Black Canyon Diversion Dam south and west along the Payette River. The canal has a diversion capacity of 1,300 cfs.

The `C` Line Canal East, with diversion capacity of 469 cfs, begins at `C` Line Canal Pumping Plant on the Black Canyon Main Canal and is 21 miles long. The `C` Line Canal West branches from the `C` Line Canal East, extends 24 miles, and has a diversion capacity of 60 cfs.

The `A` Line and `D` Line Canals begin near the terminus of the Black Canyon Main Canal. The `A` Line Canal is 33 miles long and has a diversion capacity of 226 cfs; the `D` Line Canal, 39 miles long, has a diversion capacity of 254 cfs.

Operating Agencies

The operating organization for the Arrowrock Division of the project is the Boise Project Board of Control, which was formed in 1926 by contracts between Reclamation and the five irrigation districts representing the water users that make up the project. These irrigation districts are Big Bend, Boise-Kuna, Nampa & Meridian, New York, and Wilder. Each of the irrigation districts elect representatives in proportion to their acreage served by the district, and the Board of Control selects a manager to administer day-to-day operation and maintenance.

Reclamation operated the project until April 1, 1926, when operation was turned over to the newly organized irrigation districts under the Act of December 5, 1924, known as the Fact Finders` Law. However, Reclamation retained the operation and maintenance of certain parts of the system, referred to as the `reserved works.` In 1990, operation and maintenance of the first 1/2 mile of the New York Canal was transferred to the Board of Control. Operation and maintenance of the Boise River Diversion Dam and the headworks to the New York Canal were transferred to the Board of Control in 1992.

Arrowrock Dam and Reservoir, Anderson Ranch Dam, Reservoir, and Powerplant, and the Boise River Diversion Dam Powerplant continue to be `reserved works` operated and maintained by Reclamation. Lucky Peak Dam and Reservoir is operated by the Corps of Engineers.

In the Payette Division, Reclamation operates and maintains Deadwood and Cascade Reservoirs, and Black Canyon Diversion Dam and Powerplant. All irrigation carriage and distribution systems are operated by the water users.

Anderson Ranch Dam and Powerplant, Boise River Diversion Powerplant, Cascade Dam and Deadwood Dam can be remotely operated by Reclamation from its control center at Black Canyon Diversion Dam. Automation of Arrowrock Dam is underway.

Project Development

History

The first right to divert water from the Boise River for irrigation purposes was granted in 1864. The water irrigated the townsite of Boise and supplied Fort Boise. Agricultural activity in the Boise and Payette Valleys started in the early 1880`s when settlers began filing on desert lands under private irrigation enterprises. By 1900, about 148,000 acres had been placed under irrigation.

Since its first authorization in 1905, the Boise Project has expanded in accordance with an orderly program of development that has included the construction of five major reservoirs, two principal diversion dams, three sizable pumping plants, three powerplants, and related facilities. In addition, several structures that were constructed in the early stages of development have been rehabilitated or repaired to improve operations and extend the life of the facilities.

Investigations

Diversion from the river with simple ditches served to adequately irrigate lands in the vicinity of the river, but development of additional lands at higher elevations proved too difficult and costly to be undertaken by private capital. In response to petitions by local irrigators, the Boise Project was initiated by Reclamation Service (now Reclamation) shortly after the passage of the first Reclamation Act in 1902. Subsequent investigations have resulted in the completion of many structures as need arose.

Authorization

Authorization for construction of the original Boise Project (now the Arrowrock Division) was made on March 27, 1905; the Arrowrock Dam on January 6, 1911; and Black Canyon Diversion Dam on June 26, 1922, all by the Secretary of the Interior under provisions of Reclamation Act of June 17, 1902 (32 Stat. 388). Deadwood Dam and Reservoir were approved on October 19, 1928, and Payette Division on December 19, 1935, by the President under section 4 of the Act of June 25, 1910 (36 Stat. 836), and subsection B, section 4 of the Act of December 5, 1924 (48 Stat. 701). Anderson Ranch Dam and Reservoir were found feasible and authorized on June 25, 1940, by the Secretary of the Interior under Reclamation Project Act of 1939 (53 Stat. 1187).

The original authorized purpose of each storage facility of the Boise Project includes: Deer Flat Dams (Lake Lowell), irrigation; Arrowrock Dam, irrigation; Anderson Ranch Dam, irrigation, power, flood control, conservation of fish, and recreation; Deadwood Dam, irrigation and downstream power; Cascade Dam, irrigation and power. Lucky Peak Dam, constructed by the Corps of Engineers, was authorized for flood control and irrigation purposes.

Construction

The 276,000-acre Arrowrock Division serves that portion of the Boise Project lands situated between the Boise and Snake Rivers. Lake Lowell was completed by June 1911; Arrowrock Dam and Reservoir commenced storing water in 1915; Boise River Diversion Dam was completed by October 10, 1908, and Anderson Ranch Dam was completed in 1950. The powerplant at Boise River Diversion Dam, built originally to supply power for construction of Arrowrock Dam, was placed in operation in 1912. As the reservoirs were built, a system of canals, laterals, and drains was constructed.

The 121,000-acre Payette Division includes lands between the Payette and Boise Rivers and lands north of the Payette River in the Emmett Irrigation District which are irrigated from the Payette River and from drains operated within the Arrowrock Division. Black Canyon Diversion Dam on the Payette River, which heads the gravity distribution system, was completed in 1924; Deadwood Dam and Reservoir on the Deadwood River in 1931; and Cascade Dam and Lake Cascade on the North Fork of the Payette River in 1948. The gravity distribution system was constructed during 1936-1940. Supplementing this system, a combination pump-gravity canal, designated the `C` Line, was completed in 1948.

Boise Project Benefits

Benefits include irrigation, recreation, hydropower, and flood control. Only the irrigation and hydropower benefits were included in this summary from Reclamation's website.

Irrigation

The project area, comprising about 397,000 acres, was once desert land except for small sections of river bottom. Principally through facilities provided by Reclamation, irrigation farmers have turned the desert into a productive agricultural area with thriving cities and towns.

A major portion of the Nation`s requirement for sweet corn seed is grown on the Boise Project. The project also produces large quantities of grain, alfalfa hay, pasture, sugar beets, corn, potatoes, onions, apples, and alfalfa seed. The hay and forage crops support a large number of dairy and beef cattle.

Hydroelectric Power

The Boise Project, as a multiple-purpose feature, produces hydroelectric power at three power plants: A 40,000 kW installation at Anderson Ranch Dam: a 10,200 kW plant at Black Canyon Dam, and a 3300 kW powerplant at Boise River Diversion Dam.

Black Canyon Powerplant and Boise River Diversion Dam Powerplant provide energy for pumping water to the Payette Division lands and the Emmett Irrigation District. Anderson

Ranch Powerplant serves pumping loads in the Minidoka and Owyhee Projects. Surplus power from these plants is turned over to the Bonneville Power Administration for marketing.

Boise Project Federal Reserved Rate

The Black Canyon Irrigation District receives the Southern Idaho rate. Southern Idaho power plant net generation is a combination of the Boise, Minidoka, and Palisades Project hydropower production which also include Anderson Ranch and Black Canyon hydropower plants, as shown in appendix B, "plant net generation (kWh)" table. Tables in appendix B display Southern Idaho irrigation pumping rates for fiscal years 2001 – 2014, with 2015 – 2020 year forecast estimations.

Southern Idaho rates fall under a contract for one rate for all districts, although transmission rates vary. The FY14 actual period rate was 22.80 mills/kWh which has been the actual rate since FY08, and the estimated 2015 rate is 25.00 mills/kWh. The 2015 estimated wheeling rate for Black Canyon Irrigation District is 2.22 mills/kWh, shown in appendix B.

Columbia Basin Project

Summary

As shown in table 2, the PN rate applies to entities within five projects in addition to the Columbia Basin Project (CBP). In the CBP, the Spokane Tribe of Indians receives the reserved PN rate. The CBP is located in east central Washington and currently serves about 671,000 acres, or approximately 65 percent of the 1,029,000 acres originally authorized by Congress, in portions of Grant, Lincoln, Adams, and Franklin Counties, with some northern facilities located in Douglas County. A summary of basic project comparison elements is shown in table 5.

Although the project was authorized in 1935, the first half of project lands were developed primarily in the 1950's and 1960's, with some acreages being added sporadically until 1985. The 1945 feasibility report anticipated a 70-year period of incremental development to complete the CBP. It was anticipated that further incremental development of the CBP would depend on future needs and any irrigation of additional lands would utilize water from the Columbia River already reserved for the CBP.

Recent irrigated acreage estimates range from 530,086 and 1,159,830 acres. The CBP area has an average annual precipitation is 6.8 inches with a mean temperature of 51 degrees Fahrenheit and 212 days in the growing season with an elevation of between 3,500 and 1,500 ft.

Principal project features include Grand Coulee Dam, Franklin D. Roosevelt Lake, Grand Coulee Power Plant Complex, switchyards, and a pump-generating plant. Primary irrigation facilities are the Feeder Canal, Banks Lake, the Main, West, East High, and East Low Canals, O`Sullivan Dam, Potholes Reservoir, and Potholes Canal. There is over 300 miles of main canals, about 2,000 miles of laterals, and 3,500 miles of drains and waste ways on the project.

All of the principal features have been constructed, except the East High Canal and the extension of the East Low Canal, on which construction has been indefinitely deferred.

Table 5—Columbia Basin Project Summary

Project Element	Data
Irrigated acres	530,086 – 1,159,830 acres*
Average annual precipitation	6.8 in
Mean temperature	51° F
Growing season	212 days
Elevation of irrigable areas	500 – 1,500 ft
Project authorization	1935
Storage Dams	6
Canals	333 mi
Laterals	1,933 mi
Pumping Plants	240
Drains	3,163 mi
Tunnels	0
Power plants	1
Transmission Lines	21 mi
Substations	42

Source: Reclamation website
*530,086 figure from Reclamation website; 1,159,830 figure from Reclamation GIS.

General Description

The Columbia Basin Project (CBP) is located in east central Washington and currently serves about 671,000 acres, or approximately 65 percent of the 1,029,000 acres originally authorized by Congress, in portions of Grant, Lincoln, Adams, and Franklin Counties, with some northern facilities located in Douglas County. These first half of project lands were developed primarily in the 1950's and 1960's, with some acreages being added sporadically until 1985. The 1945 feasibility report anticipated a 70-year period of incremental development to complete the CBP. It was anticipated that further incremental development of the CBP would depend on future needs and any irrigation of additional lands would utilize water from the Columbia River already reserved for the CBP.

Principal project features include Grand Coulee Dam, Franklin D. Roosevelt Lake, Grand Coulee Powerplant Complex, switchyards, and a pump-generating plant. Primary irrigation facilities are the Feeder Canal, Banks Lake, the Main, West, East High, and East Low Canals, O`Sullivan Dam, Potholes Reservoir, and Potholes Canal. There is over 300 miles of main canals, about 2,000 miles of laterals, and 3,500 miles of drains and waste ways on the project.

All of the principal features have been constructed, except the East High Canal and the extension of the East Low Canal, on which construction has been indefinitely deferred.

The Odessa Subarea is a region of deep ground water as designated by the Washington Department of Ecology (Ecology), and underlies the eastern most portion of the authorized CBP, east of and uphill from the existing East Low Canal of the CBP. Ecology permitted irrigation wells in the Odessa Subarea in the mid-1970s, anticipating that the CBP would eventually provide project water to these lands via the construction of a second canal, the East High Canal. However, this canal has not yet been built; and as a result, ground water pumping has continued. The aquifer is declining to such an extent that the ability of farmers to irrigate their crops is at risk and domestic, commercial, municipal, and industrial uses and water quality are affected. The urgency of this matter will continue to grow.

Project Plan – Operation

The Columbia River is characterized by heavy, sustained flows during the late spring and early summer months, the peak flow usually occurring in mid-June. Most of the water comes from the forested slopes of the Rocky Mountains in British Columbia, western Montana, and northern Idaho, where snow and heavy rains result in prolonged summer river flow. There is usually ample water for irrigation and power generation (both irrigation pumping and commercial) and for reversible pump-generation. Releases are made in July and August to ensure adequate water in the lower Columbia River to enhance fish migration.

