



HARVESTS OF PLENTY

A History
of the Yakima
Irrigation Project,
Washington

Centennial
Edition

United States
Department of the Interior
Bureau of Reclamation

June 2002

Front Cover Photograph: Apples from the Oscar Ellefson Orchard, November 1909.
(National Archives, Rocky Mountain Region, Denver, Record Group 115)

Back Cover Photograph: Compacting the embankment of the Kittitas Main Canal, April 1928.
(National Archives, Rocky Mountain Region, Denver, Record Group 115)

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A HISTORY OF THE YAKIMA IRRIGATION PROJECT, WASHINGTON



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BUREAU OF RECLAMATION
UPPER COLUMBIA AREA OFFICE
YAKIMA, WASHINGTON

June 2002

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All photographs are on file in Record Group 115 at the National Archives, Rocky Mountain Region, Denver

Introduction

*Paradise is in the geographic center of the State of Washington,
the home of the big red apple, where dollars grow on trees.*

Dr. C.H. Burbank, 1911

These effusive words spoken at the National Congress of Irrigation reflect the spirit of unbounding optimism that permeated the Yakima Valley at the start of the twentieth century's second decade. The city of Yakima was experiencing a period of lively growth and, in all directions, signs of economic prosperity were apparent. Substantial commercial buildings sprouted up in the business district, and handsome homes lined the residential streets. The basis for the newfound wealth and confidence could be found in the surrounding valley, where a vast acreage of farms and orchards flourished, all made possible by irrigation.

The entry of the newly created United States Reclamation Service (Reclamation) into the Yakima Valley in the early twentieth century transformed a patchwork of small, private irrigation efforts into an integrated system that eventually provided water to almost one-half million acres. Even though the area was the site of Washington's earliest and most extensive private irrigation development, by 1905 the limits of that development had been reached.¹ All of the available unregulated flows of the Yakima River were in use, and water shortages plagued farming.² As was common in many other arid regions in the West, private irrigation interests simply lacked the financial resources and engineering capability to construct large-scale water storage and delivery systems.

The Yakima Project was among the first undertaken by Reclamation and, as also became a typical pattern, the intervention of the Federal Government was welcomed once locals became vexed by the shortcomings of private irrigation developments. These had been created where lands could be watered easily and inexpensively, but failed to deliver to lands where a considerable amount of investment was required. Citizens joined forces to petition Reclamation for an irrigation project and found their strongest advocate in their local

¹ Department of the Interior, U.S. Geological Survey, Second Annual Report of the Reclamation Service, p. 494.

² Relander, Click, "The Battleground of National Irrigation," Pacific Northwest Quarterly, Vol. 52, No. 4 (October 1961), p. 147.

Congressman, Wesley L. Jones. Later on, as farm prices fell following World War I, some of those same farmers who benefited early on from Reclamation water, objected to any further Federal involvement. They perceived additional irrigation development as competition.

Ultimately, the Yakima Project succeeded in making the Yakima Basin one of the most productive agricultural areas in the Nation. This was accomplished through the construction of six storage reservoirs in the Cascade Mountains that capture spring runoff and release it when needed during the summer months (see table 1). Together, the reservoirs store more than a million acre-feet of water. It is distributed to nearly one-half million acres of valley farmlands by six irrigation divisions, named for the geographic areas they serve. Among the six is an Indian reservation that was the object of an attempted “land grab” in the early project planning.³

The construction of all these facilities to store, regulate, and move water in a unified system that covers nearly 200 miles is an engineering feat. Tieton Dam stands out among the other features; at the time of its completion, it was heralded as one the largest dams in the world and the largest earth-filled dam. The Yakima Project has served its original irrigation purpose well for nearly 100 years and has brought prosperity to farmers who benefited from its waters; in fact, the first two Reclamation projects to repay their construction costs were in the Yakima Valley. However, all of this success in diverting water to make arid lands flourish has not occurred without consequences. In recent years, the negative effects on the native fisheries have increasingly been the focus of attention and, once again, the role of the Federal Government is being challenged.

Table 1.—Features of the Yakima Project

Storage Reservoirs			
Dam name	Construction dates	Storage capacity (acre-feet)	Major modifications
Bumping Lake Dam	1909-1910	33,700	1994-97: Safety of Dams rehabilitation, including new spillway
Kachess Dam	1910-1912	239,000	1990s
Keechelus Dam	1913-1917	157,800	Outlet works reconstructed 1976-78
Clear Creek Dam	1914-1915	5,300	Raised in 1918; rehabilitated in 1964
Tieton Dam	1917-1925	198,000	
Cle Elum Dam	1931	436,900	Spillway gates added in 1936

³ The Wapato Division was built and is operated by the U.S. Bureau of Indian Affairs.

Table 1.—Features of the Yakima Project (continued)

Irrigation Divisions					
Name	Authorization date	Initial construction date	Irrigable acres	Acres irrigated	Major modifications
Sunnyside	March 27, 1906	1906-1912 (originally constructed by private interests in 1891)	103,600	1911: 51,000 1913: 63,000 1923: 95,000 1929: 102,000 1946: 82,745 1960: 78,557	1914: Benton Extension
Tieton	March 27, 1906	1906-1911	ca. 24,000 Later increased and then reduced to 27,000	1913: 18,283 1923: 28,550 1929: 30,769 1946: 24,470	1916: Main Canal enlarged 1984-86: Piping of distribution system
Kittitas	December 25, 1925	1926-1932	72,000	1933: 50,484 1946: 54,186	
Roza	September 18, 1935	1936-46	72,000	1946: 27,108	
Kennewick	June 12, 1948	1952-1958	19,171		
Kennewick Extension	August 25, 1969	deferred			

Project Setting

Located in south-central Washington, the Yakima Basin sits in the rain shadow east of the Cascade Mountains.⁴ While the coastal lands west of the mountains are drenched with rain and the lands at the eastern edge of the State receive sufficient precipitation to grow crops without irrigation, the central area is arid. In fact, early surveyors scanning the vast sagebrush flats reported that the Yakima Valley was “fit only for a habitat of rattlesnakes and jack

⁴ The Yakima Basin includes both the Yakima and Kittitas Valleys. Yakima Valley is broadly used in this report to include the Kittitas Valley.

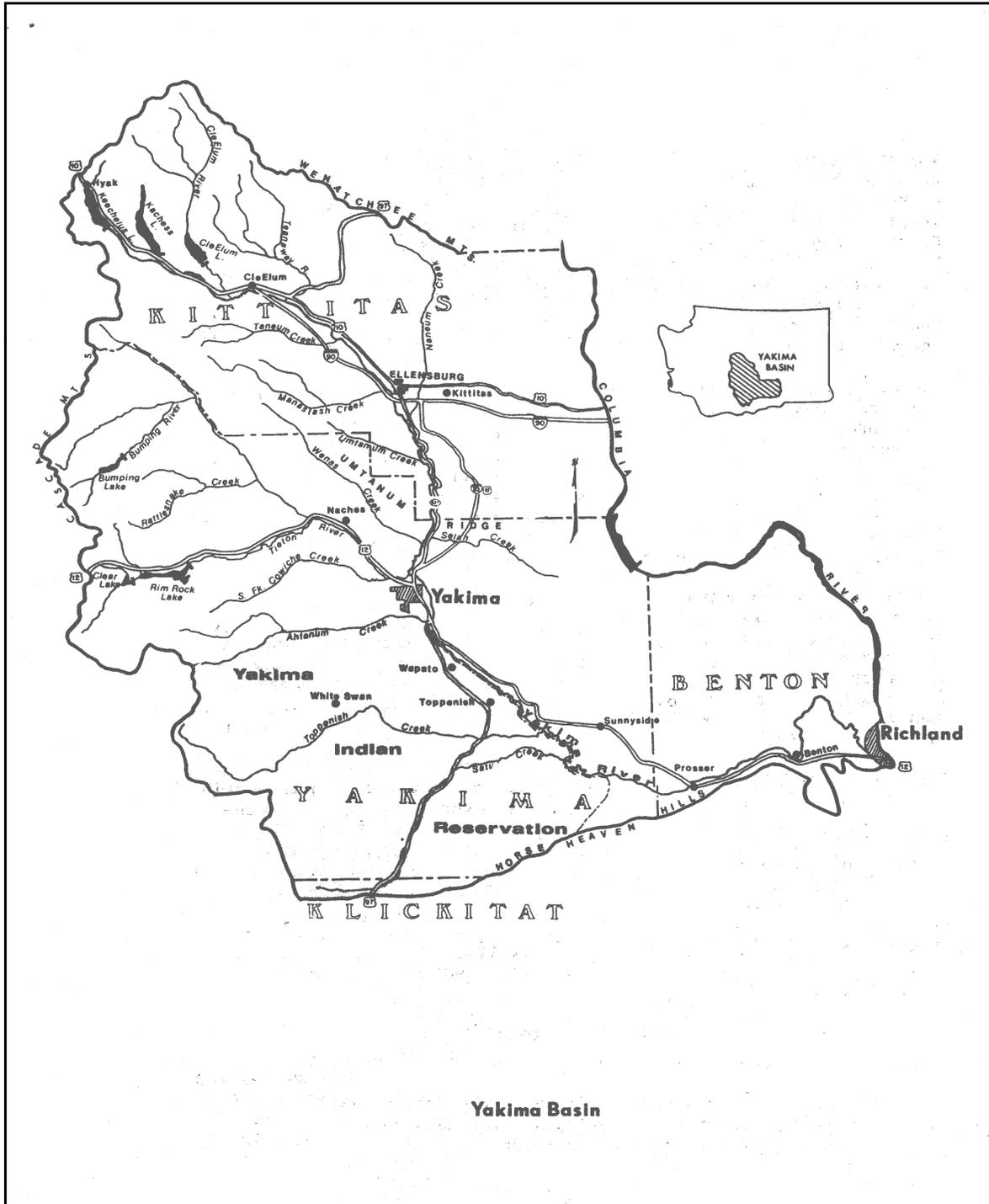


Figure 1.—Yakima Basin location map.

Source: Pacific Northwest River Basins Commission. The Yakima Basin Level B Study. May 1977.

rabbits.”⁵ Less than 10 inches per year of rain fall in the expansive basin, while the mountains to the north and west receive from 80 to 140 inches of moisture.

Defining the basin and capturing abundant moisture from the Cascade Range is the 216-mile-long Yakima River. With its headwaters below Snoqualmie Pass in the forested slopes above Keechelus Lake, the river flows in a general southeasterly direction through the broad Kittitas Valley, then through a series of ridges before entering Union Gap, a cut in Yakima Ridge about 6 miles south of the city of Yakima. Below that, the Yakima River turns to the east and flows through valley farmlands before entering the Columbia River about 10 miles above the mouth of the Snake River. The total length of the basin is about 135 miles, the greatest width is 65 miles, and the average width is less than 40 miles.

Along its route, the Yakima River collects water from various tributaries that spill down from the Cascade Mountains and its foothills. The largest of these tributaries, the Naches River, joins the Yakima River at the north edge of the city of Yakima. The Naches River has its own major tributaries, the Tieton and Bumping Rivers, which also drain the east slope of the Cascades. Just above Union Gap, the Yakima River gains additional waters from Ahtanum Creek,⁶ the last significant tributary before the river enters the Columbia. Other smaller tributaries in the lower basin include Toppenish and Satus Creeks.

An ample water supply, along with a favorable climate and fertile soils, all contribute to the Yakima River Basin’s predominance in agriculture. Warm, dry summers and cool, wet winters provide good growing conditions. The soils, largely comprised of volcanic ash, are rich and deep. Devoid of water they are unproductive, but with irrigation they yield plentiful crops.

⁵ U.S. Department of the Interior, Reclamation Service, Yakima Project, Annual Project History Through 1912, p. 1.

⁶ "Ahtanum" is sometimes spelled "Atanum." The former spelling will be used throughout this document.

Early Private Irrigation Efforts in Washington

Early irrigation in arid Washington consisted of small individual efforts undertaken by Euro-American settlers. Dr. Marcus Whitman is credited with constructing the first irrigation ditch in around 1840, at what later became the Whitman Mission Donation Land Claim, 6 miles west of Walla Walla.⁷ The next record of irrigation development took place in the Yakima Valley on Ahtanum Creek. In 1847, a mission was established on that stream by the Oblate Fathers and, prior to 1852, they furrowed out a ditch to irrigate their garden.⁸ Other individuals attempted modest irrigation enterprises in various parts of the State in the following decades. In 1858, Hiram Smith settled on Osoyoos Lake in Okanogan County and constructed a ditch to divert water from Nine Mile Creek to water his orchard. In the 1860s and early 1870s, additional irrigation development occurred in the Yakima Valley, around Walla Walla, and in the Wenatchee Valley. West of the Cascade Mountains, where the moist climate allowed agriculture without irrigation, small orchards were planted around Olympia, on the Island counties, and in the Puyallup and White River Valleys.

The diversion of water for irrigation on a small scale continued to be the pattern in Washington up until the early 1890s. Grass was the main crop grown on irrigated lands; orchards and vegetable gardens were cultivated primarily for domestic use. Individuals or, in some cases, small groups built ditches to take water mainly from creeks and streams, with a few from various rivers. All of these efforts were easily constructed, fairly primitive, and relatively inexpensive. Where farmers joined together and formed cooperatives to construct a ditch, the shareholders were local men, the capital was local, and the purpose was

⁷ Different dates are given for Whitman's Ditch. In Washington State Historical Society's Building a State, 1889-1939, 1846 is the year cited for construction. Rose Boening describes the ditch as being in place by 1841. See Boening, Rose M., "History of Irrigation in the State of Washington," Part One, Washington Historical Quarterly, Vol. 9, No. 4 (October 1918).

⁸ Numerous missions were founded in the Yakima Basin, thereby confusing exactly where irrigation occurred. Different sources also cite different dates for the establishment of various missions. The date of 1847 for the establishment of a mission by the Oblate Fathers on Ahtanum Creek (presumably St. Joseph's Mission) comes from Building a State, p. 233. According to the Yakima River Basin Historical Resource Survey, the St. Joseph mission on Ahtanum Creek was established in the summer of 1848 by the Oblate Fathers, Casimir Chirouse and George Blanchet. The mission was preceded a year earlier by that of St. Rose, located at the mouth of the Yakima River and also founded by the Oblate Fathers. See Heritage Research Center, Yakima River Basin Historical Resource Survey, Overview and Management Recommendations, Missoula, Montana, December, 1986, p. 43-44.

improvement of their respective lands. This type of individual or cooperative development reached its peak in the 1880s.

That same decade, construction of the transcontinental railroad network brought about significant changes in agricultural development. Outside of the major cities, Washington had remained a sparsely populated State until a transportation system made remote areas suddenly accessible. Lured by the publicity of the railroad companies, settlers moved into the “hinterlands,” hoping to achieve prosperity. Recognizing the financial potential of shipping produce to far off markets, many of the newcomers took up farming and, as a result, agricultural production greatly expanded.

In various locales, farmers began experimenting with planting orchards on a larger scale. Irrigation proved to be a necessary ingredient for excellent results. Most of the substantial irrigation development occurred east of the Cascades, along the Columbia plains, or in the foothills of the Cascades where the water supply was ample.⁹ In Garfield County, peaches, plums, prunes, apricots, grapes, and small fruits were nourished with water from the Snake River. Yakima and Walla Walla became the centers of apple production. By 1890, Yakima County was the leader in the amount of land dedicated to fruit growing and at the forefront of irrigation efforts. Over 3,500 acres were covered with orchards. Okanogan and Spokane Counties also could boast many fruit farms. Canning and packing plants sprang up in association with the burgeoning fruit industry. An increase in the growth of vegetables as commercial crops also occurred.

By the close of the 1880s, most of the waters of the small streams in central and eastern Washington had been appropriated and the easily constructed systems had been built. Although irrigation had advanced significantly in the State, it was still in an experimental phase; the number of acres irrigated in 1890 was 49,399, hardly a vast amount.¹⁰ Irrigation was practiced in two-thirds of the counties, yet only about 1 of every 10 farmers applied it. In fact, Washington had the smallest irrigated acreage of the leading 11 irrigation States.

To help support irrigation and attempt to address the increasing conflicts over water rights, the State legislature passed a law in 1890, allowing the organization of irrigation districts that followed certain procedures. The legislation also authorized irrigation districts to issue bonds

⁹ “Irrigation Aided by Irrigation in the State of Washington,” First Biennial Report of the State Board of Horticulture of the State of Washington for the Years 1891-1892, Olympia, Washington, State Printer, 1893, p. 288.

¹⁰ United States Geological Society, 13th Annual Report, 1891-1892, Part III, p. 124.

to cover operating costs. During the next 2 years, seven districts were established but after that no more were created until 1911, when the presence of Federal reclamation projects spurred activity.¹¹

The last decade of the nineteenth century witnessed a burst in irrigation activity in Washington, signaled by several factors. The first was the construction of larger and more complex irrigation projects, requiring substantial capital and engineering expertise. No longer were local interests necessarily capable of developing these systems; larger corporations funded by outside investors were formed to build water delivery projects. Eastern capitalists eyed the projects as lucrative financial opportunities with profits to be made in land and water sales.

Unfortunately, the larger irrigation systems constructed and eagerly promoted by outsiders did not always equate with success. Often, the projects were poorly designed and executed and, therefore, did not operate properly. Due to insufficient capital to complete various ambitious developments, some promoters first sold off the lands to be supplied with irrigation water and then sold the irrigation systems to the water users associations. The latter became strapped with systems that sometimes were inadequate to serve all the lands under them or, in other cases, the water supply was insufficient to reach all the lands. During the financial panic of 1893, a number of projects were abandoned altogether.

A second factor promoting irrigation development was the introduction of power for pumping water, allowing it to be delivered to areas that couldn't be reached with a gravity system. Along the Snake River, in particular, pumping was employed to raise water over the high banks. By 1900, irrigated acreage in Washington climbed to 135,470, almost a threefold increase since 1890. It was the greatest percentage increase in the period between 1890 and 1930. Even western Washington experienced irrigation development to augment precipitation and produce greater yields. Among the ventures undertaken was that in the Sequim area in Clallam County.¹² Yet even with all this growth, the State still lagged way behind others. In comparison, by 1900, Colorado had 1.6 million irrigated acres and California was close behind, with 1.5 million acres.¹³

¹¹ Dryden, Cecil, History of Washington, Portland, Oregon, Binford and Mort, 1968, p. 243; Nesbit, Robert C., and Charles M. Gates, "Agriculture in Eastern Washington, 1890-1910," Pacific Northwest Quarterly, Vol. 52, No. 4 (October 1961), p. 288.

¹² Building a State, p. 242.

¹³ Sheller, Roscoe, "Irrigation in the Valleys of the Yakima," draft manuscript, no date, p. 13.

Early Irrigation in the Yakima Valley

Dominating the irrigation scene in Washington at the turn of the century was the Yakima Valley. In 1890, Yakima County had 15,129 acres under irrigation. By 1900, the county could boast 47,588 irrigated acres and the largest system of canals in the State. The area was building a reputation as a center of orchard cultivation, with its fruits being shipped to many different markets.¹⁴ Popular periodicals and brochures eloquently touted the advantages and opportunities of the prospering valley and enticed new settlers. At the center of activity was the City of North Yakima, now simply called Yakima, located between the Selah Gap to the north and the Union Gap on the south.

Irrigation in the Yakima Valley had an early start. The first attempts appear to have been made in 1847 by the Oblate priests who established a mission among the Yakima Indians, occupants of the area during the period of Euro-American exploration and settlement.¹⁵ Some sources state that the Indians learned simple irrigating techniques from the missionaries; others suggest that Chief Kamiakin irrigated a garden with water from Ahtanum Creek prior to that time. At any rate, by the mid-nineteenth century, the Yakama cultivated streamside gardens, where they raised potatoes, melons, squash, barley and Indian corn.¹⁶

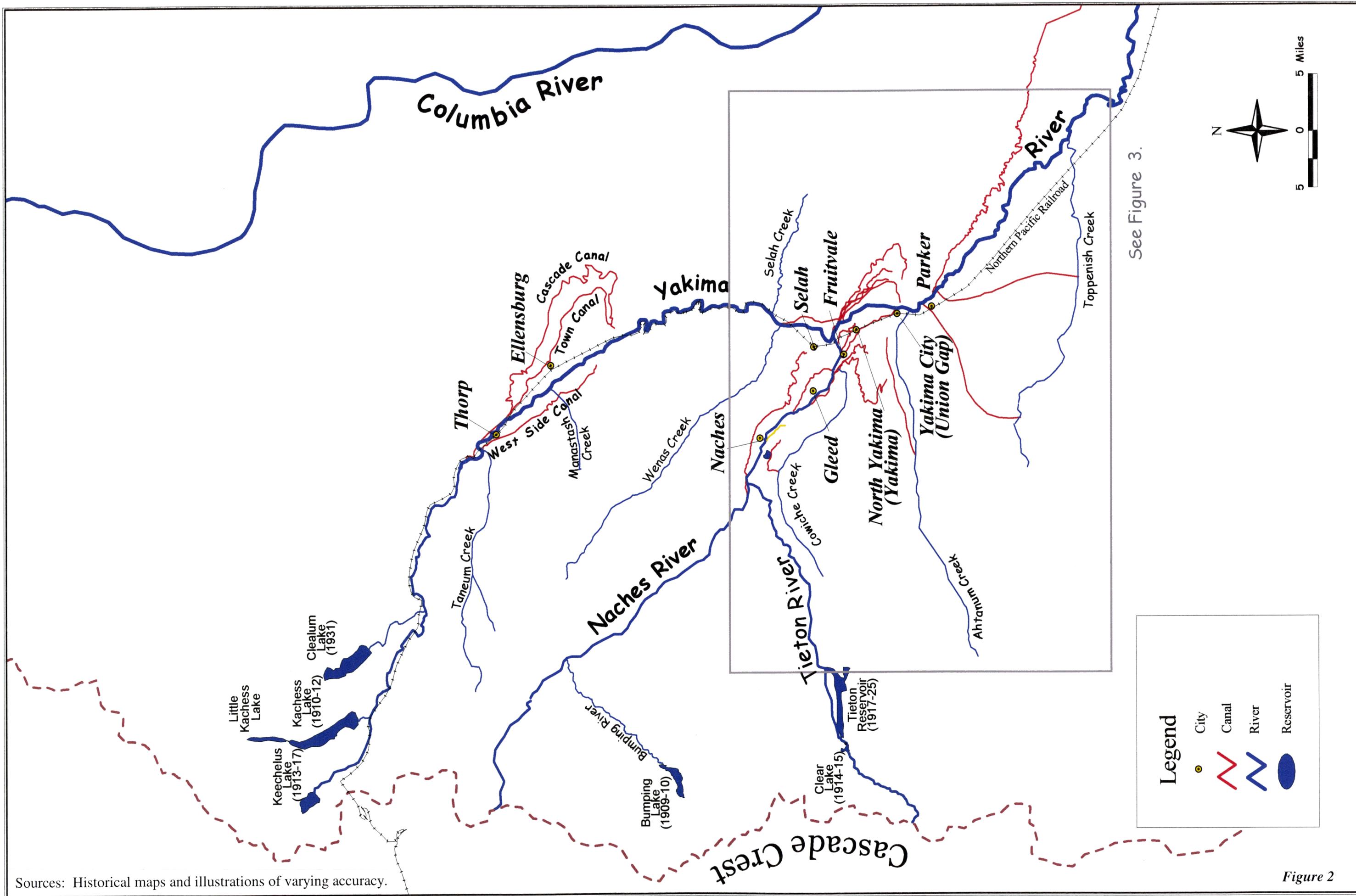
As throughout the West, the entry of Euro-American settlers created conflict with the Indian inhabitants as their territory was increasingly appropriated. In May 1855, Territorial Governor, Isaac F. Stevens, assembled leaders of the various tribes of the interior plateau region to negotiate a treaty. The outcome was the ceding to the United States of about 17,000 square miles of territory from the crest of the Cascade Mountains on the west to the Columbia River on the south, including much of the Columbia Basin lands east of the Columbia River. Lands reserved for the Yakima Indians were located in the southwest corner of the Yakima Valley and totaled 1,875 square miles, extending from the crest of the Cascades down to the fertile valley lands west of the Yakima River. The treaty was not ratified by Congress until March 8, 1859, after which President Buchanan signed it on April 18, 1859. By then, violent outbreaks between the Yakima and Euro-Americans had ended.

With the settlement of Indian conflicts and creation of the Yakima Indian Reservation, the Yakima Valley experienced a slow influx of settlers. In 1861, F. Mortimer Thorpe became

¹⁴ Pollard, Lancaster, *A History of the State of Washington*, American Historical Society, New York, 1937, p. 264-266; Nesbit, "Agriculture in Eastern Washington," p. 286.

¹⁵ The Yakama Nation currently uses an "a" instead of an "i" in Yakima. The latter spelling is used throughout this document to be consistent with the historic literature that was consulted.

¹⁶ CH2M Hill, *Historic and Archaeological Resources in the Yakima-Tieton Irrigation District*, November 1982, p. 5-5.



See Figure 3.

Sources: Historical maps and illustrations of varying accuracy.

Figure 2

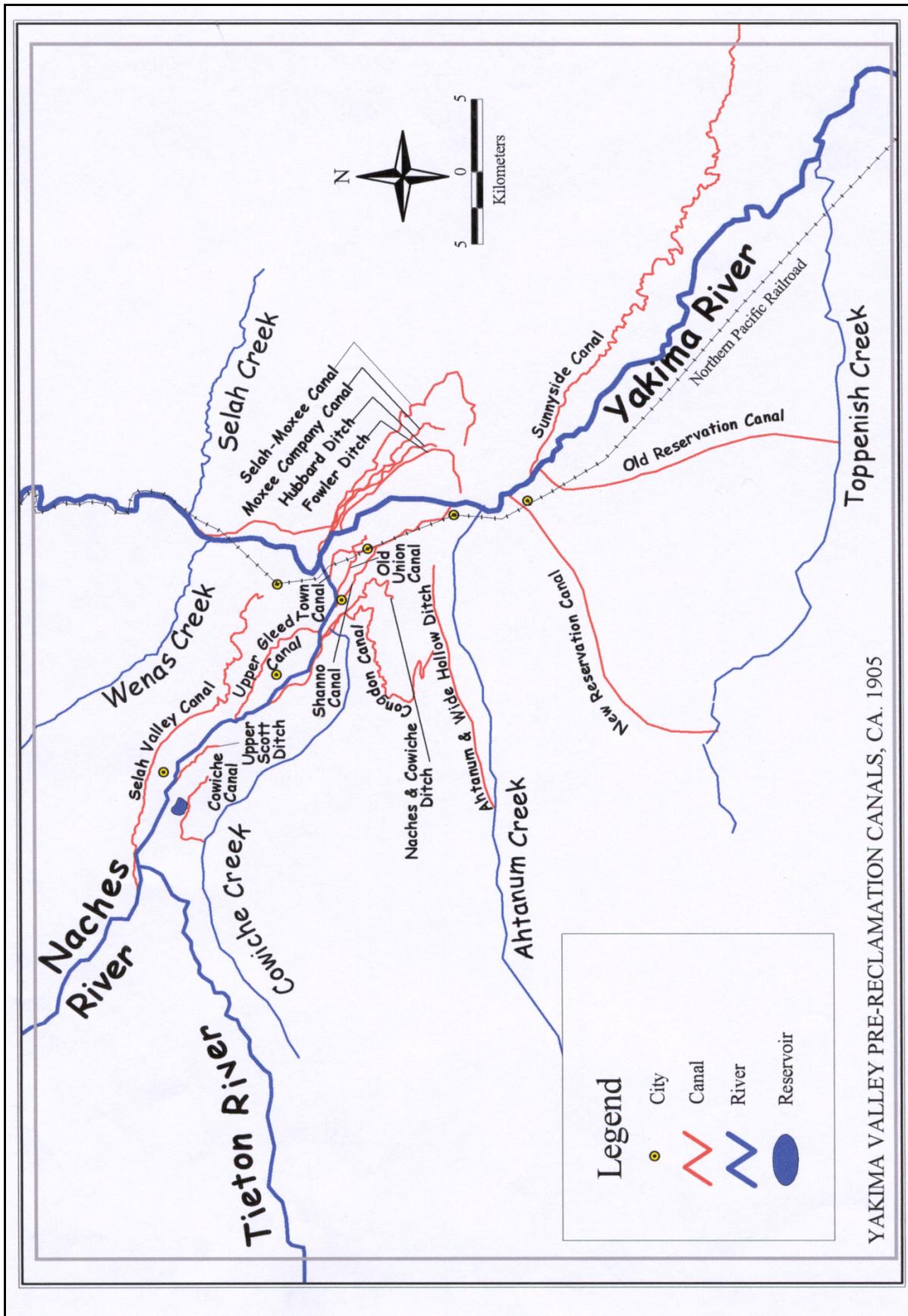


Figure 3
 Source: Historical maps and illustrations of a varying accuracy.

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the first known pioneer in the area, when he and his family settled with a herd of cattle at what became known as Moxee City.¹⁷ The earliest to arrive were cattlemen who grazed livestock on the open grasslands and sold beef to hungry miners in Idaho and Montana. The ranchers established small subsistence gardens, which they watered with simple ditches from nearby streams and rivers. Not surprisingly, the newcomers chose to cultivate lands where water was readily available. Cattle, sheep, and horse ranching continued to dominate in the Yakima Valley through the 1870s and into the early 1880s. As elsewhere in Washington, grain and hay were the principal crops grown during this period. Local ranchers tended to dismiss the notion of farming, saying that the “land was no good except for pasture.”¹⁸

Yet throughout the area, individual attempts at irrigation were demonstrating the possibilities of farming.¹⁹ Some of the more prominent efforts will be discussed here to provide an overview of that development. The Naches River was the source for a number of the earliest irrigation endeavors in the Yakima Valley. Entering the Yakima River from the northwest, the Naches was later touted as the “most important stream for irrigation purposes in Washington,” due to the fact that its waters could easily be used to irrigate vast areas of the State’s best agricultural lands.²⁰ N.T. Goodwin and others who organized themselves as the Farmers Cooperative Company were among the first to dig a ditch from the Naches River. Around 1867, they began construction on a small diversion located 1 mile above the mouth of the Naches on the south side. In the 1870s, this ditch was enlarged and expanded, becoming known as the Old Union Canal. It was 6 miles long, approximately 7 feet wide, and traversed through North Yakima, eventually irrigating about 2,300 acres in and around that community.²¹ The Nelson Ditch, established by J.B. Nelson, took water from the north side of the Naches River and dates to this same period.

The first ditch of substantial size to be constructed in the area was that of the Shanno brothers, Charles and Joseph, and their partner, Sebastian Dauber. They settled on a sagebrush flat at what is now the town of Union Gap (then called Yakima City) and, in 1871, dug a ditch to

¹⁷ Sometimes, “Thorp” is spelled with an “e” at the end. According to Ch2M Hill, Thorpe settled first in the Klickitat Valley in 1858 then relocated to the Moxee Valley in 1861.

¹⁸ Barton, C.M., “North Yakima,” The Northwest Magazine (May 1889), p. 18.

¹⁹ The history of early irrigation development is somewhat confusing because different sources cite different dates and different spellings for various irrigation pioneers and ditches.

²⁰ Schiach, William Sidney, ed., An Illustrated History of Klickitat, Yakima, and Kittitas Counties, Spokane, Washington, Interstate Publishing Company, 1904, p. 316.

²¹ See State Board of Horticulture, First Biennial Report, 1893, p. 291; Boening, “History of Irrigation in the State of Washington,” October 1918, p. 265; U.S. Department of Agriculture, Office of Experiment Stations, Irrigation in the State of Washington, O.L. Waller, Bulletin 214, Washington, Government Printing Office, 1909, p. 41; Lyman, W.D., History of the Yakima Valley, Vol. I, Chicago, S.J. Clark Publishing Company, 1919, p. 353.

divert water from a branch of Ahtanum Creek to their property. The project was not particularly successful, so in 1873, they embarked on a more ambitious undertaking, constructing an 18-mile-long ditch to divert water from the south side of the Naches. The ditch, known as the Shanno Canal, measured 18 feet across the bottom and reached Yakima City in 1875. Initially, the water was primarily applied to small gardens and a little wheat. In 1881, the water was used to grow alfalfa, which became a major crop in the Yakima Valley.²²

Another cooperative effort to divert water from the Naches River was the Naches-Cowiche Canal. In 1880, a group of farmers combined resources to build a ditch to water lands to the west of North Yakima. A year later, the underfinanced project was reorganized and attracted new investors, including J.H. Hubbard of Washington, DC. The ditch, with a heading on the south side of the Naches River, 5 miles northwest of North Yakima, was apparently renamed the Hubbard Ditch, and the project was brought to fruition.²³ The Scott Ditch dates to 1885 and was also built by private parties. Its heading was in the south side of the Naches River, about 12 miles above its mouth. The 3-mile-long ditch irrigated about 60 acres of alfalfa, clover, hops, potatoes, sorghum, and wheat.²⁴

A number of early ventures used the Yakima River as the source for irrigating crops. Around 1872, Judge John W. Beck constructed a ditch from the Yakima River to water his lands near Union Gap. There, he established a prospering orchard of about 100 trees. In 1879, another canal was built to divert water from the Yakima River, just below Union Gap, to irrigate lands in that vicinity. Called the Konnewock Ditch, it played a prominent role in the history of Yakima. It was the first ditch of importance below the Union Gap and was the origin of the later and grander Sunnyside Canal. It also represented the transition to larger projects requiring cooperative effort. The initiative was spearheaded by Captain Robert Dunn, Joseph Bartholet, Sr, Matt Bartholet, and C.V. Fowler, and originally served 3,000 acres. The first water was diverted in the spring of 1880.²⁵ Another ditch that was constructed to obtain water from the Yakima, mentioned in several accounts and dating to this time period, is the Fowler

²² “Shanno” is sometimes spelled “Schanno,” or even “Scannon.” See Lyman, p. 353; Boening, p. 265.

²³ Waller, 1909, p. 41; Sheller, “Irrigation in the Valleys of the Yakima,” p. 35; U.S. Geological Survey, 19th Annual Report, 1897-98, p. 463. The history of this ditch is confusing because of the apparent name change (see Sheller). Some sources continue to refer to the Naches-Cowiche Canal. Another ditch referred to as the Hubbard was constructed to take water from the Yakima River near the mouth of the Naches River. It supplied water to lands belonging to the Moxee Company in the Moxee Valley, southeast of the city of North Yakima. (History of Klickitat, p. 317).

²⁴ State Board of Horticulture, First Biennial Report, p. 290-91; Yakima Valley Historical Society, “Minutes of Meeting at Museum,” February 14, 1960, p. 3.

²⁵ There are various spellings for the name of the ditch other than Konewock. They include “Konewock,” “Kennewock,” and “Konowock.” See Lyman, p. 362; U.S. Bureau of Reclamation memos dated August 14, 1926, to Irrigation Manager, Sunnyside, and August 16, 1926, from Assistant Engineer, Paul Taylor.

Ditch, constructed in 1884. The heading was on the east side of the Yakima River, near North Yakima, and the 8-mile-long ditch watered about 1,500 acres in the Moxee Valley. Crops grown included fruit, small grain, alfalfa, hops, corn, and tobacco.²⁶ The ditch was extended down around Union Gap in the early twentieth century to cover about 2,800 acres.²⁷

A ditch to divert water from Ahtanum Creek was constructed in 1879. Called the Ahtanum and Wide Hollow Ditch, it headed on the north side of the Creek and carried water for 10 miles toward the town of North Yakima, irrigating about 250 acres.²⁸ To the north, in the Kittitas Valley, irrigation followed the same pattern as throughout the basin. At first, small diversions were constructed to water small plots of land close to the supply. In 1870, the Cook family began using water from the stream that bears their name. A year later, a group of farmers built a ditch on Manastash Creek. The first substantial project in the Kittitas Valley was the construction of the Taneum Irrigation Canal, a considerable undertaking for the time. An association of farmers, with J.E. Bates as president, collaborated on the 9-mile-long canal, which had its heading on Taneum Creek and served 3,700 acres of land near Thorp in the west Kittitas Valley. The first water was delivered in 1873.²⁹ In 1885, the Town Canal was built by the Ellensburg Water Company to supply lands east of Ellensburg. This marked the first attempt to divert water from the Yakima River for property in the Kittitas Valley. By 1890, 17 miles had been completed and about 2,000 acres of orchard crops, wheat, oats, barley, potatoes, and hay were being irrigated.³⁰

On the Yakima Indian Reservation, small-scale irrigation was also initiated to produce crops on the arid but fertile valley lands. Although water rights were not specified in the 1855 treaty, it was intended that the now-confined Indians would settle into an agricultural lifestyle. Provisions were made in the treaty for an agricultural school and for a superintendent of farming to teach the Indians. By 1865, they had an estimated 1,000 to 1,200 acres under irrigation.³¹

With the ever-increasing number of irrigation enterprises in the Yakima Valley, it was inevitable that conflicts over water use would develop. To address the mounting problems,

²⁶ State Board of Horticulture, First Biennial Report, p. 291; Boening, "History of Irrigation in the State of Washington," 1918, p. 268. The latter cites the acreage watered as 15,000, which appears to be an error.

²⁷ Waller, 1909, p. 40.

²⁸ State Board of Horticulture, First Biennial Report, p. 290.

²⁹ Lyman, History of the Yakima Valley, p. 356. He states that the canal was "put through" in 1872. Boening, "History of Irrigation in the State of Washington," 1918, p. 264; Washington Historical Society, Building a State, p. 236.