Irrigation water is pumped from Franklin D. Roosevelt Lake by the Grand Coulee Pump-Generating Plant, adjacent to the reservoir at the left abutment of the dam. The Pump-Generating Plant has a total of 12 units, which include 6 pumping units and 6 pump-generating units.

The widely distributed irrigation works that extend southward from the Grand Coulee Pump-Generating Plant begin with the 16 mile feeder canal which carries water to Banks Lake, the equalizing reservoir. This 27-mile-long reservoir occupies the floor of the upper Grand Coulee between North Dam near the town of Coulee Dam, Washington, and Dry Falls Dam near Coulee City. The Main Canal flows southward from the outlet works at Dry Falls Dam into the northern end of the irrigable area. The West, East High, and East Low Canals are fed by the Main Canal and carry water over a large portion of the project area.

O`Sullivan Dam, in the central part of the project area, created the Potholes Reservoir where return flows from the northern part of the project are recaptured. The Potholes Canal extends into and serves the southern part of the project area.

Facility Descriptions

Grand Coulee Dam and Franklin D. Roosevelt Lake

Grand Coulee Dam is one of the largest concrete structures ever built. This barricade, which raises the water surface 380 feet above the old riverbed, was originally 4,300 feet long, 550 feet high, and contains about 12 million cubic yards of concrete. The original dam was modified for the Third Powerplant by construction of a 1,170-foot-long, 201-foot-high forebay dam along the right abutment approximately parallel to the river and at an angle of 64 degrees to the axis of Grand Coulee Dam. The total length of the main dam, forebay dam, and wing dam is 5,223 feet. The spillway of the dam is controlled by 11 drum gates, each 135 feet long, and is capable of spilling 1 million cubic feet of water per second with Lake Roosevelt at full pool (1290.0 feet above sea level). The dam also contains forty 102- inch-diameter outlet tubes. Within the dam are 8.5 miles of inspection galleries and 2.5 miles of shafts.

Franklin D. Roosevelt Lake, the reservoir behind the dam, extends 151 miles northeast almost to the Canadian border and up the Spokane River, a tributary of the Columbia, to within 37 miles of Spokane. The total storage capacity of the reservoir is about 9.4 million af, and the active capacity is about 5.2 million af.

The average discharge at Grand Coulee over a period of years is approximately 109,000 cfs. On June 12, 1948, during an historic Columbia River flood period, the maximum discharge (turbine and spill) recorded was 637,800 cfs. The annual volume inflow has varied from a minimum of 48.5 million af to a maximum of 111.8 million af. The average annual inflow to Lake Roosevelt is 99.3 million af. The April through July inflow accounts for 65 to 70 percent of the total annual inflow volume.

Grand Coulee Powerplant Complex

Power facilities at Grand Coulee Dam consist of a powerplant on both the left and right sides of the spillway on the downstream face of the dam, the Third Powerplant on the downstream face of the forebay dam, an 11.95/115-kilovolt switchyard, a 230-kilovolt consolidated switchyard, and the 525-kilovolt Third Powerplant cable spreading yard and switchyard located high on the hills west of Grand Coulee Dam.

As constructed, the Left and Right powerplants contained a total of eighteen 108,000-kilowatt units, nine in each powerplant. Rewinding these units has increased the capacity to 125,000 kW each, for a total of 2.25 million kW. Three small station service units of 10,000 kW each in the left powerplant increase the total to 2.28 million kW for the left and right powerplants.

The Third Powerplant has six units. The first three units have a nameplate rating of 600,000 kW each and the last three are rated at 805,000 kW each, for a total of 4.215 million kW in the Third Powerplant. Total generating capacity for Grand Coulee (including the Grand Coulee Pump-Generating Plant) is 6.809 million kW.

Before construction could start on the Third Powerplant, it was necessary to modify transmission of power from the existing Right and Left Powerhouse and route all generation to a new 230-kilovolt low-profile consolidated switchyard. Originally there was a switchyard on each side of the river, one for each of the existing powerplants. The right switchyard was in the area now occupied by portions of the forebay dam and the Third Powerplant. A new oil-filled pipe-type 230-kilovolt cable system running the Left and Right Powerhouses through galleries in Grand Coulee Dam and through an underground tunnel was installed to convey power up to the new consolidated switchyard. Due to many problems with this cable system it was replaced with overhead lines in 1987-1989.

Power generated at the Third Powerplant is transmitted by 525-kilovolt cables, almost 5 inches thick that run from the powerplant transformers through a gallery in the dam and through a tunnel to the 525-kilovolt cable spreading yard and then overhead to the switchyard on the hills west of the dam. About 4 miles of the 525- kilovolt cable is required for each of the six units in the Third Powerplant. The oil impregnated insulation around the cable is efficient to the point where a hand can safely be placed on the cables only 1.5 inches from the copper core which carries the electrical energy.

At the switchyards, power generated at Grand Coulee Dam is delivered to the transmission lines of the Bonneville Power Administration, a Federal marketing agency for federally produced power in the Pacific Northwest.

John W. Keys, III Pump-Generating Plant

Six pumping units, each rated at 65,000 horsepower and with a capacity to pump 1,350 cfs at a 292- to 310-foot head, initially were installed in the plant to lift water from Franklin D. Roosevelt Lake to the 1.6-mile-long feeder canal for delivery into Banks Lake.

The plant was designed to accommodate 12 such units. In the early 1960`s, with the Northwest facing power shortages, investigations showed the potential the site offered for pump-back storage. It was determined feasible that the last six units be reversible; that is, that water be returned from Banks Lake back through these units to generate power during peak power demand periods. Units 7 and 8 are each rated at 67,500 horsepower and lift 1,605 cfs in the pumping mode (with both Franklin D. Roosevelt Lake and Banks Lake full). They are each rated at 50,000 kW in the generating mode. The last four units are each rated at 67,500 horsepower and can lift 1,700 cfs in the pump mode and 53,500 kW in the generating mode. The total generating capacity of the John W. Keys, III Pump- Generating Plant is 314,000 kW. Table 6 summarizes the overall number of pumping plants, number of units in each, total capacity in cfs, total dynamic head in feet, and total horsepower.

Table 6—Columbia Basin Project Pumping Plant Data

Unit	Designation	Number of Units	Total Capacity	Total Dynamic	Total HP
GCPGP	Grand Coulee Pump-Generating	12	17,730	292-310	525,000
Block No. 1	Block No. 1 - 5 relift	8	103	6-35	428
Block No. 2	Burbank No. 1	3	40.5	90	600
	Burbank BP 0.3	1	9	24	30
Block No. 3	1 plant	4	29.5	85	400
Block No. 11	Lower Scooteney	3	76	149	1,500
	Upper Scooteney	3	24	97	300
	Upper Scooteney (PE 27A - 2nd relift)	1	9	155	200
	2 plants	2	5.75	14	15
Block No. 12	2 plants	3	17	4-27	45
Block No. 13	6 plants	6	25.3	10.5-22	75
Block No. 14	Mesa	4	160	82	1,800
	9 plants	18	103	5.5-28	241
Block No. 15	Ringold	4	232	35-38	1,230
	Ringold relift	3	118	14.5	480
	12 plants	17	153.7	6-52	923
Block No. 16	Eltopia Branch	3	72	50	600
	11 plants	20	110	10.5-70	205
Block No. 161	1 plant	3	28	26	120
Block No. 17	Sagemoor	4	88	91	1,200
Block No. 18	13 plants	26	177.8	5.5-34.5	355.5
Block No. 19	5 plants	8	37.5	7.5-70	205
Block No. 20	White Bluffs No.	4	178	85	2,000
	9 plants	17	95.7	8-72	500
Blocks No. 21 and 48	Radar	5	256	118-277	8,100
	White Bluffs No 2	6	222	63-106	2,250

Block No. 23	3 plants	7	20	15-18	72.5
Block No. 24	1 plant	3	36	260	1,500
Block No. 201	1 plant	2	10.2	11	20
Block No. 40	5 plants	8	40	11-45	125
Block No. 401	– 2 plants	3	35.8	11-25.5	125
Block No. 41	– 7 plants	13	95	5-35	297.5
Block No. 42	– 9 plants	18	135	10-32	522.5
Block No. 43	– 7 plants	9	54.1	4-64	268
Block No. 44	Warden	3	135	55	1,050
	North Warden	3	72	57	600
	Warden Relift	4	57	51-96	550
	6 plants	8	49	12-125	525
Block No. 45	15 plants	24	165.5	7-45	528
Block No. 46	1 plant	2	8	22-23	32.5
Block No. 47	- 5 plants	8	43	8.5-23	130
Block No. 48	- 1 plant	2	14.4	17	40
Block No. 49	Lower Saddle	4	112	94	1,600
	Upper Saddle	4	90	15-113	1,365
	PE-17	1	14	86	200
Block No. 70	W-9	3	47	85-230	1,100
	2 plants	2	25	7-54	140
Block No. 71	- 2 plants	2	17	6-29.5	63
Block No. 72	- 11 plants	12	60	5-90	302.5

Block No. 73	Quincy	9	421	59-260	10,018
	2 plants	3	17.3	13-80	90
Block No. 74	Babcock	10	292	44-221	6,200
	Babcock W.W.	2	20	32	120
Block No. 741	1 plant	3	17.2	70	190
Block No. 75	3 plants	5	35	8-18	85
	1 plant	1	3	21.5	12.5
Block No. 76	2 plants	10	99.6	5-20	185
Block No. 77	Evergreen	8	253	83-222	6,800
	2 plants	4	47.2	18-20	127.5
Block No. 78	4 plants	6	51	6-13	102.5
Block No. 79	1 Plant	1	3	20	10
	Frenchman	8	197	54-264	4,700
Block No. 80	Hope Valley	3	60	84	760
Blocks No. 80 and 81	Frenchman Hills	9	432	170-314	13,500
Block No. 82	Low Gap	4	85.6	72	900
Block No. 83	Sand Hollow	4	178	65	1,600
	6 plants	11	44.4	6-20	95
Block No. 85	4 plants	6	21.4	9-18	65
Block No. 86	1 plant	1	3	16	10
Block No. 87	5 plants	10	47	6.5-51	220
Block No. 88	1 plant	2	11	7	15
Block No. 89	14 plants	28	134.3	5-33	365
Block No. 70 Soap	Lake Lenore No.	4	35	60	350
	Lake Lenore No.	5	40	197	1,200

Lake Protective Works	Lake Lenore No.	1	4	250	150
	6 deep wells	6	16.8	220-304	800
Totals		473	2,004.55		608,630
Source: Reclamation website					

Banks Lake

North Dam
Dry Falls Dam

Banks Lake, the equalizing reservoir, was created by building two rock-faced, earthfill dams at the north and south ends of the Ice-Age channel of the Columbia River, now known as the Grand Coulee. This 27-mile-long reservoir, with an active storage capacity of 715,000 af, feeds Columbia River water into the Main Canal. In addition, it provides water on a return flow basis to produce power when the pump generating units are operating in the generating mode.

Major features forming and serving Banks Lake are the feeder canal with a capacity of 26,000 cfs, North Dam, 2 miles southwest of Grand Coulee Dam, and Dry Falls Dam and Main Canal headworks near Coulee City, 29 miles south of Grand Coulee Dam.

In conjunction with the addition of the six pump/generating units the canal size was increased. The south side of the canal was removed, the base widened from 50 feet to 80 feet, an entire new south wall constructed, 8 feet added to the top of the north wall, and a new flume section was added to bypass a duplex tunnel cut- and-cover section. This increased the operating capacity to 26,000 cfs. Reconstruction was completed in 1981.

Main Canal

Pinto Dam

The Main Canal begins at the headworks at Dry Falls Dam and consists of unlined and concrete- lined sections. Total length of the canal, including siphons, tunnels, and Billy Clapp Lake, is 18.4 miles. The first 1.8 miles from Dry Falls Dam to the Bacon Siphon and Tunnel structures has been increased in capacity from 13,200 to 19,300 cfs. Bacon Siphon and Tunnel structures consist of two siphons, each about 1,000 feet long, and two tunnels, each about 2 miles long, that carry the water to Billy Clapp Lake. This lake, some 6 miles long and formed by the construction of the earthfill Pinto Dam, is a segment of the canal system. Construction of an equal length of very difficult and expensive canal was thus avoided.

West Canal

The West Canal has an initial capacity of 5,100 cfs and a length of 82.2 miles. It is one of two canals formed by the bifurcation of the Main Canal. The West Canal skirts the northwest periphery of the project and en route is carried across the lower Grand Coulee through the world`s largest inverted siphon at the north end of Soap Lake. The canal continues around the upper margin of Quincy Basin to the northern base of Frenchman Hills, which it penetrates by a 9,000-foot tunnel, ending in an easterly branch across the Royal Slope. The capacity of the canal is reduced progressively as water is diverted into lateral distribution systems built to serve the entire northwestern portion of the project.

East Low Canal

The East Low Canal, having an initial capacity of 4,500 cfs, also begins at the bifurcation of the Main Canal. The East Low Canal extends southerly in a contour course through the rolling eastern uplands, passes through or near the towns of Moses Lake and Warden, and terminates just east of the Scooteney Reservoir. An extension of the canal which would carry water southward and to the east of the towns of Connell, Mesa, and Eltopia, has been deferred.

O`Sullivan Dam

O`Sullivan Dam, one of the larger zoned earthfill dams in the United States, is on Crab Creek about 15 miles south of Moses Lake. The 27,800-acre Potholes Reservoir formed by this dam collects return flows from all irrigation in the upper portion of the project for reuse in the southern portion. Active storage capacity of the reservoir is 332,200 af. A system of waste ways has been built on both the West and East Low Canals to provide operational safety for the canals and a means of delivering water into Potholes Reservoir to supplement the natural and return flows.

Potholes Canal

The Potholes Canal has a capacity of 3,900 cfs, begins at the headworks of O`Sullivan Dam, and extends 62.4 miles in a southerly direction to irrigate lands in the southwestern and south-central portions of the project. Irrigation Blocks 2 and 3, located in the southernmost tip of the South District, receive irrigation water pumped directly from the rivers: Block 2 from the Snake River and Block 3 from the Columbia River.

East High Canal

This proposed 88-mile-long canal, designed for an initial capacity of about 7,500 cfs, would divert water from the Main Canal immediately above Summer Falls and Billy Clapp Lake, to serve lands east of the East Low Canal extending from the northernmost point of the project area south to Washtucna Coulee. Some 357,000 acres have been proposed for service from the East High Canal. An Environmental Impact Statement was completed in 1993 but was not filed. Construction of the East High Canal is in a deferred status.

Relift Pumping Plants

About 360,000 acres of the irrigable lands within the project are located at elevations higher than the gravity canals and laterals. Some of these high lands are being served by relift pumping plants at various points within the project.

Operating Agencies

All basic irrigation facilities applicable to the three Columbia Basin Irrigation Districts (Quincy-Columbia Basin Irrigation District, East Columbia Basin Irrigation District, and South Columbia Basin Irrigation District) are operated by the irrigation districts. Irrigation facilities operated as reserved works by Reclamation include Dry Falls Dam, Main Canal through the bifurcation works including Pinto Dam and Billy Clapp Lake, and O`Sullivan Dam, Potholes Reservoir, and Potholes Canal headworks. Grand Coulee Dam, Powerplant, and Pumping Plant, and Banks Lake also are operated by Reclamation as reserved works.

Project Development

History

The earliest settlement of the project area centered upon extensive use of the natural grasses for dryland grazing on unfenced rangeland. In the first decade of the 20th century, large numbers of homesteaders moved into the project area, acquired land under homesteading laws, and undertook conventional dry farming. Since the average annual rainfall over the entire area is less than 10 inches, dry farming could not result in permanent agricultural development. A few years of above-normal rainfall lent an appearance of success to farming operations after the grasslands were first plowed, but dry farming was doomed to failure on all but those lands with deep soils and high water-holding capacities. Even so, dry farming of cereal grains on a permanent basis was possible only through the consolidation of land holdings and the farming of very large tracts of land.

Investigations

With the establishment of Reclamation Service in 1902 (now Reclamation) and the already apparent difficulties of dry farming in the area, interest developed in the possibility of irrigating with water from the Columbia River. Reclamation Service undertook certain general investigations in 1904, but the basic problem of lifting Columbia River water from its deep canyon onto the plateau surface was more than the young agency could hope to contend with at that time.

In 1918, local interests initiated a proposal for irrigation of the project area; they worked resolutely in the following years to achieve that goal. It was proposed that a high dam be built on the Columbia River at the head of the upper Grand Coulee, a unique geological feature in the ancient riverbed of the Columbia, formed when the original channel was blocked by glaciers during one of the Ice Ages. By building such a dam, irrigation water could be made available to the irrigable lands lying 50 miles to the south.

An alternative proposal, which had strong backing in the State of Washington, called for construction of a canal to convey water from the Pend Oreille River in northern Idaho generally westward across the plateau surface and into the middle portion of the project area.

Many engineering and economic studies were made by various organizations and governmental agencies. The conclusive and culminating study was prepared by the Corps and published as House Document No. 103, 73d Congress, 1st session. The report recommended constructing the high Grand Coulee Dam at its present site and pumping irrigation water up into the Grand Coulee. In connection with this report, Reclamation submitted a report on the proposed irrigation plan for the Columbia Basin Project. Reclamation report, dated January 7, 1932, recommended construction of the project essentially as it is now being built.

The landowners in the project area worked throughout the latter part of the 1930`s to organize irrigation districts as a prerequisite to the construction of irrigation works. The three irrigation districts formed by February 1940 were the Quincy- Columbia Basin Irrigation District, the East Columbia Basin Irrigation District, and the South Columbia Basin Irrigation District.

In 1939, Reclamation, with the cooperation and assistance of about 45 different Federal, State, local, and private organizations, undertook a program of non- engineering studies important to settlement and development of this large project. This program of 28 problem studies was known as the Columbia Basin Joint Investigations. They were carried to completion, and the reports were published during World War II. The conclusions and recommendations made regarding the 28 problems were heavily drawn upon in drafting the Columbia Basin Project Act of 1943.

A rapidly expanding power market in the Pacific Northwest experienced power shortages in 1951-1952. Investigative studies were undertaken as a result of these shortages and in February 1954, Reclamation prepared a report on a proposed Third Powerplant at Grand Coulee Dam. It was concluded that the Third Powerplant was feasible from an engineering point of view; however, it was recommended that the development be held in abeyance until such time as prospective requirements for capacity, and energy resulting therefrom, provided definite prospects for financial feasibility. In January 1965, a feasibility report was issued recommending authorization to construct the Third Powerplant with a rated capacity of not less than 3.6 million kW. Authorizing legislation followed in June 1966.

Authorization

The Columbia Basin Project was begun with the allocation of funds for Grand Coulee Dam pursuant to the National Industrial Recovery Act of June 16, 1933. The project was specifically authorized for construction by the Rivers and Harbors Act approved August 30, 1935 (49 Stat. 1028, 1039-1040, Public Law 74-409), The Columbia Basin Project Act of March 10, 1943 (57 Stat. 14, Public Law 78-8), reauthorized the project, bringing it under the provisions of Reclamation Project Act of 1939.

Units 7, 8, and 9 of the Right Powerhouse were authorized by a finding of feasibility approved by the Secretary of the Interior on January 5, 1949.

Construction of the Third Powerplant was authorized June 14, 1966 (80 Stat. 200, Public Law 89-448), as amended by the Act of September 7, 1966 (80 Stat. 714, Public Law 89-561).

The authorized purposes are the control of floods, improvement of navigation, regulation of stream flow, storage and delivery of stored water for reclamation of lands, and other beneficial uses, and the generation of electric energy. Storage and delivery of water for municipal and industrial purposes is a beneficial use and a project purpose.

In 1980, the U.S. District Court confirmed that fish and wildlife was also a project purpose pursuant to the Fish and Wildlife Coordination Act of August 12, 1958 (72 Stat. 563, Public Law 85-624).

Construction

Construction of the Columbia Basin Project, including Grand Coulee Dam and all related features, was assigned to Reclamation. Funds were made available by the Public Works Administration on July 27, 1933, by an allotment of $63 million under section 202 of the National Industrial Recovery Act.

A temporary project headquarters was established at Almira, Wash., 21 miles from the dam site. Excavation for the base of the dam, and construction of highway and railroad connections to the dam site and the necessary construction camp facilities was started in December 1933. In August 1934, the first of two major contracts for the construction of Grand Coulee Dam and Powerplant was awarded. Originally, the building of Grand Coulee

Dam was planned in two stages. A low dam was to be built first, with a foundation designed so that a high dam could later be superimposed on it. A pumping plant and other components of the irrigation system also would be added in the second stage.

On August 30, 1935, the Congress authorized construction of the high dam and the irrigation project. From 1933 to 1941, construction of the dam property proceeded on a rapid schedule. By 1941, Grand Coulee Dam was essentially completed, the Left Powerhouse constructed, and the foundations placed for the Right Powerhouse and pumping plant.

During World War II, efforts centered entirely on the installation of hydroelectric power generating units in the Left Powerhouse. During this period, six 108,000- kilowatt Grand Coulee generators, two 75,000-kilowatt generators scheduled for Shasta Dam, and two 10,000-kilowatt station service generators were installed.

After World War II, the two Shasta generating units were removed and three 108,000-kilowatt generators were installed in the Left Powerhouse to complete the nine planned units. A third station service generator was installed, and the Right Powerhouse completed with nine 108,000-kilowatt units installed. The last of the eighteen 108,000-kilowatt generating units was placed in commercial operation in September 1951. Thus, about 18 years after the beginning of construction on Grand Coulee Dam, the powerplant was completed as originally planned, and maximum power production was available to meet power needs in the Pacific Northwest and to pump irrigation water for the Columbia Basin Project lands.

The eighteen 108,000-kilowatt generating units were rewound to increase the rating of each unit to 125,000 kW. The first unit was rewound in 1964, and the last unit was completed in August 1980.

Construction of the Third Powerplant formally began July 12, 1967, when the contract was awarded to modify the then existing switchyards, especially the right powerhouse switchyard where the forebay and forebay dam would be located. Excavation of the forebay began with a contract award on December 5, 1967. The first unit in the powerplant, rated at 690,000 kW, went into operation in August 1975, and the fourth unit, rated at 805,000 kW, went on the line in April 1978. The sixth and last unit was completed in May 1980, which basically completed the Third Powerplant as authorized. The stator windings in the last three units were replaced starting in October 1996 and completed in December 1998.

Due to downstream river fluctuations resulting from power peaking operations following construction of the Third Powerplant, extensive downstream riverbank protection work was done in the 7 miles just downstream of the dam. Major stabilization features included installation of automatic drainage wells, water level monitoring, monitoring wells including earth movement, three vertical drainage shafts with horizontal drainage pipes, reshaping and placing armor rock for the entire 6 miles both underwater and above water, and a real-time computer monitoring system. Currently there is a 22-foot tailbay drawdown restriction over a 24-hour period. The stabilization program exceeded $75 million in contract costs.

Construction of Irrigation Facilities

Construction of Grand Coulee Pumping Plant began in 1946. By 1951, six 65,000-horsepower pumps had been installed to serve the initial irrigation development on the project. Immediately following World War II, construction started on the primary irrigation facilities. In the spring of 1952, the first irrigation water was delivered to the irrigation system, then serving about 66,000 irrigable acres.

However, the delivery of irrigation water to this large acreage in 1952 did not mark the first irrigation of project lands. In 1948, a pumping plant on the Columbia River near Pasco was completed that served about 5,400 acres on Irrigation Block 1 (Pasco Pumping Unit). In 1950, the Burbank Pumping Plant on the Snake River south of Pasco brought water to about 1,200 acres in Irrigation Block 2 (Burbank Pumping Unit). Block 1 now receives water from the Potholes Canal.

In 1973, two of the pump-generator units were installed, each unit rated at 67,500 horsepower when pumping and 50,000 kW when generating. In 1983 and early 1994, the remaining four pump/generating units, each rated at 67,500 horsepower when pumping and 53,500 kW when generating, were placed in service.