³⁰ Lyman states that the ditch was built by the City of Ellensburg, p. 356. See also State Board of Horticulture, p. 289; Washington Historical Society, p. 236.

³¹ Boening, p. 272. For a description of early canals on the Yakima Indian Reservation, see Waller, p. 42.

Washington's territorial legislature passed a law in February 1886, regulating irrigation and water rights in Yakima and Kittitas Counties. Under the Act, owners of agricultural lands were granted the use of stream and creek water for irrigation. An additional advantage was given to farmers wishing to irrigate; condemnation of another person's property to build water conveyance structures was allowed if the owner objected. The principle of prior appropriation was established for water rights. Unforeseen and far greater problems revolving around the use of water would emerge in the following decades and require subsequent legislation.

Arrival of the Railroad

In addition to slowly expanding irrigation, other forces greatly influenced and hastened development in the Yakima Valley in the 1880s. With the entry of the Northern Pacific Railroad by the middle of the decade, dramatic changes occurred. The valley's isolation abruptly ended, and swift population growth followed. The pattern of settlement was largely determined by the railroad, which was granted practically one-half of the land in the valley, including thousands of acres on the Indian reservation. Townsites were established along the railroad right-of-way. Yakima City, now the site of the Town of Union Gap, was incorporated in 1883 with a population of 400. Shortly thereafter, the Northern Pacific Railroad announced its selection of a station site several miles to the north, in what would initially be called North Yakima. Fearful of the consequences of being bypassed, the disappointed and angry residents of Yakima City accepted the railroad's offer to move the town's buildings to North Yakima. Among the 60 or so structures relocated were the courthouse, First National Bank, and various hotels.³² The original town was subsequently renamed Union Gap. On January 27, 1886, North Yakima was pronounced the county seat of Yakima County and its prominence was clearly established. In 1918, North Yakima was shortened to Yakima.³³

Within a few years following its founding, North Yakima had the appearance of a bustling community. By 1890, the town had a population of 1,535 and a "fine new brick hotel, a spacious opera house, a dozen brick commercial blocks, two new bank buildings, and hundreds of modern frame residences." Electricity and a municipal water system were about to be introduced.³⁴ Residents of the area consisted primarily of "Americans," with some English, Scottish, Germans, and Swedes. The attributes of the city were enhanced by the lands

³² *The Yakima Valley*, North Yakima, Washington, Yakima Valley Commercial Club, 1911, p. 4.

³³ Dryden, *History of Washington*, p. 319.

³⁴ Barton, *Northwest Magazine*, 1889, p. 18.

around it, which were poetically described in a journal of the time as “pretty farms, smiling orchards, acres of hops vines, vast cattle ranges, blue tinted foot-hill, jagged peaks, leaping cascades, running rivers, purling brooks, mountain gaps and two snow-covered sentinels-Tacoma and Adams.”³⁵

In 1886, the town of Ellensburg was incorporated to the north, on the flatlands of the Kittitas Valley, the same year the Northern Pacific Railroad laid down its tracks there. The community grew quickly thereafter, spurred by the discovery of gold and iron in the Okanogan country. In 1888, Ellensburg doubled in population and, although it lost its bid as the site of the State capitol, it became the county seat.³⁶

With easy access to new markets for farm products, small-scale farming began to replace ranching as the dominant agricultural pursuit. Ten-acre tracts of tilled soil replaced the sage-covered rangelands. The variety of crops grown expanded to meet the demands of the wider marketplace. Alfalfa hay, fruit, and hops emerged as leading products. It was only natural that with greater profits to be made, larger-scale irrigation projects would be attempted.

The first of these was the Selah Valley Canal, constructed by the Selah Valley Ditch Company between 1887 and 1889. The canal had its heading on the north side of the Naches River, just above the mouth of the Tieton River, and generally paralleled the Naches. With a bottom width of 12 feet and a top width of 24 feet, the 30-mile-long canal was considered an ambitious undertaking at the time. Originally built to deliver water to 6,000 acres, it was extended in the early twentieth century to cover an additional 5,000 acres in the broad meadowlands of the Selah Valley.³⁷

Another major irrigation venture taking out of the Naches River was the inspiration of Chester A. Congdon, a lawyer and business entrepreneur who first visited the Yakima Valley in 1887 on an inspection tour. Impressed with what he saw, Congdon and several associates formed a partnership to purchase lands west of North Yakima in what became the “Nob Hill” section. To bring water to the newly acquired property, the syndicate formed the Yakima Valley Canal Company and constructed the Congdon Canal, sometimes referred to as the Yakima Valley Canal. The canal diverted water from the south side of the Naches River, 12 miles above its mouth. During its 16-mile course, much of the canal was in flumes, and it crossed Cowiche Canyon in an inverted siphon. Water carried in the canal helped transform the sagebrush desert between Cowiche and Ahtanum Creeks into “the splendid suburban

³⁵ Ibid.

³⁶ Dryden, p. 321.

³⁷ Waller, 1909, p. 40; Lyman, 1919, p. 353; Schiach, 1904, p. 317. The latter states that the canal irrigated 3,000 acres in 1901.

section which makes Yakima one of the wonders of the West.”³⁸ Construction of the canal started around 1894 and, at the time, the project was the second largest irrigation enterprise in the valley. Water was distributed among the company’s shareholders, with one share for each acre of land under the canal.

Along the Yakima River, a number of larger irrigation projects were initiated in the late nineteenth century; some were successful, others were not. In Kittitas County, more than 25,000 acres, primarily around Ellensburg, were irrigated by 1890 with water drawn from the Yakima River. A majority of ditches were still owned by the farmers using the water, but the two largest enterprises were owned by corporations. These included the previously mentioned Ellensburg Water Company Ditch and the Westside Irrigation Company’s canal, built in 1889. The latter, sometimes referred to as the West Kittitas Canal, generally paralleled the Yakima River on the west side, was 14 miles long, and averaged 12 feet wide. By 1900, the number of irrigated acres in the county had nearly doubled to 47,373.³⁹

One ambitious project, which would have added vastly to the irrigated acreage in Kittitas County, was the dream of local pioneers who organized the Kittitas Valley Irrigation Canal Company. In the late 1880s, they conducted some initial survey work for a “high line” ditch that would have watered over 80,000 acres in the northern part of the Kittitas Valley. In 1892, the company began construction of the canal and got as far as clearing a right-of-way 25 miles long and 100 feet wide. After spending about \$20,000, the project was abandoned, when the financial panic of 1893 brought work to a standstill. Years later, the project was resumed by the Bureau of Reclamation and will be discussed in a subsequent chapter of this report.⁴⁰

In contrast to the failed private effort to build a high line canal in the Kittitas Valley was the successful project undertaken by the Cascade Canal Company, a locally formed group with an initial capital of \$150,000. In 1903, they began construction of the Cascade Canal, whose intake was on the north side of the Yakima River, 5 miles above Thorp. The 43-mile-long canal traversed in a southeasterly direction and required nearly 6 miles of fluming and two tunnels. It delivered water to about 13,000 acres of irrigable farmlands near Ellensburg. In conjunction with the canal, the company filed a claim for water from Lake Kachess and, by 1904, had built a rock-filled timber crib dam at the south end of the lake. This was the first attempt in the valley to control irrigation flows by impounding the upper lakes.⁴¹

³⁸ Lyman, 1919, p. 361; see also Schiach, 1904, p. 317; Waller, p. 41.

³⁹ Pollard, 1937, pp. 46, 264.

⁴⁰ Washington Historical Society, 1940, p. 236; Schiach, 1904, p. 254; Lyman, 1919, p. 356.

⁴¹ Lyman, p. 357; Hess, Roise and Company, “Kachess Dam HAER No. WA-79, Kittitas County, Washington,” draft report, p. 9.

Farther down on the Yakima River, the Moxee Company, landowners in the Moxee Valley, built the Moxee Company Canal in 1888. With a heading on the east side of the Yakima River below the confluence with the Naches, the canal ran in a southerly direction and measured 18 feet wide on the bottom. Together with the Moxee Company's Hubbard Ditch, the Moxee Company Canal irrigated 7,000 acres.⁴²

In the same vicinity, the 27-mile-long Selah-Moxee Canal was constructed to water about 7,000 acres in the Selah and Moxee Valleys. The canal heading was on the east side of the Yakima River near the mouth of Selah Creek, and the route included a flume crossing the canyon of the Selah Ridge before entering the Moxee Valley. The project, which was owned and operated by a stock company, cost between \$70,000 and \$80,000. Company shares, each one representing 1 acre of land, initially cost \$25 and were almost all owned by farmers with property under the ditch. On June 8, 1901, a celebration was held to honor completion of the canal.⁴³

In the lower Yakima Valley, there were grandiose schemes for providing water to the dry lands in the Kennewick District. In 1893, the Yakima Irrigation and Improvement Company acquired the rights to the "Ledbetter" project, which had been launched several years earlier but had not progressed very far. The ambitious project involved the construction of a major ditch with a heading on the "south side of Horn Rapids," in the vicinity of Prosser Falls. Conceived by an eastern promoter named Ledbetter, the scheme originally contemplated the irrigation of about 210,000 acres.⁴⁴ By the end of 1893, the canal had been completed as far as Kennewick, some 34 miles from its starting point. A year later, water reached Hover. The canal was too small to provide an adequate water supply, however. Due to the hard economic times, work came to a standstill and remained so until 1902. That year, the ditch, water rights, and real estate of the struggling company were sold to the Northern Pacific Irrigation Company. After that, construction resumed, and by 1904, the canal was capable of irrigating 15,000 acres.⁴⁵

⁴² Boening, p. 268. The Moxee Company was under the presidency and management of William Ker. Gardiner Hubbard of Washington, DC (presumably J.H. Hubbard of DC, cited by Sheller) was, with Ker, the chief stockholder. See also Lyman, p. 354; Waller, p. 39. Lands in the Moxee Valley were also irrigated from artesian wells. By 1904, over 30 wells supplied water for agriculture. Schiach, p. 318.

⁴³ Lyman, p. 361; Waller, p. 39.

⁴⁴ U.S. Department of the Interior, Reclamation Service, History of the Washington Division, 1902-1913, Volume I, Part I, p. 100.

⁴⁵ Information on the construction of this canal is confusing, due to somewhat conflicting accounts. In Lyman, the name of the canal company is cited as the "Yakima Improvement and Irrigation Company." He states that the Northern Pacific Railroad purchased the canal rights in 1902. The First Biennial Report of the State Board of Horticulture, 1891-92, p. 291, refers to the company as the "Yakima Irrigating and Improvement Company." It appears that the company built a smaller, 9-mile-long ditch in 1889, with a heading on the north

Another noteworthy project in the lower Yakima Valley involved the use of hydropower to pump water up to lands on the south side of the Yakima River. The Prosser Falls Irrigation Company built a power station at Prosser Falls, utilizing the 20-foot drop to run pumps driven by turbines. About 2,000 acres of land were irrigated in this manner. The system was later absorbed into the Federal Government's Yakima Project.⁴⁶

In addition to using the waters of the Yakima and Naches Rivers early on for irrigation purposes, there were great plans to irrigate about 46,000 acres from the Tieton River. The Cowiche and Wide Hollow Irrigation District was formed to implement the project, and the district paid Guy Sterling to conduct some initial investigations. Sterling proposed building an 11-mile-long canal. On January 9, 1892, the district held an election that authorized the issuance of \$500,000 in bonds for construction. Although there was overwhelming support for the undertaking among the district voters, the canal was never built. The interest sparked by the project did not die, however, and helped prepare the way for Reclamation's Tieton Division.⁴⁷

In the upper Cowiche Valley, a group of settlers formed the Cowiche Reservoir and Canal Company to build a small, off-stream reservoir for irrigation purposes in the basin of Cowiche Creek, 25 miles northwest of North Yakima. Water for the reservoir was obtained from the north fork of Cowiche Creek by means of a canal approximately 3 miles long. The purpose of the reservoir was to capture water during the early spring flood season and reserve it for use during irrigating months when Cowiche Creek was fully appropriated. At the time of construction in 1896, the reservoir was believed to be the first in Washington to provide the sole source of water for irrigation.⁴⁸

side of the Yakima River, 4 miles above Kiona. Called the Kiona Ditch, it served to irrigate about 4,000 acres of company lands around Kiona. See Lyman, p. 354-55 and Schiach, p. 228. Nesbit states that the Northern Pacific, Yakima and Kittitas Irrigation Company took over the canal company in 1902.

⁴⁶ Waller refers to the company as the "Prosser Falls Land, Irrigation, and Power Company." See p. 43; see also Lyman, p. 355.

⁴⁷ Lyman, "Celebration Honoring the Yakima-Tieton Irrigation District For Becoming the First Federal Reclamation Project to Complete Repayment of the Cost of Constructing Irrigation Works," Fact Sheet, p. 361. On file at the Upper Columbia Area Office library, 4.005. The Fact Sheet describes Sterling's plan as covering about 35,000 acres. The irrigation/storage divisions on the Yakima Project were often referred to as "units," particularly in the early days of the project. For consistency, the term "division" will be used throughout this document.

⁴⁸ United States Geological Survey, 19th Annual Report, 1897-98, Part IV, Hydrography.

The Sunnyside Canal

Of all the private irrigation ventures initiated in the Yakima Valley, none compared in scope to the Sunnyside. In fact, the project was the largest private canal system in Washington at the time of its construction. Started in 1891, the Sunnyside Canal stretched 56 miles by 1906 and included a network of nearly 75 miles of laterals. The expansive system was capable of serving 48,000 acres of land, of which 40,000 were under irrigation. The lands covered by the canal were located on the northeast side of the Yakima River, roughly from Union Gap to below Prosser. Deep, rich soils on the benchlands rising up from the river made the area ideal for irrigation. In less than two decades, lush alfalfa and orchards replaced acreage previously covered by sagebrush and home to coyotes and jackrabbits. By 1904, publicity about the transformation of the Sunnyside area was widespread. The area had “come to be thought of by multitudes as a sort of Utopia, a land of sunshine and warmth and good cheer, the birthplace of fatness and plenty, the home of industry, morality, and thrift.”⁴⁹

The Sunnyside Canal traces its origins to the previously mentioned Konnewock Ditch, constructed in 1879 to irrigate lands north of the Yakima River below Union Gap. Ten years later, Walter N. Granger, a successful irrigation engineer who had completed three large projects in Montana, arrived in the Yakima Valley to scout out development possibilities. He was there at the behest of his acquaintance, Thomas F. Oakes, president of the Northern Pacific Railroad. Oakes had a vital interest in the valley because his company owned a vast patchwork of lands there that stretched for 20 miles on either side of the tracks. The real estate had been a grant from the Federal Government in return for constructing the railroad. Not only would the Northern Pacific Railroad benefit from the sale of these lands, but also from the transport of locally grown crops to outside markets.

Oakes offered Granger an option on 90,000 acres of railroad land at \$1.25 an acre if he would undertake its development. Granger spent several days exploring the area and was impressed with what he saw, especially in the lower Yakima Valley. At the end of his visit, Granger wired Oakes an acceptance of the offer and then sent for a crew of engineers from Montana.⁵⁰

⁴⁹ Schiach, p. 222. See also Chaffee, “History of Adjudication of Water Rights of the Yakima River and Tributaries,” ca.1963. Waller, 1909, states that the canal was designed to water 68,000 acres and, at the time, it irrigated 43,000 acres (p. 42).

⁵⁰ This account of Granger’s early involvement with the Sunnyside Canal is derived from a pamphlet entitled, “The Sunnyside Canal,” written by Roscoe Sheller. The pamphlet is on file at the Lower Columbia Area Office. Other accounts vary somewhat. In “Trail Blazers in Yakima Valley Irrigation Development,” *Yakima Valley Progress* (July 1926), pp. 3-5, the author, C.A. Foresman, asserts that Granger was sent to the Yakima Valley by Colonel John Lamborn, land commissioner for the Northern Pacific. This article states that McIntyre and his crew came from Helena, Montana. For other accounts, see Boening, p. 22, and Lyman, p. 359.

Surveys of six different possible canal routes were completed by November 1889 by a group of engineers under the supervision of John D. McIntyre. He proposed a scheme to irrigate a huge expanse of 200,000 acres, generally between Union Gap and Prosser, by constructing two canals. One would have headed in the Naches River 2 miles above its junction with the Yakima River, and the other would have drawn water out of the Yakima River 5 miles above Union Gap. McIntyre also recognized the possibilities of increasing water supplies by developing storage reservoirs, a concept that became integral to Reclamation's Yakima Project.⁵¹

As a result of the encouraging surveys, Granger and his associates formed the Yakima Canal and Land Company on December 4, 1889. In need of additional financing, Granger joined forces with the Northern Pacific Railroad Company, which purchased two-thirds of the stock. The outcome of the consolidation was the creation of the Northern Pacific, Yakima and Kittitas Irrigation Company (NP, Y & K Company). More surveys of canal routes and reservoir sites were conducted in 1890, this time by C.R. Rockwood, a young engineer who would later become involved in irrigating California's Imperial Valley. He was assisted by William H. Hall, a well-known irrigation engineer working in southern California.⁵² In a report written by Hall, he echoed McIntyre by reiterating the importance of incorporating storage reservoirs into an irrigation system. The NP, Y & K Company's ambitious plan now included the construction of seven reservoirs, one irrigation canal in Kittitas County, and two more in Yakima County, referred to as the upper and lower canals. To secure rights to the headwaters of the Yakima River, the NP, Y & K Company filed notice of appropriation for the waters of Keechelus, Kachess, and Cle Elum Lakes.⁵³

At the close of 1890, the Konnewock Ditch Company and NP, Y & K Company entered into a contract whereby the latter agreed to take over and extend the existing 3-mile-long ditch as part of its lower canal.⁵⁴ The NP, Y & K planned to build a 65-mile-long "lower" canal that would provide water to 80,000 acres of land. Construction of the canal, with its heading on the north side of the Yakima River, about 2 miles below Union Gap, began in the spring of

⁵¹ Schiach, p. 183.

⁵² Ibid. Foresman ("Trail Blazers in Yakima Valley Irrigation Development," p. 4) states that Rockwood and Hall completed their surveys prior to the formation of the Northern Pacific, Yakima and Kittitas Irrigation Company. In a Yakima Herald article dated March 31, 1892 ("Water Crowned King"), Hall is referred to as the State irrigation engineer of California. Hall's middle name is given as "Hamilton" or "Hammond" in different sources.

⁵³ Foresman, "Trail Blazers in Yakima Valley Irrigation Development," p. 5. There are different spellings for Lake Cle Elum; sometimes it is spelled "Clealum." The former spelling will be used throughout this document.

⁵⁴ National Archives, RG 115, Entry 3, Box 1020, copy of deed. The conditions of the contract were finally met, and the sale was made final on March 3, 1893.

1891. According to an interview conducted with Granger many years later, “The valley was sparsely settled and little local help could be secured. The railway company moved in what was needed in carloads from old construction camps to sidings near the points where the work was in progress.” Granger further recalled that as many as 2,500 men and 800 teams were employed in the construction.⁵⁵ C.R. Rockwood, who had devised the general layout of the irrigation system, was in charge of the project until 1893.

A “falling steel” dam, and concrete and stone headgates, were built at a cost of \$40,000 where the Sunnyside Canal diverted from the river.⁵⁶ On March 26, 1892, upon completion of the dam and first 25 miles of canal, a grand dedication ceremony was held. The local paper touted the canal’s capacity as sufficient to “float a good-sized ship.” The dimensions were impressive: the bottom width measured 30 feet, the top width 62 feet, and the depth was 8 feet.⁵⁷ A month after the dedication, the first water deliveries were made from the canal. Work continued in 1893 under the direction of Robert Sterling with hopes running high among settlers and company officials alike. Construction costs had reached about \$750,000, and the canal covered 64,000 acres of potentially irrigable land.⁵⁸ To enhance profits from land sales, two townsites were laid out along the canal route, Sunnyside and Zilla. Granger became president of each townsite company.

The financial collapse of 1893 brought a halt to the prevailing optimism in the lower Yakima Valley. It also brought a halt to the grand plans of the NP, Y & K Company. Work on the Sunnyside Canal stalled, and initial preparations for dams at Lake Keechelus and Bumping Lake came to a halt. The NP, Y & K Company fell on hard times and went into receivership. Granger managed to hold on as company superintendent. Finally, with improvement in the economic climate, the canal enterprise was purchased by the Washington Irrigation Company on June 25, 1900. The latter company was organized primarily by Portland and Seattle investors. Granger still continued on as superintendent. With new financial backing, progress on the Sunnyside Canal resumed and by 1904, it had been extended to about 56 miles. Hundreds of miles of laterals and sublaterals had also been constructed to serve the approximately 32,000 acres then under irrigation. It was touted as the largest system anywhere in the Pacific Northwest and one of the four largest in the country. The Washington

⁵⁵ Foresman, 1926, p. 5.

⁵⁶ The 360-foot-long dam had a concrete foundation and a massive wooden superstructure fastened to the foundation by huge steel hinges. Yakima Herald, “Water Crowned King,” p. 4.

⁵⁷ Ibid.

⁵⁸ Schiach, p. 317; Foresman, p. 5; State Board of Horticulture, 1893, p. 291. Project History through 1912, p. 4.

Irrigation Company aggressively promoted settlement of the area through advertisements and sold its irrigated landholdings at prices ranging from \$30 to \$60 per acre, including a perpetual water right.⁵⁹

By 1904, there were 47 canals and ditches spread up and down the Yakima, Naches, and Tieton Rivers.⁶⁰ With about 150,000 acres under irrigation, the Yakima Valley was lauded as the leading example of irrigation development in Washington, and its farmers were touted as among the most prosperous in the West.⁶¹ Their produce was eagerly sought after by the booming mining camps of northern Idaho, Montana, and British Columbia. William Smythe, a leading irrigation proponent at the time, wrote that the Yakima Valley “is one of the few places in the West where water is relatively more abundant than land, and consequently, where there need be no limitation upon growth by reason of lack of moisture.”⁶² Yet amid this reigning optimism, there were signs of troubled waters. In 1903 and 1904, it became apparent for the first time that the water supply in the Yakima River had been over-appropriated, resulting in demand that exceeded availability in the low flow periods during the summer months. The following year, water shortages became critical, and the increasing tangle of private irrigation companies could no longer deliver on their promises. Tensions between the competing companies ran high and erupted when the newer Union Gap Irrigation Company built a low crib dam at the outlet of Lake Cle Elum. The Washington Irrigation Company retaliated by blowing up the dam in August 1905 so that water could reach lands at the lower end of the Sunnyside Canal.⁶³

⁵⁹ Project History Through 1912, p. 5. Schiach, p. 316-317.

⁶⁰ Sections of Yakima Investigations report sent to A.P. Davis on April 29, 1905, National Archives, RG 115, Entry 3, Box 1020, p. 63.

⁶¹ The figure of 150,000 acres is taken from a letter dated July 4, 1904, to A.P. Davis from T.A. Noble, National Archives, RG 115, Entry 3, Box 1020.

⁶² Smythe, William, The Conquest of Arid America, Norwood, Massachusetts, Norwood Press, 1905, p. 200.

⁶³ Project History Through 1912, p. 7.

Early on in the expansion of the West, the United States Government recognized the need to address rights to the use of water there, particularly as they related to mining. Initially, Congress passed laws that acknowledged local control over the use of water in mining, manufacturing, and agriculture. The first such law was passed in July 1866. At the time, there was insufficient understanding of the magnitude and complexity of irrigation systems that would be needed to cultivate vast expanses of arid lands. Under the 1873 Timber Culture Act, settlers were required to plant 40 out of 160 acres with trees, under the belief that trees encouraged rainfall. In 1877, the Desert Lands Act was passed which gave settlers 640 acres of arid land on the condition that proof of irrigation be demonstrated within 3 years. None of these Federal laws proved successful in establishing widespread irrigation.

At the forefront of a national irrigation movement was John Wesley Powell, noted explorer of the Colorado River. In 1876, Powell published A Report on the Lands of the Arid Region of the United States, with a More Detailed Account of the Lands of Utah. In this important document, Powell asserted that two-fifths of the United States had a climate that generally could not support farming without irrigation, that the 160-acre standard homestead tract was totally inappropriate for western farming, that reservoirs were needed to store water for irrigation, and that private companies did not have the financial resources or public interest to construct the required reservoirs and delivery systems. His advocacy for a greater Federal presence was highly disputed by those in favor of unchecked western expansion.

In 1881, Powell succeeded Clarence King as the head of the United States Geological Survey (Geological Survey) and, under his direction, the agency began its survey and mapping of the United States. Congress passed a Joint Resolution in March 1888 that not only authorized a survey of arid western lands, but also allowed for the withdrawal of all lands found irrigable. The resolution further provided that the lands could be reopened to settlement under the Homestead Act by proclamation of the President. In October 1888, at the onset of a drought in the West, Powell secured an initial modest amount of \$100,000 from Congress to begin the irrigation survey of arid western lands. In March 1889, an additional \$250,000 was appropriated to continue the work. Surveys were conducted of possible reservoir sites and canal routes in Montana, Idaho, Nevada, California, Utah, New Mexico, and Colorado.

In the summer of 1889, Powell was invited to accompany the United States Senate Committee on the Irrigation and Reclamation of Arid Lands, headed by Senator William Stewart of Nevada, on a tour to view first hand the irrigation needs of the arid West. Public hearings

were held at various points along the way, and in either August or September, the Committee swung through North Yakima, Ellensburg, and Walla Walla, where they heard the concerns of local citizens. In a report written afterwards, it was noted that “At North Yakima and Ellensburg can be seen the results of irrigation on an extensive scale . . . The Kittitas Valley without water is but a sage-brush desert; irrigated it becomes a garden spot and produces bountifully of cereals, fruits, and vegetables.”⁶⁴ As the irrigation survey continued its work of identifying arid lands suitable for withdrawal, the implications for massive Federal intervention became ever more apparent. Fierce negative reaction engendered largely by speculative and grazing interests resulted in the repeal in 1890 of the portion of the 1888 Joint Resolution allowing for the land withdrawals except for the reservoir sites themselves.

The first attempt by the Federal Government to study the existing water supplies in the Yakima Valley was made by the Geological Survey in 1892, when several gaging stations were established in the basin.⁶⁵ The report summarizing the findings was written by F.H. Newell, a hydrographer who later became the first Director of Reclamation. In addition to describing the Yakima River and its tributaries and recognizing the existing irrigation ditches, the report notes the abundance of water available in the high mountain lakes. Newell wrote, “These lakes serve as natural reservoirs, regulating, to a certain extent, the discharge of the streams, reducing the height of the floods, and increasing the summer flows. Their usefulness in this regard could be greatly increased at moderate expense by erecting suitable dams and gates at their outlets.”⁶⁶ Newell could not have foreseen that under his leadership at Reclamation, his recommendations would become reality.

Up until 1890, broad public and political support for an organized irrigation movement did not exist. As William Smythe wrote, “Irrigation was an unpleasant word, repellent and depressing. The word “arid” was synonymous with worthlessness.”⁶⁷ Attitudes towards irrigation were changing however. The worsening drought plaguing the West and devastating farmers was the catalyst for a series of National Irrigation Congresses, the first of which was held in Salt Lake City in 1891. In 1893, Powell was invited to address the International Irrigation Congress meeting in Los Angeles. Expecting to find support for his message of careful planning under the auspices of the Federal Government, Powell was distraught to hear people talking idealistically about unlimited irrigation of the West. After informing the

⁶⁴ Stegner, Wallace, Beyond the 100th Meridian, Penguin Books, New York City, 1954, pp. 313-316. “Irrigation in the United States,” Richard Hinton, 51st Congress, 1st Session, Report 928, Part 6, Washington, Government Printing Office, 1890, p. 42-43.

⁶⁵ Washington Historical Society, 1940, p. 238.

⁶⁶ “Results of Stream Measurements,” F.H. Newell, 14th Annual Report, United States Geological Survey, 1892-93, Part II, Accompanying Papers, pp. 132-134.

⁶⁷ Smythe, p. 264.

audience that there was insufficient water to fulfill these grand visions, he was booed. Tired and defeated, Powell resigned from the Geological Survey in 1894.

The Carey Act

That same year, in response to pressure exerted by Western States, the U.S. Congress passed the last major irrigation legislation prior to the Reclamation Act of 1902. The Carey Act asserted responsibility of the States rather than the National Government in overseeing irrigation development. The law granted each Western State up to 1 million acres of public domain on condition that the lands be irrigated and occupied. Following approval by the Secretary of the Interior of a State's request for participation, settlers on the segregated arid lands were given 10 years to cultivate at least 20 out of each 160-acre tract. Once proof of irrigation and settlement was submitted to the Secretary of the Interior, the lands would be turned over to the States and, in turn, patented to the settlers.

In order to participate in the program, the Washington State Legislature passed a law creating a Commissioner of Arid Lands in 1895. The Commissioner was to select lands under the terms of the Act and enter into contracts with individuals or corporations for reclamation. Land was to be sold to individuals in 10- to 40-acre tracts.

In 1895, a survey was conducted under the direction of the Commissioner of Arid Lands for a large irrigation project in the Yakima Valley that covered an area encompassing 444,000 acres of land, of which 285,000 acres were deemed irrigable. Water would be delivered through a 114-mile-long main canal, called the Naches and Columbia River Irrigation Canal, that would have a heading on the north bank of the Naches River about 16 miles above its confluence with the Yakima River. From there, the canal was designed to cross the Yakima River at Naches Gap, then cross the Moxee Valley and continue in a southeasterly direction through the Sunnyside area. A dam at Bumping Lake would be built to provide storage.⁶⁸ Under the Carey Act, the State requested approval from the Secretary of the Interior to segregate about 56,000 acres in the lower valley to be patented to settlers. Friction over the project developed between landholders in the upper and lower valleys, and the project never advanced beyond the planning stage.⁶⁹

⁶⁸ Report on Carey Act Survey submitted by H.K. Owens, Engineer, to L.S. Howlett, Commissioner of Arid Lands, January 4, 1896, National Archives, Rocky Mountain Region, RG 115, Entry 3, Box 1020.

⁶⁹Lyman, p. 368.

In Washington, as in most other Western States, the Carey Act was unsuccessful. The States simply did not have the financial resources or technical expertise to implement large-scale irrigation projects. Another reason given for the Act's failure in Washington was the conservative State government that generally opposed State intervention in local affairs.⁷⁰ Thus, although the State applied for 86,854 acres under the Carey Act, the claim lapsed due to lack of development.

The Federal Indian Bureau was also a participant in the Yakima Valley irrigation scene late in the nineteenth century.⁷¹ In 1896, they constructed an irrigation ditch with a wooden headgate in the Yakima River, just south of Parker. The ditch, originally named after Indian agent, Lewis T. Erwin, and later referred to as the Old Reservation Canal, proceeded almost straight south for a length of about 12 miles after crossing the Northern Pacific Railroad tracks. Laterals extended off of the canal in a generally east to west direction. By 1897, a 3.2-mile-long canal called the Toppenish was also completed on the reservation by the Indian Bureau.⁷²

As the nineteenth century came to a close, the role of the Federal Government in western irrigation development continued to be sharply debated. In a matter of just a few years, the issue would be settled with passage of the Reclamation Act. Meanwhile, in its limited role, the Geological Survey returned to the Yakima Valley to study the water supply and conduct surveys of possible reservoir sites. In 1897, Cyrus C. Babb and two assistants, accompanied by a cook and pack train, examined and took measurements at Bumping Lake. Babb returned in September 1898 to explore the Ahtanum, Cowiche, and Wenas Basins. The results of his 1898 reconnaissance were disappointing; he reported a lack of any suitable or available reservoir sites.⁷³

Passage of the Reclamation Act of 1902

By 1901, it had become evident that the array of incentives for local and State development of large-scale irrigation works had been unsuccessful in yielding significant results. Support for a greater Federal role was growing among western congressmen, and the movement received

⁷⁰ Boening, 1919, p. 38.

⁷¹ The Bureau of Indian Affairs was created in 1824 and was situated in the War Department until 1849, when it was moved to the Department of the Interior, where it remains today. The Bureau of Indian Affairs was sometimes referred to the "Indian Service" or "Indian Bureau." For consistency, the latter term will be used throughout this document.

⁷² Heritage Research Center, *Yakima River Basin Historical Resource Survey*, pp. 99-101.

⁷³ U.S. Geological Survey, *19th Annual Report, Part IV*, p. 473. *20th Annual Report, Part IV, 1898-99*, p. 505-508.

a tremendous boost when Theodore Roosevelt became President in September 1901. Having lived in the West, he had firsthand knowledge of its arid condition and acted quickly to establish a Federal reclamation program. In his message to Congress at the opening session in December 1901, he became the first President to recommend legislation for the reclamation of arid lands in the West.

With the strong support of the President behind them, a committee of 17 congressmen, one from each Western State, met under the chairmanship of Nevada Representative, Francis G. Newlands, and drafted an irrigation bill. The bill quickly passed through both Houses of Congress and was signed into law by President Roosevelt on June 17, 1902.

Under the terms of the Newlands Act, commonly referred to as the Reclamation Act, the Secretary of the Interior was authorized to locate and construct irrigation works in the arid Western States and territories. Funding for construction of these projects was to come from the sale of public lands within the benefiting States and territories. Following completion of project facilities, project lands would be opened for settlement under provisions of various homestead laws and in tracts no larger than 160 acres. The 160-acre limitation was designed to prevent land speculation and to encourage homesteading by individuals and families, a major focus of western irrigation supporters. Settlers were required to reclaim at least one-half of their land for agriculture. Project construction costs were to be repaid over a period of time by the project settlers. The agency established to administer the provisions of the Act was initially called the United States Reclamation Service (Reclamation). F.H. Newell was named Chief Engineer of the new bureau.⁷⁴

Among the committee of 17 that drafted the Reclamation Act was Representative Wesley L. Jones of North Yakima. Educated as a lawyer, Jones moved to North Yakima from Illinois with his wife and son in 1889. The family settled in town, and Jones later purchased a 100-acre ranch under the Sunnyside Canal. In 1899, he was first elected to the U.S. House of Representatives and served in the four succeeding Congresses. In 1909, Jones was elected to the U.S. Senate and held a seat there until his death on November 19, 1932.

Throughout his long public service career, Jones was a strong advocate of irrigation and, in particular, pushed for water development projects in his own State. During the debate for passage of the Reclamation Act, Jones spoke passionately, with hyperbole, and at length

⁷⁴ In 1923, the official name of the agency was changed to the Bureau of Reclamation. The U.S. Reclamation Service was originally placed within the U.S. Geological Survey. In 1907, it was established as a separate bureau within the Department of the Interior. Newell's title changed from Chief Engineer to Director. He remained in that position until December 1914. Reclamation will be used throughout this document when referring either to the U.S. Reclamation Service or the Bureau of Reclamation.

about the merits of irrigation and the bill under consideration. “Pass this bill and you make “the waste places glad” and “the desert to bloom as the rose . . . Pass this bill and its beneficent influences will lighten the burdens and gladden the hearts of our people of every class and condition, largely solve the social problems of discontent that agitate our cities . . . ” Jones even went on to make the claim that by irrigating the arid lands of the West, there would be more moisture in the air and, consequently, more precipitation. He also espoused the philosophy of “home building” that was at the foundation of the Reclamation Act. “The very essence of this bill is home building. This is its aim, purpose and object . . . To own in his own right a plat of ground, however small; to live in his own cottage, however humble, and to sit at his own fireside with his wife and children around him has been the acme of the heart’s desire of the true American.”⁷⁵

Following passage of the Reclamation Act, Jones would be instrumental in securing an irrigation project for Yakima. His continued and dogged persistence over the ensuing years resulted in significant Reclamation appropriations for the Yakima Valley and elsewhere in Washington. Just as he constantly badgered Reclamation officials, Jones continually received letters from eastern Washington farmers who offered advice, pushed for projects in their own communities, or complained about actions of Reclamation. At his death, Jones was lauded as “the father of the Yakima Valley and delighted always in its service.”⁷⁶

Yakima Project Investigations

Immediately following creation of Reclamation, the agency began planning surveys in the West to determine the most feasible reclamation projects. Wesley Jones actively lobbied Reclamation to undertake investigations in Washington and, in 1903, the agency sent engineers out into the field there. In August 1903, an office was established in Spokane and Mr. T.A. Noble, a civil engineer previously in private practice in Seattle, was placed in charge as Division Engineer.⁷⁷ The initial focus of investigations was on two possible projects: the Okanogan, which would irrigate about 11,000 acres; and along the Columbia River, where it is joined by the Spokane River (now the Columbia Basin Project). The preliminary studies indicated that the latter project would be excessively expensive. Reconnaissance

⁷⁵ Congressional Record-House, 57th Congress, consideration of Senate Bill 3057, pp. 6751-57.

⁷⁶ U.S. Congress, Memorial Services for Wesley L. Jones, House Document No. 568, 72nd Congress, 2d Session, Washington, Government Printing Office, 1933.