Since 1952, extending the major canals and constructing relift pumping plants and lateral systems has progressed on a regular schedule. As a result, irrigation of land on the Columbia Basin Project has proceeded in an orderly and efficient manner, which has brought about a well-rounded development. Roads, schools, towns to serve the newly irrigated lands, and many other aspects of the settlement and growth of a newly irrigated area have kept pace with Reclamation`s schedule of construction.

Project Benefits

Although benefits of the CBP include irrigation, recreation, power, and flood control, only discussion of irrigation and power were included.

Irrigation

Construction of the Columbia Basin Project has brought some 671,000 acres under irrigation. The soil and climatic conditions are favorable to the growth of grain, alfalfa hay, ensilage crops, dry beans, fruit, sugar beets, potatoes, sweet corn, and seed and other specialty crops. Dairy farming and beef production are significant in the area.

Power

The average annual net generation for the Grand Coulee Powerplant from 1994 through 2005 was about 21.2 billion kilowatt-hours; this compares to an average of 11 to 15 billion kilowatt-hours prior to the Third Powerplant. Hydroelectric power generated at Grand Coulee Dam furnishes a large share of the power requirements in the Pacific Northwest. Energy produced by the Third Powerplant alone is sufficient to furnish the power needs for the cities of Seattle and Portland. As required by law, the revenue derived from this power not only will repay the power investment but also will repay a large portion of the irrigation investment on the Columbia Basin Project. The power operation at Grand Coulee is for both base load and peaking power.

CBP Federal Reserved Rate

As shown in table 2, the PN rate applies to entities within five other projects. For the CBP, the Spokane Tribe of Indians receives the reserved PN rate, which was 10.380 mills/kWh for the FY14 actual rate.

Minidoka Project

Summary

In the Minidoka Project, the A&B, Burley, Falls, Milner, and Minidoka Irrigation Districts receive the Southern Idaho reserved power rates, as shown in table 7. Minidoka Dam is a combined diversion, storage, and power structure located just south of Minidoka, Idaho. The reservoir, Lake Walcott, has a total storage capacity of 210,200 af (active 95,200 af). Water is diverted at the dam into a canal on each side of the river. Minidoka Project spans Idaho and Wyoming in a total of 16 counties. Project lands extend discontinuously from the town of Ashton, in eastern Idaho along the Snake River, about 300 miles downstream to the town of Bliss in south-central Idaho. The project furnishes irrigation water from five reservoirs that have a combined active storage capacity of more than three million af. Water from Palisades Reservoir in the Palisades Project is instrumental in helping to meet the Minidoka Project water requirements.

A full or supplemental irrigation water supply is furnished to over a million acres in the arid Snake River valley of southern Idaho. Much of the famed Idaho potato crop is grown in this valley, and sugar beets, dry beans, sweet corn, field grains, alfalfa hay, and irrigated pasture diversify the land use. Cattle raising and dairying are important industries. Recent estimates place the number of irrigated acres at between 1,062,093 and 1,905,135 acres. The project was authorized in 1904. The average annual precipitation is 10.3 inches, mean temperature is 48 degrees Fahrenheit, and the growing season is 154 days with an elevation of between 4,225 and 5,000 ft.

The project works consist of Minidoka Dam and Power plant and Lake Walcott, Jackson Lake Dam and Jackson Lake, American Falls Dam and Reservoir, Island Park Dam and Reservoir, Grassy Lake Dam and Grassy Lake, two diversion dams, canals, laterals, drains, and some 177 water supply wells. Natural flow of the Snake River and some of its tributaries, and water stored in the reservoirs at Jackson Lake, Grassy Lake, Island Park, American Falls, and Lake Walcott are delivered at numerous diversion points to the A & B, Falls, Fremont-Madison, Burley, and Minidoka Irrigation Districts, American Falls Reservoir District No. 2, and supplemental supply contractors.

Originally power was developed on the project for pumping water to lands lying above the gravity canals and for pumping drainage water. Power was also furnished to several small communities in the area. Subsequently, Federal power has been provided for groundwater pumping projects.

Table 7—Minidoka Project Summary

Project Element	Data
Irrigated acres	1,062,093 – 1,905,135 acres*
Average annual	10.3 in
Mean temperature	48° F
Growing season	154 days
Elevation of irrigable areas	4,225-5,000 ft
Project authorization	1904
Storage Dams	3
Diversion Dams	3
Canals	1,662 mi
Laterals	3,929 mi
Pumping Plants	4
Irrigation wells	177
Drains	1,249 mi
Tunnels	0
Power plants	1
Transmission Lines	3.4 mi
Substations	184

Source: Reclamation 1981 Project Data book, and website

1,905,135 figure from current GIS information;1,062,093 taken from 1992 data

General Description

Minidoka Project lands extend discontinuously from the town of Ashton, in eastern Idaho along the Snake River, about 300 miles downstream to the town of Bliss in south-central Idaho. The project furnishes irrigation water from five reservoirs that have a combined active storage capacity of more than 3 million af.

The project works consist of Minidoka Dam and Powerplant and Lake Walcott, Jackson Lake Dam and Jackson Lake, American Falls Dam and Reservoir, Island Park Dam and Reservoir, Grassy Lake Dam and Grassy Lake, two diversion dams, canals, laterals, drains, and some 177 water supply wells.

Project Plan – Operations

Natural flow of the Snake River and some of its tributaries, and water stored in the reservoirs at Jackson Lake, Grassy Lake, Island Park, American Falls, and Lake Walcott are delivered at numerous diversion points to the A & B, Falls, Fremont-Madison, Burley, and Minidoka Irrigation Districts, American Falls Reservoir District No. 2, and supplemental supply contractors.

A full or supplemental irrigation water supply is furnished to about 1.1 million acres. Water from Palisades Reservoir in the Palisades Project is instrumental in helping meet the Minidoka Project water requirements.

Originally power was developed on the project for pumping water to lands lying above the gravity canals and for pumping drainage water. Power was also furnished to several small communities in the area. Subsequently, Federal power has been provided for groundwater pumping projects.

Facility Descriptions

Minidoka Dam and Powerplant

Minidoka Dam is a combined diversion, storage, and power structure located just south of Minidoka, Idaho. A key structure in the initial development of the project, the zoned earthfill dam is 86 feet high. The reservoir, Lake Walcott, has a total storage capacity of 210,200 af (active 95,200 af). Water is diverted at the dam into a canal on each side of the river. The original concrete powerplant, forming a section of the dam, was completed in 1909 and had five generating units. Unit 6 was added in 1927 and unit 7 in 1942 to provide a total capacity of 13,400 kW.

During 1989 - 1990, the spillway radial gates were replaced. The original gates were installed in 1913 and were in need of complete replacement.

Units 1 through 5 in the Minidoka Powerplant have been retired and preserved as museum pieces in the powerplant. Unit 6 has been replaced and modern controls have been installed in Unit 7. In addition, a new powerhouse, the Allen Inman Powerplant, housing two units was constructed near the left abutment of the dam. With these changes, the nameplate generating capacity was increased from 13,000 kW to about 28,000 kW. These activities were completed in 1997.

North Side Canal

Water is diverted from the north side of Lake Walcott into the North Side Canal, a gravity canal and lateral system serving 72,000 acres of land called the Gravity Division, in the vicinity of Rupert, Idaho. The 8-mile main canal has an initial capacity of 1,700 cfs.

South Side Canal

Water is diverted on the south side of Lake Walcott near the right abutment of Minidoka Dam into the South Side Canal. The 13-mile canal serves a narrow strip of the Gravity Division before delivering the majority of its flow to a series of three large pumping plants. Each plant lifts the water about 30 feet, for a total lift of about 90 feet. The system, served by the pumps, is known as the South Side Pumping Division and serves 48,000 acres adjacent to Burley and Declo. The canal is 13 miles long and has an initial capacity of 1,325 cfs.

Title to the South Side Canal, as well as all rights-of-way, pumping plants, canals, laterals, drains, transmission lines, and appurtenant facilities, were transferred to the Burley Irrigation District (the operating agency for the South Side Pumping Division) in 2000, pursuant to Congressional authorization.

Jackson Lake Dam

A temporary rock filled crib dam was completed in 1907 by Reclamation at Jackson Lake to store 200,000 af for the Minidoka Project until the storage requirements could be determined. A portion of this dam failed in 1910, and in 1911 a concrete gravity structure with earth embankment wings was built at the site. The new dam increased storage capacity to 380,000 af. In 1916, further construction raised the dam 17 feet to a structural height of 65.5 feet, with a total storage capacity of 847,000 af (active 847,000 af).

Safety concerns were identified at the dam in the mid-1970's, and from 1977 to 1989 the level of Jackson Lake was maintained at a lower than normal level because of concerns for possible dam failure during an earthquake. The dam foundation was completely replaced using a technique called dynamic compaction, and a grout curtain was installed below the foundation. The combination water release structure/bridge was also replaced. This work was completed in 1989 under authority of Reclamation's Safety of Dams Act making the full capacity available again.

American Falls Dam

Project storage was increased by 1,700,000 af in 1927 with the completion of American Falls Dam, a 94-foot-high composite concrete and earth structure on the Snake River near American Falls, Idaho. A core-drilling program in the early 1960`s revealed that the concrete in portions of the dam was in a relatively advanced stage of deterioration due to a chemical reaction between alkalis in the cement and the aggregate. This type of reaction, unknown at the time of construction, resulted in a significant loss in strength and durability, threatening the competence of the dam. In the early 1970`s, storage was limited to 11.3 feet below full pool, which reduced the reservoir storage capacity to 1,125,000 af, about 66 percent of maximum design capacity.

By congressional act of December 28, 1973, the American Falls Reservoir District, acting as the constructing agency representing the storage space holders, was authorized to finance and contract for the replacement of American Falls Dam. The new dam, completed in 1978, replaced the concrete portion of the original structure and was built immediately downstream from the old dam. During reconstruction the reservoir area was surveyed and the total storage capacity is now 1,672,600 af (active 1,672,600 af).

Island Park Dam

The Upper Snake River Division of the project includes Island Park Dam, Cross Cut Canal and Diversion Dam, and Grassy Lake Dam.

Island Park Dam is located 38 miles north of Ashton, Idaho, on Henrys Fork. The dam is a zoned earthfill structure 91 feet high. Water stored at Island Park and Grassy Lake Reservoirs is used in Fremont and Madison Counties in northeastern Idaho, and Teton County in Wyoming.

Island Park Reservoir has a total storage capacity of 135,500 af (active 135,200 af) which includes 1 foot of surcharge that is filled on a recurring basis and is part of the allocated storage space.

Safety of Dams modifications were completed at Island Park Dam in the early 1980's. This consisted of replacing the deteriorated concrete in the spillway and excavation and replacement of liquefiable materials in the right abutment.

Cross Cut Diversion Dam and Canal (Title Transfer)

Water for irrigation in the Upper Snake River Division is diverted from Henrys Fork into the Cross Cut Canal by the Cross Cut Diversion Dam. The dam is a concrete weir which raises the water 10 feet above the streambed.

Cross Cut Canal extends southeast from the diversion dam 6.6 miles to the Teton River. The canal furnishes irrigation water for 112,000 acres of land in Fremont and Madison Counties. The title to the Crosscut Diversion Dam and Canal has been transferred to the Fremont-Madison Irrigation District.

Grassy Lake Dam

This 118-foot-high zoned earthfill storage dam is on Grassy Creek in Wyoming near the southern boundary of Yellowstone National Park. The reservoir has a total storage capacity of 15,500 af (active 15,200 af) which supplements the storage at Island Park. Storage at Grassy Lake Dam is augmented by a 0.7-mile canal from Cascade Creek which is fed from the Cascade Creek Diversion Dam, a rock filled log crib weir that is 14 feet high.

Recent operation and maintenance modifications included the installation of a seepage blanket and drain at the toe of the dam in 1996 and 1997. Due to the poor condition of the spillway chute concrete, the reservoir had been restricted 1 foot below full capacity for the summer resulting in a storage capacity of 14,800 af.
During the winter there was a 5 foot restriction resulting in a storage capacity of 13, 655 af. Corrective action work was completed in the year 2000. In 2006, the spillway was replaced due to damage caused by concrete deterioration.

Milner-Gooding Canal

In 1928, construction began on the Gooding Division of the Minidoka Project. The work consisted primarily of building the Milner-Gooding Canal which heads at Milner Dam on the Snake River 12 miles west of Burley, Idaho. This 70-mile canal extends to the North Gooding Main Canal northwest of Shoshone, Idaho.

The Milner-Gooding Canal and its connecting laterals furnish a full water supply for 20,000 acres and a supplemental supply for 78,667 acres. The initial capacity of the canal is 2,700 cfs. Title to the Milner-Gooding Canal and all appurtenant structures was transferred to the American Falls Reservoir District #2.

North Side Pumping Division

The North Side Pumping Division consists of some 77,000 acres of irrigable public land that have been withdrawn from entry, of which some 62,000 acres (Unit B) are irrigated by pumping ground water from deep wells, and 15,000 acres (Unit A) by pumping from the

Snake River. A portion of the storage space in American Falls Reservoir, augmented by storage from Palisades Reservoir, is used to supply irrigation water to Unit A lands.

Water for Unit A is pumped from the Snake River by a pumping plant located about 8 miles west of Burley. The plant capacity is 270 cfs and the dynamic head is 168 feet. The pumping plant delivers water to a 4.4-mile-long unlined canal that has the same capacity.

Seven groups of deep wells, totaling 177 wells from 12 to 24 inches in diameter, initially supplied water for Unit B. The average discharge of these wells was about 6.4 cfs. Currently, 174 wells are being used. A distribution system consisting principally of unlined ditches distributes water in both units.

The A & B Irrigation District, (operating agency of the North Side Pumping Division) in conjunction with Reclamation, has undertaken a program to enhance wetlands. The purpose of this program is to address the quality of runoff, both natural and irrigation return flows, which are injected into the aquifer by drainage wells, and to provide wildlife habitat and to allow reuse. Wetlands naturally filter water as it flows through the vegetation and provides a mechanism for increased natural recharge. Several wetland projects are completed and others are on-going.

During replacement of American Falls Dam, the Idaho Power Company relocated its powerplant to take advantage of head that was previously wasted between the reservoir surface and the powerplant forebay, increasing the generating capacity to 112,400 kW.

In 1991, the Falls River Rural Electric Cooperative (FRREC) received a license from FERC to construct and operate a small powerplant at Island Park Dam, located on the Henrys Fork of the Snake River. Generation from the 2-unit, 4,800 kilowatt plant began in 1994.

Fall River Rural Electric Cooperative (FRREC) also received approval in 1995 to modify the spillway of Island Park Dam with an adjustable lip to allow water that was previously spilled during irrigation surcharge to be passed through the powerplant to provide additional power generation. This modification, which is a 1-foot-high inflatable rubber collar, was completed in 1995. When Island Park Reservoir elevation is above 6302.0 feet, the rubber collar can be inflated or deflated to control spill. Operation of the rubber collar also improves water temperature conditions downstream in Henrys Fork, which benefits its rainbow trout fishery. Table 8 summarizes the number of pumping plants, number of units in each, total capacity in cfs, total dynamic head in feet, and total horsepower.

Table 8—Minidoka Project Pumping Plant Data

Designation	Number of Units	Total Capacity (cfs)	Total Dynamic Head (ft)	Total Horsepower
South Side Pumping Division				
Lift No. 1	6	1,011	31	4,040
Lift No. 2	6	891	34	3,590
Lift No. 3	3	453	31	2,340
North Side Pumping				
Unit A	5	240	168	6,000
Unit B	177	1,128	129-345	38,000
Totals	197	3,723	393-609	53,970
Source: Reclamation website				

Operating Agencies

The Gravity Division has been operated by the Minidoka Irrigation District since January 1, 1917; the South Side Pumping Division by the Burley Irrigation District since April 1, 1926; Gooding Division by American Falls Reservoir District No. 2 since May 1, 1933; and the Upper Snake River Division by Fremont-Madison Irrigation District since November 15, 1940. The Fremont- Madison Conveyance Act (Public Law 108-85) directs the Secretary of the Interior, through Reclamation, to transfer all right, title, and interest of the United States in certain facilities, land, and a water right permit of the Minidoka and Teton Basin Projects to the Fremont Madison Irrigation District. The North Side Pumping Division, last to be developed, was turned over to the A&B Irrigation District for operation on March 1, 1966. Operation of Island Park Dam and Grassy Lake by Fremont Madison Irrigation District.

Project Development

History

In 1904, the lower Minidoka Project area around the present cities of Burley and Rupert was a nearly uninhabited sagebrush desert with only a few scattered ranches. After construction of the initial phases of the project brought water to the land, giving opportunity for expansion, it became a prosperous, highly developed farm area. By 1919, 2,208 farms were in operation, there were 6 towns, and the total population was about 17,000.

Investigations

Early investigations of irrigation possibilities in Idaho were made under the direction of the Geological Survey in 1889-1890. These surveys included a preliminary examination of the Minidoka Project, when survey lines were run from 15 to 35 miles westward on both sides of the Snake River from the Minidoka Dam site. Additional surveys were made in 1895. Private organizations became interested in developing the area at various times after 1887.

At the time of passage of Reclamation Act of June 1902, considerable data relative to the area were available for use by the State Engineer, who was responsible for cooperating with Reclamation Service in Idaho. During 1902, information obtained about the storage potential in the headwaters of the Snake River indicated that suitable capacities could be developed at reasonable cost. On November 17, 1902, the Secretary of the Interior withdrew from public entry a large body of land embracing the proposed irrigable area of the Minidoka tract, rendering it subject to filing under the terms of Reclamation Act.

Authorization

The Minidoka Project was authorized by the Secretary of the Interior on April 23, 1904, under the 1902 Reclamation Act. Investigation and construction funds for the Gravity Extension Unit (Gooding Division) were provided by the Interior Department Appropriation Act, 1927, the Act of January 12, 1927 (44 Stat. 934) and the Secretary`s finding of feasibility July 2, 1928, and was approved by the President on July 3, 1928 pursuant to section 4 of the Act of June 25, 1910 (36 Stat. 836) and subsection B of section 4 of the Act of December 5, 1924 (43 Stat. 702). The Upper Snake River Storage Project was authorized by a finding of feasibility by the Secretary of Interior on September 6, 1935, and approved by the President on September 20, 1935, pursuant to the foregoing acts. The North Side Pumping Division was authorized for construction by the Act of September 30, 1950 (64 Stat. 1083, Public Law 81-864). Replacement of American Falls Dam was authorized by Act of December 28, 1973 (87 Stat. 904, Public Law 93-206).

Subsequently however, the Act of September 25, 1979 (93 Stat. 437, Public Law 96-69) authorized that unobligated appropriations made for the payment of Teton Dam failure claims of up to $19 million could be used to pay some of the American Falls Dam replacement costs and would be non-reimbursable pursuant to Reclamation Safety of Dams Act.

Transfer of facilities and rights-of-way of the South Side Pumping Division to the Burley Irrigation District was authorized by the Congress on January 27, 1998 (112 Stat. 3219-3221; Public Law 105-351).

The original authorized purpose of each storage facility of the Minidoka Project: Minidoka Dam, irrigation and power; Jackson Lake Dam, irrigation, American Falls Dam, irrigation and power; Island Park Dam, irrigation; and Grassy Lake Dam, irrigation.

The Act of September 30, 1950, authorizing the Palisades Project, authorizes the upper Snake River reservoir system to be operated for flood control.

Construction

Construction activities on the project began in 1904 at Minidoka Dam which, with its associated diversions and canals, formed the nucleus of the present development. Headwaters storage began with the erection of the temporary Jackson Lake Dam in 1905.

Later major developments were the enlargement of Jackson Lake in 1911 and 1916, the original construction of American Falls Dam in 1925-1927, construction of Grassy Lake and Island Park Dams in 1935-1939, and American Falls Replacement Dam in 1976-1978.

The first power came from the Minidoka Powerplant in 1909; the last generator was installed in 1942.

Construction on the last project land area to be developed, North Side Pumping Division, began in 1948 and was completed in 1959.

The Palisades Reservoir, while not a part of the Minidoka Project, contributes greatly to the project`s success by storing excess flows for later release and by increasing the available power supply.

Project Benefits

Although the Minidoka Project has irrigation, recreation, fish and wildlife, hydropower, and flood control benefits, only irrigation and hydropower benefits are included below.

Irrigation

There are over a million irrigated acres in the arid Snake River valley of southern Idaho. Much of the famed Idaho potato crop is grown in this valley, and sugar beets, dry beans, sweet corn, field grains, alfalfa hay, and irrigated pasture diversify the land use. Cattle raising and dairying are important industries.

Hydroelectric Power

The Minidoka Powerplant serves large irrigation pumping requirements on and near the Minidoka Project in southern Idaho. Power not needed for Reclamation project purposes is marketed in the Federal Southern Idaho Power System administered by the Bonneville Power Administration.

Minidoka Project Federal Reserved Rate

Minidoka Project districts receiving the Federal reserved Southern Idaho rate include A&B Irrigation District, Burley Irrigation District, Falls Irrigation District, Milner Irrigation District, and Minidoka Irrigation District. Southern Idaho power plant net generation is a combination of the Boise, Minidoka, and Palisades Project hydropower production which also include Anderson Ranch and Black Canyon hydropower plants, as shown in appendix B under "plant net generation (kWh)." The table displays Southern Idaho irrigation pumping rates for fiscal years 2001 – 2014, with 2015 – 2020 year forecast estimations.

Southern Idaho rates fall under a contract for one rate for all districts, although transmission rates vary.

The FY14 actual period rate was 22.80 mills/kWh which has been the same rate since FY08, and the estimated 2015 rate is 25.00 mills/kWh. Based on estimated 2015 rates, A&B Irrigation District's wheeling rate is expected to be 8.45 mills/kWh, Burley Irrigation District at 2.38 mills/kWh, and Falls Irrigation District would be 5.70 mills/kWh. The Milner Irrigation District and Minidoka Irrigation District are near the substation so there are no wheeling costs.

Owyhee Project

Summary

In the Owyhee Project, the Owyhee Ditch Company, Owyhee Irrigation District, and South Board of Control receive the Federal reserved Southern Idaho rate, shown in table 2, and appendix B. A summary of basic project comparison elements is shown in table 9. The Owyhee Project, authorized in 1926, lies west of the Snake River in Malheur County, Oregon, and Owyhee County, Idaho.

About 72 percent of the lands are in Oregon, and 28 percent in Idaho, shown in figure 2. Irrigable lands are divided into the Mitchell Butte, Dead Ox Flat, and Succor Creek Divisions. Principal towns in the area are Homedale, Idaho, and Adrian, Nyssa, and Ontario, Oregon.

The project furnishes a full irrigation water supply to roughly 105,000 acres of land lying along the west side of the Snake River in eastern Oregon and southwestern Idaho. An additional estimated 13,000 acres are furnished supplemental water. The fertile lands and favorable climate, combined with a good supply of irrigation water, make possible the production of abundant crops on the Owyhee Project, principally grain, hay, pasture, sugar beets, potatoes, onions, sweet corn, and alfalfa seed. Livestock and dairy products contribute to the returns from the land.

Recent estimates show irrigated acreages to be between 102,723 and 110,015 acres. The area received an average annual precipitation amount of 9.8 inches, average annual mean temperature is 51 degrees Fahrenheit with about an 188-day growing season and mean elevation of between 2,250 and 2,500 feet.

The key feature of the project is Owyhee Dam, on the Owyhee River about 11 miles southwest of Adrian, Oregon, which acts as both a storage and diversion structure. Project works also include canals, pipelines, tunnels, 9 pumping plants (table shows 26?), laterals and drains, and 3 non-Federal power plants. Water for irrigation of project lands is both stored in Lake Owyhee and pumped directly from the Snake River. The water is released from Lake Owyhee through a 3.5- mile tunnel to Tunnel Canyon where the North and South Canals have their headings. The North Canal distributes water to the Mitchell Butte and Dead Ox Flat Divisions. The South Canal distributes water south to the Succor Creek Division.