⁷⁷ In June 1905, the office of the Division Engineer was moved to North Yakima in anticipation of the construction planned in the area. On September 7, 1905, the office of the Pacific Division, which included Washington, Oregon, California, and Nevada, was established in Portland, Oregon, with D.C. Henny as Supervising Engineer and E.G. Hopson as Assistant Supervising Engineer.

surveys were also made for two other projects. The first, known as the Big Bend Project, contemplated diverting the waters of the Spokane River onto arid lands in the central part of the State. The second, identified as the Palouse Project, considered irrigating an area between the Columbia and Snake Rivers in the area of Pasco. Both of these projects were dismissed by Reclamation following further analysis.⁷⁸

Meanwhile, in Yakima, there was interest among some residents in obtaining a Federal Reclamation project. In January 1903, a citizen petition was delivered to the Secretary of the Interior, urging investigation of a proposed Tieton-Cowiche Canal. This canal would take water from the Tieton River, about 9½ miles above its mouth, traversing to the south, and empty into Ahtanum Creek. In response to the request, T.A. Noble was instructed to conduct a preliminary assessment. His findings were included in a report dated March 31, 1903, in which he expressed doubts about the feasibility of the project due to expensive storage requirements and complicated water rights. F.H. Newell concurred with Noble's assessment and in a letter written several months later advised, "It seems to me that this (a Yakima Basin project) is one of the projects to be considered for the future, after we have taken up others which seem to offer opportunities for reclaiming public land. I advise that you concentrate, at first, on the Okanogan Project, . . . Then take up the general reconnaissance on the Great Bend Project and get this well started, . . ." ⁷⁹

During this same time, Congressman Jones was pushing the Indian Bureau to construct an irrigation canal through the Yakima Indian Reservation. The purpose of the project was not to improve agricultural conditions for Indians, but to open the reservation to white farmers who could lease irrigated lands from them. The Indian Bureau concurred with the desirability of the project. Only limited farming was being done by the Indians, and the Indian Bureau feared that unless water appropriated for the reservation were put to beneficial use, the Government would forfeit its water rights to eager private users. In March 1903, Jones received approval for the canal from Secretary of the Interior, Ethan A. Hitchcock.⁸⁰ With this action, the Federal Government again broke its 1855 treaty with the Yakima Indian Nation; under the terms of that treaty, the 1,200,000-acre Yakima Reservation had been set aside for exclusive use of the Indians.⁸¹

⁷⁸ Department of the Interior, U.S. Geological Survey, Second Annual Report, 1902-1903 and Third Annual Report, 1903-1904.

⁷⁹ Letter from F.H. Newell to T.A. Noble, dated May 18, 1903, National Archives, RG 115, Entry 3, Box 1020.

⁸⁰ Coulter, Calvin Brewster, "The Victory of National Irrigation in the Yakima Valley," Pacific Northwest Quarterly, April 1951, p. 105. Also, a letter dated January 10, 1903, from W.H. Code, U.S. Indian Inspector, Irrigation Engineer, to Secretary of the Interior, National Archives, Denver, RG 115, Entry 10, Box 625.

⁸¹ Relander, Click, "The Battleground of National Irrigation," p. 147. The Federal Government had previously broken its treaty when it allowed the railroad a right-of-way through the reservation.

Despite opposition to the new canal by off-reservation citizens who were fearful that their water supply would be jeopardized, Jones was successful in pushing the construction forward. The heading of the new Indian Canal was located across the river and upstream from the headgate of the Sunnyside Canal.⁸² The Indian Canal ran southwest from Union Gap for about 4 miles. Laterals A, B, and C headed from the Indian Canal to the south.⁸³ By 1905, about 3,000 acres were being irrigated from what was known as the New Reservation Canal.

Despite reluctance to get involved in the Yakima Basin, Reclamation conducted further studies of possible irrigation projects there in the spring of 1904. This time, George H. Bliss, assistant engineer under the supervision of T.A. Noble, was sent out in the field. Based on Bliss's surveys, two feasible irrigation schemes were identified. The first was the earlier mentioned Tieton-Cowiche plan to irrigate about 40,000 acres of land west of Yakima using water diverted from the Tieton River. The second plan was the so-called Ledbetter scheme that would irrigate about 100,000 acres of land in the lower Yakima Valley below Kiona. Both proposals depended on developing a water storage supply. Possible reservoir sites were located at Lake Keechelus, Lake Kachess, and Lake Cle Elum, at the head of the Yakima River; Bumping Lake on the Naches River; and McAllister Meadows (now Rimrock Reservoir) on the Tieton River. At the time, the Cascade Lumber Company had partially finished a timber dam on Lake Keechelus, and the Cascade Canal Company had completed its rock-filled dam at Lake Kachess.

Bliss and his survey party also examined three possible main canal routes that were called the Naches and Columbia River, Tieton-Cowiche, and Ledbetter.⁸⁴ The Naches and Columbia River Canal would take out of the Naches River about 3-1/2 miles below the Tieton River in Township 14N, Range 7E, Section 5. The route had been previously surveyed in 1895 under the Carey Act. The 140-mile-long canal would cross the Yakima River and head in a southeasterly direction to its terminus at the Columbia River. Because of its great length in proportion to the amount of land irrigated, this scheme was considered too costly and impractical.

The second and third canals, the Tieton-Cowiche and Ledbetter, were thought to be more feasible. The Ledbetter Canal, of which segments had already been privately constructed, took water out of the Yakima River at the head of Prosser Falls at Prosser. If completed as conceived

⁸² Coulter, Calvin, "The Victory of National Irrigation in the Yakima Valley," 1951, p. 116.

⁸³ This system of laterals was later abandoned with the construction of the Wapato Division in the 1910s and 1920s. Heritage Research Center, p. 101.

⁸⁴ Ledbetter was sometimes spelled "Leadbetter."

by Bliss, the canal would follow the Yakima River for the first 18 miles and then split, with one branch crossing the river and the other branch continuing along the east bank.⁸⁵

Even though possible projects had been identified in the Yakima Basin and there was an estimated 400,000 acres of irrigable lands, Reclamation remained hesitant about entering the area for a number of reasons. Too many small private irrigation enterprises were already in existence, and the agency did not wish to compete with them. Much of the land to be benefited by irrigation was already in private ownership. The many conflicting water rights presented major obstacles, and the development of necessary storage would be expensive. Finally, although there were those who favored Federal intervention, there was also a faction that expressed strong opposition.

By 1905, irrigation development in the Yakima Valley had reached an impasse. Greatest opposition to Federal involvement came from the Washington Irrigation Company, owners of the Sunnyside Canal. The Company's attorney, E.F. Blaine, was instrumental in forming the Washington State Irrigation Association (WSIA), which strongly objected to Federal intervention. They lobbied for endorsement of a State bill that would give the Washington Irrigation Company control of Lake Cle Elum under the belief that whoever controlled the storage reservoirs of the Yakima River headwaters would control irrigation in the valley below. Blaine argued that his company had to store water in order to supply its lands under the Sunnyside Canal. The WSIA's attempt to gain private control of Lake Cle Elum through legislation was opposed by those in favor of Federal irrigation development. Four individuals led the resistance against WSIA's legislative proposal: Congressman Jones, State Senator Andrew J. Splawn, T.A. Noble, and Colonel William W. Robertson, editor and owner of the Yakima *Republic* newspaper. Splawn was successful in defeating the bill when it reached the State Senate.⁸⁶

Having failed at their attempt to win control of Lake Cle Elum, the Washington Irrigation Company tried another strategy. The company recommended that the State revive the earlier Carey Act claim to about 56,000 acres in eastern Yakima County and offered to supply the lands with irrigation water from an extended Sunnyside Canal. Acreage to be furnished with water was located around the lower end of the Rattlesnake Hills, in the vicinity of the Columbia River. The plan appeared attractive to the State because it would stand to gain about \$500,000 dollars from the sale of the land to settlers at \$10 an acre. Among other factions, however, the company's new plan aroused suspicion and opposition. Reclamation was opposed to the idea

⁸⁵ See Reclamation Service's Third Annual Report for summary of Bliss's 1904 investigations and recommendations.

⁸⁶ Coulter, Calvin, "The Victory of National Irrigation in the Yakima Valley," p. 105-6.

because appropriations for the Sunnyside Project alone already exceeded the entire natural flow of the Yakima River during summer months, and adding 56,000 acres of lands to the project would mean that other water users lower down the river would be left dry. Farmers and businessmen also rallied against the Washington Irrigation Company. They perceived the scheme as just another attempt by the company to get control of the lakes. The company's critics projected that once the State got involved, the company would go back to the legislature and claim that it needed storage in the lakes in order to provide increased water deliveries. Without that additional storage, farmers realized that there would be insufficient water for lands in the upper valley above Sunnyside and for the higher lands in the lower valley. The strong objections were successful in stalling approval by the Secretary of the Interior of the State Land Commissioner's renewed request to segregate the lands.⁸⁷

In spite of the contentious situation in Yakima, Reclamation did not give up on the possibility of a project there, especially after the Palouse Project was set aside. During February and March 1905, Reclamation engineer, Calvin Casteel, conducted a reconnaissance survey of a proposed high line canal on the Yakima Indian Reservation and of reservoir sites along Satus Creek for a possible project in the vicinity of Mabton.⁸⁸ Agency officials proceeded cautiously, however, and on March 11, 1905, F.H. Newell wrote to T.A. Noble:

*Various letters have been received from you regarding the Yakima Valley situation. In this matter I expect that you will use great discretion and not be unduly conspicuous, or attempt to influence the land-owners, but rather to take a somewhat reserved position and let them take the lead; that is to say, while it is important that you should furnish information and advice when called upon, at the same time it is important to preserve in the minds of the people in the Yakima Valley the fact that we are not importuning them, or trying to induce them to do something which they do not wish done. We can well afford to let them come to us.*⁸⁹

Newell's letter was written just a week after Washington Governor McBride signed a new irrigation law that had been introduced due to pressure exerted by Reclamation. The latter had made it clear that it would build no projects in Washington until such a law was on the books. In 1904, the Governor appointed a commission to draft language that was submitted to the

⁸⁷ Ibid, p. 107-8. This source cites the lands to be segregated at 56,000 acres; elsewhere, the figure of 55,000 acres is used. In the April 22, 1905, Board of Engineers report, a figure of about 57,000 acres is given.

⁸⁸ Letter dated March 6, 1905, from T.A. Noble to F.H. Newell, National Archives, RG 115, Entry 10, Box 625.

⁸⁹ Letter dated March 11, 1905, from F.H. Newell to T.A. Noble, National Archives, RG 115, Entry 3, Box 1020. A number of people unhappy with Reclamation's interference in Yakima sent a letter of complaint against Noble to the Secretary of the Interior (RG 115, Entry 3, Box 1020).

legislature in 1905. After a bitter fight, the legislature finally agreed on a bill that was signed by the Governor on March 4, 1905. The new law authorized the United States Government to acquire lands for reservoir sites and canals through eminent domain. It further granted the Federal Government the exclusive right to use any lakes in Washington for storage purposes and the right to withdraw all unappropriated water for 4 years in order to develop reclamation projects. Although Reclamation had wanted the law to require settlement of the chaotic water rights situation, this measure was not included.⁹⁰

The new legislation paved the way for Reclamation projects in Washington. The small Okanogan Project became the first in the State. Construction started in 1905 on Conconully Reservoir on the Salmon River and the first lands were irrigated in 1908. Reclamation also became serious about a project in Yakima. On April 22, 1905, four Reclamation engineers, T.A. Noble, A.J. Wiley, D.C. Henny, and A.P. Davis, submitted a report on irrigation investigations in the Yakima Valley. The opening paragraph asserts that, due to the complete appropriation of water on the Yakima River and its tributaries, no further irrigation development would be feasible without storage facilities. The report went on to identify three possible projects in the Yakima Basin: (1) the Kittitas Project, involving a diversion from the Yakima River above the Cle Elum River to irrigate about 60,000 acres near Ellensburg; (2) the Tieton Project, involving a diversion from the Tieton River to irrigate about 40,000 acres lying west of North Yakima; and (3) the enlargement of the Sunnyside Project to irrigate upwards of 150,000 acres. The latter included investigating the merits of the previously described Ledbetter scheme, a diversion lower down on the Yakima River near Prosser.

The Board of Engineers concluded its report with a set of three recommendations that were approved by F.H. Newell:

1. Immediate surveys to determine the feasibility and cost of water storage on Lakes Cle Elum, Kachess, Keechelus, Bumping Lake, McAllister Meadows, and any other promising reservoir sites.

⁹⁰ Coulter, Calvin, "The Victory of National Irrigation in Yakima Valley," pp. 110-113. The Act was put into effect upon the filing of a list showing the streams and lakes to be investigated by the United States. The list acted as a withdrawal from further appropriation. The list was filed on May 4, 1905, and a more exact description of the lakes and streams to be withdrawn was filed later in the year. Included in the list were all the waters of the Yakima watershed, thus withdrawing them from further appropriation until December 19, 1909. (Letter report dated January 21, 1911, from Charles Swigart to F.H. Newell.) Later, upon several requests of the United States, the period of withdrawal was extended by the State Land Commissioner to February 20, 1913, and then to January 1, 1914, with the understanding that further extensions could be granted. (Twelfth Annual Report of the Reclamation Service, 1912-1913, p. 239).

2. Immediate investigations of the irrigation possibilities of an expanded Sunnyside Canal.
3. Continued surveys to determine the feasibility and cost of the Kittitas, Cowiche, and Ledbetter Projects.

Newell postponed a decision on two other recommendations by the Board of Engineers, pending further study. These pertained to limiting the existing water rights of irrigators in the Yakima Basin to then present use, and requiring the Northern Pacific Railway to insure satisfactory irrigation of its lands under government projects.⁹¹

Time was of the essence in the minds of the board members; Reclamation should develop storage and irrigation facilities in the Yakima Basin as soon as possible. The pace of Reclamation's investigations and activities there quickened. On May 10, 1905, Reclamation filed a request with the State Land Commissioner for a withdrawal of the waters of the Yakima River and its principal tributaries in order to develop reclamation projects. The agency further requested the withdrawal of the State lands over which rights-of-way were required and all State land suitable for irrigation under the Yakima Project.⁹² Reclamation engineers were sent out in the field to measure existing stream diversions, continue investigations of the various possible reservoir sites, and analyze potential irrigation projects.

At the same time, circumstances on the Sunnyside Project were changing in favor of Reclamation. The Washington Irrigation Company realized that its future was bleak, given its failure to secure storage rights, and the expanded authority of Reclamation granted under the new State legislation. The company offered to sell the Sunnyside Canal, including all of its water rights and laterals, for a cash payment of \$250,000, on condition that the company retain the lands it still owned along with the accompanying water rights. Reclamation would be obligated to continue delivering water to lands then being irrigated by the Sunnyside Canal, about 30,000 acres, and to deliver water to the company's lands, amounting to about 16,000 acres. The Company would pay Reclamation \$1 per acre annual maintenance fees for

⁹¹ Report by Board of Engineers to F.H. Newell, dated April 22, 1905, National Archives, RG 115, Entry 3, Box 1020.

⁹² Fourth Annual Report of the Reclamation Service, 1904-05, p. 337. Letter report from Charles H. Swigart to F.H. Newell, dated January 21, 1911. Under the March 4, 1905 Act, passed by the State of Washington, Reclamation was given 4 years to withdraw unappropriated waters in which to authorize construction of storage reservoirs. The expiration date was set at December 19, 1909. In 1909, an extension was filed.

irrigating the lands it continued to hold. In order to buy time for further investigations of the Sunnyside Project, Reclamation engineers arranged for an option on the purchase under the above terms that would expire on December 1, 1905.⁹³

Interest and speculation as to Reclamation's intentions in the Yakima Basin ran high. In a letter written to T.A. Noble by A.P. Davis, Assistant Chief Engineer, he advised,

*The situation in Washington [DC?] is quite intense and we will have to move and act with extreme caution and be sure of every step. Great care should be taken not to give out results nor matters of policy until these have been fully considered in this office. I note the investigations that are in progress and hope that we may find some promising project in the Yakima Valley which can be taken up in connection with the Okanogan.*⁹⁴

Noble responded that, "We are now investigating every feasible project (in the Yakima Valley), and if there is one we will undoubtedly find it." Since the amount of Reclamation funds available to the State of Washington from the sale of public lands there was relatively small, Noble conjectured that the Sunnyside Project would be more viable than either the more expensive Kittitas or Tieton schemes.⁹⁵

Throughout the summer and into the fall of 1905, letters flew back and forth between Reclamation headquarters in Washington, DC and Reclamation engineers working in the Yakima Valley regarding the various projects under consideration. Among the matters discussed in correspondence was that of using the Reclamation Act to open up allotted lands on the Indian Reservation to white settlers. In order to conform to provisions of the Reclamation Act, David C. Henny, Supervising Engineer of Reclamation's newly created Pacific Division, proposed reducing the holdings of each Indian from 80 acres to 20 acres; mandating the Indians to dispose of their lands in excess of 20 acres to white settlers; and requiring all to join a water users association. Henny further suggested that Indians cultivating their own lands be exempt from maintenance fees, but those leasing out their lands be required to pay 10 percent of their lease income to cover maintenance costs. Congressman Jones was eager to support such an effort, as was Chief Engineer of the Indian Bureau, W.H. Code. Henny explained that "Mr.

⁹³ An option to sell the Sunnyside Project to the Federal Government was submitted by the Washington Irrigation Company on June 6, 1905, and was extended on October 23, 1905.

⁹⁴ Letter dated May 23, 1905, from A.P. Davis to T.A. Noble, National Archives, RG 115, Entry 3, Box 1020.

⁹⁵ Letter dated May 30, 1905, from T.A. Noble to A.P. Davis, National Archives, RG 115, Entry 3, Box 1020.

Code is anxious for it to appear that all the above matter, which virtually evolved during my conversation with him, is a suggestion coming from Reclamation.”⁹⁶

Henny’s concept of creating a Reclamation project on the Indian Reservation was thoroughly endorsed by Newell, although he questioned whether it could be successfully carried out due to anticipated objections by the Indian Bureau. Newell advised that the matter be pursued “with great care and ability to obviate the active opposition of the Indian Agent and the Indian Bureau, and this I regard as the only considerable obstacle.”⁹⁷ Reclamation’s Chief Engineer perceived that if the Indian lands were developed as a Reclamation project, the proposed storage would provide the Yakima Indians with sufficient irrigation water for their reduced acreage. He wrote, “I think we have a good case in the fact that the Indians have no adequate water right in view of prior appropriation and no one can furnish the storage necessary but Reclamation, and the scheme fits in beautifully with the general Yakima project.”⁹⁸

With Newell’s solid backing, Henny took up the matter again with Congressman Jones and representatives of the Indian Bureau. Contrary to Newell’s doubts, the latter seemed amenable to the idea. It was agreed that the issue should be brought up with the Secretary of the Interior through channels other than the Indian Bureau and Reclamation. Jones volunteered to contact the Secretary as a representative of the interests in the valley and its people. He also resolved to introduce the necessary legislation in Congress.⁹⁹ Newell fired back a cautionary letter to Henny stating that, “In regard to the Yakima Indian Reservation, I will take this up with great caution, as there is a strong feeling in the Indian Office that we are trying to usurp their rights.”¹⁰⁰

The findings of the investigations carried out in the Yakima Valley by a Reclamation Board of Engineers during the summer of 1905 were presented in two reports. The first, dated October 16, dealt with the Tieton Project and recommended its construction subject to certain conditions. The second document, dated October 31, reiterated the need for storage in order to irrigate any new lands.¹⁰¹ The three engineers estimated that there were 340,000 acres of

⁹⁶ Progress report dated September 2, 1905, from D.C. Henny to A.P. Davis, National Archives, RG 115, Entry 3, Box 1020, pp. 4-6.

⁹⁷ Letter dated September 13, 1905, from F.H. Newell to D.C. Henny, National Archives, RG 115, Entry 3, Box 1020.

⁹⁸ *Ibid.*

⁹⁹ Letter dated September 18, 1905, from D.C. Henny to F.H. Newell, National Archives, RG 115, Entry 3, Box 1020.

¹⁰⁰ Letter dated September 29, 1905, from F.H. Newell to D.C. Henny, National Archives, RG 115, Entry 3, Box 1020.

¹⁰¹ Board of Engineers’ letter report to F.H. Newell, dated October 31, 1905, National Archives, RG 115, Entry 3, Box 1020. The Board of Engineers consisted of A.P. Davis, A.J. Wiley, and D.C. Henny.

nonirrigated lands that could be watered under proposed Reclamation canals, plus an area of over 100,000 irrigable acres on the Yakima Indian Reservation. Since the projected supply of water, with the addition of storage reservoirs, was enough to cover only about 300,000 acres, the engineers recommended splitting the Yakima Valley into various irrigation divisions that could each be developed separately. The following divisions were identified: Ledbetter, 210,000 acres; Sunnyside, 40,000 acres; Tieton, 24,000 acres; and Kittitas, 60,000 acres.

Before constructing any project, the engineers advocated the adjudication of the tangled private water rights, as well as a settlement of water rights on the Yakima Indian Reservation. These rights had never been adjudicated, and only a small portion of the reservation's 125,000 readily irrigable acres were being reached with water.¹⁰²

Finally, the Board of Engineers recommended that first priority be given to construction of the Sunnyside Project. They advised that a sum of \$ 1 million be authorized to purchase the Sunnyside Canal rights and property, except lands to be irrigated, and to construct the first phase of the Sunnyside Division.¹⁰³ Responding within a week to the completed report, Newell recommended to the Secretary of the Interior the approval of the Sunnyside option and the allotment of \$1 million for purchase and construction. He also advised the Secretary of the need to determine water rights in the valley, both private and Indian.¹⁰⁴

Apprised of Reclamation's demand for the settlement of water rights in the Yakima Valley prior to any construction, Yakima residents held a public meeting at which a citizens' committee was formed to take on the charge. Adjustment of the claims before a court would have dragged on for too long. On November 16, 1905, the committee, acting under the auspices of the North Yakima Commercial Club, issued a notice stating that they had settled the rights of many water users but that their work was still incomplete. The committee worked diligently over the next several months obtaining agreements from appropriators limiting their claim to a definite amount of water.

On December 12, 1905, Secretary of the Interior, E.A. Hitchcock, gave conditional approval for the Tieton and Sunnyside Projects and set aside the sums of \$1 million and \$750,000, respectively, from the Reclamation Fund. The money was not to be used for construction until

¹⁰² The following spring, Joseph Jacobs, District Engineer, estimated that there were 180,000 acres of irrigable lands on the Indian reservation and that only 54,000 acres were being irrigated, leaving 126,000 potentially irrigable acres.

¹⁰³ Letter report dated October 31, 1905, from Board of Engineers, A.P. Davis, A.J. Wiley, and D.C. Henny to F.H. Newell, National Archives, RG 115, Entry 3, Box 1020, pp. 2-7.

¹⁰⁴ Letter dated November 8, 1905, from F.H. Newell to D.C. Henny, National Archives RG 115, Entry 3, Box 1020.

eight conditions had been satisfied. Among these were the adjustment of all conflicting water claims, the guarantee of sufficient water for the Yakima Indians, the settlement of any issues pertaining to the Federal Government's purchase of the Sunnyside Canal system, and the pledge to irrigate enough lands under the projects to repay the construction costs through user fees.¹⁰⁵

Over the next few months, the pace of activity in the Yakima Valley quickened in an effort to meet all of the Secretary's requirements. On January 8, 1906, James H. Fraser, chairman of the citizens' committee, announced that it had settled enough water rights to submit its findings to Reclamation. Eventually, it became necessary for the committee to raise a large fund to purchase the remaining rights.¹⁰⁶ On February 1, the daily *Yakima Republic* revealed that D.C. Henny had been appointed Reclamation's construction supervisor in Yakima. News that the State's request to segregate some 56,000 acres of land under the Carey Act was rejected by Secretary of the Interior, E.A. Hitchcock, was published on February 23. This finally brought closure to one of the main stumbling blocks to Reclamation's Yakima Project. Hitchcock also withdrew from public entry 737,350 acres of public land, including all of the Yakima lakes and surrounding lands, for irrigation purposes.¹⁰⁷

On March 6, the so-called "Jones Law" was passed (H.R. 10067, Public Law No. 36), authorizing allottees on the Yakima Indian Reservation to sell 60 acres of their allotments to obtain means to repay the costs associated with a Reclamation irrigation project. This opened the way for a Reclamation project on the reservation, provided the Indians consented to sell off their excess land. On March 10, two more important steps were taken that brought the Yakima Project closer to reality. On that day, both the Tieton Water Users Association and Sunnyside Water Users Association were organized.¹⁰⁸ Their role would be to collect construction repayment costs and operation and maintenance charges for the United States.

Five days later, D.C. Henny submitted a letter report to F.H. Newell, summarizing progress on the eight conditions imposed by the Secretary of the Interior. Based on the advances that had been made, Henny recommended that, "the option of the Washington Irrigation Company be immediately exercised and authority be granted for the construction of the Tieton and Sunnyside Projects but that no construction contracts be entered into until it shall have become apparent

¹⁰⁵ Letter dated December 12, 1905, from E.A. Hitchcock to the Director of the U.S. Geological Survey, Lower Columbia Area Office files.

¹⁰⁶ Notice of Water Users Meeting, North Yakima, Washington, November 16, 1905, Lower Columbia Area Office files.

¹⁰⁷ "Reclamation Due to Business Men," *Yakima Morning Herald*, April 6, 1930.

¹⁰⁸ Letter dated March 12, 1906, from D.C. Henny to F.H. Newell, National Archives, RG 115, Entry 3, Box 1020. Also, "U.S. Takes Up Yakima Irrigation," *Yakima Morning Herald*, March 30, 1930, p. 18.

that the subscription of water users association stock covers satisfactorily the lands falling within limits of development at present contemplated.”¹⁰⁹

This last impediment was overcome by March 20, 1906. A week later, Acting Secretary of the Interior, Thomas Ryan, approved the purchase contract with the Washington Irrigation Company and the construction of the Tieton and Sunnyside Projects.¹¹⁰ In obtaining the property of the Washington Irrigation Company, the United States acquired one of the oldest and largest water rights in the Yakima Valley. Within just 2 weeks of the purchase, Henny wrote to Newell, recommending that the initial appropriations for the two approved Yakima projects be increased and that funding be requested for the Indian (later called Wapato) project and for storage facilities. A response from the Acting Chief Engineer (no name on copy of letter) indicates just how difficult it had been to obtain the Secretary’s support for Reclamation’s entry into the Yakima Valley:

You do not appear to understand the situation here. Strenuous effort was necessary to induce the Secretary to make any allotment at all to Washington projects and when these were finally made, the Sunnyside was cut down from \$1,000,000 to \$750,000. . . We still have some hope of inducing more generous treatment of the Yakima Valley projects, but under the condition of the fund, the undertaking of new projects could not properly be recommended and certainly would not be approved by the Secretary.

The Reclamation Fund, which depended on the proceeds from the sale of public lands, was already proving inadequate to pay for the construction costs of approved Reclamation projects, let alone new ones. The Acting Chief Engineer went on to suggest that a possible strategy would be to obtain additional storage funds in association with the proposed Indian project, due to pressure that could be brought to bear by the Indian Office. However, he held out little hope, even for this tactic.¹¹¹

A major step forward in Reclamation’s Sunnyside Project took place on June 23, 1906, when the Washington Irrigation Company signed a deed with the U.S. Government, finalizing the sale of

¹⁰⁹ Letter report dated March 15, 1906, from D.C. Henny to F.H. Newell, National Archives, Entry 3, Box 1020.

¹¹⁰ Letter dated March 27, 1906, from Acting Secretary, Thomas Ryan, to the Director of the U.S. Geological Survey, copy in Lower Columbia Area Office files.

¹¹¹ Letter dated April 5, 1906, from D.C. Henny to F.H. Newell, National Archives, RG 115, Entry 10, Box 625 and letter dated April 6, 1906, from the Acting Chief Engineer to D.C. Henny, National Archives, RG 115, Entry 3, Box 1020. By the end of June 1906, Hitchcock had made a tentative allotment of \$100,000 for irrigation development on the Yakima Indian Reservation. See letter from W.L. Jones to Hitchcock, dated June 26, 1906, National Archives, RG 115, Entry 10, Box 625.

the Sunnyside Canal system for \$250,000. Included were all of the branch canals, laterals, and associated features such as flumes, headgates, and ditchriders' houses. Excluded from the sale were 9,000 acres of irrigable land owned by the Washington Irrigation Company, along with the appurtenant water rights.

At the same time, Congressman Jones remained in the midst of negotiations for a Reclamation project on the reservation. Reclamation was hesitant to conduct extensive investigations there until it had some assurance that the Indians would be willing to sell off surplus lands to repay construction costs. The Indian Bureau asserted that it could not induce the Indians to sell until they knew exactly how much water they would receive and how much it would cost them. Jones attempted to convince the Secretary of the Interior of the need to obtain buy-in from the Indians that they would participate according to Reclamation requirements. The Congressman was concerned that the Indians would be reluctant to sell because of existing rules that gave them only monthly payments of about \$10 for the sale of their inherited lands, rather than a lump sum. He wrote to Hitchcock, "It is true that much of their money would be squandered, but it is also true that many of these Indians are as capable of handling their money and affairs as the average white man. One thing is true, the Indian will never become a man as long as he is treated as a child."¹¹² The Indians were, in fact, opposed to selling off excess allotted lands to repay Reclamation costs and, ultimately, this plan was dropped.¹¹³

Reclamation engineers continued their investigations of construction needs and presented their findings to Newell in early July 1906. They strongly advised beginning work on the storage facilities as soon as possible, in order to occupy the strategic points at the outlet of the upper Yakima lakes. Specific recommendations included the immediate construction of low temporary crib dams at Lake Keechelus and Lake Cle Elum, to be followed by the installation of permanent dams there. They further suggested that a permanent dam be built at Lake Kachess, capable of storing 220,000 acre-feet. The board also concluded that there were enough commitments from landowners under the Tieton Division to begin construction there. The same did not apply to the Sunnyside Division, although the engineers recommended that "immediately upon transfer to the United States of the Sunnyside Canal such renewals of structures as are found necessary be undertaken . . ."¹¹⁴ Newell concurred with the proposals to begin work on the

¹¹² Letter dated June 26, 1906, from W.L. Jones to E.A. Hitchcock, National Archives, RG 115, Entry 10, Box 625.

¹¹³ Heritage Research Center, Yakima River Basin Historical Resource Survey, p. 122.

¹¹⁴ Letter report dated July 6, 1906, from Board of Engineers, A.J. Wiley, D.C. Henny, E.G. Hobson, and Joseph Jacob to F.H. Newell, National Archives, RG 115, Entry 3, Box 1020. It is unclear why the engineers alluded to the transfer of property as pending, because consummation of the sale had occurred on June 23, 1906.

Tieton Division, the Sunnyside structures, and the temporary dams. Construction of a Reclamation project in the Yakima Valley was finally set to move from politicking and paper to the ground.

Within a few months, work crews were indeed in place on the Sunnyside Division. Over the next several years, construction proceeded up and down the valley on other components of the Yakima Project as funding was appropriated. The Tieton Division was started in the spring of 1907, temporary crib dams were constructed at the outlets of Lakes Keechelus and Cle Elum during the fall and winter of 1906 and 1907, and preparations for Bumping Lake Dam were commenced in the fall of 1906. On March 31, 1909, the piecemeal development of the project was discontinued when the Secretary of the Interior called for the consolidation of the separate Federal irrigation ventures in the Yakima Valley under one unified Yakima Project. At the time, six main divisions were designated: Sunnyside, Tieton, Wapato, Kittitas, Storage, and Benton (formerly Ledbetter).¹¹⁵ Just a month earlier, there was a change in the organizational structure of Reclamation. On February 1, the Pacific Division was divided in two with the creation of a new Washington Division. Charles Swigart was appointed supervising engineer of all work in that State, with oversight of the various divisions of the Yakima Project.¹¹⁶

¹¹⁵ Later (about 1919), the Benton Division was eliminated and portions thereof were established as the Roza and Kennewick Divisions. Early on, the divisions were usually referred to as units.

¹¹⁶ Reclamation Record, February 1909, p. 19. Swigart came to Reclamation with almost two decades of experience with railroad and bridge companies and in general contracting. He had been educated in Ohio at Heidelberg College and Ohio State University. Immediately prior to becoming supervising engineer of the Washington Division, Swigart had been project engineer on the Tieton Division. Swigart left Reclamation in 1915 to become a consulting engineer. Rodgers, Andrew D. III, Federal Reclamation's Pioneer Period, Part II, 1966 (unpub.), p. 481, 489.

Sunnyside Division

In 1906, headquarters for the Sunnyside Division were established at Zillah, with C.W. Paine placed in charge of construction and Walter N. Granger appointed to stay on as irrigation manager, overseeing matters relating to operation and maintenance.¹¹⁷ Both men reported to District Engineer, Joseph Jacobs, stationed in North Yakima. He received permission to erect a new, two-story office building, including a porch and outside vault.¹¹⁸

The Sunnyside Canal, when purchased by the Federal Government, was 56 miles long, had a capacity of 650 cubic feet per second at the intake, supplied water to about 36,000 acres, and included mostly wooden control structures that were badly deteriorated and leaking.¹¹⁹ The system also included two main laterals (Snipes Mountain and Rocky Ford), with a combined length of about 25 miles, and about 50 miles of smaller laterals.¹²⁰ Under the Washington Irrigation Company, the system was built to primarily water the lands owned by the company. Reclamation planned to improve and extend the Sunnyside Canal, often referred to as the Sunnyside Main Canal, to eventually irrigate about 100,000 acres. First, however, Reclamation focused its attention on replacing the old diversion dam and timber headgates near Parker, which dated from 1892-93. A new concrete dam and canal headworks, located just below the old ones, were designed to take their place. The new Sunnyside Diversion Dam measured 500 feet long between abutments and was a fixed weir of the “ogee” type. It was 8.5 feet high and 20 feet wide, including the apron. Incorporated in the dam was a 6-foot-wide sluice opening controlled by flashboards. The canal headgates consisted of six hand-operated, cast-iron gates, each one measuring 6 feet by 6 feet. The gates were designed

¹¹⁷ Granger held that position until 1910, when the operations and maintenance office was moved to Sunnyside and R.K. Tiffany was appointed Irrigation Manager.

¹¹⁸ Letters dated December 18, 1906, from D.C. Henny, Supervising Engineer, to F.H. Newell and December 31, 1906, from E. Hobson, Acting Supervising Engineer, to F.H. Newell, National Archives, RG 115, Entry 3, Box 1015. The headquarters property in Zillah (Block 23) was included in of the purchase from the Washington Irrigation Company. Jacobs took over as district engineer upon T.A. Noble's departure from the Reclamation Service. Jacobs was a civil engineering graduate of Kansas State University who had been with the U.S. Geological Survey for some years and many years in railroad work. Jacobs resigned as district engineer in 1908 but remained a project consultant. Rodgers, Andrew D. III, *Federal Reclamation's Pioneer Period*, Part II, 1966 (unpub.), pp. 478, 483.

¹¹⁹ Figures vary from 32,000 to 40,000, regarding the number of acres being irrigated. The figure of 36,000 acres is from the Yakima Project, Annual History Through 1912, Vol. 1, p. 11.

¹²⁰ *Ninth Annual Report of the Reclamation Service, 1909-1910*, p. 292.

for a capacity of about 1,075 cubic feet per second. Tainter gates were installed behind the cast-iron ones in the event of an emergency need to shut off the water into the canal. A fish ladder was incorporated at the south side of the old masonry gatehouse, which was retained, and an earthen dike, 10 feet wide at the top, was built on the south side of the river, extending upstream from the dam for nearly a mile.



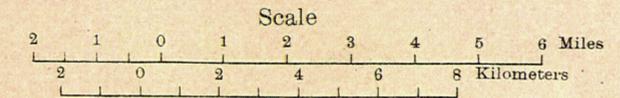
View showing gravel excavation at Sunnyside Dam, October 29, 1906.