Originally, the irrigation works were designed to supply water to the entire project by gravity from Lake Owyhee. Because of the irregular flow of the Owyhee River, storage of a 2-year water supply is advisable. Pumping water from the Snake River for lower lying lands makes this possible. A contract executed in 1936 provides for the operation of existing pumping plants to irrigate from 30,000 to 35,000 acres.

Project works, except Owyhee Dam and related works which were retained and operated by Reclamation, were transferred to the water users (represented by the North and South Boards of Control) in 1952 for operation and maintenance. Two years later, Owyhee Dam and related works also were transferred to a Joint Committee comprised of representatives of the

North and South Boards of Control for operation and maintenance. On July 14, 1989, all irrigation entities of the North Board of Control merged into the Owyhee Irrigation District and the North Board of Control was dissolved. Owyhee Dam is now operated by the Owyhee Irrigation District in cooperation with the South Board of Control.

Table 9—Owyhee Project Summary

Project Element	Data
Irrigated acres	102,723 – 110,015 acres*
Average annual precipitation	9.8 in
Mean temperature	51° F
Growing season	188 days
Elevation of irrigable areas	2,250 – 2,500 ft
Project authorization	1926
Storage Dams	1
Canals	172 mi
Laterals	543 mi
Pumping Plants	9
Drains	227 mi
Power plants	3 (non-Federal)
Transmission Lines	19.4 mi
Substations	7

Source: Reclamation Water and Power Resources Project Data and website
*110,015 figure from current GIS information; 102,723 taken from 1992 data.

General Description

The Owyhee Project lies west of the Snake River in Malheur County, Oregon, and Owyhee County, Idaho. Principal towns in the area are Homedale, Idaho, and Adrian, Nyssa, and Ontario, Oregon. The project furnishes a full irrigation water supply to over 105,000 acres of land lying along the west side of the Snake River in eastern Oregon and southwestern Idaho. An additional 13,000 acres are furnished supplemental water. About 72 percent of the lands are in Oregon, and 28 percent in Idaho. Irrigable lands are divided into the Mitchell Butte, Dead Ox Flat, and Succor Creek Divisions. The key feature of the project is Owyhee Dam, on the Owyhee River about 11 miles southwest of Adrian, Oregon, which acts as both a storage and diversion structure. Project works also include canals, pipelines, tunnels, 9 pumping plants, laterals and drains.

Project Plan – Operations

The Owyhee River Basin above Owyhee Dam contains 11,160 square miles and has an average runoff of about 760,000 af. Water for irrigation of project lands is both stored in Lake Owyhee and pumped directly from the Snake River. The water is released from Lake Owyhee through a 3.5-mile tunnel to Tunnel Canyon where the North and South Canals have their headings. The North Canal distributes water to the Mitchell Butte and Dead Ox Flat Divisions. The South Canal distributes water south to the Succor Creek Division.

Originally, the irrigation works were designed to supply water to the entire project by gravity from Lake Owyhee. Because of the irregular flow of the Owyhee River, storage of a 2-year water supply is advisable. Pumping water from the Snake River for lower lying lands makes this possible. A contract executed in 1936 provides for the operation of existing pumping plants to irrigate from 30,000 to 35,000 acres.

Facility Descriptions

Owyhee Dam

Owyhee Dam is a concrete, thick-arch structure which was designed to carry about three-fourths of the water load by arch action, and the remainder by gravity action. The dam rises 417 feet above foundation in the river section, and 530 feet above the low point of the excavated fault zone. At the time of its construction, Owyhee ranked as the world`s highest dam. The arch section is 623 feet long, and a gravity tangent extends 210 feet to the right abutment. The total capacity of Lake Owyhee is 1,120,000 af (active 715,000 af).

Owyhee Dam became a proving ground for theories being developed to assist with the design and construction of Hoover Dam, whose unprecedented size - it would tower more than 300 feet higher than Owyhee - required totally new construction methods. The trial load method of design, developed first for Pathfinder and Buffalo Bill Dams, was refined in the design of Owyhee Dam and, later, Hoover Dam. Cooling methods, necessary to remove excess heat of cement hydration from mass concrete and bring a dam to stable temperatures, were carefully studied. A 28-foot-square section extending through the dam was cooled artificially by circulating river water through 1-inch pipes spaced at 4-foot intervals.

Water for irrigation is diverted through a horseshoe-type tunnel 16 feet 7 inches in diameter and 3.5 miles long. This tunnel heads in the reservoir 80 feet below normal maximum water surface.

The needle valves in the outlet works were replaced by the jet flow gates in 1991 as a part of an operation and maintenance modifications program.

North Canal

This canal extends from the diversion works, 3.5 miles from Owyhee Dam, northward 61.5 miles to the Snake River near Weiser, Idaho. The diversion capacity is 1,190 cfs. The canal contains several siphons and tunnels. The most noteworthy structure is the Malheur River Siphon, which carries water from the Mitchell Butte Division across the Malheur Valley to the Dead Ox Flat Division. It is an 80-inch steel pipe siphon approximately 4.3 miles long with a monolithic concrete pipe section at each end. The design capacity of the siphon is 325 cfs.

South Canal

The South Canal extends from the diversion works near Owyhee Dam through a 5-mile tunnel and then southward 37 miles to the Snake River south of Marsing, Idaho. The diversion capacity of the canal is 490 cfs.

Pumping Plants

Dead Ox Pumping Plant, on the Snake River about 5 miles north of Payette, Idaho, pumps water to several irrigation districts in the Dead Ox Flat Division. The plant has five pump units with a total capacity of 176 cfs.

Owyhee Ditch and Ontario-Nyssa Pumping Plants, on the Snake River 5 miles south of Nyssa, Oregon, pump water to the former Ontario-Nyssa Irrigation District area and the Owyhee Ditch Company in the Mitchell Butte Division. The Owyhee Ditch Pumping Plant has a capacity of 222 cfs and the Ontario-Nyssa Pumping Plant a capacity of 130 cfs.

Gem Pumping Plant, 2 miles south of Marsing, Idaho, pumps water from the Snake River to the Gem Irrigation District in the Succor Creek Division. It has a capacity of 334 cfs.

Power Distribution System

Power from the Southern Idaho Federal Power System is transmitted over lines of a private power company to various points on the Owyhee Project. A project transmission line extends 19.4 miles from Ontario-Nyssa substation at Dunaway, Oregon, to Owyhee Dam.

Non Federal Powerplants

In the 1980s, the water users began pursuing development of hydroelectric power generating facilities on the Owyhee Project and obtained Federal Energy Regulatory Commission licenses to construct and operate three powerplants. These included a 5,000 kilowatt powerplant at Owyhee Dam, using power outlet facilities installed during construction, an 8,000 kilowatt powerplant at Tunnel No. 1, the major diversion works for the project, and a 2,000 kilowatt powerplant on the Mitchell Butte Lateral. These powerplants were placed in operation between 1985 and 1993. Table 10 summarizes the number of pumping plants, number of units for each, total capacity in cfs, total dynamic head in feet, and total horsepower.

Table 10—Owyhee Project Pumping Plant Data

Designation	Number of Units	Total Capacity (cfs)	Total Dynamic Head (ft)	Total Horsepower
Mitchell Butte Division				
Ontario-Nyssa	4	130	120	2,250
Owyhee Ditch	3	222	50	1,500
Dead Ox Flat Division				
Dead Ox	5	176	50-111	2,675
Succor Creek Division: 1				
Succor Creek No.	1	15	61	---
Succor Creek No.	1	15	66	---
Gem District				
Gem	9	334	76-180	7,610
South	1	13	20	40
North	1	5.5	33	30
Kingman Colony District				
Kingman Colony	1	6	44	40
Totals	26	916.5	520-685	14,145
Note: Succor Creek No.1 and No. 2 are direct-connected hydraulic powered units. Other plants are supplied power from Boise Project power plants.				
Source: Reclamation website				

Operating Agencies

Project works, except Owyhee Dam and related works which were retained and operated by Reclamation, were transferred to the water users (represented by the North and South Boards of Control) in 1952 for operation and maintenance. Two years later, Owyhee Dam and related works also were transferred to a Joint Committee comprised of representatives of the North and South Boards of Control for operation and maintenance. On July 14, 1989, all irrigation entities of the North Board of Control merged into the Owyhee Irrigation District and the North Board of Control was dissolved. Owyhee Dam is now operated by the Owyhee Irrigation District in cooperation with the South Board of Control.

Project Development

History

Scouts, trappers, and traders visited the project lands in the early part of the 19th century. Permanent settlers arrived about 60 years later. At the beginning of the 20th century, irrigation in the project area was limited to about 6,000 acres from Owyhee Ditch, diverted from the Owyhee River, and to smaller acreages from Wilson Ditch, the Snake, and individual diversions from Succor Creek. Later, private organizations became interested in developing storage to provide adequate late-season water and to irrigate additional lands at higher elevations. Several dam sites were investigated and various irrigation plans considered, but the inaccessibility of the sites made construction costs prohibitive.

Investigations

From 1903 to 1905, Reclamation Service made topographic surveys of the irrigable lands in the Owyhee River Basin and of possible reservoir sites. During the following years several reports were made by Government engineers, State cooperative boards, and private companies. After studying various plans and making intensive investigations, Reclamation issued a feasibility report in January 1925 that recommended construction of the project substantially as it has been developed.

Authorization

Construction of the project was found feasible by the Secretary of the Interior on October 9, 1926, and approved by the President on October 12, 1926 under the provisions of section 4 of the Act of June 10, 1910 (36 Stat. 836) and subsection B of section 4 of the Act of December 5, 1924 (43 Stat. 702). The authorized purpose of the Owyhee Project is irrigation.

Construction

Contracts were awarded and work started on the storage dam and canal system in 1928. The first water from constructed works was delivered to the project lands in 1935, and the lateral system was extended to the last irrigation area in 1939.

Project Benefits

Although the Owyhee Project benefits include flood control, irrigation, and recreation and fish and wildlife, only irrigation is discussed because of relevance. The fertile lands and favorable climate, combined with a good supply of irrigation water, make possible the production of abundant crops on the Owyhee Project, principally grain, hay, pasture, sugar beets, potatoes, onions, sweet corn, and alfalfa seed. Livestock and dairy products contribute to the returns from the land.

Owyhee Project Federal Reserved Rate

Southern Idaho power plant net generation is a combination of the Boise, Minidoka, and Palisades Project hydropower production which also include Anderson Ranch and Black Canyon hydropower plants, as shown in appendix B under "plant net generation (kWh)." The table displays Southern Idaho irrigation pumping rates for fiscal years 2001 – 2014, with 2015 – 2020 year forecast estimations. Southern Idaho rates fall under a contract for one rate for all districts, although transmission rates vary. The Owyhee Irrigation District, Owyhee Ditch Company, and South Board of Control receive Southern Idaho power rates. The Owyhee Irrigation District has a 2015 estimated wheeling rate of 1.83 mills/kWh. The Owyhee Ditch Company has a 2015 estimated wheeling rate of 1.69 mills/kWh. The Southern Board of Control has a 2015 estimated wheeling rate of 1.94 mills/kWh.

Yakima Project

Summary

The Yakima Project, authorized in 1905, provides irrigation water for a comparatively narrow strip of fertile land that extends for 175 miles on both sides of the Yakima River in south-central Washington. A summary of basic project comparison elements is shown in table 11. The irrigable lands presently being served total approximately 464,000 acres. Crop production on the Yakima Project occurs on nearly one-half million acres of land. Principal crops are fruit, vegetables, forage, hops, and mint (Reclamation, accessed May 2015). Average annual precipitation is 7.5 inches with a mean temperature of 50 degrees Fahrenheit and a growing season of 177 days and elevation of 400 to 2,200 feet.

There are seven divisions in the project: Storage, Kittitas, Tieton, Sunnyside, Roza, Kennewick, and Wapato. The Wapato Division is operated by the Bureau of Indian Affairs, but receives most of its water supply from the Yakima Project for irrigation of 136,000 acres of land. Over 45,000 acres not included in the seven divisions are irrigated by private interests under water supply contracts with Reclamation.