Early in October 1906, a construction camp was established on the south side of the river near the dam site. That fall, winter, and following spring between 30 and 100 men were employed on the project. A second camp was then established on the north side of the river. By October 15, 1907, the dam and headgates were completed.¹²¹

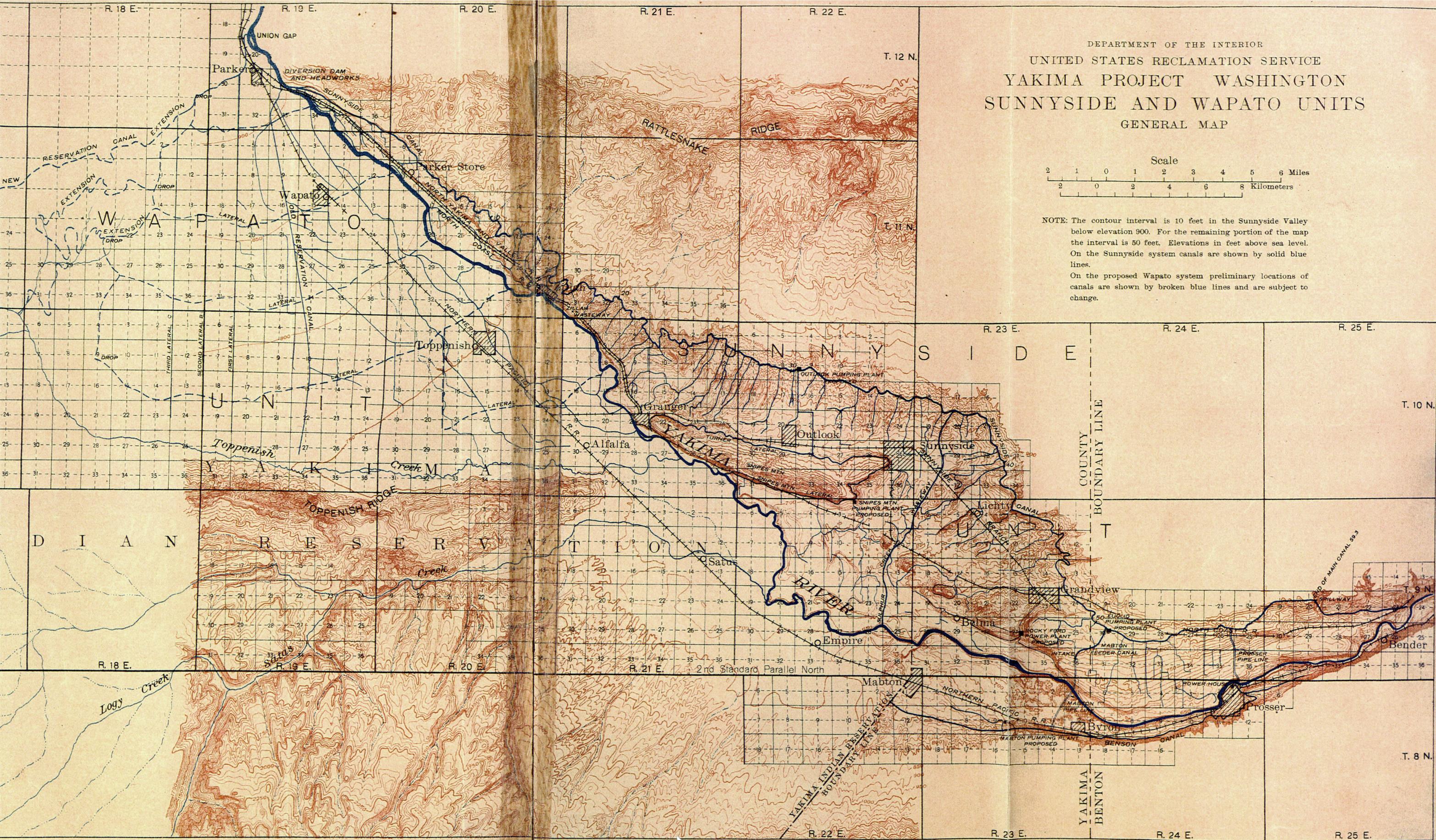
The next phase of construction on the Sunnyside Division involved extending the Sunnyside Canal to 60 miles in length, enlarging it, upgrading the deteriorated wooden structures, and incorporating new ones. This work took place between 1907 and 1912. A Bucyrus Dredge, a Lidgerwood excavator, and horse teams pulling scrapers accomplished the task of enlarging the canal. During this same busy time, the operation and maintenance functions were moved

¹²¹ Yakima Project, Annual History Through 1912, pp. 28-32.

DEPARTMENT OF THE INTERIOR
 UNITED STATES RECLAMATION SERVICE
YAKIMA PROJECT WASHINGTON
SUNNYSIDE AND WAPATO UNITS
 GENERAL MAP



NOTE: The contour interval is 10 feet in the Sunnyside Valley below elevation 900. For the remaining portion of the map the interval is 50 feet. Elevations in feet above sea level. On the Sunnyside system canals are shown by solid blue lines. On the proposed Wapato system preliminary locations of canals are shown by broken blue lines and are subject to change.



Source: U.S. Department of the Interior. Reclamation Service. Yakima Project, Annual History Through 1912.

NOVEMBER 1910

Figure 4

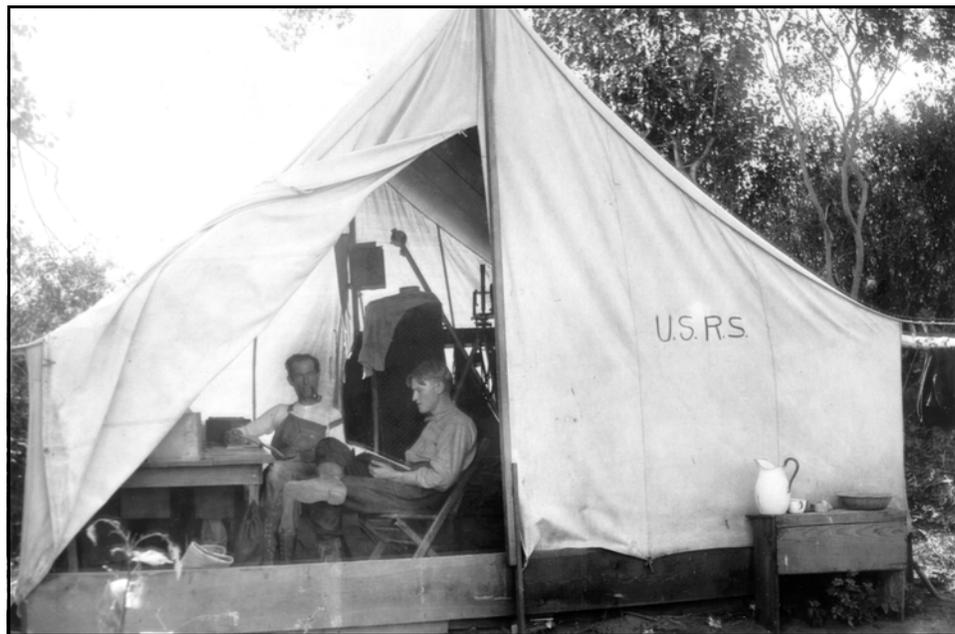
from Zillah to a new office, barn, and warehouses at Sunnyside, and a telephone line was strung from there to North Yakima.

Prior to its purchase by the Federal Government, the entire Sunnyside Canal had been operated without any wasteways.¹²²

The Zillah Wasteway, located about 17 miles below the heading, existed but was

nonfunctioning due to improper construction. Work began on rebuilding the wasteway in spring 1907 and was completed in February 1908. A concrete drop-headworks structure with four gate openings was installed. The cast-iron gates were operated by a turbine that took advantage of the drop between the Sunnyside Canal and the concrete-lined wasteway channel. A 700-foot long wooden flume was built at the end of the concrete section to discharge the wasteway water back into the river. Next to the wasteway, a patrol house was erected.¹²³

A more extensive wasteway named the Sulphur Creek Wasteway was authorized by the Secretary of Interior on December 16, 1906, and was built between 1908-1910. Due to problems with various contractors, Reclamation's own forces were used at the end to finish construction. In addition to providing an emergency outlet for surplus water from the Sunnyside Canal, the 8-mile-long wasteway served as a main drain for lands around the town of Sunnyside. Prior to construction, large tracts of land under the canal had become swampy and alkaline, due to lack of proper drainage.¹²⁴ Located about 37 miles from the start of the



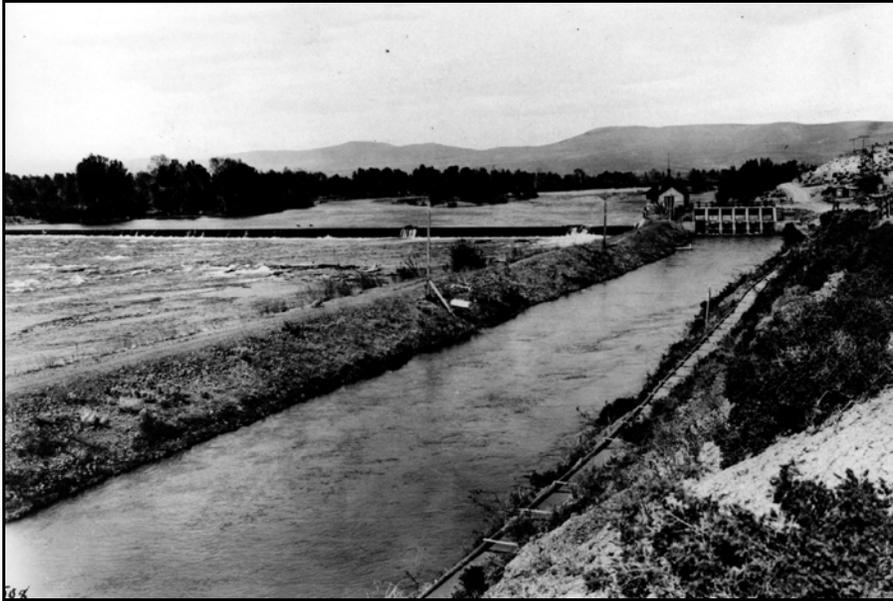
Reclamation headquarters office at headworks of Sunnyside Canal.

¹²² Wasteways are used to empty the canal for inspection, maintenance, seasonal shutdown, or an emergency such as a canal bank failure.

¹²³ Ibid, pp. 63-64. C.B. Cox, assistant engineer, was in charge of the construction of Sunnyside Dam, the Zillah Wasteway, and the extension of the Sunnyside Canal. Cox, an M.I.T. graduate, had been involved in early investigations of the Okanogan, Priest rapids, and Palouse projects. Rodgers, Andrew D. III, *Federal Reclamation's Pioneer Period, Part II, 1966* (unpub.), p. 476.

¹²⁴ Letter dated February 24, 1908, from Board of Engineers, E.G. Hobson, C.H. Swigart, and E. McCulloh to F.H. Newell, Director, U.S. Bureau of Reclamation, National Archives, RG 115, Entry 10, Box 625.

Sunnyside Canal, the wasteway turnout consisted of a reinforced-concrete, drop-headworks structure with four cast-iron gates. The first mile of the wasteway was concrete lined; the



Headgates at Sunnyside Canal (no date).

remaining seven had no lining except for timbers laid in the bottom. Along the length of the wasteway, there were 17 concrete drop structures of rather unusual design, due to the half hexagon shape of the upper weir wall. This design addressed the need for the drops to dissipate the force of water coming into the drop basin from three directions. Wooden pony truss and stringer bridges were built over the wasteway at public and private road crossings, and two wooden flumes were constructed to carry drainage water over the wasteway. A wooden drop structure at the end of the wasteway discharged water into the Yakima River.



Sunnyside Unit, Bucyrus dredge in operation. Enlargement of Main Canal, April 5, 1910.

Other features built along the Sunnyside Canal included concrete culverts, concrete turnouts, and 14 wooden Howe-truss highway bridges. Twenty-five concrete drops were built, some with cast-iron gates, others with wooden ones.

Mabton Division

The idea of irrigating lands to the south of the Yakima

River in the vicinity of Mabton was first proposed by C.N. Stahl in a 1903 letter written to the Secretary of the Interior. Several investigations were conducted by Reclamation engineers, and the concept was deemed feasible. Water would be diverted from the Sunnyside Canal, carried south in a combination of open canal and pipe, transported under the Yakima River in a siphon, and then distributed to lands south and east of Mabton. As usual, Congressman Jones was closely involved in project matters. In January 1908, Jones recommended to F.H. Newell that the Mabton Division seemed a wise next step, given the fine lands located there and the readiness of the farmers to irrigate. Final plans for the Mabton Siphon were drawn up in March 1908, and on April 27, 1908, construction was authorized.

Work started on the Mabton Siphon in June 1908 and by the spring of 1912, the Mabton Division was nearly completed. Part of the construction was completed by contractors, the rest by Reclamation forces, referred to as “force account.” A concrete headgate with four cast-iron gates diverted water from the Sunnyside Canal at mile 50.35 into the 1.5-mile-long unlined Mabton Feeder Canal. A half-dozen wooden bridges were constructed across the canal. At the end of the Feeder Canal, water was transported in concrete pipe to the 48-inch-diameter wood stave siphon that crossed beneath the Yakima River. The siphon emptied into a pipeline that extended south and ended to the west of Byron. From there, water was delivered to the irrigable lands through a main lateral running west for 8 miles to the boundary of the Indian reservation. Along the main lateral were seven wooden flumes totaling 2,100 feet in length. A second, smaller lateral (2.6 miles long) headed to the east from the end of the Mabton pipeline. Standard turnouts and measuring boxes on the laterals were constructed of wood.¹²⁵ The completed Mabton Canal served about 10,000 acres.

Prosser Division

Like the Mabton Division, the Prosser Division was located on the south side of the Yakima River and received its water from a lateral heading south off of the Sunnyside Canal at mile 55.04. It was originally thought that the lands in the Prosser Division, which, in part, had been irrigated previously by the Prosser Falls Land and Power Company’s ditch system, could be watered by an extension of the East Lateral of the Mabton Division. This presented numerous engineering difficulties, however, and a decision was made to build an independent lateral to serve the lands around Prosser. Before Reclamation would begin construction, the agency required that the water rights in the area be settled to its satisfaction. Reclamation stipulated that 90 percent of the lands having water rights under the Prosser Falls and Power

¹²⁵ *Yakima Project, Annual History 1902-1912*, pp. 86-101. U.S. Department of the Interior, Reclamation Service, *Cost Report, Yakima Project, Washington*, August 25, 1910, pp. 162-63.

Company's canal and 90 percent of the new lands to be irrigated from the proposed system subscribe to the Sunnyside Water Users Association. The town of Prosser also had to enter into an agreement with Reclamation to receive irrigation water. By August 1910, these conditions had been largely met and approval was granted to go forward with construction. On November 1, 1910, bids for most of the work were opened in North Yakima, and by May 1911, the project was completed.¹²⁶

The Prosser Lateral consisted mainly of concrete and wood stave pipeline. A wooden turnout on the Sunnyside Canal diverted water into a natural drainage channel for about ½ mile, then into a 456-foot-long open earthen ditch, referred to as a “feeder canal.” From there, water entered into a 10,587-foot-long pipeline, two-thirds of which consisted of 31-inch-diameter wood stave pipe milled at Ballard, Washington. The intake and outlet sections were of reinforced-concrete pipeline manufactured by force account in Prosser. The pipeline was built in 6-foot-long sections using collapsible steel forms made especially for this purpose. A four-span steel bridge carried the pipeline over the Yakima River. On the south side, the pipeline emptied into a 1,664-foot-long steel flume and, from there, water entered the main canal of the Prosser Division. After a short distance, this canal divided into two branches, one heading west as far as the town of Byron, the other going east for about 2.5 miles. A small distribution system delivered water to farmers. In addition to the new construction, the old ditch system was improved and used to the extent possible.¹²⁷ Upon completion, the Prosser Lateral served about 3,000 acres.

Snipes Mountain Division

Another component of the Sunnyside Division was the Snipes Mountain Division, largely completed by the spring of 1912. This area, encompassing about 14,000 acres, was located southeast of Granger and was irrigated by the 14-mile-long Snipes Mountain Canal and its branches. The canal took out of the Sunnyside Canal at mile 30.25. In existence since 1893, the Snipes Mountain Canal was enlarged by Reclamation to a capacity of 183 cubic feet per second, and a new concrete headworks structure with three cast-iron gates was built. Ten concrete drop structures were also added along the length of the lateral. The two main branches of the Snipes Mountain Lateral were known as the South Branch (3.5 miles long)

¹²⁶ Yakima Project, *Annual History 1902-1912*, pp. 110-114, *Tenth Annual Report of the Reclamation Service, 1910-1911*, p. 232.

¹²⁷ *Ibid.*

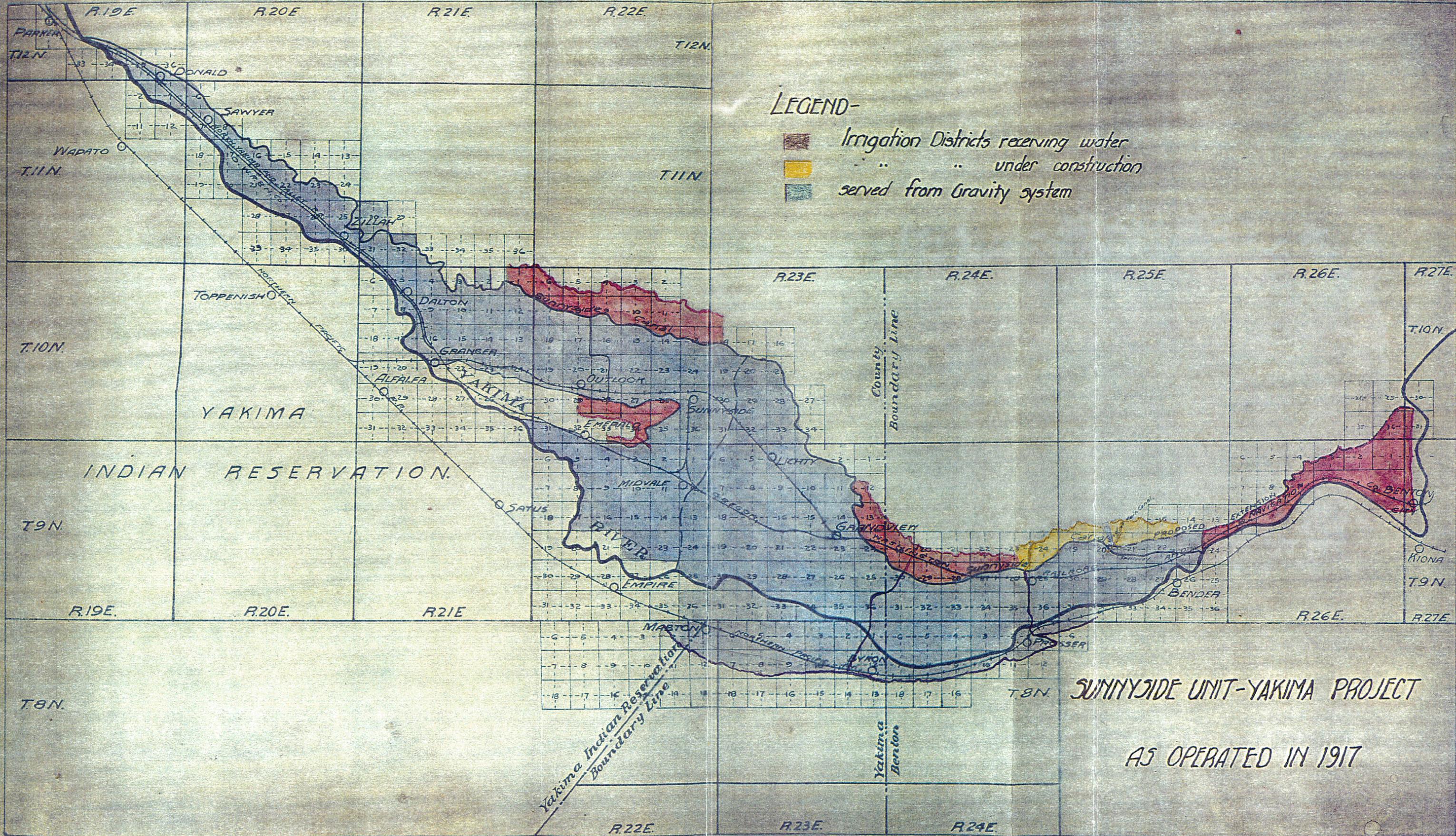


Figure 5

and the “E” Lateral (3.2 miles long). The “E” Lateral took off of the main lateral at mile 6.41, where there was a drop of about 37 feet. A series of hydraulic pumps were installed at the drop to lift water to irrigate about 250 acres.

Preliminary studies were done by Reclamation to install other pumping plants in the Sunnyside Division to take advantage of the drops and irrigate higher lands. These included the Euclid Pumping Plant (later renamed Grandview) on the Sunnyside Canal at the head of the Mabton Main Lateral; the Outlook Pumping Plant on the Sunnyside Canal north of the town of Outlook; and the Mabton Pumping Plant off of the Mabton West Lateral near Byron. Construction of the pumping plants was urged by local citizens, but Reclamation deferred until certain conditions had been met. Reclamation felt that private enterprise could take on the initiative. In September 1911, Sunnyside Division residents signed a petition addressed to the Secretary of the Interior, asking him to approve construction of the plants. The conditions laid down by Reclamation remained in force. At the time the initial enlargement of the Sunnyside Canal was completed, the pumping plants remained on paper only.¹²⁹

The first irrigation of Sunnyside lands under Reclamation occurred in 1907. By 1913, about 80,000 acres in the Sunnyside Division were open for irrigation, of which about 63,000 acres actually received water. There were 2,450 irrigated farms. Fruits of all kinds were being grown, as well as vegetables and hay. The principal vegetable crop was potatoes, and alfalfa was the primary hay crop. New settlers moved into the area, drawn by the available irrigation water and impressive transportation network. Railroad lines traversed the valley, and no farmer was more than 2 or 3 miles away from a shipping point. Signs of the new prosperity were evident in all directions: substantial businesses and comfortable residences were sprouting up in towns, while on the farms, profits were being invested in new fencing, barns, outbuildings, and homes.¹³⁰

Four years later, in 1917, Reclamation could boast that the Sunnyside Division was capable of irrigating about 102,000 acres. Additional improvements to, and expansion of, the system made this possible. The Sunnyside Canal was widened from mile 50 to mile 60, including the construction of two drop structures at miles 52.6 and 57.6, and the replacement of a wooden flume at mile 55 with a steel one. The capacity of the canal had been increased to 1200 cubic feet per second at the intake. Elsewhere on the Sunnyside Canal, numerous wood turnouts were replaced with ones of steel and concrete. The system had been augmented by 50 miles of branch canals and 460 miles of laterals and sublaterals.

¹²⁹ Annual Project History Through 1912, p. 149.

¹³⁰ Tenth Annual Report of the Reclamation Service, 1910-1911, p. 234. Thirteenth Annual Report of the Reclamation Service, 1914-1914, p. 298.



One of the beautiful farm homes in the Yakima Valley.

An extension to the Sunnyside Canal, known as the Benton Canal, lengthened it 10 miles and brought water to an additional 4,600 acres north of the Yakima River in the vicinity of Benton City. This work was completed for Reclamation by private contractors in 1914-15. Most of the construction was done in the spring of 1914

when, for a time, 350 men and 80 horses were employed. An overflow concrete weir and diversion works were built at mile 59.4 for the Benton Canal extension.¹³¹

By 1917, Reclamation had also added several pumping plants to deliver water to higher lands. At mile 30.25 of the Sunnyside Canal, at the head of the Snipes Mountain Canal, the Outlook Pumping Plant was built to irrigate about 4,500 acres to the north. Two pumping units were housed in a reinforced-concrete structure. Water was lifted 109 feet and distributed through a series of laterals.

The Snipes Mountain Pumping Plant was built at mile 9.04 (southwest of the town of Sunnyside) of the Snipes Mountain Canal to irrigate about 2,000 acres lying above the gravity system. The works were comprised of a wood stave penstock, a concrete structure housing two pumps and turbines, and a wood stave delivery pipe. Another small pumping plant on the Snipes Mountain Canal, known as the Hillcrest Plant, was installed to irrigate about 175 acres. Located at mile 6.42 of the canal, the plant consisted of one pump and turbine in a reinforced-concrete building.

¹³¹ "Final Cost Report, Sunnyside Irrigation District, Yakima-Sunnyside Project," no author, ca. 1916.

The earlier proposed Euclid Pumping Plant had been built and was renamed the Grandview Pumping Plant. Located at the head of the Mabton Feeder Canal, the plant consisted of three pumping units installed in a reinforced-concrete structure. The plant made possible the irrigation of about 3,900 acres lying above the Sunnyside Canal to the east of Grandview.¹³²

An important step in the operation and maintenance of the Sunnyside Division was the creation of numerous irrigation districts there. By 1917, established irrigation districts included the Sunnyside, Snipes Mountain, Outlook, Granger, and Grandview.¹³³ Each irrigated district operated and managed its own respective system within the larger division. The Sunnyside Irrigation District comprised about 4,600 acres at the extreme lower end of the Sunnyside Division, in the area served by the Benton extension. The Snipes Mountain Irrigation District consisted of about 2,000 acres near the center of the Division, but lying above the gravity system, and the Outlook Irrigation District embodied about 4,500 acres north of the town of Outlook and above the Main Canal. The Grandview Irrigation District served the lands under the Grandview Pumping Plant, and the Granger Irrigation District was created to water about 1,600 acres. Under contracts with the United States, the districts agreed to repay construction costs over a period of 20 years.¹³⁴ On January 22, 1917, the Sunnyside Valley Irrigation District (SVID) was organized to replace the Sunnyside Water Users Association. By far the largest irrigation district on the Sunnyside Division, the SVID extended from Sunnyside Diversion Dam to the start of the Benton Canal and encompassed about 80,000 acres, representing 77 percent of Sunnyside Division lands.

Also in 1917, the Prosser Irrigation District was established to irrigate about 4,000 acres north of Prosser. These lands were not part of Reclamation's original plans for the Sunnyside Division; a water delivery system was built there at the request of landowners. After completing investigations in early 1917, Reclamation engineers proposed that the agency construct the necessary works provided the landowners form a district and enter into a contract to repay construction costs. On May 12, 1917, a vote was held to create the Prosser

¹³² For information on pumping plants, see "Irrigation District Management, Yakima Project, Sunnyside Unit," R.K Tiffany, Reclamation Record, September 1916, p. 416. Also see U.S. Reclamation Service, Yakima Project, Sunnyside Unit, Annual Report for O&M, 1916, pp. 11-12 and Yakima Project, Sunnyside Unit, Annual Report for Operation and Maintenance for 1917, p. 6-7.

¹³³ A seventh district, the Zillah Irrigation District, was established in 1920 and comprised only 106 acres.

¹³⁴ "Irrigation District Management, Yakima," Reclamation Record, September 1916, p. 416. Funds for construction of a siphon and two laterals to deliver water from the Sunnyside Canal to the Granger Irrigation District were not available until fall of 1922. Construction was completed in 1923. The reinforced-concrete siphon has a headgate located at mile 23.09 of the Sunnyside Canal. See Department of the Interior, Bureau of Reclamation, Yakima Project, Granger Irrigation District, Data Compiled May 1925 for Board of Survey and Adjustments, pp. 4-7.

Irrigation District and a board of directors was elected. A contract was entered into with the United States on December 1, 1917, and construction began in January 1918. Lands in the Prosser Irrigation District are above the Sunnyside Canal, therefore, it was necessary to build pumping facilities. Two plants known as the Prosser Pumping Plant and Spring Creek Pumping Plant

were built at mile 55.05 and mile 59.02, respectively, of the Sunnyside Canal. Wood stave penstocks supplied water to the plants, each of which contained one pump connected to a 174 horsepower turbine. Small concrete buildings housed the pumping units.



Settler's house and outbuilding on Granger Irrigation District, July 1926.

The original distribution system consisted of nearly 6 miles of canal along with numerous wooden flumes, turnouts, drop structures, and bridges. The first delivery of water to the Prosser Irrigation District was made in 1919.¹³⁵

In addition to the irrigation districts established on the Sunnyside Division, private drainage districts were also formed under State law for the important task of constructing drains.¹³⁶

Tieton Division

The original irrigation plan for Reclamation's Yakima Project included development of the Tieton Division to irrigate about 24,000 acres of lands lying between the Naches River and

¹³⁵ Department of the Interior, Bureau of Reclamation, Yakima Project, Prosser Irrigation District, Data Compiled May 1925 for Board of Survey and Adjustments, pp. 4-9.

¹³⁶ Fourteenth Annual Report of the Reclamation Service, 1914-1915, p. 295.

Ahtanum Creek in the vicinity of North Yakima.¹³⁷ At the time Reclamation conducted its investigations, only about 40 farms irrigating some 1,570 acres were in existence there. Water for the division would be taken from the Tieton River at a diversion about 15 miles above its confluence with the Naches. A Main Canal heading at the south end of the diversion dam would carry water along the south side of the Tieton River through the narrow Tieton Canyon and eventually to the bench lands west of the city of North Yakima. Construction of the Tieton Division was divided into two components: (1) the Canyon Division, which included the diversion dam and Main Canal, and (2) the Valley Division, which encompassed the distribution system beginning at the point where water from the Main Canal was delivered into the North Fork of Cowiche Creek.

On April 12, 1906, the Tieton Water Users Association authorized its trustees to enter into a contract with the Secretary of the Interior for building the Tieton Division. During that summer, Reclamation engineers produced final plans and specifications so that, by fall, construction was ready to begin. The first step involved improving and extending a wagon road, including seven timber bridges, into Tieton Canyon. This work continued into the spring of 1907. In the meantime, Reclamation solicited bids for construction of the 12-mile-long canal and diversion dam. When bids were opened on November 15, 1906, none were received for execution of the dam and canal headworks. Likewise, no bids were obtained for the 11 tunnels included in the specifications for the Main Canal or for most of the work on the open canal sections. Reclamation decided to proceed with the construction using force account.

In spring 1907, construction camps were established at various points along the canal route and a telephone line was strung connecting the camps to Reclamation's office in North Yakima. Nearly 400 men were initially employed to undertake the challenging job of building the canal along the steep canyon walls.

Because of the difficult terrain that the canal route would follow, the original design included a series of 11 tunnels. As construction proceeded, it was determined that only six tunnels would be required. Starting at the upper end of the Tieton Main Canal and proceeding downstream, these tunnels are the Steeple Tunnels, numbers one and two, 100 feet long; Trail Creek Tunnel, 3,120 feet; Columnar Tunnel, 1,200 feet; Tieton Tunnel, 2,730 feet; and North

¹³⁷ The number of acres to be irrigated varies from 24,000 to 40,000 in different early reports. Apparently, the project was originally planned to embrace 24,000 acres. A petition to increase that amount to 34,000 acres was approved in 1910. The added acreage included mostly poorer land. By 1918, the acreage had been reduced to 32,000 acres and, in 1927, to 27,000 acres. "Celebration Honoring the Yakima-Tieton Irrigation District For Becoming the First Federal Reclamation Project to Complete Repayment of the Cost of Constructing Irrigation Works," Fact Sheet, on file at Upper Columbia Area Office library, 4.005.

Fork Tunnel, 3,810 feet. The latter tunnel at the lower end of the canal penetrates the divide between the Tieton River and the North Fork of Cowiche Creek. Of the Tieton Main Canal's total 12-mile length, about two miles are tunnel.

Preliminary work on the tunnels by force account was started in February 1907. In order to provide power to the drilling equipment, it was necessary to first build a powerplant in Tieton Canyon. A 3,500-foot-long power canal, located near the lower end of the Main Canal, was excavated to supply water to the plant. A log and brush diversion dam on the Tieton River diverted water into the canal. The frame powerplant was equipped with two turbines and generators to deliver power to the tunnel drills.

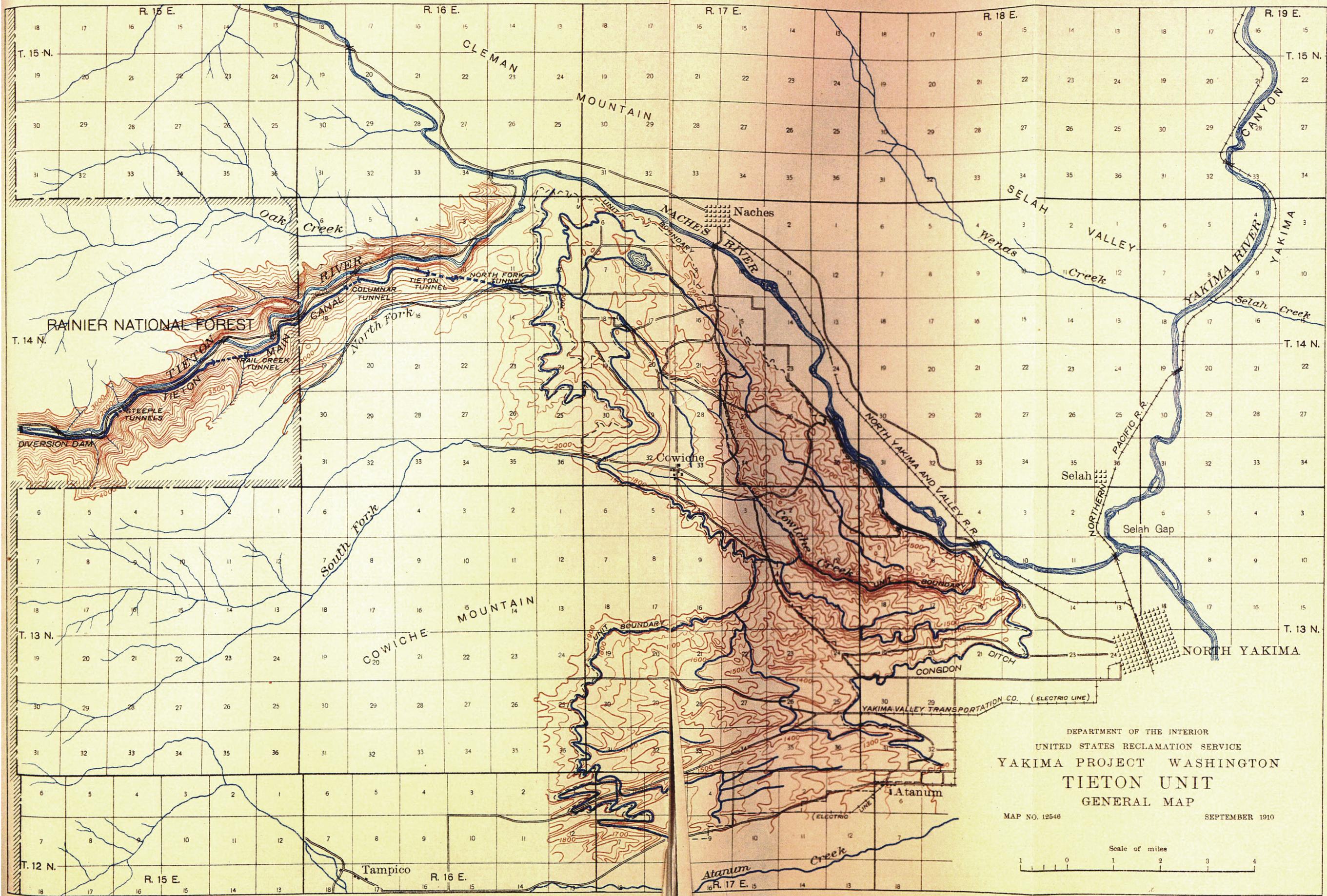
With completion of the powerplant, work on the tunnels began in earnest in the spring of 1907. All but the Columnar Tunnel were excavated by force account. The two short Steeple Tunnels were dug by hand and the rest were machine drilled. Along some tunnel sections where the ground was soft, permanent timber cribbing was required. Construction of the tunnels proceeded between 1907 and the fall of 1908.¹³⁸



Combined crusher and mixer, Tieton Main Canal. Weisberger's camp. Lady at extreme left, September 28, 1907.

Excavation of the open canal sections by force account began at the same time as the tunnel work. Not only was the job challenging because of the canal's location on a precipitous hillside, but also due to the varying types of material encountered. These ranged from loose

¹³⁸ Project History Through 1912, Tieton Unit, pp. 7-27. Ninth Annual Report of the Reclamation Service, 1909-1910, pp. 295-296.



Source: U.S. Department of the Interior. Reclamation Service. Yakima Project, Annual Project History Through 1912.

Figure 6

topsoil to solid rock. Originally, a steep uphill slope was planned for the open canal stretches, but this was found unfeasible in all but a few places due to the danger of sloughing. Many slopes had to be flattened out to eliminate this hazard. Because of the various difficulties, almost all of the excavation had to be performed by hand. Ultimately, in addition to the force account work which resulted in the excavation of about 300,000 cubic yards of material, two small contracts were negotiated for the excavation of several short canal stretches. All canal excavation work was completed by the end of August 1908. At the time, the 600 or so men employed on the Tieton Main Canal were divided into 12 different camps.¹³⁹

The original plan was to line only certain sections of the canal. However, because of the soil conditions, it was decided to line the entire length, except for two short segments. At first, in-place lining was considered, but the costs would have been very high and the steep topography would have made it difficult to set up concrete mixing equipment. An alternate plan was devised to manufacture the lining in 2-foot-long sections at suitable sites in the



Reinforcement weaving and bending machine, Tieton Main Canal, September 28, 1907.

¹³⁹ Reclamation Record, August 1908, p. 70.

canyon and then transport the sections to various points along the canal for installation. Two shapes were designed, one for the open sections and one for the tunnels.¹⁴⁰ Both shapes were reinforced with steel rods. The choice of the precast concrete sections was an unusual design solution for the time.¹⁴¹

The manufacture and placement of the lining was contracted out to Theodore Weisberger of North Yakima on January 5, 1907. Weisberger established a plant site at Station 80 of the Main Canal and built a hydro-operated powerplant there in the spring of 1907. Weisberger experimented with various methods of producing and installing the concrete lining, and the first section was finally placed in November of that year. Progress was slow, however, and Reclamation terminated Weisberger's contract in February 1908 and proceeded using force account. Canal construction was a challenge, since a number of ravines had to be crossed at right angles. This was accomplished by placing the precast segments on fills of rock and earth. Unfortunately, these fills soon began to settle as the rocks disintegrated and the finer materials began to wash out.

Along the Tieton Main Canal route, numerous control, regulating, and measurement features were incorporated. These included, among other things, 5 automatic wasteways to allow for emergency release of water from the canal, 8 tunnel entrance and outlet transitions, 20 culverts, 64 rock walls for crossing small gulches or for reinforcing the lower canal bank, 103 drain tile outlets, 25 overhead flumes with log supports, and a concrete Cippoletti weir at the end of the Main Canal.

Designed by Ensign, two of the automatic wasteways were controlled by floats in the canal that responded to variations in the level of the surface water and were connected with the operating mechanism of the gates by electric circuits. When water in the canal reached a certain level, the gates would automatically open. Although the wasteway design was experimental, it proved to be successful and was modified for the other wasteways.¹⁴²

In October 1909, the Tieton Main Canal was completed. A month later, the Reclamation powerplant in Tieton Canyon was shut down. By then, the Tieton Diversion Dam and canal headworks had also been finished. The dam consisted of a concrete overflow spillway that was 3 feet high and 110 feet long. The headworks structure for the Tieton Main Canal was

¹⁴⁰ *Annual Project History Through 1912, Tieton Unit*, pp. 64-84. At the Trail Creek Tunnel, the lining was done in place.

¹⁴¹ Bureau of Reclamation, "Report on Yakima Project for the President's Water Resources Policy Commission," June 14, 1950, on file at the Upper Columbia Area Office library, 4.005.

¹⁴² *Ibid.*, pp. 107-113. Ensign was presumably O.H. Ensign, electrical engineer with the Reclamation Service for many years. Ensign was responsible for the design of numerous early powerplants.

located at the dam's east abutment. Built of reinforced concrete, the headworks contained three 4- by 5-foot gate openings, each controlled by a cast-iron gate. There were two sluiceways in the dam crest immediately adjacent to the headgates. At the opposite end of the dam, a 400-foot-long, rock-faced embankment extended up to high ground. A frame gatekeeper's cottage was built below the dam headgates. Construction of the dam complex began July 30, 1908, and was completed in December of the same year.¹⁴³

The Valley Division, or distribution system, was built between 1909 and 1911. After emerging from the North Fork Tunnel, the Tieton Main Canal emptied into the North Fork of Cowlitz Creek. From there, water was diverted at five points by low diversion dams into eight main laterals. The diversion dams were all small earthen structures while the lateral headings varied. Two headings were concrete structures incorporating cast-iron gates; one consisted of two pipes with circular cast-iron gates, and two were concrete structures with flashboard.

The eight main laterals branched out to the main points of the lands to be irrigated. From these laterals, numerous smaller ones carried water to all reaches of the Tieton Division lands. Original plans and surveys conducted by Reclamation did not include construction of the sublateral system, but it turned out to require extensive engineering work. Area farmers petitioned the Secretary of the Interior for Reclamation to design and build the distribution system right down to 40-acre farm units. The request was granted on March 27, 1909.

Construction of the distribution system was performed by contractors and force account. Contractors completed the excavation of the main laterals, while Government forces built all the structures and sublaterals. Hundreds of men and horses were employed during the construction. Structures on the main laterals included flumes, turnouts, culverts, drops, and bridges. The flumes and culverts (box and pipe) were usually of standard design, as were the turnouts from the main laterals to the sublaterals. These turnouts consisted of concrete pipe through the canal embankment with wooden gates. The concrete pipe was manufactured on the project.

Most of the main lateral flumes were open steel ones, known as Maginnis flumes, resting on wooden trestles with concrete foundations.¹⁴⁴ During the summer of 1910, a new metal

¹⁴³ *Ibid*, pp. 22-24.

¹⁴⁴ The Maginnis flume was named after its inventor, Pat Maginnis. In 1902, he erected the first nonriveted semicircular metal flume to be used in the Nation for the conveyance of irrigation water. The device was patented and used extensively in the West for carrying water along steep hillsides and across topographic depressions of moderate depth. The rough interior of the flume reduced its carrying capacity. By 1920, the development of flumes with smooth interior surfaces had made use of the Maginnis flume nearly obsolete. Letter report on Metal Flumes by Julian Hinds, Engineer, Bureau of Reclamation, Denver, April 1920, National

flume, known as the Hess Flume, was introduced in the market. The joints were made so that the interior of the flume was smooth, greatly increasing its carrying capacity. This type of flume was installed in 1911. Drops were either open rock-paved or concrete chutes with check basins. Forty-two timber bridges were built where laterals crossed highways, nine wasteways and drainage crossings were constructed, and Cippoletti weirs were placed at the head of all the main laterals.

In addition to all the standard features on the main laterals, there were several that, even though small, were of unique design. The crossing of the LM main lateral over the Middle Fork of Cowiche Creek consisted of wooden planks and looked like a highway bridge. The steel flume crossing of the LM main lateral over the South Fork of Cowiche Creek incorporated a water-tight joint at the upper end of the flume where it intersected the concrete headwall. This joint was a groove filled with asphalt.¹⁴⁵

The sublateral system was comprised of 170 miles of open ditches with capacities ranging from 2 to 10 cubic feet per second. Structures on the sublaterals were all small and built on standard plans. They included pipe drops, concrete pipe or wooden siphons, wooden flumes, timber checks, and culverts.¹⁴⁶

A headquarters complex for the Tieton Division was established on the site of a construction camp in the northeast 1/4 of Section 34, Township 14N, Range 17E. An office, three houses, a barn, and several outbuildings made up the complex. In addition to these buildings, seven patrol houses were built along the canal system.¹⁴⁷

Irrigation on the Tieton Division started in May 1910, with water being delivered to about 1,660 acres of land. Because storage water was not yet available, the Main Canal had to be shut down later in the summer when the low flows in the Tieton River were fully appropriated. With the completion of Bumping Lake Dam in 1910, spring runoffs could be captured for later use and supplemental irrigation water could be supplied to the Tieton Division late into the summer (see section on Bumping Lake Dam for fuller description).

When the area served by the Tieton Division was ready for settlement, more than 90 percent of the land was in private ownership. The remaining public lands were opened for settlement as water became available. By 1912, the 2,000 acres of Federal lands were all open for entry. Water was delivered on a rotation schedule, with about one cubic foot per second allocated

Archives, RG 115, Entry 7, Box 27.

¹⁴⁵ *Ibid.*, pp. 165-187.

¹⁴⁶ *Ibid.*, pp. 187-193, *Cost Report, Yakima Project, Washington*, August 25, 1910, p. 122.

¹⁴⁷ *Project History Through 1912, Tieton Unit*, p. 194.

for every 120 acres.¹⁴⁸ By 1913, water on the Tieton Division was being supplied to 1,000 farms irrigating 18,283 acres. A large portion of this land was planted in fruit trees. The average size of farms was about 20 acres. Over the next few years, the population growth was rapid. New homes, churches, schools, and roads were built to keep up with the increase.¹⁴⁹

Within 6 years of its completion, the carrying capacity of the Tieton Main Canal was deemed inadequate, and Reclamation initiated enlargement plans. A design proposed by Guy C. Finley for raising the sides of the canal about 16 inches was approved in 1916, and construction began that fall. Mule teams were used to haul the concrete construction materials to points along the canal, and crews poured an average of 140 to 400 linear feet of canal per day. The canal's capacity was increased to 335 cubic feet per second.¹⁵⁰ In 1917, 1918, and 1920, new and better transitions were built at the intakes of the tunnels.

In 1917, the Yakima-Tieton Irrigation District was formed and received official approval from the State Superior Court on September 14 of that year. On July 18, 1918, the district entered into a contract with the United States to enlarge and improve the Tieton Main Canal and distribution system in order to deliver a larger supply of water to project lands. In connection with the enlargement, the project's irrigable acreage was adjusted from 35,000 to 32,000 acres.¹⁵¹

Storage Division

As construction of the Sunnyside and Tieton Divisions proceeded, so too did plans for building storage reservoirs at the headwaters of the Yakima River and its tributaries. Creating sufficient storage was integral to the overall success of the Yakima Project, and the six reservoirs that would eventually make up the Storage Division comprise a major component of the Yakima Project. Surveys of the natural lakes in the summer of 1905 had identified five feasible reservoir sites. Ranked in order of capacity and importance, the lakes were Cle Elum, Kachess, Keechelus, Bumping Lake, and McAllister Meadows (now called Rimrock Reservoir). Together, the lakes were thought to be able to store between 800,000

¹⁴⁸ Historic and Archaeological Resources in the Yakima-Tieton Irrigation District, CH2M Hill, November 1982, p. 5-12, Project History Through 1912, p. 204.

¹⁴⁹ Department of the Interior, Bureau of Reclamation, Yakima Project, Tieton Division, Data Compiled May 1925 for Board of Survey and Adjustments, pp. 23-24.

¹⁵⁰ CH2M Hill, p. 5-12.

¹⁵¹ Bureau of Reclamation, Yakima Project, Annual Project History, 1946, p. 120.

and 900,000 acre-feet.¹⁵² As it turned out, four permanent storage dams were built between 1909 and 1917, but they did not include one at McAllister Meadows or Lake Cle Elum. These dams were not completed until 1925 and 1933, respectively. Instead, the North Fork of the Tieton River became the site of one of the first four project storage dams. Known as Clear Lake Dam, it was built in 1914.

The remote and rugged mountain country presented numerous challenges for Reclamation in the construction of the Storage Division. Extensive and costly road systems had to be built to provide access to the dam sites. Transporting equipment over rough terrain, adverse weather conditions, and maintaining a skilled labor force were difficult. In numerous instances, Reclamation had to rely on force account to complete project features because contractors were not interested in bidding. Often, laborers had to be brought in from other States to help complete projects.

*Bumping Lake Dam*¹⁵³

The first of the reservoirs to be built was at Bumping Lake, located on the headwaters of the Bumping River, a main tributary of the Naches River. The dam stores and provides water to downstream irrigators as “replacement” for water diverted from the Tieton River into the Tieton Canal, thus depleting flows into the Naches.

Bumping Lake, a remote natural lake on the eastern slope of the Cascade summit and the remnant of an ancient glacier, had been eyed as a potential reservoir site as early as 1894. That summer, the Northern Pacific, Yakima and Kittitas Irrigation Company sent a crew of about 10 men out there to begin construction of a timber crib dam. Facing economic hard times, the company ran out of money and the project was abandoned.

The first surveys of the lake conducted by Reclamation occurred in the summer of 1905, when a crew of engineers led by H.K. Doolittle mapped the area. The following spring, another crew under the supervision of C.E. Hewitt conducted borings and dug test pits. More investigations continued in the fall of 1908, when a group of Reclamation engineers performed soil and rock analyses at the site.

¹⁵² Fourth Annual Report of the Reclamation Service, pp. 339-340; Fifth Annual Report of the Reclamation Service, p. 282. Clear Lake was a later addition to the storage division.

¹⁵³ The following description of the construction of Bumping Lake is excerpted from the draft HAER report on Bumping Lake, No. WA-30, by Stephen Emerson, Archaeological and Historical Services, Eastern Washington University, May 28, 1999.

Based on the site evaluations, plans and specifications were developed for an earthfill dam with a puddled core serving as a cutoff wall. Reclamation solicited construction bids with an opening date of November 15, 1906. None were received, and the project was readvertised for a bid opening on July 1, 1907. Again, no bids were submitted. The site was so distant and inaccessible that contractors simply were not interested. Thereafter, Reclamation project engineers opted to build the dam using force account. Permission to proceed was granted by Director, F.H. Newell, on November 18, 1908.

Before any construction could occur on the dam, a wagon road had to be carved out of the difficult terrain to allow for transport of supplies and materials. Costs for building the road were to be split between Reclamation, State of Washington, and Yakima County. The route was from Naches City, along the Naches River, and up the Bumping River to the dam site. Bids for the first section of road were opened on August 17, 1906, and a contract was awarded to C.E. Lum of North Yakima. Construction began the next month, and the company soon found out what a difficult task it was facing. At the same time, another crew employed by the State of Washington set out to work on the road. By the end of October, C.E. Lum's company completed their section of road, but the State and county funds were already almost completely expended. That same month, Reclamation dispatched a crew of 75 men to attempt to finish the remaining 20 miles of road before winter. A devastating flood in November 1906 destroyed much of the hard-won progress that had been made and caused a major setback. Work on the road was not resumed until August 1908. Using only force account this time, Reclamation finally finished the 20-mile road and a telephone line in December 1908.

As work on the road was winding down, work at the dam site was gearing up. Initial preparations included the construction of accommodations for the crews, offices for the engineers, corrals for the horses, storehouses for equipment, and a number of shop buildings. A camp site, referred to as Camp 22, was established along the road to Naches within a mile of the dam. Buildings were made of lumber that was harvested and milled onsite. Horse teams were used to haul the saw mill and other equipment up the rough wagon road. In addition to the frame structures, tents were erected for some of the sleeping quarters and for the mess halls. One of the camp buildings was occupied by personnel of the Young Men's Christian Association (YMCA). These men furnished the isolated dam workers with reading and writing materials, entertainment, educational lectures, and religious instruction. A second camp for timber crews was set up south of the dam site and probably consisted of tents.

By May 17, 1909, enough progress had been made on the camp to begin work on Bumping Lake Dam. The initial workforce consisted of 250 to 300 men. Their first task was to prepare the dam foundation area. The site was cleared of all trees, roots and vegetation were removed, and the ground was leveled. Other crews were busy locating and preparing

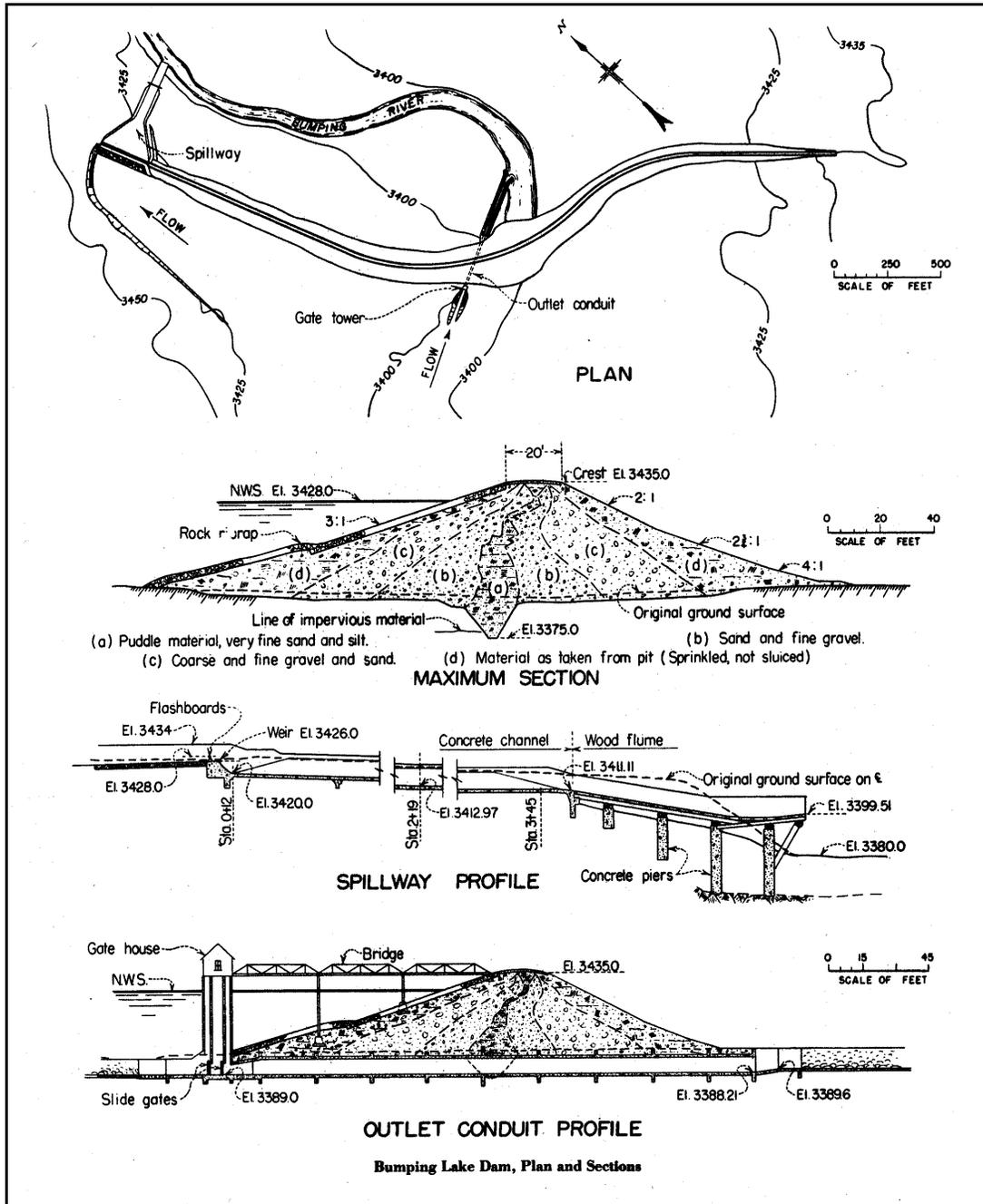


Figure 7.—Bumping Lake Dam, plan and sections.

Source: U.S. Department of the Interior, Water and Power Resources. Project Data. Denver, U.S. Government Printing Office, 1981.

quarries, and gravel and sand beds, where construction materials could be obtained. Still other crews built a network of construction roads and narrow-gauge rail tracks.

With these preparations completed, work shifted to the construction of the actual earthen dam embankment. The first step was the excavation of the cutoff trench along the axis of the dam. Several pieces of heavy equipment were hauled in to expedite this task. These included a 45-ton Bucyrus steam shovel mounted on steel wheels and moved about on tracks, and an “orange-peel excavator” set up on skids which could be dragged around. In addition, horse-drawn fresno scrapers were utilized, especially in the initial trenching.

Excavation of the cutoff trench began on the south side of the Bumping River in early June 1909. Original plans had called for a puddled cutoff wall consisting of materials removed from the trench, wetted down, and then compacted. Due to the unsuitable nature of the loose gravel, rocks, and sand excavated from the trench, it was necessary to transport more satisfactory material by cart, dump the fill along the excavated trench, and sluice it into place using high-pressure streams of water. Following its deposition in the trench, the fine sand and silt was distributed and compacted using high-pressure hoses. The process used to create the cutoff wall is known as the semi-hydraulic method.¹⁵³

In order to complete the central section of the cutoff wall, the course of the Bumping River had to be diverted away from it. The plan was to build a cofferdam to divert water into the concrete outlet conduit and outlet channel. As work on the conduit proceeded, so too did construction of the concrete gate tower and the spillway at the north end of the dam. The spillway consisted of a wide uncontrolled concrete weir, 2 feet high, a wide concrete-lined spillway which narrowed into a channel, followed by a timber flume which directed the water into a pool in the Bumping River. The spillway was about 550 feet long.

On October 17, 1909, the cofferdam was completed, the river could be diverted through the outlet conduit, and work on the central section of the embankment cutoff wall could proceed. Hopes of moving ahead quickly were dashed by wet weather and rising water levels in Bumping River. Men were directed to raise the cofferdam to protect the cutoff trench. Toward the end of November, the river rose again. This time, orders were given to cut into the dam at a point where cemented gravel would prevent uncontrolled erosion. It was feared that, otherwise, the whole dam might be swept away. Water damage to the cutoff trench was minimal, but the setback ended the 1909 construction season at Bumping Lake.

¹⁵³ The semihydraulic method differs from the hydraulic fill procedure in that materials are transported and dumped onto the dam by a means other than water. As materials are unloaded onto the dam, jets of water are used to wash the fine materials toward the core, and the coarser materials remain towards the outer slope.

Work resumed in April 1910, as men and horses made the difficult journey back up to the lake. The water-damaged cutoff trench was repaired, and the cutoff wall was completed. Slowly, the earthen embankment took form, starting at the south end. To carry the horse-drawn material cars over the river to the north end of the dam, a temporary timber trestle was built. Tracks were laid across the trestle and the embankment approaches. As the embankment material rose higher, the tracks for the cars were raised.

While work progressed on raising the embankment through the spring and summer of 1910, other crews were finishing the spillway and associated timber flume. Another ongoing activity that summer and fall was the gathering and placing of riprap on the upstream face of the embankment. Still other men were engaged in erecting a steel footbridge connecting the control tower to the embankment, constructing a frame damtender's house just north of the spillway, and clearing timber from the expanded reservoir area. By the close of the 1910 construction season, the only work remaining was completion of the reservoir clearing. This was continued the following spring and intermittently over the succeeding years.

When completed, the dam embankment was 60 feet high with a crest length of nearly 3,000 feet. Beneath the center of the dam was a concrete outlet conduit. Flow through this outlet was controlled by slide gates located at the bottom of the control tower, which was situated on the upstream side of the dam embankment. The gates were operated from the frame gate house at the top of the tower. Originally, the gates were hand operated, but later, a gasoline motor was installed to move them. An overflow spillway was located at the northern end of the dam. It consisted of a concrete weir and a funnel-shaped concrete spillway chute that led to a timber flume. The spillway returned water to the Bumping River when the reservoir's maximum level was reached.

The outlet gates of Bumping Lake Dam were first closed on November 3, 1910, and water began to collect in the reservoir. By July 1911, it was full and water was pouring over the spillway weir. Two repairs were necessary that first season. A drainage trench had to be built along the downstream toe of the dam to direct seepage into the river, and the paved conduit channel had to be repaired with concrete due to damage caused by water exiting the conduit with great force. A series of metal baffles were installed at the conduit outlet to dissipate the force. Additionally, the downstream face of the embankment was prepared and seeded with clover.

Although small compared to some of the later dams built on the Yakima Project, Bumping Lake holds the distinction of being the first one undertaken by Reclamation in the Yakima Basin. The project engineering demonstrates creative and successful approaches to problems encountered during construction, as well as the transition from the use of horse teams to motorized equipment.

The success of the project inspired confidence in Reclamation and contributed to the agricultural development of the region.¹⁵⁴

*Kachess Dam*¹⁵⁵

The second storage reservoir on the Yakima Project to be completed by Reclamation was Lake Kachess, created by damming a natural lake located at the headwaters of the Kachess River, a small tributary of the Yakima River. The lake actually consisted of two parts: (1) the lower or main lake, called Kachess on old maps; and (2) a smaller upper lake, called Piwallus on old maps. A mile-long channel joined the two bodies of water.

On April 1, 1907, after many rounds of negotiations, Reclamation assumed control of the crib dam that had been built at Lake Kachess by the Cascade Canal Company some years earlier. The decision to construct a permanent dam there as the second feature of the Storage Division was based on several reasons: the anticipated costs were reasonable, the lake's larger area translated into greater storage capacity; the small amount of flood discharge expected could be easily controlled during construction; and, perhaps most importantly, conditions at the site permitted the gradual development of the reservoir's full capacity. Kachess water would support the Sunnyside Canal, and Reclamation anticipated that the acreage watered by that canal would increase by 13,000 acres each year as the population and demand for water grew. Building the reservoir in stages would allow Reclamation to erect working portions of the dam and outlet works as appropriations became available, thereby producing functional returns on the work each season.

In the summer of 1908, detailed investigations for the dam were conducted and, thereafter, Reclamation engineers developed plans for an earthfill structure with a puddled core. The preliminary design concept was nearly identical to that for Bumping Lake Dam. Ultimately, however, a dam completed in 1908 on Reclamation's Umatilla Project in Oregon served more as a model for the one built at Lake Kachess. Cold Springs Dam consisted of a rolled earth embankment with a concrete cutoff wall in the foundation rather than a central puddled core. Charles Swigart and David C. Henny had both been involved in building Cold Springs Dam and served on the Board of Engineers for Kachess.

¹⁵⁴ *Yakima River Basin Historical Resource Survey*, p. 166.

¹⁵⁵ The information on Kachess Dam is excerpted, in large part, directly from the draft Kachess Dam HAER report, No. WA-79, by Hess, Roise, and Company.

The first phase of construction, to be completed by force account, was authorized by the Secretary of the Interior on February 14, 1910. Reclamation crews arrived at the site in April 1910 and established a small temporary camp near the county road to Easton. As the camp was being set up, other men began the task of diverting the Kachess River from the construction site. This was accomplished fairly easily by cutting a channel between parallel stretches of winding river connected by a hairpin turn. The river's flow was diverted into the channel, thereby bypassing the hairpin turn, which coincided with the construction site for the outlet works.

Work proceeded on excavating the intake which extended beneath the lake and beyond its southern shore to the embankment site. The intake consisted of three elements: a 1,250-foot-long open inlet channel under the natural lake connected to a 1,350-foot-long, horseshoe-shaped, reinforced-concrete buried conduit which fed into a 300-foot-long open channel immediately to the north of the embankment. This excavated inlet channel delivered water into a 300-foot-long concrete outlet conduit buried beneath Kachess Dam. From there, water exiting the conduit flowed into an open outlet channel on the downstream side of the dam. Extending nearly 500 feet, the open channel released water back into Kachess River.

Reclamation crews used an orange-peel excavator mounted on a wood raft to dig the 1,250-foot-long open inlet channel. In September 1910, the task of building the concrete conduit intake section started. Workers employed horse teams, a steam shovel, and a drag-line excavator to dig a 1,400-foot trench for the conduit. Three shifts worked around the clock and successfully completed 200 feet of the conduit in early January 1911, when work shut down for the rest of the winter.

Two months later, construction resumed with preparations for building the earthen embankment. Two nearby borrow sites were located to supply the material for the dam. Other activity included building the concrete outlet conduit that would pass through the dam's foundation and core wall, delivering water from the reservoir to the outlet channel downstream from the dam. To accommodate an expanded workforce, a larger residential camp was constructed; the old camp remained in use as the site of corrals and shops. Just as at Bumping Lake, YMCA personnel were present at Lake Kachess. The "YMCA Secretary" offered classes at the clubhouse, which was stocked with games, books, and magazines.

Although Reclamation solicited bids to have the dam built by contract, the agency ultimately rejected all proposals as too high and received permission in April 1911 to build the dam with its own crews. E.H. Baldwin was the engineer in charge of construction at Kachess. During the 1911 construction season, workers constructed the concrete cutoff wall embedded in the dam's foundation. Plans called for the cutoff to be founded on a bedrock base, but the hard

material encountered while digging the trench was determined stable enough to serve as support. The spillway also began to take shape that summer.

By November 1911, the project was nearly half complete; the foundation, intake, and outlet conduit were finished. The major tasks remaining included the permanent gatehouse and tower and the earthfill embankment. The 1912 construction season began in March with the erection of a timber trestle parallel and adjacent to the centerline of the dam and running the length of the dam site. The trestle was about 800 feet long and as high as the proposed dam crest. Crews laid a double railroad track across the trestle, and dump cars pulled by a locomotive hauled materials from the nearby borrow pits across the trestle. The cars dumped fill from the trestle to the ground below, where earth scrapers spread it across the dam site. Steam rollers then compacted each layer of fill to eliminate voids in the embankment. As the dam rose, the trestle was buried inside it, although the bracing timbers were removed as the compacted layers of fill provided more support for the piles. Finer earthen matter from one borrow pit composed the upstream two-thirds of the embankment, and coarser gravel from another pit was used in the remaining downstream third; this arrangement was meant to limit seepage and facilitate drainage through the earthen structure. To collect and discharge water that did manage to penetrate the dam, two drainage trenches were installed before fill was placed for the embankment. A protective layer of riprap was placed on both the upstream and downstream faces of the dam.



As the embankment took shape, work began on the reinforced-concrete gate tower and gatehouse on the upstream side of the dam at the downstream end of the intake. Two sets of three 4-foot by 10-foot cast-iron sluice

Dumping material from trestle, Kachess Dam, June 1, 1912.

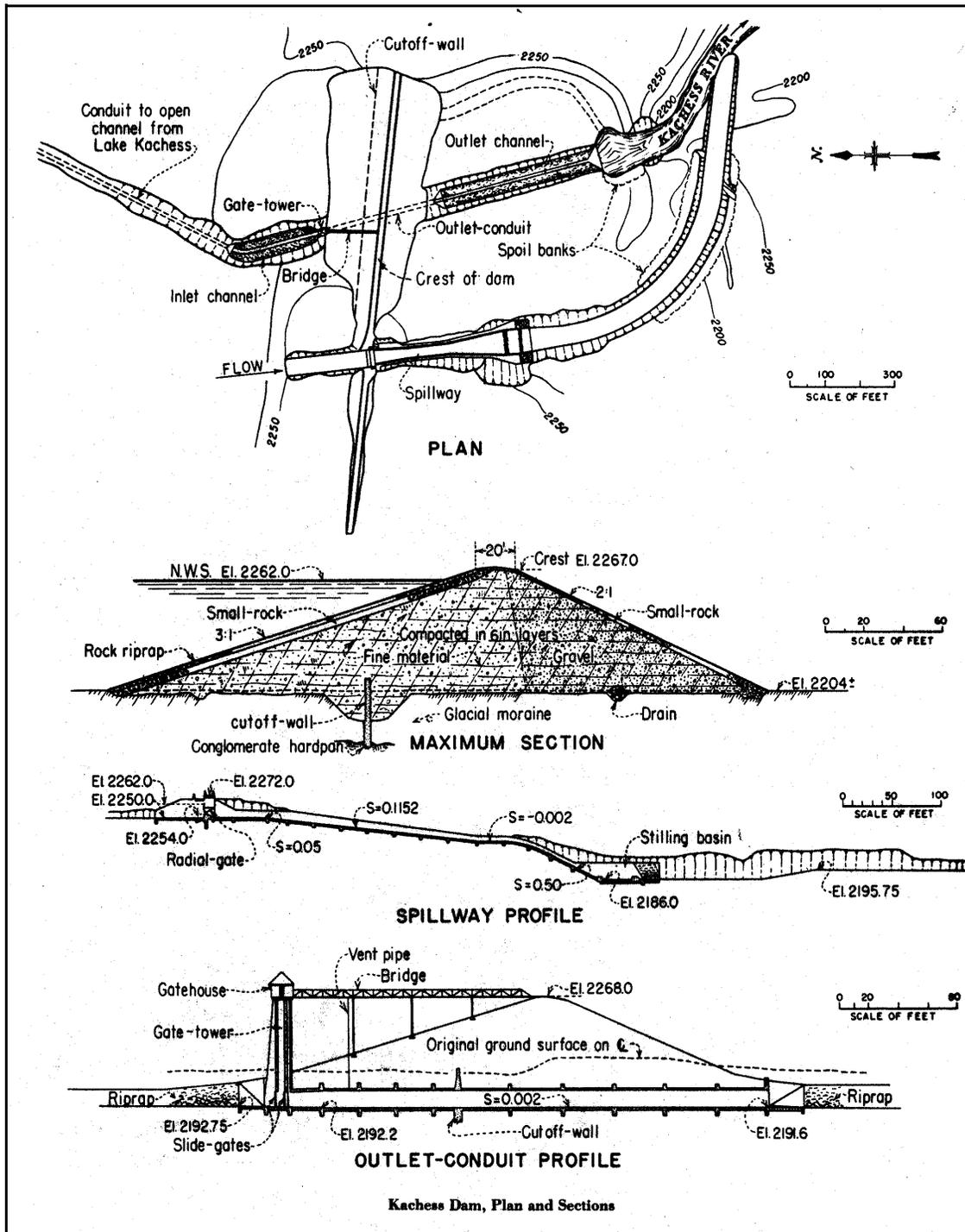


Figure 8.—Kachess Dam, plan and sections.

Source: U.S. Department of the Interior. Water and Power Resources. Project Data. Denver, U.S. Government Printing Office, 1981.

gates were installed in the base of the tower to serve as the operating and emergency gates. The sluice gates controlled the flow of water from the inlet works into the outlet conduit and channel. The gates were powered by a turbine located in the base of the tower and connected by shafts and gears to the operating mechanism in the gatehouse atop the tower. A four-span steel footbridge was built to link the gatehouse to the crest of the dam. Around the same time, workers constructed a wood-frame damtender's house southeast of the dam.

By November 1912, the only remaining tasks consisted of clearing timber between the old and new shorelines of the enlarged reservoir. Reclamation had let a contract for timber removal prior to the dam's construction, but the winning contractor failed to perform. Following completion of the dam, Reclamation sent in its own forces to clear the timber, selling the wood for a profit. During the next few seasons, the work of clearing timber proceeded, although it was halted before all timber was removed.

As finished, Kachess Dam was a zoned earthfill dam with a structural height of 115 feet. The crest was 20 feet wide, and the maximum base width was 335 feet. Beneath the embankment, upstream of and parallel to the center axis, a low concrete cutoff wall supported by a puddled core rose from the base of the foundation trench. The original spillway was located about a half mile east of the dam and consisted of a 4-foot-high concrete weir with a 250-foot-wide crest. The completed dam was capable of storing 210,000 acre-feet in the reservoir, although the lake did not reach first maximum storage until 1916. In 1936, the original spillway was replaced by an open spillway and spillway channel at the west end of the dam. Originally contemplated but never built was a feed canal from Lake Keechelus to Lake Kachess to route excess runoff from the first to the latter potentially larger lake.

Keechelus Dam

Lake Keechelus is a natural lake, originally about 4 miles long and one-half mile wide, located on the headwaters of the Yakima River, about 12 miles from Easton. The storage dam constructed there as part of the Yakima Project is the only one on the mainstem of the Yakima River.

Following investigations for a dam at Lake Keechelus in the summer of 1905, Reclamation engineers recommended that initial temporary storage be provided at the lake by constructing a small, rock-filled crib dam. Approval was granted and bids were solicited twice, but both



View showing a part of the proposed Keechelus Lake Reservoir, October 31, 1905.

times were unacceptable. In the fall of 1906, Reclamation resorted to force account to build the dam. Completed in April 1907, the dam raised the lake level 10 feet and allowed for about 15,000 acre-feet of storage.¹⁵⁶

Reclamation continued its studies for a permanent dam at Lake Keechelus and based on topographic surveys, test pits, and exploratory drilling, selected an earthen embankment design. As investigations and plans were being finalized, Reclamation contracted out the job of cutting timber within the expanded reservoir area. The work proceeded slowly and continued over several years.

In February 1912, a Reclamation Board of Engineers convened in North Yakima to discuss, among other things, the plans for Keechelus Dam. Those in attendance were Chief Engineer A.P. Davis, Consulting Engineer D.C. Henny, Supervising Engineer H.W. Savage, and

¹⁵⁶ Annual Project History Through 1912, Storage Division, p. 78.

Project Engineer E.H. Baldwin.¹⁵⁶ The final design consisted of a zoned earthfill dam 6,500 feet long and 20 feet wide at the crest. The hydraulic height would be 68 feet; the structural height 128 feet. It was estimated that about 522,000 cubic yards of material would be required for the embankment. This would be divided into two zones, the upstream half consisting of fine earthfill and the downstream half consisting of coarser gravel fill. A cutoff trench would be excavated the full length of the dam, and a concrete cutoff wall would be constructed to intercept any seepage under the upper toe of the dam. The outlet works would consist of a 3,300-foot-long tunnel. Control would be from a concrete gate tower containing six slide gates with hydraulic operating cylinders. Two hand-operated cylinder gates for service control would also be installed. A concrete overflow spillway, with a crest length of 300 feet, would be located in solid rock at the north end of the dam.¹⁵⁷

By the summer of 1912, Reclamation was ready to begin construction. In August, a temporary camp was established just south of the crib dam along the lakefront. Preparations continued with the layout of a permanent camp site, located east, several feet downstream of the dam site and on both sides of the river. Bunk tents were erected to accommodate about 120 men. The camp also featured a warehouse, repair shop, store, mess tent, kitchen, and corrals for about 50 horses. A 700-foot-long spur track off of the Chicago, Milwaukee, and St. Paul Railroad line was built to transport materials and supplies close to the site. With the completion of Kachess Dam, heavy equipment utilized there was available and shipped off to Keechelus. A steam shovel, dinkey locomotives, and an excavator were among the pieces delivered.¹⁵⁸

That first construction season, work on the dam consisted of clearing and grubbing the site. The following spring, this activity was continued, as well as enlargement of the construction camp to accommodate about 600 men. Excavation of the outlet tunnel was started, but difficult conditions were encountered and progress that year was slow. A board of consulting

¹⁵⁶ Ibid, 1912 Season, p. 2. E.H. Baldwin was transferred from the North Platte Project to the Yakima Project in spring 1909. In August 1909, he was placed in charge of the storage unit and oversaw construction of Bumping Lake Dam and Kachess Dam. In 1912, Baldwin left Yakima to work on Reclamation's Rio Grande Project in New Mexico. Andrew D. III, Federal Reclamation's Pioneer Period, Part II, 1966 (unpub.), pp. 490-91.

¹⁵⁷ United States Reclamation Service. Information Relating to Yakima Project, Yakima, Washington, July 1921. Revised to July 1924. P. 8. On file at Upper Columbia Area Office Library. C.E. Crownover, University of Nebraska civil engineering graduate, was Keechelus Dam's construction engineer. Prior to joining Reclamation, he had been employed as a railroad engineer for the Great Northern Railroad. Crownover took over from E.H. Baldwin as project engineer of the storage unit in October 1912. Crownover left Reclamation in about 1922 but returned in the mid-1930s to become construction engineer of the Roza Division. Rodgers, Andrew D. III, Federal Reclamation's Pioneer Period, Part II, 1966 (unpub.), pp. 493-94, 500.

¹⁵⁸ Ibid, p. 52-61.