Storage dams and reservoirs on the project are Bumping Lake, Clear Creek, Tieton, Cle Elum, Kachess, and Keechelus. Other project features include 7 storage dams, 5 diversion dams, 416 miles of canals, 1,698 miles of laterals, 30 pumping plants, 144 miles of drains, 3 power plants, and transmission lines. The project has an installed generating capacity of 24,937 kW. Much of the power produced is used for pumping irrigation water; the surplus is marketed by the BPA as a part of the Columbia River Federal Power System.

In terms of operating entities and preferential power rates, the Roza Irrigation District is the only district receiving Federal reserved power, shown in table 2. The Kittitas Division is operated by the Kittitas Reclamation District, the Roza Division by the Roza Irrigation District, the Kennewick Division by the Kennewick Irrigation District, and the Tieton Division by the Yakima-Tieton Irrigation District. The major features of the Sunnyside Division distribution system are operated by the Sunnyside Valley Irrigation District and the Board of Control. The Storage Division is operated by Reclamation. Pumping plants and laterals serving the smaller districts are operated and maintained by those districts. Laterals of 10 cfs or less usually are maintained by the water users. The Wapato Division is operated by the Bureau of Indian Affairs.

Table 11—Yakima Project Summary

Project Element	Data
Irrigated acres	325,514 – 511,123 acres*
Average Annual	7.5 in
Mean Temperature	50° F
Growing season	177 days
Elevation of irrigable areas	400 - 2,200 ft
Project Authorization	1905
Storage Dams	7
Diversion Dams	5
Canals	416 mi
Laterals	1,698 mi
Pumping Plants	30
Drains	144 mi
Power plants	2
Transmission Lines	73.4 mi
Substations	11

Source: Reclamation website Last updated January 2013
*511,123 figure from current GIS information; 325,514 taken from 1992 data.

General Description

The Yakima Project provides irrigation water for a comparatively narrow strip of fertile land that extends for 175 miles on both sides of the Yakima River in south- central Washington. The irrigable lands presently being served total approximately 464,000 acres.

There are seven divisions in the project: Storage, Kittitas, Tieton, Sunnyside, Roza, Kennewick, and Wapato. The Wapato Division is operated by the Bureau of Indian Affairs, but receives most of its water supply from the Yakima Project for irrigation of 136,000 acres of land. Over 45,000 acres not included in the seven divisions are irrigated by private interests under water supply contracts with Reclamation. Storage dams and reservoirs on the project are Bumping Lake, Clear Creek, Tieton, Cle Elum, Kachess, and Keechelus. Other project features are 5 diversion dams, canals, laterals, pumping plants, drains, 3 powerplants, and transmission lines.

Project Plan – Operations

Irrigation water for the approximately 59,000 acres of land in the Kittitas Division is diverted from the Yakima River into the Main Canal by the Easton Diversion Dam near Easton, Wash. The Main Canal carries the water along the south side of the river to a point near Thorp, where it divides into the North and South Branches. The North Branch Canal crosses the Yakima River through a siphon to irrigate land lying on the north side of the river, while the South Branch Canal continues generally southeast from the point of division to irrigate lands lying on the south side of the river.

The Tieton Division includes nearly 28,000 acres of land lying west of the city of Yakima between the Naches River and Ahtanum Creek. Irrigation water for the lands in this division is diverted from the Tieton River by the Tieton Diversion Dam, about 8 miles downstream from Rimrock Lake. The diversions flow through Tieton Main Canal and, after supplying the distribution system of the Tieton Division, drain into Ahtanum Creek about 14 miles west of Union Gap.

The Sunnyside Division consists of some 103,000 acres of land lying mostly north of the Yakima River, and extends from the Sunnyside Diversion Dam, on the Yakima River near Parker, to the vicinity of Benton City. Water is diverted from the Yakima River by the Sunnyside Diversion Dam and flows generally southeast through the Sunnyside Canal, which supplies the distribution system of the division. Four irrigation districts in the Sunnyside Division pump water to their lands by hydraulic turbine pumps at drops on the Sunnyside Canal.

The Roza Division, a unit containing approximately 72,500 acres of land north of the Yakima River, extends from the vicinity of Pomona to a point north of Benton City. The distribution system is supplied by the Roza Canal, which originates at the Roza Diversion Dam on the Yakima River about 10 miles north of Yakima. The Roza Powerplant is adjacent to the Roza Canal, 3 miles from Yakima.

The Kennewick Division is a combined irrigation and power development. It includes the 12,000-kW Chandler Powerplant and over 19,000 acres of irrigable land, of which some 4,600 acres are in the Kennewick Highlands and have been irrigated for many years. All of the lands receive a full water supply.

The Storage Division has supervision over the entire Yakima River water supply, both natural river flow and the stored water in six reservoirs. The reservoirs have a total active capacity of 1,065,400 af.

Facility Descriptions

Bumping Lake Dam and Bumping Lake

Bumping Lake Dam is an earthfill structure on the Bumping River about 29 miles northwest of Naches. The dam, completed in 1910, is 60 feet high and contains 253,000 cubic yards of material. In 1973, the road crossing the spillway was replaced and a new concrete T-beam bridge was installed to replace a wood-truss bridge. Situated at the lower end of a natural lake, the dam formed a reservoir with an active capacity of 33,700 af constructed over a natural lake having unknown dead storage capacity.

Modifications to Bumping Lake Dam were undertaken in 1994-1997 under Reclamation's Safety of Dams Program. These modifications included the installation of an interceptor drain at the downstream toe of the dam, construction of downstream and upstream stability berms, replacement of the concrete spillway, installation of a steel liner in the outlet tunnel, and replacement of the outlet channel lining. The outlet gates, gate house, and gate operators were replaced in the early 1990's.

Kachess Dam and Kachess Lake

Kachess Dam is an earthfill structure located on the Kachess River about 2 miles northwest of Easton. This dam, 115 feet high with a volume of 200,000 cubic yards, also was built at the lower end of a natural lake, and created a reservoir with an active capacity of 239,000 af constructed over a natural lake having unknown dead storage capacity.

The discharge channel for Kachess Reservoir is 2,877 feet long and was constructed from the natural lake to the intake structure of the dam's outlet works. This was done so the natural lake could be used for storage. The first 1,182 feet consists of an open cut inlet channel leading to a 9 foot diameter tunnel for 1,393 feet and then 302 feet of open channel to the intake structure. Significant siltation had occurred in the discharge channel causing a restriction in passing the necessary water downstream.

In 1996, sediment was removed from the inlet channel and a new channel was excavated along the existing tunnel. In addition, a new intake structure was constructed, the steel bridge from the dam to the intake structure replaced, and the outlet works conduit lined with a minimum of 4-inch thick reinforced concrete overlay. The channel improvements were accomplished under Phase II of the Yakima River Basin Water Enhancement Project; Title XII of the Act of October 31, 1994. The intake structure and outlet conduit work was done as a part of Reclamation's Operations and Maintenance Modifications Program.

Keechelus Dam and Keechelus Lake

Keechelus Dam was constructed at the lower end of a natural lake and is on the Yakima River 10 miles northwest of Easton. This earthfill structure, completed in 1917, is 128 feet high and contains 684,000 cubic yards of material. Keechelus Lake has an active capacity of 157,900 af constructed over a natural lake having unknown dead storage capacity. Total rehabilitation of the outlet works and control tower was started in 1976. The two original cylinder gates were replaced by a single 8.5-foot-square hydraulically operated slide gate, and a new concrete chute and stilling basin that is 156 feet long, 18 feet wide, up to 28 feet deep was constructed. The concrete outlet conduit was partially lined with reinforced concrete, and a 22-inch-diameter pipe was installed in the outlet conduit to bypass minimum flows for fishery and stream enhancement when the outlet gates are closed.

In mid-1998, it was determined that dam safety deficiencies existed at Keechelus Dam due to the potential for dam failure from piping and/or internal erosion of embankment materials. A reservoir operating restriction to elevation 2510 feet was imposed together with increased monitoring and surveillance pending implementation of corrective actions. This operating restriction limited storage to 140,920 af. The reservoir could be operated above elevation 2510 feet for the control of large flood events. Modifications were performed on the dam between April 2002 and November 2003 under Reclamation's Safety of Dams Program.

Modifications included removing and rebuilding much of the dam cross-section to include embankment zones and drainage features, construction of a bentonite slurry cutoff wall in the right abutment, and construction of a downstream drain along the entire length of the dam - all to control seepage and prevent internal erosion of the new structure. The reservoir operating restriction was lifted in early 2004.

Clear Creek Dam and Clear Lake

Clear Creek Dam, a concrete thin-arch structure on the North Fork of the Tieton River about 30 miles southwest of Naches and 48 miles west of Yakima, creates a reservoir with an active capacity of 5,300 af. The dam is 83 feet high and contains 5,800 cubic yards of concrete. Originally constructed in 1914, the dam was raised 21 feet in 1918 to its present height. Rehabilitation work in 1964 consisted primarily of placing new concrete in the arch section between elevation 2,991.0 and the crest, repairing cracks and poorly consolidated concrete with neoprene and epoxies, and installing protective wire-mesh fences from the abutments to upstream areas.

As the result of investigations conducted in 1987-1989, Reclamation concluded there were horizontal bands of deteriorated concrete in the section replaced in 1964. These conditions could result in sudden failure of the dam. The water level of Clear Lake was immediately lowered to reduce the likelihood of dam failure.

Early in 1990, two holes were cut through the dam to further drain the lake to a point that only 230 af could be stored.

Overwhelming public support was expressed for reconstructing the dam and returning Clear Lake to its original condition, due mostly to the loss of recreational value. Reconstruction was accomplished through local, State, and Federal funding and consisted of converting the dam into a gravity structure by buttressing the arch with a new concrete section immediately downstream. A new 48-inch outlet conduit was installed near the elevation of the breach (2956.5 feet) to permit discharge whenever the lake was below the spillway crest. Clear Lake is now used primarily for recreation and most of the discharge is by the spillway.

Tieton Dam and Rimrock Lake

On the Tieton River about 40 miles west of Yakima, Tieton Dam is an earthfill structure with a concrete core wall that extends from the crest to about 100 feet below the riverbed. The dam is 319 feet high and contains 2,049,000 cubic yards of material. The reservoirs active capacity is 198,000 af.

Cle Elum Dam and Lake

Cle Elum Dam, on the Cle Elum River 10 miles northwest of Cle Elum, is an earthfill dam constructed at the end of a natural lake that forms a reservoir with an active capacity of 436,900 af. The dam is 165 feet high and, including the dikes, contains 1,411,000 cubic yards of material.

The outlet works of Cle Elum Dam were modified in 1977-1979 under Reclamation's Safety of Dams Program.

Roza Diversion Dam

Roza Diversion Dam located 10 miles north of Yakima, diverts water from the Yakima River for irrigation and power. The dam is a concrete weir, movable crest structure, 486 feet long at the crest, 67 feet high, and contains 21,700 cubic yards of concrete.

Easton Diversion Dam

Easton Diversion Dam located on the Yakima River near Easton, is a concrete gravity ogee weir, movable crest structure. This dam is 66 feet high and contains 5,800 cubic yards of concrete.

Other Diversion Dams

Sunnyside Diversion Dam, on the Yakima River near Parker, is an 8-foot-high concrete weir with an embankment wing. Tieton Diversion Dam, on the Tieton

River about 16 miles southwest of Naches, is a 5-foot-high concrete weir, flanked by an embankment wing. Prosser Diversion Dam, on the Yakima River near Prosser, is a 9-foot-high concrete weir.

Intensive Federal, State, tribal, and local efforts in conjunction with the Northwest Power Planning Council resulted in Congress authorizing implementation of Phase I of the Yakima River Basin Water Enhancement Project in 1984. The purpose of Phase I is to reduce anadromous fish mortality at outdated fish ladders at diversion dams and inadequate fish screens at diversion canals. Ladders and screens at the largest diversion dams and canals were completed in 1989 and a similar Phase II program is underway at the smaller diversions.

Chandler Powerplant

The Chandler Powerplant develops 12,000 kW, which are delivered to the Bonneville Power Administration.

Roza Powerplant

More than 70 miles of transmission lines deliver power to pumping plants in the Roza Division. The Roza Powerplant develops 12,937 kW.

Canal and Drainage Systems

Main canals and laterals deliver water to the project lands. The canals vary in capacity from 347 cfs in Tieton Canal to 2,200 cfs in Roza Canal. Over 140 miles of drains make up the drainage system.