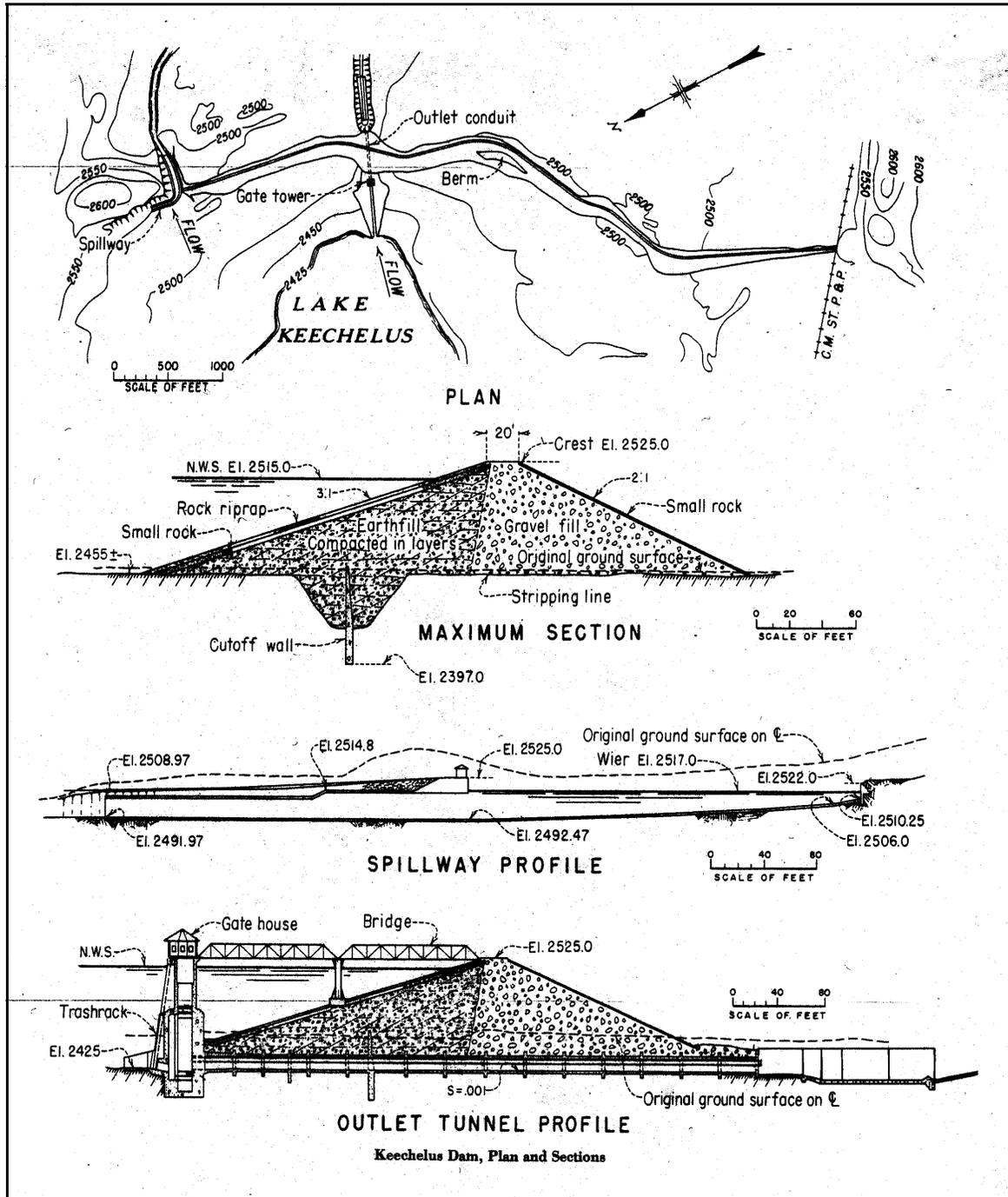


Figure 9.—Keechelus Dam, plan and sections.

Source: U.S. Department of the Interior. Water and Power Resources. Project Data. Denver, U.S. Government Printing Office, 1981.



Camp at Lake Keechelus, building Keechelus Dam, 1913-17.

engineers revised the design and abandoned the tunnel scheme. As constructed, the outlet works consisted of a 12-foot by 12-foot, horseshoe-shaped conduit under the dam and a 3,800-foot-long open channel that connects with the Yakima River.

Other advancements were made during 1913. Excavation of the cutoff trench with a drag-line excavator was started, a portion of the core wall was placed, and then the trench was backfilled around the completed section of core wall.¹⁵⁹ Relocation of a stretch of State highway was also accomplished. More than 500 men and 125 head of stock were employed at the height of the construction season.

In 1914, progress continued on the cutoff trench and core wall, and the embankment began to take form. A rock crushing and aggregate screening plant, as well as a concrete mixing plant, were built onsite. A hydroelectric plant was erected to provide 400 horsepower. The process

¹⁵⁹ A sheet piling core wall was installed, as well as the concrete core wall. The core wall runs the entire length, with concrete used in the higher portions and wood sheet piling for low portions. In the river section, the core wall was carried down 60 feet below natural ground. U.S. Bureau of Reclamation, Information Relating to Yakima Project, Washington, Yakima, July 1921, revised to July 1924.

used to build the dam was as follows: the earthfill material for the cutoff trench was puddled to the top of the core wall, 4 feet above the bottom of the cutoff trench. The remainder of the trench was filled using the spreading, sprinkling, and rolling method. The upstream portion of the embankment was placed in thin layers, sprinkled, and thoroughly compacted with heavy steam rollers. The downstream gravel portion was spread but not rolled. A blanket of riprap, 2 feet thick, was placed as protection on the upstream face. Underneath the riprap, a 3-foot-thick layer of smaller foundation rock was spread. The fine material used in the backfill of the cutoff trench and the upstream half of the dam was obtained from a borrow pit at the north end of the dam. It was excavated with a steam shovel, hauled with dinkey cars on a narrow-gauge track, and spread in place using scrapers and fresnos.

The coarser gravel for the downstream side of the embankment was obtained from a pit at the south end of the dam and transported to the dam site in the same manner as the fine material.¹⁶⁰ Most of the riprap and smaller foundation rock was picked out of the borrow pits. Some riprap rock was quarried at the spillway cut.

In order to construct the outlet works beneath the dam, it was necessary to first build two cofferdams and a diversion flume to remove water from the site. The conduit was then excavated by hand, with the work rushed as much as possible. This entire operation was accomplished in the spring of 1915. During this same time, the stretch of core wall across the old river channel was placed. This consisted of building a concrete wall in a trench that extended about 24 feet below the subgrade of the conduit.¹⁶¹

By the end of fiscal year 1915, about 60 percent of the dam had been completed. It would be another 2 years before the rest of the structure was finished. Excessive moisture in 1916 made it difficult to obtain dry materials to work with and shortened the construction season to only 3 months. During that time, the concrete in the gate tower was completed, and all gates and operating mechanisms were installed. The excavation of the spillway was finished, and the concrete weir and lining were placed. The stilling basin at the end of the conduit was constructed, and the footbridge from the dam to the outlet tower was erected. When finally completed in 1917, the dam contained 684,000 cubic yards of material and created a reservoir with 152,000 acre-feet of active storage. The enlarged lake is 6 miles long by one-half to 1 mile wide.

¹⁶⁰ Ibid, p. 295-96, Reclamation Record, October 1914, p.372, 385.

¹⁶¹ Fifteenth Annual Report of the Reclamation Service, 1915-1916, p. 454.

Clear Creek Dam

The fourth storage facility built by Reclamation in conjunction with the Yakima Project is Clear Creek Dam. The structure is located on the North Fork of the Tieton River a short distance below the junction of Clear Creek. The site is about 40 miles west of Yakima and about 12 miles above Tieton Dam, originally designated as the McAllister Meadows Dam.

Reclamation engineers conducted extensive investigations for Clear Creek Dam in 1913. A small regulating reservoir was deemed necessary at the site, due to the marked daily fluctuations in the Tieton River caused by sun action on the glaciers forming its source. The increased diversions into the Tieton Canal had made it practically impossible to maintain a steady flow in the river. The proposed dam would also provide a small amount of storage for the Tieton Division.

The original concrete single-arch dam was designed so that its height could later be increased to provide additional storage. Construction was started and finished without delay or incident in 1914. Sufficient labor could not be found in Yakima, so some workers were brought in from Seattle. A camp was set up at the site. Construction facilities consisted of a concrete mixing plant, a steam pumping plant, and a small electric-light plant. In addition, a large guy derrick located in the riverbed handled excavation and concrete, and a stiff-leg derrick placed on the riverbank handled concrete aggregate. Earthen cofferdams were built above and below the dam site, and the river was diverted through a flume. After clearing and excavating for the foundation and abutments, the concrete was poured in place in forms. By December, both the dam and a watchman's house had been finished. The camp was dismantled, and machinery was moved to Naches.¹⁶²

In 1918, the second phase of the dam was completed. This included raising the height 21 feet, adding a spillway, and constructing two small earthen dikes southeast of the dam. The final appearance consisted of a concrete arch dam with a structural height of 83 feet and a hydraulic height of 60 feet. The radius of the arch was 120 feet and the length on top was 161 feet. A straight gravity-section concrete abutment existed at either end of the arch. The sections were 90 and 150 feet long, respectively. The outlet works consisted of two 36-inch-diameter, cast-iron pipes through the base of the dam near the north abutment, controlled by two 36-inch-diameter slide gates. Originally, these were hand operated. About 600 feet

¹⁶² Reclamation Record, July-August 1914, p. 289; September 1914, p. 337; December 1914; p. 481. U.S. Department of the Interior, Reclamation Service, A Resume of Storage Operations, Paul Taylor, 1919, p. 3.

northwest of the dam, a 100-foot-wide overflow spillway was cut through a rock ridge. The lake created behind Clear Creek Dam has a storage capacity of 5,800 acre feet.¹⁶³

In addition to serving a central function in the Yakima Project, the storage reservoirs also developed into popular recreation resorts. With their beautiful mountain settings, the lakes attracted visitors wishing to enjoy the magnificent scenery, as well as the fishing, boating, and hiking opportunities. By 1917, a large log hotel and numerous temporary camps had been constructed at Bumping Lake; 3 large hotels and 40 or 50 “tent houses” had been built at Lake Keechelus; and 50 or 60 temporary camps dotted the shoreline behind the temporary crib dam at Lake Cle Elum.¹⁶⁴

¹⁶³ U.S. Reclamation Service, Information Relating to Yakima Project, Washington, Yakima, Washington, July 1921, revised to July 1924, p. 9.

¹⁶⁴ Reclamation Record, November 1917, p. 526.

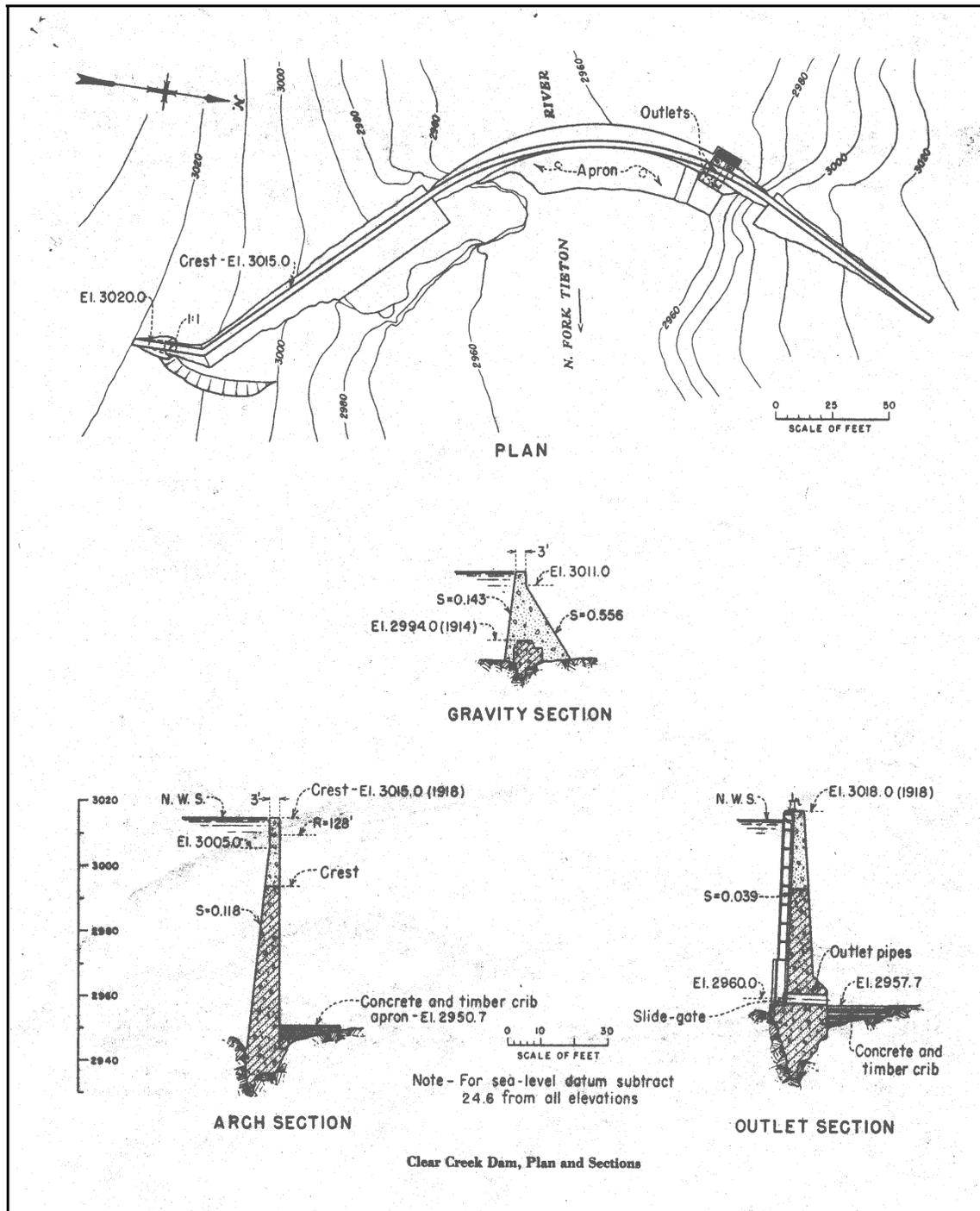


Figure 10.—Clear Creek Dam, plan and sections.

Source: U.S. Department of the Interior. Water and Power Resources. Project Data. Denver, U.S. Government Printing Office, 1981.

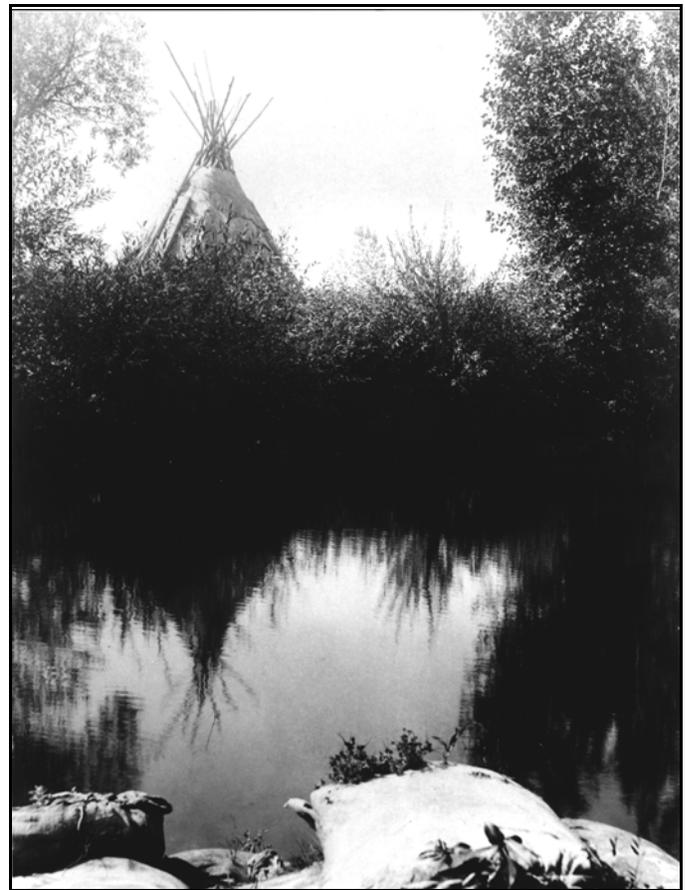
Chapter

4

Irrigation on the Yakima Indian Reservation

While approval given by the Secretary of the Interior on March 27, 1906, for the Yakima Project applied only to construction of the Tieton and Sunnyside Divisions, preliminary investigations had been carried on during 1905 that demonstrated the feasibility of an Indian project. Although only about 17,000 acres were then being irrigated on the Yakima Indian Reservation, Reclamation engineers computed that about 120,000 acres could be irrigated at a relatively small per-acre cost. Water rights were a stumbling block, however. On February 19, 1903, the Superintendent of the Yakima Indian Reservation had filed an appropriation notice for 1,000 cubic feet per second in anticipation of the carrying capacity of the New Reservation Canal. When the water rights of the Yakima Valley were settled, based on actual diversions measured in August 1905, only 147 cubic feet per second were approved for the Yakima Indian Reservation.¹⁶⁶ This was hardly sufficient to develop a large irrigation project. In fact, it was estimated that the Indian lands, or Wapato Division, would require approximately 1,425 cubic feet per second for full development. During the season of low flows in the Yakima River, about 1,278 cubic feet per second would have to be furnished from storage.¹⁶⁷

The first tentative allotment of \$100,000 for investigating an Indian Reclamation project was made by the Secretary of the Interior on June 16, 1906. Reclamation had been hesitant to expend resources there without some assurance of how construction costs



Irrigating canal on Yakima Indian Reservation near heading, September 1907.

¹⁶⁶ Copy of letter from U.S. attorney to the Attorney General, dated November 19, 1913, on file at Upper Columbia Area Office library. U.S. Reclamation Service, Cost Report Yakima Project Washington, August 23, 1910, p. 5.

¹⁶⁷ *Ibid*, p. 5.

would be repaid to the Reclamation Fund. This task was turned over to the Indian Bureau. Preliminary surveys and cost estimates were conducted by Reclamation in the fall of 1906. Further studies were performed by Reclamation during the winter of 1908 and 1909. The results were described by a Board of Engineers in reports dated June 2 and July 23, 1909. The board presented three development options that were similar in the distribution system design but differed in the method of diversion from the Yakima River and the use of pumping.¹⁶⁸



Yakima woman at work in hop vineyard, stripping the vines, September 1907.

Project construction was not authorized, however, as other features of the Yakima irrigation system took priority. Finally, under the Act of April 4, 1910 (36 Stat. 286), Congress appropriated \$250,000 for building a badly needed drainage system on the reservation. The lower or southern end of the Wapato Division was swampy. A 42-mile-long drainage system was installed by the Indian Bureau in accordance with Reclamation plans.

In a letter to F.H. Newell, dated January 14, 1911, a Reclamation Board of Engineers recommended that an appropriation of \$500,000 be secured to begin construction on the Wapato Division as soon as possible. While construction of other units of the Yakima Project might be handled by private enterprise, the engineers felt that this would never be possible on the reservation. In their assessment, development of the Wapato Division could be phased and surplus storage water for the reservation would become available upon completion of Kachess Dam.¹⁶⁹

The matter of the Yakima Indian Reservation was taken up by the House of Representatives in 1912. A “Report on the Condition of the Yakima Indian Reservation, Washington” (House

¹⁶⁸ Ibid, pp. 2-5.

¹⁶⁹ Letter from A.P. Davis, Chief Engineer; D.C. Henny, Consulting Engineer; and C.H. Swigart, Supervising Engineer to F.H. Newell, dated January 14, 1911, National Archives, RG 115, Entry 10, Box 625.

Document No. 1299), submitted to Congress by Reclamation and Indian the Bureau, described the need for additional water for irrigation. The report also presented a plan and cost estimate for reclaiming 120,00 acres on the Yakima Indian Reservation. The accompanying letter from the Secretary of the Interior concluded that the appropriation of 147 second-feet made in 1906 was inadequate and that additional water should be provided from the storage under construction as part of the Yakima Project. A Joint Congressional Commission, appointed in 1913 to investigate the necessity and feasibility of securing storage water for the reservation, basically supported the report's conclusions.¹⁷⁰

On August 1, 1914 (38 Stat. 604), Congress passed an act to rectify the fact that the "Indians had been unjustly deprived of the portion of the waters of the Yakima River to which they are equitably entitled."¹⁷¹ The law stipulated that the reservation receive at least 720 second-feet of water for irrigation in the low water season. This was the amount considered necessary to irrigate 40 acres on each 80-acre allotment, of which there were 1,800. There was no storage charge on the water to be delivered to the total 72,000 acres (40 times 1,800) of allotted lands.

Within a few years, it became apparent that even the 720 second-feet of water guaranteed to the reservation was not sufficient to irrigate the 120,000 acres of irrigable lands. On March 31, 1921, a Memorandum of Agreement was signed between Reclamation and Indian Bureau, guaranteeing the Yakima Indian Reservation a right of 250,000 acre-feet of stored water annually for the 48,000 acres. Repayment for this water was scheduled over a 20-year period. The previous appropriation of 720 second-feet remained in place.¹⁷² Even the additional water provided in 1921 proved insufficient and, over the years, additional agreements increasing the amount were negotiated.

The 1914 Act that established additional water rights for the reservation also authorized construction of the Wapato (sometimes referred to as the Wapato-Satus) Project. Two years later, on May 18, 1916, Congress appropriated an initial \$200,000 (39 Stat.154) for building a diversion dam in the Yakima River and for starting the enlargement of the Wapato irrigation and drainage systems. This law also provided storage water for the remaining 40 acres of each allotment, totaling about 48,000 acres. The storage costs were to be reimbursed from the lands.¹⁷³ The combined acreage of irrigable lands on the Wapato Project to be served by natural flows from the Yakima River and stored water totaled 120,000 acres. Construction of the system was undertaken by the United States Indian Bureau and was funded annually at

¹⁷⁰ Heritage Research Center, pp.122-23, History and Description of Projects, Yakima Reservation, no author, Wapato, Washington, 1952, p. 3.

¹⁷¹ History and Description of Projects, Yakima Reservation, p. 3.

¹⁷² Heritage Research Center, p. 123.

¹⁷³ History and Description of Projects, Yakima Reservation, p. 6.

levels ranging between \$190,000 and \$500,000 up until 1923. At the time, about 72,000 acres were irrigated, and about one-half of the farmland was operated by tenants. The short-term leases, usually for not more than a year, were blamed for poor agricultural practices.¹⁷⁴ Thereafter, appropriations were made intermittently and the project was expanded.

Irrigation development on the Reservation involved two other separate projects, the Ahtanum and the Toppenish-Simcoe. The Ahtanum Unit relied on the unstored flow of Ahtanum Creek for its water and irrigated 5,000 acres on the south side of that creek. The first \$23,000 in funding for this unit was appropriated under the Act of May 25, 1918 (40 Stat. 562). The following year, the Act of June 30, 1919 (41 Stat. 27) provided \$75,000 for beginning the Toppenish-Simcoe Unit, which was planned to irrigate 17,000 acres (later revised to 35,000). Two creeks bearing the name of the unit supplied its water.¹⁷⁵

The Wapato Division, as completed, is the largest unit of the Yakima Project; it covers roughly one-third of the valley's irrigated land mass. The Wapato Division has always been operated by the Indian Bureau. Reclamation's involvement is limited to administering water supply contracts that specify the amount of water to be delivered to the Wapato Division.

¹⁷⁴ U.S. Department of Agriculture, "Farm Management Problems on Irrigated Farms in Hay and Potato Areas of the Yakima Valley, Washington" by E.R. Johnson, U.S. Dept. of Agriculture Bulletin No. 1388, March 1926, p. 6.

¹⁷⁵ "Irrigation on the Yakima Indian Reservation," Yakima Valley Progress, May 1922, p. 7.

Although a dam at McAllister Meadows was not completed until 1925, Reclamation engineers had identified the potential storage site as early as 1904. That spring, George Bliss investigated the location as part of preliminary studies for the Yakima Project. McAllister Meadows, now the site of Tieton Reservoir, was a large natural meadow situated on the Tieton River, about 30 miles west of Yakima and a few miles from the summit of the Cascades. The picturesque setting is framed with mountain views that include Mount Rainier. The actual dam site is a narrow gorge in the Tieton River canyon just below McAllister Meadows. When a Reclamation Board of Engineers presented their findings on the Yakima Project in April 1905, they included McAllister Meadows as one of the sites warranting further studies. Additional surveys were conducted in the summers of 1905 and 1908. Excavation of test pits indicated the feasibility of a dam and, by 1910, conceptual plans and cost estimates for Tieton Dam had been developed.¹⁷⁶ Reclamation engineers proposed a rockfill structure with an impervious core and concrete outlet works. The spillway design had not been determined.

The first construction at the Tieton Dam site was a wagon road originating at the headworks of the Tieton Main Canal. The closest railroad connection was at Naches, about 26 miles away. The road was built in 1913 as part of the Clear Creek Reservoir Project, located about 12 miles above McAllister Meadows. The following year, an engineering party conducted further investigations for Tieton Dam in order to prepare final designs and cost estimates. Detailed topographical surveys were made, as well as studies for camp sites, borrow pits, the spillway, and a power canal. In the Fifteenth Annual Report of Reclamation, the proposed dam was described as 195 feet high and 1,000 feet long. The spillway would be constructed in rock at the north end of the dam, and the outlet works would consist of a 1,500-foot-long tunnel through the solid rock cliff at the north end of the dam.¹⁷⁷

In February 1917, a board of consulting engineers (comprised of D.C. Henny, A.J. Wiley, and Charles Swigart) met with C.E. Crownover, Reclamation project manager, to go over the plans for Tieton Dam and discuss construction methods. That same year, work on the dam began in earnest. A construction camp capable of accommodating 600 men was built, a temporary power plant was installed, and 1,400 feet of a diversion tunnel were excavated.

¹⁷⁶ Tieton Dam was sometimes referred to as Rimrock Dam during construction.

¹⁷⁷ Fifteenth Annual Report of the Reclamation Service, 1915-1916, p. 45.

After the initial burst of activity, things came to a standstill. In the spring of 1918, due to the country's involvement in World War I, Secretary of the Interior, Alexander T. Vogelsang, ordered a halt to construction. It would be another 4 years before work resumed.

In April 1921, an appropriation of \$675,000 rekindled the Tieton Dam Project and, this time, progress was unhindered until completion in 1925. The massive undertaking required a large labor force, and 570 men were employed at the height of construction. The bulk of the work was accomplished by government forces, with small contracts let for hauling, clearing, woodcutting, and similar items. The Government camp consisted of 112 houses for married employees and 12 bunk houses to accommodate 570 men. The latter were equipped with steam heat, hot and cold running water, and bath facilities. Other facilities included an excellent water supply, sewerage system, garbage disposal service, fire protection network, and central heating plant. A hydroelectric generating plant supplied light and power for the camp and construction plants.¹⁷⁸ The camp's kitchen and bake shop were outfitted with electric ovens, steam kettles, bread and cake mixing machinery, dishwashing machines, and electric griddles. Three construction shifts meant that the kitchen had to serve up eight meals a day, beginning with breakfast at 6:30 a.m. and ending with supper at 12:15 a.m.¹⁷⁹ A school and store, both operated by the Government, further met the needs of employees and

their families. The camp, located just below the dam, had the appearance of a small town and was called Rimrock.



School house and school children, Tieton Dam.

As completed, the Tieton Dam is an earth, gravel, and rock fill embankment with a concrete core wall that extends from bedrock to crest and is anchored in solid rock on both abutments. The height from the deepest core wall foundation to the crest is 321 feet. The

¹⁷⁸ The hydroelectric plant at the site furnished power for the compressor, electric shovel, sluicing plants, cableways, and gravel plant.

¹⁷⁹ V.G. Evans, "Camp and Mess House, Tieton Dam," *Reclamation Record*, February 1923, pp. 66-67.

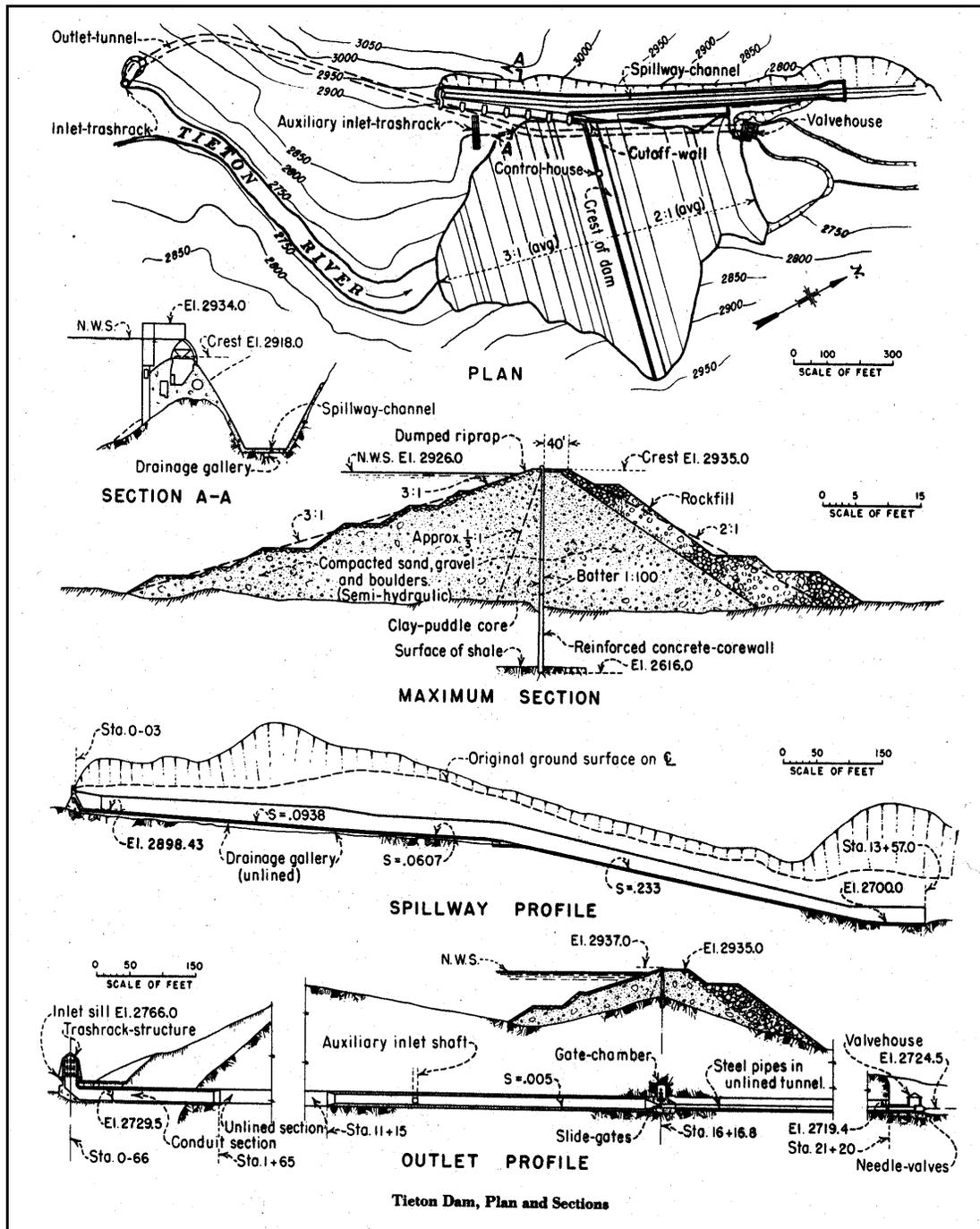


Figure 11.—Tieton Dam, plan and sections.

Source: U.S. Department of the Interior. Water and Power Resources. Project Data. Denver, U.S. Government Printing Office, 1981.

length of the dam along the crest is 905 feet and the thickness from toe to toe is 1,110 feet. The spillway consists of a side-overflow concrete crest nearly at a right angle with the dam and a concrete-lined channel extending to a point well below the dam. The spillway crest is divided into six bays—each equipped with a 65-foot long by 8-foot high drum gate. Each gate can be controlled independently. The total length of the spillway is 390 feet. Both the spillway crest and channel are constructed in the solid rock that forms the west abutment of the dam. The spillway capacity under normal conditions with the gates down is 30,000 second-feet. This capacity can be increased to 50,000 second-feet before the dam would be overtopped.

The outlet control works are located in the tunnel that was used to divert the Tieton River during construction. Two hydraulically operated, 5-foot by 6-foot slide gates are installed on the center line of the core wall. These gates are provided with two independent sets of controls, one in a chamber immediately above the gates and another on top of the dam. From these gates, two 72-inch electric-welded steel pipes lead to two 60-inch balanced needle valves and one 24-inch balanced needle valve in a house at the mouth of the tunnel. These valves have a combined discharge capacity of 1,700 second-feet and are used to control the flow for the irrigation demand. A vertical trashrack is provided at the upstream end of the tunnel, and an auxiliary trashrack with an independent intake leading through a shaft to the tunnel is provided just below the spillway crest.¹⁸⁰

The man placed in charge of the immense construction project was Frank T. Crowe, a prominent Reclamation engineer who later achieved fame as the construction superintendent for Hoover Dam. Crowe started out with Reclamation in 1904 and, by the time he was appointed to oversee Tieton Dam, had been engineer in charge of building six other dams. Crowe remained in Yakima until July 1924, when he was promoted to general superintendent of construction for all of Reclamation. His one regret at the time was that he had to move from Yakima to Denver. According to a local newspaper account, he was considering settling in Yakima and going into the contracting business. Walter Ward, the engineer selected to succeed Crowe on the Tieton Dam Project, also had a long association with Reclamation. He joined the agency in 1910 and had served as irrigation manager for the Salt River Project in Arizona, as the project manager at King Hill, and had just completed a diversion dam on the Payette River near Emmett, Idaho.¹⁸¹

¹⁸⁰ Christopher, Willis, "Tieton Dam Construction, Yakima Project, Washington," New Reclamation Era, February 1926, p. 32-33.

¹⁸¹ "Crowe Named to Superintend All Engineering Jobs," The Yakima Republic, May 10, 1924. "Engineer Picked to Take Charge at Rimrock Dam," The Yakima Republic, June 7, 1924.

The first work undertaken was the tunnel to divert water from the dam site during construction. The 22-foot-wide and 2,200-foot-long tunnel was drilled through solid rock. Upon completion of a coffer dam, the entire flow of the river was channeled through the tunnel. Thereafter, attention shifted to building the core wall and embankment.

The concrete core wall stretches across the canyon and is tied solidly into bedrock at either side. The wall extends nearly 100 feet below the streambed in places, deep into solid rock. Below the ground surface, the core wall is 5 feet thick with no reinforcing. Above the ground, the wall tapers to a 1-foot thickness at the top of the dam and is heavily reinforced. Excavation for the core wall was accomplished using mining methods, rather than an open trench. It was deemed nearly impossible to shore up an open cut of such great depth. Three principal shafts were sunk into the bedrock and horizontal drifts at various levels were excavated off of these. The drifts were filled with concrete one level at a time. Concrete was mixed outside, dumped into cars, lowered, and taken out on some drift from which it could be conveniently dumped to fill a lower drift. The work was difficult, especially in the section below the river, but the method proved to be successful. Above ground, wooden forms were used to place the concrete. During construction of the embankment around the core wall, engineers carefully took daily readings to determine if the concrete wall had deflected at all under pressure of the fill material. One writer of the time noted that the core wall “must be humored like a great plate glass window.”¹⁸²

The embankment was placed using the semihydraulic fill method. Earth, gravel, and boulders were excavated from borrow pits, loaded on dump cars, hauled to trestles located on the upper embankment slope, and then dumped. Jets of water from high-pressure hoses were directed on the dumped material. This sluicing separated the smaller rocks, sand, and clay, and pushed them towards the core wall, leaving the coarser material on the outer slope. The pressure of the water jets compacted the outer slopes and filled in voids with smaller rock and gravel. A pool of water was maintained on the upstream face of the core wall. The fine particles of clay suspended there gradually settled out against the core wall and formed an impermeable “puddle core.” In building the fill on the downstream side of the core wall, the material was dumped and washed in the same manner, but no pool was maintained against the core wall. The clay was carried off with the jets of water, leaving behind a deposit of sand. Rock excavated from the tunnel and spillway was used to reinforce both the upstream and downstream outer slopes of the embankment.

The cost of building Tieton Dam was \$4,373,600, which turned out to be \$240,000 less than estimated in 1921. When completed, the massive earthfill structure stood 21 feet higher than

¹⁸² “Rimrock Dam a Marvel of Engineering Skill,” *Yakima Valley Progress*, November 1923, p. 9-10.

all others of its type.¹⁸³ The dam broke new ground in other respects. It was the first Reclamation dam designed on the basis of a stability analysis. This method has sometimes been referred to as a wedge analysis; soil characteristics were assumed on the basis of the angle of repose. Tieton Dam, as well as McKay Dam on the Umatilla Project in Oregon, built at the same time, represented “radical departures from previous designs” in that both were constructed using pervious materials with water seepage prevented by thin diaphragms. In the case of Tieton, the concrete core wall serves this function. McKay and Tieton also appear to be the first instances where grouting was used on Bureau earthen dams. Although Tieton operated reasonably well over the years, the difficulties of construction associated with the deep cutoff and high core wall discouraged the use of this design again.¹⁸⁴

Tieton Dam was dedicated on July 2, 1925. An editorial of that date in the Yakima Herald states,

*The dedication ceremonies to be held at noon mark the completion of one of the largest dams in the world and the largest earth-filled dam. The significant fact about the occasion, however, is that the building of the Tieton Dam anticipates the further development of this fertile valley. . . We have demonstrated here in this valley that Reclamation has not been a failure. The results already obtained justify the opening up of the four other divisions of the Yakima Project to settlers. This project stands out as one of the two most successful projects which have been undertaken by the government.*¹⁸⁵

The world’s highest earthfill dam formed a lake about 10 miles long and more than 1 mile wide in places. Water stored in the high mountain reservoir could irrigate by gravity flow most of the highest ground around Yakima, leaving the water from the Yakima and Naches Rivers for irrigation of the lower valley lands. The additional storage provided at Tieton furnished water for another 100,000 acres of land.¹⁸⁶

¹⁸³ “Rimrock Dam a Marvel of Engineering Skill,” p. 9.

¹⁸⁴ Bureau of Reclamation, “Development of Earth Dam Design in the Bureau of Reclamation,” August 1958, p. 8.

¹⁸⁵ “The Tieton Dam and Reclamation,” Reclamation Record, August 1925, p. 123.

¹⁸⁶ Foresman, C.A. “Yakima Irrigation Project Safe in Matter of Storage Waters.” Yakima Valley Progress, October 1924, p. 5.

Chapter

6

Rapid Growth of Irrigated Agriculture in the Yakima Valley and Washington

With the construction of Federal Reclamation projects in Washington, the development of irrigated agriculture increased dramatically. The days of entrepreneurial large-scale irrigation projects waned as the United States Government became the dominant force in water development. Between 1900-1910, the number of irrigated acres in Washington climbed from 135,470 to 334,378. About one-quarter of that acreage was under Reclamation and Indian Bureau projects. Irrigated farms were the most expensive in the State: in 1910, the value of undeveloped lands that were under irrigation projects ranged from \$100 to \$150 per acre in Benton, Yakima, and Kittitas Counties. Elsewhere, prices were as high as \$200 an acre.

In Yakima County, the number of irrigated farms multiplied tenfold between 1890-1910. Concurrent with that sharp rise was a spectacular increase in the value of the county's farmland, from \$1,500,000 to \$40,617,000. Due to the high cost of irrigation farming, three-fifths (1,769) of the new farms established during that 20-year span were in the 10- to 50- acre class. The number of 50- to 100-acre farms also increased, and there was a striking 100-percent increase in farms over 100 acres. This was due, in large part, to the diversification of crops grown in Yakima County. In Kittitas County, where the irrigation costs were relatively lower, the average irrigated farm in 1910 consisted of 108 acres.¹⁸⁷



Fruit exhibit, Yakima County, North Yakima Fair, September 27, 1907.

¹⁸⁷ Nesbit, "Agriculture in Eastern Washington, 1890-1910," *Pacific Northwest Quarterly*, October, 1946, pp. 286, 289.

The Yakima Valley continued to boom in the second decade of the twentieth century, as lands under the Sunnyside and Tieton Divisions opened up and the first storage features were completed. By late 1916, an article in the Reclamation Record had this to say about the impact of Federal irrigation on the area, “The Yakima Valley, considered in its entirety, dwarfs every other national reclamation project. It is so vast in area, so varied in agricultural products, so diversified in industries, that any comprehensive description would require an entire edition of the Record to do it justice.”¹⁸⁸ At the time, the Yakima Project irrigated almost 100,000 acres under reclamation operation and another 40,000 acres of land on the Indian Reservation used stored water. The valley boasted a population of 75,000 people, of whom 75 percent made a living from irrigated farming.¹⁸⁹ The average farm size was 25 acres, and 4,000 farms benefited from Reclamation water.

Major markets for most crops were within a 200-mile radius, in the cities of Seattle, Tacoma, Portland, and Spokane. In the fruit industry, however, Yakima had established a worldwide reputation. Miles and miles of fruit trees stretched up and down the valley, with orchards climbing up the hillsides. Growers shipped their apples as far away as Russia and Australia. Preferred varieties included the Spitzenberg, Yellow Newtown, Pippin, Winesap, Jonathan, and Rome Beauty. In 1916, it was estimated that 8,000 railroad cars of apples, 1,000 carloads of pears, 3,000 carloads of peaches, and 300 carloads of mixed fruits would be shipped from the valley. The total fruit crop value was placed at \$6 million.¹⁹⁰ Bearing orchards could fetch as much as \$800 to \$1,500 an acre.¹⁹¹

Although best known for its fruit crops, the Yakima Valley also produced wheat, oats, barley, alfalfa, and numerous vegetables such as corn, potatoes, and sugar beets. The latter crop was a newcomer, and the prospects for success looked encouraging. Test planting in many fields was undertaken in 1916 and farmers were hoping to attract a sugar beet factory. By the early 1920s, the Utah-Idaho Sugar Company had built three substantial sugar beet plants in the Yakima Valley, located at Yakima, Toppenish, and Sunnyside. Due to low yields, however, sugar beets proved unprofitable; and by the mid-1920s, the crop had been abandoned.

As irrigated agriculture assumed a larger and larger role in the Yakima Valley economy and elsewhere in Washington, farmers organized trade organizations to share information and resources. In November 1910, the Yakima Valley Fruit Growers’ Association was

¹⁸⁸ Blanchard, C.J., “Yakima Project, Sunnyside and Tieton Units,” Reclamation Record, December 1916, pp. 559-562.

¹⁸⁹ *Ibid.* More than 80 percent of the population on the project was American born and of American descent. There were also small communities of Dutch and French.

¹⁹⁰ *Ibid.*

¹⁹¹ The Yakima Valley, North Yakima, Washington, Yakima Commercial Club, 1911, p. 37.

incorporated. By summer 1915, there were 25 affiliated local districts. They had built or purchased 18 warehouses, including a cold-storage plant in Zillah that was believed to be the largest one in the country devoted exclusively to fruit storage.¹⁹² That same year, farmers banded together to stop the spread of fire blight disease up and down the valley. Groups of farmers and businessmen worked cooperatively to cut out the diseased portions of trees.¹⁹³

At a Statewide level, the newly created Washington Irrigation Institute held its first annual meeting in Yakima in January 1914. The organization was formed the previous year at a meeting in Yakima, initiated by F.H. Newell. About 40 people were in attendance, including Reclamation staff and Washington irrigation project managers and engineers. The concept of a Statewide and permanent organization to promote irrigation development was introduced by Charles Swigart, Reclamation's Supervising Engineer in charge of all projects in Washington, and E. F. Benson, who served as president of the Washington Irrigation Institute for 5 years. The organization performed a number of functions, but primarily served to educate and disseminate information.¹⁹⁴ Another role of the institute was to promote policies regarding irrigation matters and to lobby for their enactment into law.

An important law affecting irrigation in Washington was the State Water Code, passed in 1917. This was the first comprehensive law passed in the State to cover the regulation and control of its water resources. The law vested central authority with the Supervisor of Hydraulics to oversee water rights in Washington and provided a means of establishing them through the issuance of certificates. Finally, there would be some order created in the tangled web of water rights.¹⁹⁵

In the years following World War I, farmers on the Yakima Project were affected by the farm depression felt elsewhere in the West. As a result of the hardships incurred, some growers pointed to Reclamation as a source of their troubles. Faced with financial difficulties, irrigators became increasingly resentful about paying their water charges. Some Yakima Project farmers even voiced protests about expanding irrigation in the State of Washington. They perceived new projects as direct competition that would lessen their profits. In 1923, the Sunnyside Valley Irrigation District sent Senator Jones resolutions opposing any extension of Reclamation activities. The district noted that 27 out of 28 Federal Reclamation projects were already insolvent and that, on the Sunnyside Project alone, farmers owed \$100,000 in

¹⁹² Hebert, J.W., "The Yakima Valley Fruit Growers' Association," Reclamation Record, July 1915, p. 323.

¹⁹³ "Fire Blight in the Valley," Reclamation Record, January 1915, pp. 30-31.

¹⁹⁴ Tiffany, R.K., "Washington Irrigation Institute Retrospect and Prospect," Proceedings of the Washington Irrigation Institute, Ninth Annual Meeting, October 27 and 28, 1921, p.12.

¹⁹⁵ Pollard, A History of the State of Washington, p. 266.



Hauling peaches from orchard, Yakima Valley, 1929.

delinquent irrigation assessments.¹⁹⁶ This resentment against new lands being irrigated continued to persist among some farmers through the fluctuating economic times of the 1920s.

Despite the criticism lodged against Reclamation by some Yakima farmers, they apparently did not represent the majority. By the mid-1920s, others were clamoring for the agency to construct new irrigation works. The economic climate was changing, and conditions on the Yakima Project were improving. Optimism about a rosy future

prevailed again as bumper crops and record fruit shipments made newspaper headlines. On the Tieton Division, practically all lands had been cleared of sagebrush and 32,000 acres were under irrigation. On the Sunnyside Division, that figure was about 107,000 acres. The number of farms there had increased by 731 between 1913 and 1923, with the settlers representing the “very highest type of farmers and citizens.”¹⁹⁷

Toward the end of the 1920s, there was another downturn in the bright predictions made a few years earlier. Although numerous crop yields continued to climb and shipments of apples, pears, and onions exceeded those of any prior years, prices were not as high as hoped for, especially when the costs of production were considered. This was true especially for apples, grapes, and peaches.¹⁹⁸ Nonetheless, as a whole, the Yakima Project was faring better than many others. Whereas water users on other Reclamation projects were falling considerably behind on their construction repayment charges and maintenance costs,

¹⁹⁶ Forth, William, pp. 469-472.

¹⁹⁷ U.S. Department of Agriculture, “Farm Management Problems on Irrigated Farms in Hay and Potato Areas of the Yakima Valley, Wash.,” Department Bulletin No. 1388, Washington, DC, March 1926, p. 6. According to the article, about 80 percent of the farmers on the Sunnyside and Tieton Divisions were born in the United States.

¹⁹⁸ “Ranchers Secure Large Crops and Moderate Prices,” newspaper clipping, no date, 1928.

delinquency rates on the Yakima Project were relatively small.¹⁹⁹ Attacks by easterners and midwesterners on the Federal Reclamation program prompted one local newspaper writer to retort, “Federal Reclamation here is a success. It is so successful that if every other project in the United States were checked off as a total loss the Yakima Valley alone, its development and production over a period of twenty years, would justify the expenditure of every dollar that the government has ever put into irrigation projects.”²⁰⁰



View of orchards from Naches Heights Road, Tieton Division, July 7, 1929.

In November 1929, the Washington Irrigation Institute held its final meeting of the decade in Yakima. Nearly 100 delegates were on hand to listen to Ashael Curtis, president of the organization, present a keynote speech reflecting on the accomplishments of the Reclamation program in Washington. He remarked, “During the past 17 years, popular opinions of Reclamation have changed many times. When skies were rosy

and returns were good, irrigation farmers were considered astute businessmen; but when clouds gathered and farm profits dwindled, we were told that we were fools for ever having turned a furrow. . . Arid lands are not reclaimed over night, but require years of planning and development.” Porter Preston, superintendent of the Yakima Project, boosted irrigation by providing statistics on agricultural achievements in the Yakima Valley. He revealed that crop

¹⁹⁹ In September 1928, water users in the Sunnyside Valley Irrigation District received a letter from Porter Preston, Yakima Project superintendent, stating that the Government would refuse to deliver water in the 1929 irrigation season to those delinquent in their payments for more than 1 calendar year. “Delinquent Land Will Lose Water,” *The Sunnyside Sun*, September 6, 1928.

²⁰⁰ Newspaper clipping, *Yakima Daily Republic*, September 25, 1928, National Archives, RG 115, Entry 7, Box 1120.

production on the Sunnyside and Tieton Divisions alone had totaled \$158 million during the past 20 years, or more than eight times the total amount spent on the entire Yakima Project.²⁰¹

Yakima Valley farmers had good reason to boast of their accomplishments. Yakima County was the sixth greatest agricultural producing county in the United States. The area was recognized for the great diversity of crops grown there. In addition to the 226,596 acres under Government irrigation in the Yakima Valley, there were 119,446 acres being privately irrigated.²⁰²

²⁰¹ “Delegates Open Gathering With Nearly 100 Out (?)” Yakima Daily Republic, November 7, 1929. Porter Preston succeeded J.L. Lytel as Yakima Project superintendent upon his resignation in January 1928.

²⁰² “Yakima Valley Facts,” pamphlet produced by Yakima Chamber of Commerce, 1930.

By the early 1920s, with the increased storage available to the Yakima Project, attention turned to further development of the irrigation system. Four additional divisions, known as the Kittitas, Moxee, Roza, and Kennewick, had been contemplated. Although no construction had taken place, preliminary plans and estimates had been completed for all of them.²⁰³

An irrigation project in the Kittitas Valley was considered by Reclamation engineers as early as 1905, when they also submitted data on the Sunnyside and Tieton Divisions. Conceptual plans for a Kittitas project involved the irrigation of from 60,000 to 80,000 acres on both sides of the Yakima River in the Kittitas Basin above the lowlands already benefiting from private irrigation. Although the Kittitas Division was not dismissed, Reclamation officials had reservations about its feasibility due to cost.²⁰⁴ Priority was given to the development of the Sunnyside and Tieton Divisions that were immediately adjacent to and south of North Yakima. The residents of Ellensburg were informed that when funding became available in the future, they too would be the beneficiaries of a Reclamation irrigation system. Congressman Jones supported Reclamation's position and, as early as 1906, wrote optimistically about developing the Kittitas Division. "When the Tieton and Sunnyside sub-projects are completed the next portion of the Yakima Project to be taken up will undoubtedly be the reclamation of the Kittitas lands. The reports of the engineers, so far as they have gone, indicate that the cost per acre for reclaiming these lands will be quite high compared with the cost of the reclamation of the other lands. . ."²⁰⁵ Plans for the Kittitas Division dragged on, however, and another 20 years would lapse before the residents of Ellensburg received Reclamation irrigation water.

In May 1909, Reclamation was induced to conduct more thorough investigations of a highline canal in the Kittitas Valley. Based on careful surveys, project engineer E.H. Baldwin concluded that a diversion dam and canal heading in the Yakima River just above the town of Easton would probably be the most viable. The location would be advantageous because storage water from either Lake Kachess or Lake Keechelus could be used. The engineers proposed constructing an overflow concrete diversion dam with the canal headworks on the south side of the river. The main canal route would follow a contour line on the south side for 36 miles where it would divide into two laterals. One lateral would

²⁰³ "Yakima Project Washington," October 7, 1922, typewritten, no author, National Archives, RG 115, Entry 7, Box 1138.

²⁰⁴ Letter from F.H. Newell to D.C. Henny, dated September 13, 1905, National Archives, RG 115, Entry 3, Box 1020.

²⁰⁵ "The Victory of National Irrigation," p. 257.

continue for 23 miles on the south side of the Yakima River, and the other would cross under it in a siphon and follow a southeasterly route for 67 miles.²⁰⁶

Although the more thorough investigations reaffirmed the feasibility of the Kittitas Division, Reclamation continued to focus on completing other project features. Anxious to expand the amount of irrigated acreage around Ellensburg, several private groups decided to pursue canal systems on their own. One such group was the ambitious Valleys of the Yakima Water Users Association, formed in 1910. Comprised of owners of highlands lying east and north of the Yakima River not served by irrigation, the group hired Christian Andersen, an engineer previously employed by Reclamation, to investigate the feasibility of a high line canal system. Andersen presented what he considered a feasible plan that would provide water to some 300,000 acres. This would be done by pumping water for 100,000 acres from the Columbia River and supplying the other 200,000 acres with Yakima River storage from Lakes Kachess, Keechelus and Cle Elum.²⁰⁷ Andersen contemplated a diversion structure near Easton. A third of the lands to receive water would be south of the Rattlesnake Hills, in the area later incorporated in the Roza Division. The remaining lands to be irrigated would be in what later became designated the Kittitas, Moxee, and Kennewick Divisions, as well as some 140,000 acres on the northern slopes of the Rattlesnake Hills. In 1912, E.A. Moritz of Reclamation made some further investigations of the proposed project that established its infeasibility due to the limited water supply above Easton, prohibitive costs, and anticipated construction difficulties.²⁰⁸ Like so many other grandiose private schemes, this one never made it beyond dreams and drawings.

In 1911, the Kittitas Reclamation District was organized under State law and requested permission to use the survey data collected by Reclamation to plan its own project. Consent was granted, and the District proceeded to conduct its own location surveys and cost estimates. Also in 1911, the Warren Act was passed, allowing the Secretary of the Interior to sell surplus storage water to corporations and associations under certain conditions. On January 18, 1913, the Secretary of the Interior signed a Warren Act contract with the Kittitas Reclamation District for the sale of a water supply for 70,000 acres. All was set to go for the private development of a Kittitas Canal, except the financing. The Kittitas Reclamation District issued bonds, but sales lagged. In 1918, the district's Warren Act contract expired due to lack of construction progress.²⁰⁹

²⁰⁶ History of the Washington Division, 1902-1913, Volume I, p. 60-61.

²⁰⁷ "Report on Yakima High Line Canal," to F.H. Newell from a board of engineers, dated July 8, 1910, National Archives, RG 115, Entry 10, Box 625.

²⁰⁸ Swigart, C.H., and R.K. Tiffany, "Report on Compilation of Data on New Projects," April 12, 1918, on file at the Upper Columbia Area Office.

²⁰⁹ *Ibid.*, p. 72-73. U.S. Reclamation Service, 19th Annual Report, Fiscal Year 1920, Yakima Project.

The residents of Kittitas County continued to hope for a Reclamation project and, at various times, believed that construction was imminent. In March 1919, a Reclamation board of engineers decided to divide up the lands contemplated under the earlier High Line scheme into the Kittitas, Moxee, Roza, and Kennewick Divisions and to consider each area separately.²¹⁰ Senator Wesley Jones, sympathetic to the persevering of Kittitas County residents, urged Reclamation Director A.P. Davis in early 1919 to take up the Kittitas Division as the next unit of the Yakima Project. Davis responded to Jones within a few days that “it has been expected that the Kittitas people would finance their own distribution system construction and we made a contract with them for the Government to supply stored water from our reservoirs.” Davis further explained that there were insufficient monies in the Reclamation Fund to build any additional units.²¹¹

In the summer of 1923, momentum gathered for construction of additional irrigation works on the Yakima Project. On June 29, a conference was held at Sunnyside, where Reclamation boosters from towns between Cle Elum and Kennewick met to discuss the future of irrigation in the Yakima Valley. Sixty representatives of commercial organizations and community clubs united in their support to urge Reclamation to complete the Yakima Project as rapidly as possible. Attendees from the various proposed divisions were asked to “drop all contentions and thoughts of mere community betterment” and work together to get funding appropriated for the Yakima Project.²¹²

That same summer, Secretary of the Interior, Hubert Work, announced there would be money in the Reclamation Fund in 1924 to begin constructing one of the four proposed divisions of the Yakima Project. Presumably because the situation was politically sensitive, Reclamation Commissioner, D.W. Davis, and Chief Engineer, F.E. Weymouth, personally visited all four divisions before making a selection. Their inspection was followed up a few days later by that of a Reclamation board of engineers. In October 1923, the board submitted its report to Reclamation headquarters, recommending that the Kittitas Division be constructed first. Official confirmation of this decision was sent by Commissioner Davis to F.A. Kern, secretary of the Kittitas Reclamation District, on December 7, 1923.²¹³

Even though it appeared that the long-awaited construction of the Kittitas Division was finally pending, there were further delays. Reclamation practices were about to change with the

²¹⁰ Department of the Interior, Reclamation Service, Investigations by U.S.R.S. of Roza Division for the Yakima-Benton Irrigation District, Washington, May 1922, p. 7.

²¹¹ Forth, William S., Wesley Jones, A Political Biography, University of Washington, 1962, pp. 455-456.

²¹² “Unify Valley on Reclamation,” Grandview Herald, July 6, 1923.

²¹³ Kittitas Reclamation Association, The Kittitas Unit of the Yakima Reclamation Project in the State of Washington, January 1924, National Archives, RG 115, Entry 7, Box 1140. “Reclamation Chief Sends Good News,” Ellensburg Record, December 7, 1923.

creation of a Fact Finders Committee in the fall of 1923 and the appointment of Elwood Mead as Reclamation Commissioner in the spring of 1924. Secretary Work established the Fact Finders Committee to scrutinize all aspects of Reclamation and to recommend a course of action to remedy the difficulties faced by the agency in administering its irrigation projects. Most of them were in deplorable financial condition. The committee advised that proposed new Reclamation projects be studied not just from an engineering standpoint, but also from an economic and agricultural perspective. Mead served on the committee and, upon his designation as Commissioner, succeeded in tackling many of the operational and financial problems that plagued the agency. Following the course of action established by the committee, all proposed Reclamation projects underwent rigorous scrutiny to determine if they were economically viable and based on sound investigations.

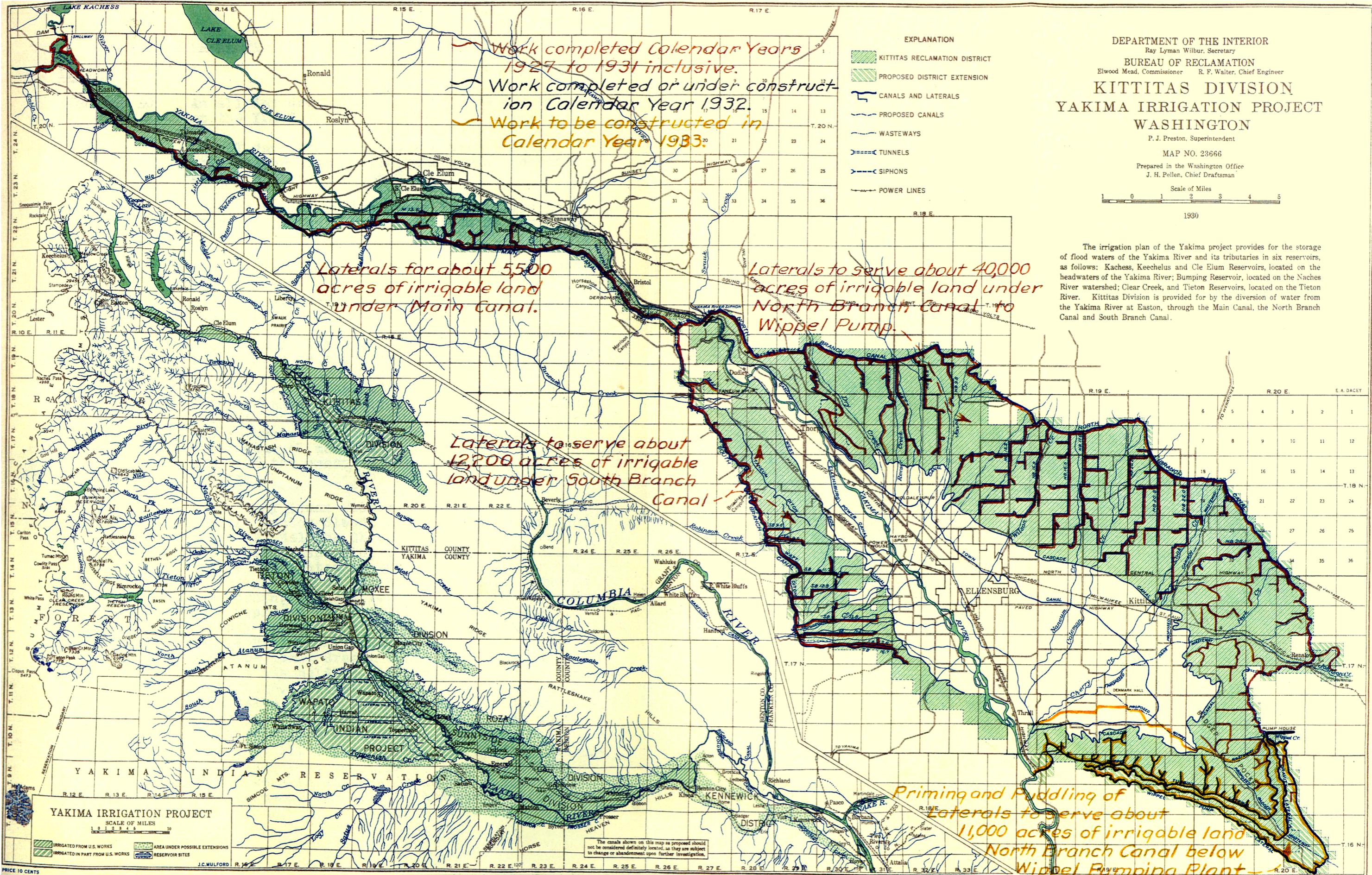
In 1924, the Kittitas Division was subject to such an examination. That summer, a crew of agricultural, engineering, and economic experts conducted a survey of the project and assembled data. They found that most of the land in the Kittitas Division was in private ownership (82 percent), with the balance belonging to the State and Federal Government and the rest controlled by the Northern Pacific Railway. Agriculture consisted mainly of growing grasses and grains, most of which were shipped elsewhere. Crop yields were high. Irrigation development in the valley had been reasonably successful, and there were about 60,000 acres under ditches. Improved irrigated lands were generally valued at from \$125 to \$350 per acre, while dry land was valued at from \$5 to \$15 an acre. The cost of constructing the Kittitas Division was estimated at close to \$9 million.²¹⁴

A few days prior to submitting their report to Commissioner Mead, one of the experts wrote to him that, “We are finding it a very difficult project, and while it seems entirely possible to work out the financial success of settlers, the rates are such that it will require somewhere between 85 and 100 years of payments before the government will be reimbursed for the construction charges. The problem is proving an exceedingly interesting one, but one that is causing both Mr. Hayden and myself a good many worries regarding working out the details.”²¹⁵ The final report cautioned Mead about the long repayment period but found the project favorable. In their conclusions, the authors wrote, “While the period of repayment is long, the project is permanent and safe from an agricultural standpoint, decidedly attractive from the viewpoint of health, educational, and social conditions, and is considered to be economically sound and feasible.”²¹⁶

²¹⁴ “Economic Aspect of Kittitas Project, Washington,” *New Reclamation Era*, February 1925, pp. 18-20.

²¹⁵ Letter from Charles F. Shaw, Professor of Soil Technology, to Dr. Elwood Mead, dated September 5, 1924, National Archives, RG 115, Entry 7, Box 1140.

²¹⁶ “Economic Aspect of Kittitas Project, Washington,” *New Reclamation Era*, February 1925, p. 19.



Source: U.S. Department of the Interior. Bureau of Reclamation. Yakima Project, Annual Project History, Kittitas Division, 1932-33.

Figure 12

A group of local businessmen appointed to review the report concurred that the repayment period would be long, but felt that the investment would be “absolutely safe” and “worthy of construction and development by the Government.”²¹⁷

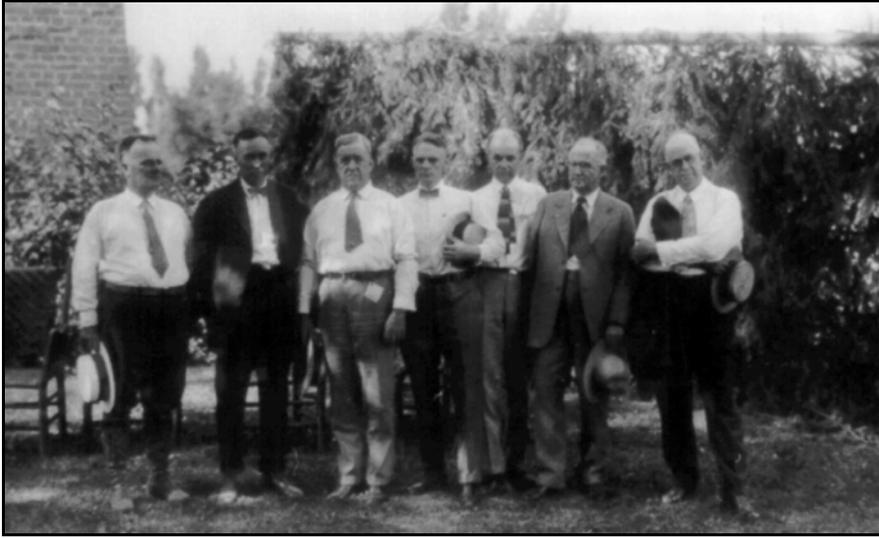
Even with these positive findings, the Kittitas Project was subject to more delays. Early in 1925, Senator Jones resumed his lobbying efforts in Congress to retain Department of the Interior appropriations amounting to some \$600,000 for use on the Kittitas, Yakima, and other Washington irrigation projects. Authorization of the Kittitas Project by Congress was complicated by the fact that the Interior bill required the State of Washington to assume some financial responsibility for the settlement and development of the Kittitas Division. Governor Hartley of Washington refused to sign such a contract between the State of Washington and the United States, so the project was once again stalled. Finally, later in the year, agreement was reached that the State would not be required to spend more than \$300,000 to help prepare the undeveloped project lands for settlement. This assistance was considered vital because Reclamation estimated that farmers would need to spend a hefty sum of between \$5,000 and \$7,000 on 60 or 80 acres to make their unimproved land productive.

On December 19, 1925, Commissioner Mead sent the Secretary of the Interior two contracts ready for execution: one between the Department and the State of Washington, the other between the Department and the Kittitas Reclamation District for the construction of the Kittitas Division of the Yakima Project. Among other things, the latter contract spelled out the construction repayment terms and limited spending by the United States to a maximum of \$9 million. Both contracts were signed that day and, with that hurdle cleared, an appropriation of \$375,000 was released to begin construction.²¹⁸

The new year of 1926 was greeted with joy by residents of the Kittitas Valley. Just a few days into January, Commissioner Mead announced that he would be sending engineers out to Yakima to take charge of the actual construction of the Kittitas Division. After years and years of studies and negotiations, the project was about to begin. The plan, as finally implemented, included close to 100,000 acres, of which approximately 72,000 were estimated to be irrigable. Of the irrigable area, about 65,789 acres were in private ownership. Most of the lands ranged in elevation from 1,700 to 2,100 feet and were located in the vicinity of

²¹⁷ Letter from John Faust et al., to Dr. Elwood Mead, dated November 15, 1924, National Archives, RG 115, Entry 7, Box 1140.

²¹⁸ Forth, p. 465, “Governor Roland Hartley’s Final Statement on the Kittitas Land Settlement Contract,” October 3, 1925, clipping located at National Archives, RG 115, Entry 7, Box 1150. Letter from Elwood Mead to the Secretary of the Interior, dated December 19, 1925, National Archives, RG 115, Entry 7, Box 1150. “Contract Signed for Kittitas Construction,” *New Reclamation Era*, February 1926, p. 31.



Right to left: R.F. Walter, Chief Engineer; Elwood Mead, Commissioner; B.E. Stoutemyer, District Counsel; Walker R. Young, Construction Engineer, Kittitas Division; J.L. Lytel, Superintendent, Yakima Project; P.A. Jones, Associate Engineer; E.R. Mills, Chief Clerk. Picture taken at "Highline" celebration, Kittitas Division, in front of Kamola Hall, Washington State Normal School, Ellensburg, Washington, July 11, 1926.

from the south side of the Yakima River, just above the town of Easton. After paralleling the Yakima River on the south side for a distance of about 26 miles, the Main Canal would divide into two branches near Thorp. The larger or North Branch, would be 36 miles long and cross



Rolling a fill (compacted embankment), Kittitas Main Canal, April 1928.

Ellensburg. Water for irrigation would be supplied from the natural flows of the Yakima River, supplemented by storage releases out of Kachess and Keechelus Lakes.

From an engineering and construction standpoint, the project was considered fairly straightforward with very few unusual features. Water would be diverted into the Main Canal from the south side of the Yakima River, just above the town of Easton. After paralleling the Yakima River on the south side for a distance of about 26 miles, the Main Canal would divide into two branches near Thorp. The larger or North Branch, would be 36 miles long and cross the Yakima River immediately in a siphon. On the other side, the canal would first follow an easterly route and then swing south to the Wippel Pumping Plant. From there, three main laterals would be routed around Badger Pocket, terminating about 8 miles southeast of Ellensburg. The

smaller, or South Branch Canal, would remain on the south side of the river and flow in a southerly direction for 14 miles to Manastash Creek.

Reclamation engineer, Walker Young, was placed in charge of construction of the Kittitas Division. Almost all of the work was performed under various contracts as funding became available.

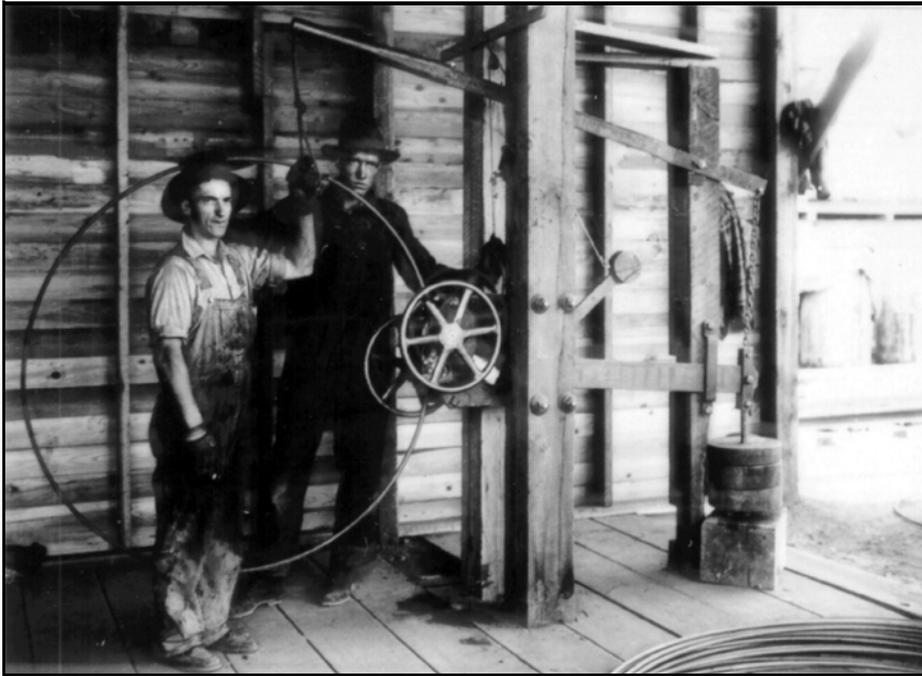
The first contract was for a segment of the Main Canal, and work



Combination section of Main Canal near Morrison Canyon siphon, Kittitas Division, July 4, 1929.

on this feature wasn't completed until October 1929. The canal was designed with a capacity of 1,320 second-feet at its upper end, requiring a bottom width of 30 feet. About 15 miles of the canal were concrete-lined, the rest was unlined earth section. Along its route, the Main Canal crossed a number of small streams, and nine inverted siphons (about 12 feet in diameter) were built at these locations. Most siphons were of concrete; the remainder were of riveted steel pipe. Other features included four wasteways, crossings under two sets of railroad tracks, and a short tunnel through a rocky point. A description of the construction activity on the Main Canal in 1928 paints a vivid picture, "Six miles of the canal this side of Easton have been completed and on the balance of the work scores of men and many large draglines and other large machines are busy. The canal is being dug in the sides of the mountains along the Yakima river canyon, thrown across many steep side canyons by means of long siphons, in some places dropping 240 feet to the bottom of the canyon and then forcing the water up the other side." At the time, over 1,000 men were employed on the construction of the Kittitas Division.²¹⁹

²¹⁹ "Construction of Kittitas Division, Yakima Project, Washington," *New Reclamation Era*, August 1926, p. 130. "Work Speeded up on Kittitas Canal," *Morning Oregonian*, April 22, 1928.



Weld testing machine, lock joint concrete pipe plant, Kittitas Division, October 8, 1928.

While construction proceeded on the Main Canal, other crews were engaged on the North Branch Canal, which had both lined and unlined sections. The outstanding feature of the canal was the nearly mile-long siphon across the Yakima River. Constructed of riveted steel pipe and supported on concrete piers, the 9.25-foot-diameter pipe crossed the river on a high steel bridge. At mile 35.7, where the North Branch Canal reached Wippel Creek,

a pumping plant was built to lift water about 130 feet to irrigate lands above the gravity canal. The plant consisted of a concrete structure containing two turbines connected to two pumps.

Next to the pumping plant, a frame caretaker's cottage and garage were erected. Other canal features included four tunnels, one bench flume, seven siphons, and a number of wasteways. The North Branch Canal was completed, including the Wippel Pumping Plant, in 1932. The following year, a wasteway at Badger Creek was installed. This was the last construction contract let on the Kittitas Division. The South Branch Canal, finished



Kittitas Main Canal at station 675, near Cle Elum, Washington, July 15, 1931.