Replacement of the entire 320-mile distribution system of the Tieton Division was completed in 1986 by the Yakima-Tieton Irrigation District with 210 miles of a closed pipe pressure system, enabling about 85 percent of their service area to receive gravity pressure service. The remaining 15 percent of the area is provided pressure service by three small pumping plants.

A reregulating dam, French Canyon Dam, with a total capacity of 670 af (active 645 af) was constructed at the terminus of the main conveyance flume which carries water for 12 miles from the Tieton River diversion. Two small hydroelectric generating plants of 2,100 kW were also constructed to provide power for the pumping plants.

Water conservation measures have also been implemented by many of the irrigation entities in the Yakima Project with funding provided in part by the State of Washington. Improvements to water delivery systems are expected to continue with Federal and State funding to be provided from the Yakima River Basin Water Conservation Program, a part of Phase II of the Yakima River Basin Water Enhancement Project authorized by Congress in 1994.

Pumping Plants

The project has 30 pumping plants varying in capacity from 500 cfs at Chandler to 1.56 cfs at Hillcrest.

Under a rehabilitation and betterment agreement, Reclamation's installed a pumping plant and intake canal for the Cascade Irrigation District during 1974- 1975. The plant has eight units with a total capacity of 160 cfs and a dynamic head of 108 feet. The 1.3-mile-long Cascade Intake Canal diverts Yakima River water to the pumping plant that delivers the water through a 300-foot-long discharge line to the portal of Tunnel No. 7 on the Cascade Irrigation District Canal. Table 12 summarizes the pumping plants, number of units in each, total capacity in cfs, total dynamic head in feet, and total horsepower.

Table 12—Yakima Project Pumping Plant Data

Designation	Number of Units	Total Capacity (cfs)	Total Dynamic Head (ft)	Total Horsepower
Kennewick Division				
Chandler	2	500	108	5,200
Amon	1	20	225	700
Sunnyside Division				
Snipes Mountain Canal	2	80	63	850
Outlook	2	48	--	800
Grandview	3	38	35-78	365
West Grandview	1	4	64	--
Prosser	1	40	106	190
Spring Creek	1	22	77	160
Hillcrest	1	1.56	--	35
Kittitas Division				
Wippel	4	65	136.5	1,500

Roza Division				
Mile 7.2-Area No. 1	4	39	106-218	1,000
Mile 16.8-Area No. 2	5	56.6	106-233	1,600
Mile 22.5-Area No. 3	5	46.9	155-237	1,600
Mile 24.0-Area No. 4	2	14	164	400
Mile 27.0-Area No. 5	1	5.5	115	100
Mile 29.6-Area No. 6	1	5.5	151	125
Mile 37.8-Area No. 7	3	21.6	157	600
Mile 42.8-Area No. 8	3	32.1	144	750
Mile 48.5-Area No. 9	3	30.6	185	900
Mile 52.4-Area No. 9A	3	33	166	900
Mile 56.1-Area No. 10	2	13.5	139	300
Mile 61.8-Area No. 12	2	11.8	150	300
Mile 67.3-Area No. 13	2	48	111	800
Mile 71.0-Area No. 14	3	33	241	1,200
Mile 78.8-Area No. 15	6	77.1	148-275	2,550
Mile 81.5-Severyns	1	3	70	40
Mile 88.3-Area No. 16	5	46	139-271	1,500
Mile 92.7-Area No. 17	2	12.2	235	500
Terrace Heights	2	6	94	80
Cascade	8	160	108	2,400
Totals	81	1,513.96	3,698.5 – 4,321.5	27,445
Source: Reclamation website				

Operating Agencies

The Kittitas Division is operated by the Kittitas Reclamation District, the Roza Division by the Roza Irrigation District, the Kennewick Division by the Kennewick Irrigation District, and the Tieton Division by the Yakima-Tieton Irrigation District. The major features of the Sunnyside Division distribution system are operated by the Sunnyside Valley Irrigation District and the Board of Control. The Storage Division is operated by Reclamation. Pumping plants and laterals serving the smaller districts are operated and maintained by those districts. Laterals of 10 cfs or less usually are maintained by the water users. The Wapato Division is operated by the Bureau of Indian Affairs.

Project Development

History

The first settlers came to the Yakima Valley in about 1860. They were cattlemen attracted by the abundance of bunch grass and wild game, and the fertile bottom lands. The first irrigation ditch of record was constructed in 1864. The ditch conveyed water from Ahtanum Creek for irrigation of a small garden above the Catholic mission.

Hops were first raised in 1872, and alfalfa was successfully grown in 1881. Private canal companies were formed along the river, and successfully irrigated a large area. Construction of the Northern Pacific Railway into the valley in 1886 gave greater impetus to irrigation development.

Investigations

As a result of a petition dated January 28, 1903, from citizens of Yakima County to the Secretary of the Interior presenting the very favorable opportunities for construction and development, investigations were initiated which led to the beginning of construction by Reclamation Service. The Sunnyside and Tieton Units were approved for construction in 1905. Early in 1906, investigation of storage sites was initiated, including Bumping Lake, McAllister Meadows (Tieton Reservoir), and Cle Elum, Kachess, and Keechelus Lakes.

Studies on a proposed Bumping Lake Enlargement dating back to the mid-1960`s were issued in a March 1976 report prepared by Reclamation and the Fish and Wildlife Service. These studies centered on a proposal to construct a new dam on Bumping River about 4,500 feet downstream from the existing Bumping Lake Dam that would impound 458,000 af of water. Benefits from the proposed additional storage would include fish resource enhancement, supplemental irrigation, flood control, and recreation.

In 1979, Congress authorized a feasibility to address the water resource needs of the Yakima River basin; the Act of December 12, 1979 (93 Stat. 1241, Public Law 96-162). An outgrowth of this study was the implementation of Phase I (fish ladders and fish screens) and Phase II (water conservation and other measures) of the Yakima River Basin Water Enhancement Project.

Authorization

The Tieton Division and the Sunnyside Division were recommended for construction by the Director, United States Geological Survey on October 24, 1905, and November 8, 1905, respectively. Construction of these divisions was authorized by the Secretary of the Interior on December 12, 1905, pursuant to Reclamation Act of 1902 (32 Stat. 388).

The Benton Division, incorporated as a part of the Sunnyside Division, and the Kittitas and Wapato were reported on by a Board of the Army Engineers and approved by the President on June 5, 1911, under section 4 of the Act of June 25, 1910 (36 Stat. 935). Appropriations for the Kittitas Division were contained in the Department of Interior Appropriations, 1926, the Act of March 3, 1925 (43 Stat. 1141, Public Law 68-580).

The Department of Interior Appropriations, 1931, the Act of May 14, 1930 (46 Stat. 279, Public Law 71-217) appropriated funds for the construction of the Kennewick Highlands Project. A finding of feasibility was made on this project by the Secretary of the Interior on March 6, 1931 pursuant to subsection B of section 4 of the Act of December 5, 1924 (435 Stat. 672) and approved by the President on March 7, 1931, pursuant to section 4 of the Act of June 25, 1910 (36 Stat. 835). The Kennewick Division, which included the Kennewick Highlands Project, was authorized by the Act of June 12, 1948 (62 Stat. 382, Public Law 80-629).

The Roza Division was found feasible by the Secretary of the Interior on November 1, 1935, under subsection B of the Act of December 5, 1924 (43 Stat. 672) and approved by the President on November 6, 1935, under section 4 of the Act of June 25, 1910 (36 Stat. 835).

The Kennewick Division Extension was authorized on August 25, 1969 (83 Stat. 106, Public Law 91-66) but has been indefinitely deferred. Cascade Irrigation District rehabilitation and betterment work was authorized by Public Works Appropriation Act dated October 7, 1970 (84 Stat. 896, Public Law 91-439).

Replacement of the Tieton Division's distribution system was accomplished under authority of the Rehabilitation and Betterment Act of October 7, 1949 (63 Stat. 701, Public Law 81-335). Pursuant to the provisions of the Budget Reconciliation Act of 1987, the Yakima-Tieton Irrigation District repaid the discounted loan in July 1988. Title to the rehabilitated facilities was retained by the United States.

Phase I of the Yakima River Basin Water Enhancement Project, the construction of fish ladders and fish screens at diversion dams and diversion canals, was authorized by the Act of August 17, 1984 (98 Stat. 1333, Public Law 98-381) and the Act of August 22, 1984 (98 Stat. 1379, Public Law 98-396).

Phase II of the Yakima River Basin Water Enhancement Project was authorized by Title XII of the Act of October 31, 1994 (108 Stat. 4550, Public Law 103-434). Phase II measures include, among other things, the Yakima River Basin Water Conservation Program providing authority to appropriate funds for the acquisition of water for fish and wildlife and for measures to improve the efficiency of water delivery and use so instream flows for fish and the reliability of the irrigation supply is improved. Also, Phase II provides for a new operating regime for the Yakima Project of specified instream target flows over Sunnyside and Prosser Diversion Dams during April through October of each year in relation to the total water supply available. This new operating regime was initiated in 1995.

The original purpose of the Tieton, Sunnyside, Wapato, Kittitas, and Roza Divisions, as well as the Storage Division, was irrigation. The Kennewick Division was authorized for irrigation, hydroelectric generation, and the preservation and propagation of fish and wildlife. The fish and wildlife purpose is associated with fish screens in the Chandler Canal and fish ladders at Prosser Diversion Dam.

Title XII of the Act of October 31, 1994 authorized fish, wildlife, and recreation as additional purposes of the Yakima Project. These purposes however, shall not impair the operation of the Yakima Project to provide water for irrigation purposes nor impact existing contracts.

Construction of the Tieton and Sunnyside Units began in 1906. The first water for irrigation of project lands was available for the 1907 season, and on October 17, 1907, the Sunnyside Diversion

Dam was completed. Development of the project progressed with the construction of Tieton Diversion Dam in 1908, Bumping Lake Dam in 1910, Kachess Dam in 1912, Clear Creek Dam in 1914, Keechelus Dam in 1917, Tieton (storage) Dam in 1925, Easton Dam in 1929, Prosser Powerplant in 1932, Cle Elum Dam in 1933, Roza Diversion Dam in 1939, and Chandler Powerplant in 1956. Distribution systems were built concurrently with the storage and diversion facilities. Prosser Powerplant was retired in 1955, and Roza Powerplant was completed in 1958. Construction of Kennewick Division facilities began in January 1953, and were completed in January 1958. Cascade Irrigation District rehabilitation and betterment work began February 1974 and was completed in May 1975.

Construction of the Phase I fish ladders and fish screens at the larger diversion dams and diversion canals began in 1984 and were completed in 1989.
Implementation of Phase II water conservation and other measures is pending completion of funding prerequisites.

Project Benefits

Although the Yakima Project has irrigation, recreation, hydropower, and flood control benefits, only irrigation and hydropower are discussed since they are most relevant.

Irrigation

The record of crop production on the Yakima Project is outstanding. Nearly one- half million acres of sage-covered lands have been transformed into one of the richest agricultural areas in the Nation. Yakima County ranks first among all counties of the United States in the production of apples, mint, and hops. Principal crops are fruit, vegetables, forage, hops, and mint.

Hydroelectric Power

The project has an installed generating capacity of 24,937 kW. Much of the power produced is used for pumping irrigation water; the surplus is marketed by the Bonneville Power Administration, as a part of the Columbia River Federal.

Yakima Project Federal Reserved Rate

The Roza Irrigation District receives the Roza Federal reserved rate. Appendix B show Roza Irrigation District FY12-FY16 rates, up for district approval, which are a five year average and includes power plant O&M and amortizations, including the carriage system, at a total of 16.77 mills/kWh. The switchyard O&M, indirect costs, amortization, and RID irrigation power average equals a total switchyard cost of 2.72 mills/kWh. Special amortizations equaled 0.70 mills/kWh. Adding the power cost, switchyard cost and special amortization, the total 5-year average power cost for Roza ID was 20.18 mills/kWh. The Roza Irrigation District 2014 actual power generation rate was at total of 19.340 mills/kWh with no power baseload or transmission baseload charges.