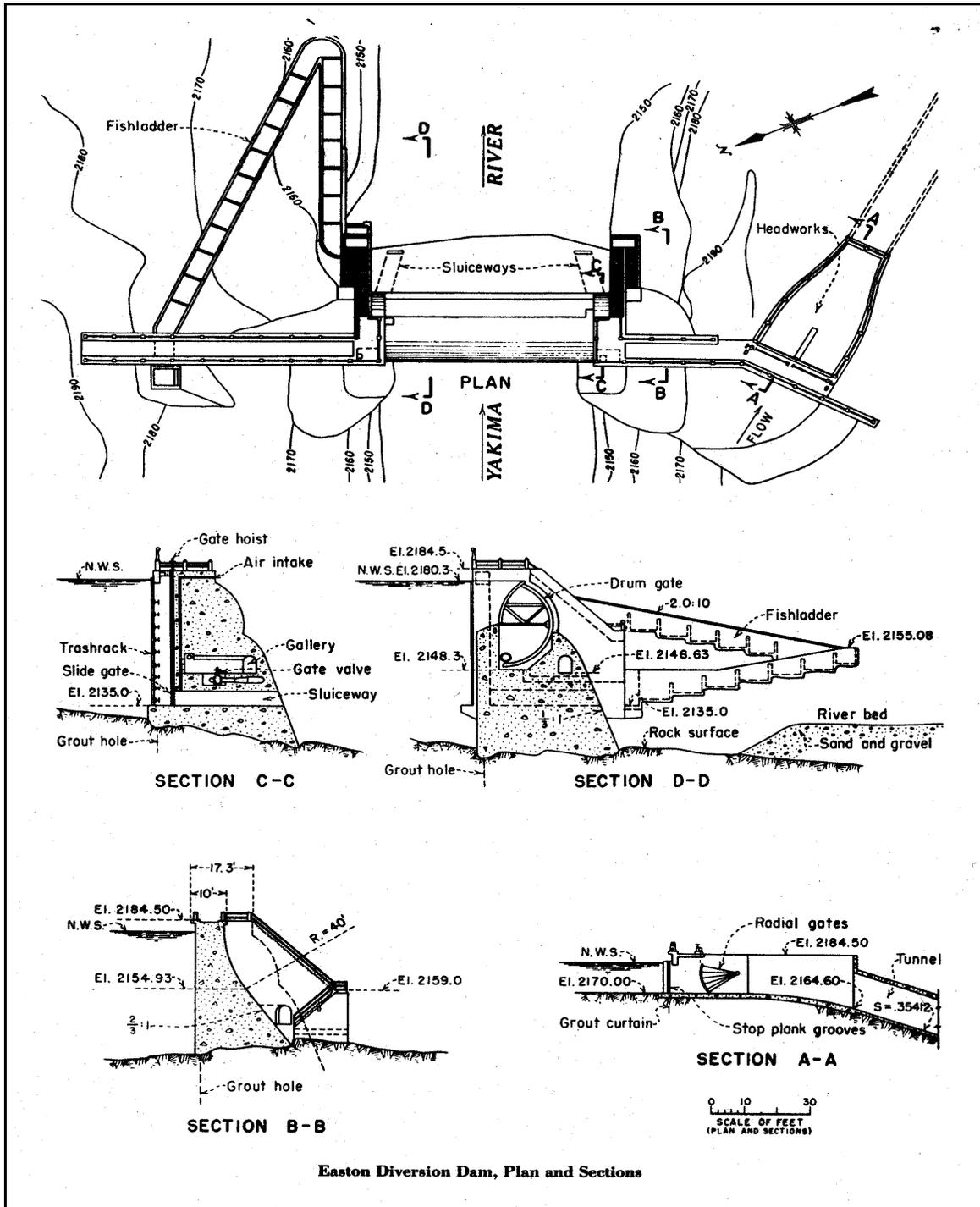


Figure 13.—Easton Diversion Dam, plan and sections.

Source: U.S. Department of the Interior. Water and Power Resources. Project Data. Denver, U.S. Government Printing Office, 1981.



Easton dam and fishway, from below, May 24, 1932.

in June 1930, was, for the most part, unlined earth section. Along its route, the canal incorporated one tunnel, two siphons, and one elevated flume.²²⁰

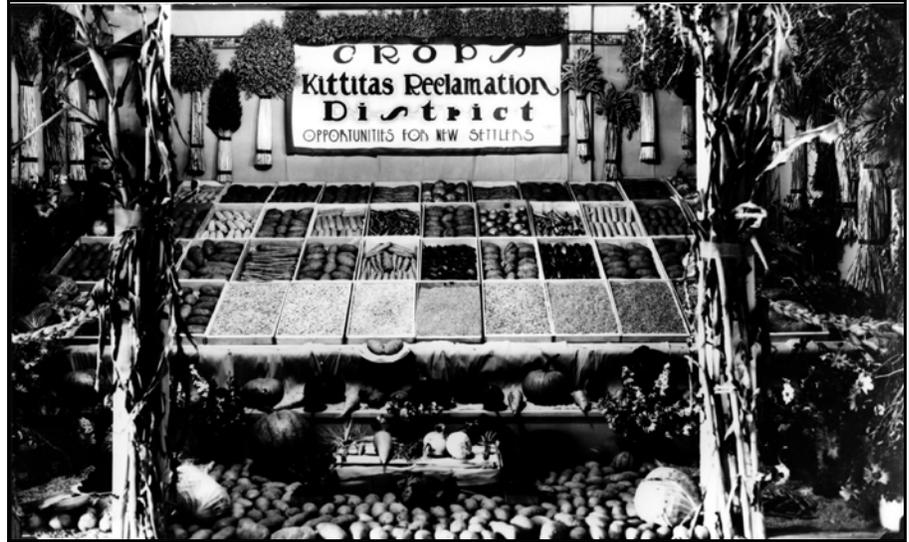
The contract for construction of the Easton Diversion Dam was awarded to C.F. Graff Company of Seattle. The dam is located in a narrow canyon with exposed solid rock abutments. The selected design was a concrete gravity ogee weir, 66 feet above the streambed. The dam crest



Plowing sagebrush land on Kittitas Division, 1932.

²²⁰ U.S. Dept. of Interior, Bureau of Reclamation, Annual Project History, Kittitas Division, Yakima Project for 1932-1933, National Archives, RG 115, Box 347, p. 14-15.

measures 248 feet including the canal heading. A single drum gate, 64 feet long by 14.5 feet high, was installed atop the center section of the dam. Two 4.8- by 6-foot sluice gates controlled by hoists on top of the crest release water near the riverbed. A fish ladder was built at the north end of the dam, and the Main Canal headworks were installed at the opposite side. The



Kittitas Division, Kittitas County Fair, 1932.

headworks consist of two 12-foot by 11-foot radial gates. Construction of the dam started in 1927 and was completed in October 1929.

Even as the project was nearing completion, there were admonitions from Washington that further appropriations would be cut off unless the lands to be irrigated were prepared for agriculture. By late 1928, Reclamation had spent \$6 million on the Kittitas Division and little



Mrs. M.T. Simmons and her daughter, Ruby, in their garden, Kittitas Division, August 5, 1932.

had been done by private owners to get their arid lands ready for development. To make matters worse, the State of Washington had failed to make its financial contributions to the project. Since the Kittitas Reclamation District was obligated to repay construction costs and payments were

based on income earned off the irrigated land, Reclamation was deeply concerned that the project become productive as soon as possible.²²¹

Additional appropriations were forthcoming, and the first water deliveries were made to lands under the Main and South Branch Canals in 1930. Water reached a portion of the lands under the North Branch Canal the following year. By August 1931, the New Reclamation Era was touting that “settlement of lands on the Kittitas Division is progressing in a splendid manner.” The following July, the same journal reported that almost 180 new families had purchased lands since the project's inception. To help promote development of the area, the Ellensburg Chamber of Commerce placed advertisements in 13 farm magazines and 61 western and midwestern newspapers.²²² The Chamber of Commerce even put up roadside billboards extolling the opportunities for settlers. Early concerns about the success of the Kittitas Division eased as development there proceeded quickly. Even though the Kittitas Division was first opened for settlement during the darkest days of the Great Depression, when agriculture was particularly hard hit, the area was settled more rapidly than any of the earlier units on the Yakima Project.²²³

²²¹ “Report on Yakima High Line Canal,” to F.H. Newell from a board of engineers, dated July 8, 1910, National Archives, RG 115, Entry 10, Box 625.

²²² U.S. Department of the Interior, Bureau of Reclamation, Annual Project History, Kittitas Division, Yakima Project for 1932-33, National Archives, RG 115, Box 347, p. 85

²²³ Washington State Planning Council, Reclamation A Sound National Policy, An Inquiry into the Effects of Irrigation Development on Local, State and National Economy, June 1936, p. 4.

The area now called the Roza Division was originally included in the vast expanse to be irrigated under various unsuccessful “High Line” schemes. This idea was forwarded in 1912 by Christian Anderson, who undertook a survey of the higher grounds east and north of the Yakima River for an association of private property owners. The ambitious proposal never materialized beyond paper (see previous chapter on Kittitas Division for description). Also in 1912, the Northern Pacific Railway Company had W.R. King survey the possibility of diverting Yakima River water north of Selah near the mouth of Roza Creek to serve lands presently under the Roza and Kennewick Divisions. Pumping would have provided water to an additional 100,000 acres north of the Rattlesnake Hills.

A study for a reduced High Line development project was completed by Reclamation in 1917. Ferd Bonstedt presented a plan for the “Naches-Yakima High Line Unit,” which would irrigate about 134,000 acres in the present Roza Division, as well as the Wenas and Moxee areas. Extra water was also to be carried through the Sunnyside Canal to cover the Kennewick Division. Bonstedt’s scheme laid out a main canal with diversions from both the Tieton and Naches Rivers.²²⁴

In 1919, with the division of the lands previously covered by the broad High Line unit into four separate areas, the Roza Division came into existence. At the time, the latter was described as embracing from 60,000 to 90,000 acres located mostly on the south slope of the Rattlesnake Ridge above the Sunnyside Canal. A diversion was to be constructed near the mouth of the Yakima River canyon. Landowners in the area wasted no time organizing themselves into an irrigation district; at the close of 1919, they filed a petition to establish the Yakima-Benton Irrigation District (now Roza Irrigation District) with the county commissioners. On July 6, 1920, the newly formed district entered into a contract with Reclamation for further studies of the Roza Division.²²⁵

The results of Reclamation’s investigations were presented in a report dated May 1922 that gives more detailed information on the proposed Roza irrigation plan. A total of 58,353 acres would be served by a 100-mile-long canal with a heading on the Yakima River, about 10 miles north of Yakima. The canal would deliver water by gravity to 46,118 acres, while

²²⁴ Department of the Interior, Reclamation Service, Report on Proposed Naches-Yakima High Line Unit, Yakima Project, October 1917, p. 1-2.

²²⁵ Department of the Interior, Reclamation Service, Annual Project History for Season 1919, Yakima Project, p. 7.

2,987 acres would be served by a direct pumping plant, and 9,248 acres by power pumping plants.²²⁶ Further progress on the Roza Division would be long and drawn out. A shortage of funds, the priority given to the Kittitas Division, and, eventually, World War II all interfered with completion of construction until 1950.

In the intervening years, Reclamation continued to study and refine plans for the Roza project. In 1927, a soil and economic report on the Yakima-Benton Irrigation District was prepared with partial funding provided by the district. At the time, some 4,500 acres were already being irrigated there with water pumped from adjoining gravity systems. The lands had proven to be among the best in the valley for fruit production. It was estimated that the Roza Division would eventually provide homes for some 1,600 families, with each operating an average farm unit of around 40 acres.²²⁷

Following authorization of the Kittitas Division in 1925, debate centered around which of the three remaining proposed Yakima divisions should be built next. In November 1927, Reclamation's chief engineer, Ray Walter, presented his recommendations to Commissioner Elwood Mead. Walter dismissed the Moxee Division from serious consideration due to its drawbacks on numerous accounts. This left just the Kennewick and Roza Divisions. Of the two, Walter placed a higher priority on the Kennewick Division for several reasons. He wrote that "it involves a far less total cost at a time when the government is already committed to a large number of expensive projects" and "from the standpoint of the Yakima Valley in general, the need for irrigation development is greater in the Kennewick vicinity than it is in the Yakima Valley."²²⁸

Just 2 months later, Mead wrote a letter to Senator Jones, outlining a proposal to add the better lands of the Moxee Division to the Roza Division and constructing the combined unit simultaneously with the Kennewick Division. Mead suggested that initiation of the Roza-Moxee and Kennewick Divisions be moved up to 1931 rather than 1934 as originally contemplated. Mead also noted that Congress was considering an appropriation of \$500,000 to begin construction of Cle Elum Reservoir, an important water storage component for the Roza Division.²²⁹

²²⁶ Department of the Interior, Reclamation Service, Investigations by U.S.R.S. of Roza Division for the Yakima-Benton Irrigation District, May 1922.

²²⁷ Department of the Interior, Reclamation Service, Economic Report, Yakima-Benton Irrigation District (Roza Division), Yakima Project, Washington, October 1927.

²²⁸ Letter from R.F. Walter to Dr. Elwood Mead, dated November 22, 1927, National Archives, Denver, RG 115, Entry 7, Box 1139.

²²⁹ Letter from Elwood Mead to Senator Wesley L. Jones dated January 12, 1928. National Archives, Denver, RG115, Entry 7, Box 1139.

Further investigations in the summer of 1928 raised new questions about the feasibility of constructing the Kennewick Division as then contemplated. The debate reopened on how to proceed with the Yakima Project with priority shifting to the Roza Division. In 1930, a joint engineering and economic board concluded that the latter division should be expanded to include desirable lands with pumping lifts up to 200 feet. The redrawn boundaries now covered about 72,000 acres, of which 45,300 would receive gravity water and the rest would be served by pumping facilities. Lands to be served were, for the most part, above areas receiving water from private canals in the East Selah and Moxee districts, near Yakima, and above the Union Gap and Sunnyside Canals, from Parker to Benton City. A pumping plant would be constructed at Yakima Ridge and would have a capacity great enough to serve other possible demands. The Roza Canal would be 99 miles long with a capacity of 2,165 second-feet for the first 12 miles. This would diminish to 1,150 second-feet or less for the remainder of the length. Construction would be costly, due to requirements for concrete flumes, tunnels, and steel siphons to traverse the unfavorable topography and railroad lines.²³⁰

The completion of Cle Elum Dam in 1932 paved the way for construction of the Roza Division. Finally, on September 18, 1935, President Roosevelt allocated \$5 million (reduced to \$4 million later that fall) from the Emergency Relief Funds to begin work on the Roza Dam and distribution system. The event was touted as “A Dream Come True” by those who had been waiting for so many years.²³¹ On December 13, 1935, the Roza Irrigation District contracted with Reclamation to construct irrigation and power facilities.

The Roza Division, as finally realized, consists of a strip of



Roza Division, H.J. Adler Construction Company's canal trimming machine at station 725, 6 miles northeast of Yakima, April 26, 1938.

²³⁰ Department of the Interior, Bureau of Reclamation, Yakima Project, Roza Division, Cost Estimate by Denver Office, September 1932.

²³¹ “A Dream Comes True,” Washington Irrigation Institute, Proceedings of Twenty-Third Annual Meeting, December 12, 1935, p. 16.

land roughly 3 miles wide by 60 miles long, along the east side of the Yakima Valley. The total irrigable lands consist of 72,000 acres, of which 45,000 acres are served by gravity and 27,000 acres by pumping. To deliver water to this area, a diversion dam was constructed 12 miles north of the city of Yakima on the Yakima River. A main canal, originally called the Yakima Ridge Canal, carries water to the Roza Division lands. Ninety-five miles in length, the canal route incorporates a series of tunnels, siphons, flumes, and wasteways. At mile 3.5, the canal crosses the Yakima River through the Pomona Siphon. Eighteen pumping plants were also built along the length of the canal.

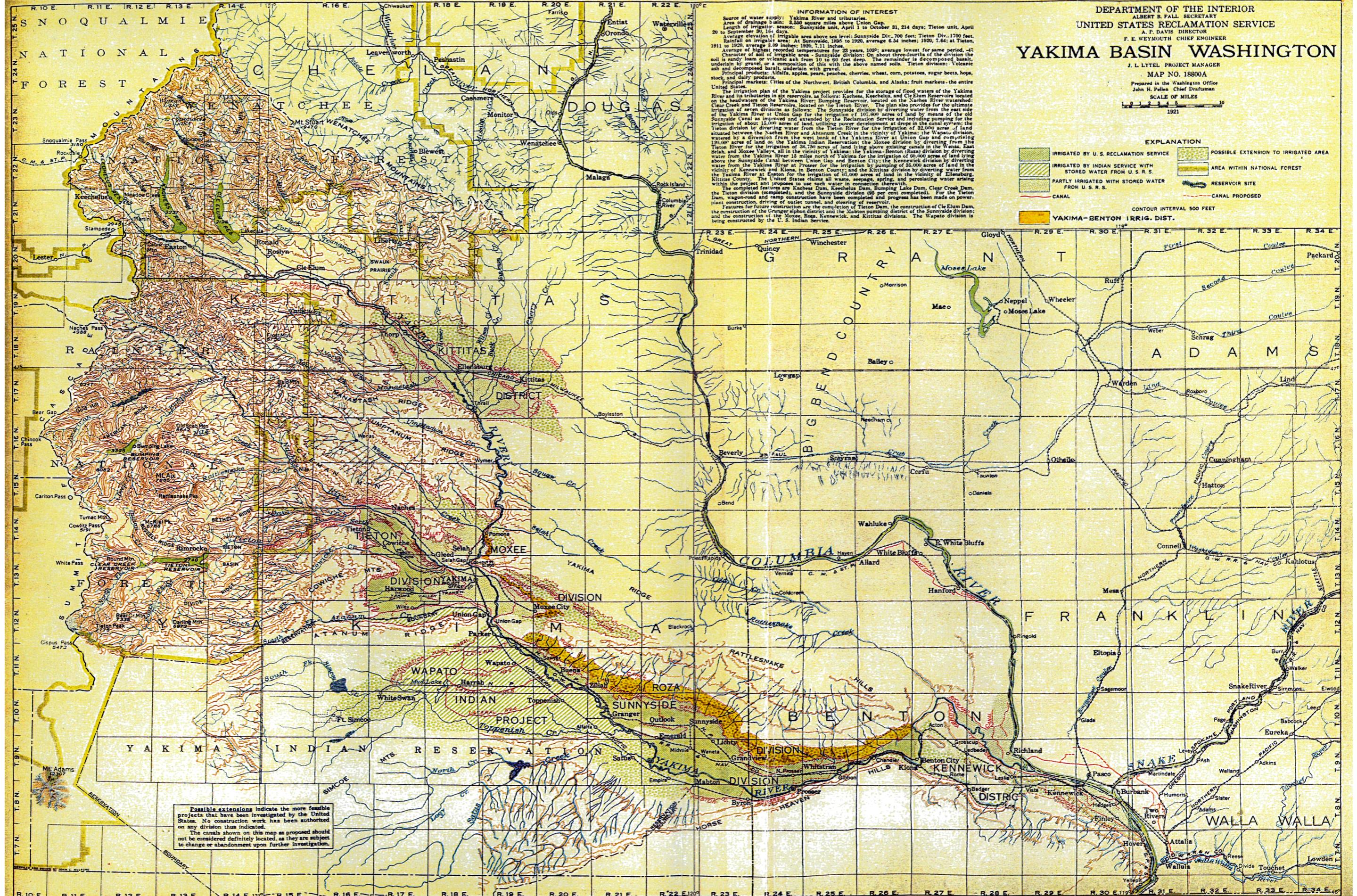


Roza Division, first water in Roza Canal; from headworks, looking downstream, December 4, 1939.

The first construction contract was signed in December 1935 and actual construction began in February 1936 when the Morrison-Knudsen Company began excavation of Tunnel No. 3 on the Roza Canal. Work was carried out under the supervision of Reclamation engineer, C.E. Crownover. Within the first 2 years, seven large

contracts for labor associated with the canal were awarded. Materials such as sand and gravel, reinforcing steel, structural steel, and machinery were purchased by Reclamation and supplied to the contractors.

Construction of the diversion dam was started in 1938 and was completed the following year. The dam design consists of a concrete ogee gravity section, upon which are superimposed two roller gates, each 110 feet long by 14 feet in diameter. The gates, electrically operated, allow a constant level of water to be maintained in the forebay. When built, the roller gates were a rather rare type, especially on dams west of the Mississippi. At the east end of the dam, an elaborate fish ladder and screening system were installed. At the opposite end of the dam, the headworks structure for the Roza Canal was constructed. Six bays, each equipped with a



INFORMATION OF INTEREST

Source of water supply: Yakima River and tributaries.

Area of drainage basin: 8,550 square miles above Union Gap.

Length of irrigation season: Sunnyside unit, April 1 to October 31, 214 days; Tieton unit, April 20 to September 29, 164 days.

Average elevation of irrigable area above sea level: Sunnyside Div., 700 feet; Tieton Div., 1700 feet.

Rainfall on irrigable area: At Sunnyside, 1895 to 1920, average 6.54 inches; 1920, 7.64; at Tieton, 1911 to 1920, average 8.09 inches; 1920, 7.11 inches.

Average of highest recorded temperatures for 23 years, 103°; average lowest for same period, -43°.

Character of soil of irrigable area - Sunnyside division: On about three-fourths of the division the soil is sandy loam or silty loam from 10 to 60 feet deep. The remainder is decomposed basalt, underlain by gravel or a composition of this with the above named soils. Tieton division: Volcanic ash and decomposed basalt, underlain with gravel.

Principal products: Alfalfa, apples, pears, peaches, cherries, wheat, corn, potatoes, sugar beets, hops, stock, and dairy products.

Principal markets: Cities of the Northwest, British Columbia, and Alaska; fruit markets - the entire United States.

The irrigation plan of the Yakima project provides for the storage of flood waters of the Yakima River and its tributaries in six reservoirs, as follows: Kachess, Keechelus, and Cle Elum Reservoirs located on the headwaters of the Yakima River; Bumping Reservoir, located on the Naches River watershed; Clear Creek and Tieton Reservoirs, located on the Tieton River. The plan also provides for the ultimate irrigation of seven divisions as follows: The Sunnyside division by diverting water from the east side of the Yakima River at Union Gap for the irrigation of 105,000 acres of land by means of the old Sunnyside Canal as improved and extended by the Reclamation Service and including pumping for the irrigation of about 15,000 acres of land, utilizing power development at drops in the canal system; the Tieton division by diverting water from the Tieton River for the irrigation of 32,000 acres of land situated between the Naches River and Astinum Creek in the vicinity of Yakima; the Wapato division, watered by a diversion from the west bank of the Yakima River at Union Gap and comprising 120,000 acres of land on the Yakima Indian Reservation; the Moxee division by diverting from the Tieton River for the irrigation of 38,750 acres of land lying above existing canals in the Wenas, East Selah, and Moxee Valleys, all in the vicinity of Yakima; the Yakima-Benton (Roza) division by diverting water from the Yakima River 15 miles north of Yakima for the irrigation of 60,000 acres of land lying above the Sunnyside Canal between Union Gap and Benton City; the Kennewick division by diverting water from the Yakima River at Prosser for the irrigation of 35,000 acres of land in the vicinity of Kennewick and Kiona, in Benton County; and the Kittitas division by diverting water from the Yakima River at Easton for the irrigation of 37,000 acres of land in the vicinity of Ellensburg, Kittitas County. The United States claims all waste, seepage, spring, and percolating water arising within the project and proposes to use such water in connection therewith.

The completed features are Kachess Dam, Keechelus Dam, Bumping Lake Dam, Clear Creek Dam, Tieton Dam, wagon-road and ramp construction have been completed and progress has been made on power-plant construction, driving of outlet tunnel, and clearing of reservoir.

Features for future construction are the completion of Tieton Dam, the construction of Cle Elum Dam, the construction of the Grandditch tunnel, and the Mabton pumping district of the Sunnyside division; and the construction of the Moxee, Roza, Kennewick, and Kittitas divisions. The Wapato division is being constructed by the U. S. Indian Service.

DEPARTMENT OF THE INTERIOR
 ALBERT B. FALL, SECRETARY
 UNITED STATES RECLAMATION SERVICE
 A. F. DAVIS, DIRECTOR
 F. E. WEYMOUTH, CHIEF ENGINEER

YAKIMA BASIN WASHINGTON

J. L. LYTEL, PROJECT MANAGER
 MAP NO. 18800A
 Prepared in the Washington Office
 John H. Pallen, Chief Draftsman
 SCALE OF MILES
 0 1 2 3 4 5 6 7 8 9 10
 1921

EXPLANATION

- IRRIGATED BY U. S. RECLAMATION SERVICE
- IRRIGATED BY INDIAN SERVICE WITH STORED WATER FROM U. S. R. S.
- PARTLY IRRIGATED WITH STORED WATER FROM U. S. R. S.
- YAKIMA-BENTON IRRIG. DIST.
- POSSIBLE EXTENSION TO IRRIGATED AREA
- AREA WITHIN NATIONAL FOREST
- RESERVOIR SITE
- CANAL
- CANAL PROPOSED

CONTOUR INTERVAL 500 FEET

Possible extensions indicate the more feasible projects that have been investigated by the United States. No construction work has been authorized on any division thus indicated. The canals shown on this map as proposed should not be considered definitely located, as they are subject to change or abandonment upon further investigation.

Source: U.S. Department of the Interior. Bureau of Reclamation. Economic Report, Yakima-Benton Irrigation District (Roza Division), Yakima Project, Washington. October 1927.

Figure 14



Roza Division, general view of diversion dam from the top of the cliff at the east end of the dam, October 7, 1939.

large revolving fish screen, were built at the canal entrance. Below that, a 28-foot by 15-foot radial gate was installed as the final control of the flow into the canal system. The total crest length of the dam is 486 feet and the structural height is 67 feet.

All concrete for the dam was manufactured at a central mixing plant, located near the aggregate stock piles a short distance from the dam. The concrete was delivered by truck to the dam site and lowered by buckets into the formwork. The blocks of concrete were separated by contraction joints sealed by “a very modern method.” This consisted of 9-inch-wide rubber water stops instead of the usual copper or wrought-iron stops.²³²

²³² Klingensmith, C.E., “Roza Diversion Dam,” *Reclamation Era*, May 1941, pp. 135-137.

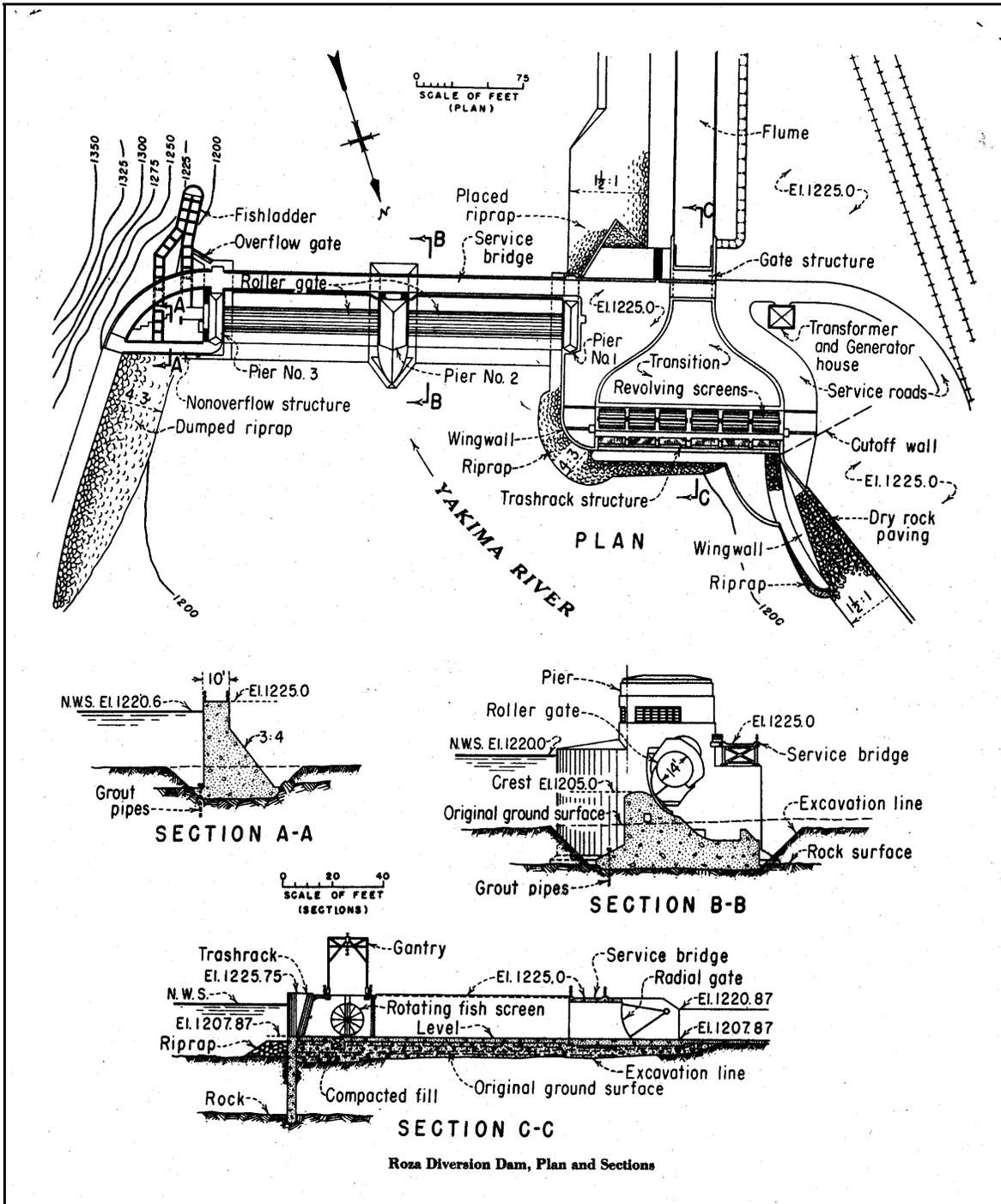


Figure 15.—Roza Diversion Dam, plan and sections.

Source: U.S. Department of the Interior, Water and Power Resources, Project Data, Denver, U.S. Government Printing Office, 1981.

In November 1942, the War Production Board suspended all project construction except that necessary to place 6,100 acres under irrigation water for the 1943 season.²³³ Work resumed that year and continued as funds and materials became available. The Roza Canal was officially completed on March 14, 1946, when Reclamation accepted the contract work of the Fiorito Company, which built the last 10 miles of canal, including Wasteway No. 7 at the end.²³⁴ The canal's terminus is to the northwest of Kiona.

The most costly and difficult features to build on the canal were the five tunnels aggregating 4½ miles in length. They are all of the standard horseshoe type, nonpressure, and concrete lined. The first tunnel, which was combined with original Tunnel No. 2, occurs shortly below the head of the canal and is about 1½ miles long.

Tunnel No. 3, located 3½ miles north of Yakima, is even longer, at 9,590 feet. Although all the tunnels were driven by more or less similar and conventional methods, a variety of construction equipment and procedures was used by the different contractors to place the lining. Much of the equipment was original in design or use and greatly accelerated the progress of the work.²³⁵



Roza Division, showing dragline placing concrete in the diversion tunnel, the last concrete to be placed in the dam, November 16, 1939.

With the completion of the main canal and gravity lateral system in 1946, water was available to all but 390 acres of the gravity system by mid-August. That same year, construction of the

²³³ Irrigation operations started in 1941, with 1,861 acres irrigated. Yakima Project, Annual Project History, 1947, p. 19.

²³⁴ "Roza Canal Completed After Ten Years," Reclamation Era, 1946.

²³⁵ Nelson, Harold, "Tunnel Lining Methods, Roza Division, Yakima Project," Reclamation Era, June 1941, p. 172-73.



Campsite of Jack Flett on his land, where water would soon be available for irrigation. Mr. Flett, a veteran, and his family planned to build a house and clear and farm part of the land in the summer of 1946.

distribution systems for two of the pump areas was initiated. Development of lands in the Roza Division occurred quickly, due to the demand for agricultural products both during and after World War II and the availability of experienced irrigation farmers. At the end of the war, many service men returned to the Yakima Valley in search of opportunities. Some got jobs on the Roza Division as laborers on canal patrol, in the office, or on field survey crews. Veterans were also given preference on 36 farm units in the Roza Division, which were opened to homesteaders in the latter half of 1946.²³⁶

Irrigation facilities on the Roza Division were completed in 1950, the same year in which service was inaugurated to the 27,000 acres under pumping plants. Power for pumping was initially supplied by the Bonneville Power Administration. In August 1958, Reclamation placed the Roza Powerplant in operation. This 11,250-kilowatt hydroelectric plant, located east of the city of Yakima, was built to provide power for the 18 pumping plants on the Roza Division.²³⁷ The plant's generator was manufactured in Austria, and installation was overseen by three Austrian engineers. More than 70 miles of transmission lines were installed to carry power from the plant to the various pumping stations. Excess power is marketed through the Bonneville Power Administration.

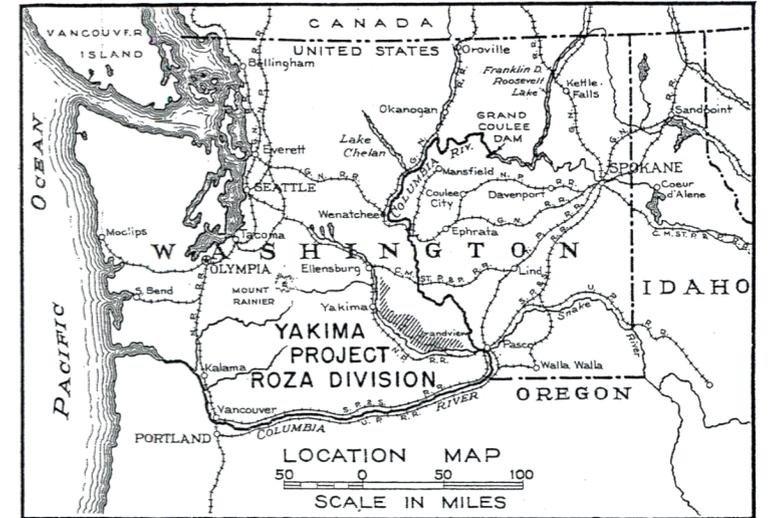
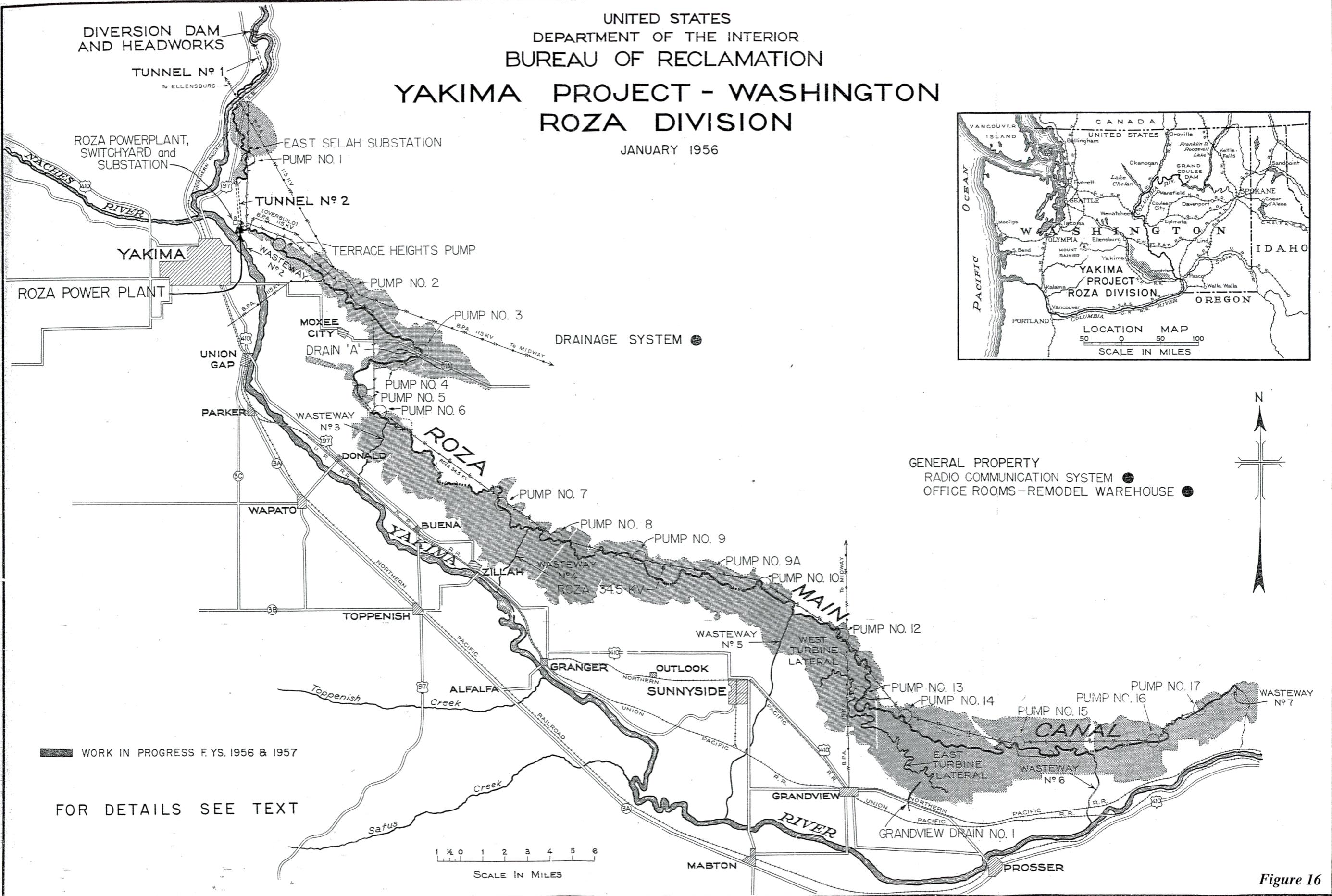
²³⁶ "Return of the Homesteader," *Reclamation Era*, July 1946, pp. 149-50.

²³⁷ "Yakima Federal Irrigation Project," no author, Ca. 1960, on file in the Upper Columbia Area Office library (4.005).

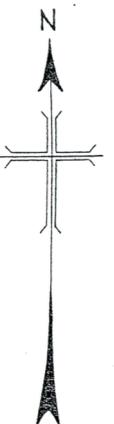
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

**YAKIMA PROJECT - WASHINGTON
ROZA DIVISION**

JANUARY 1956



GENERAL PROPERTY
RADIO COMMUNICATION SYSTEM ●
OFFICE ROOMS-REMODEL WAREHOUSE ●



WORK IN PROGRESS F. YS. 1956 & 1957

FOR DETAILS SEE TEXT

SCALE IN MILES
0 1 2 3 4 5 6

Figure 16

YAKIMA - ROZA

Source: U.S. Department of the Interior. Bureau of Reclamation. Yakima Project, Annual Project History, 1956.



View of Lake Cle Elum from outlet, July 22, 1931.

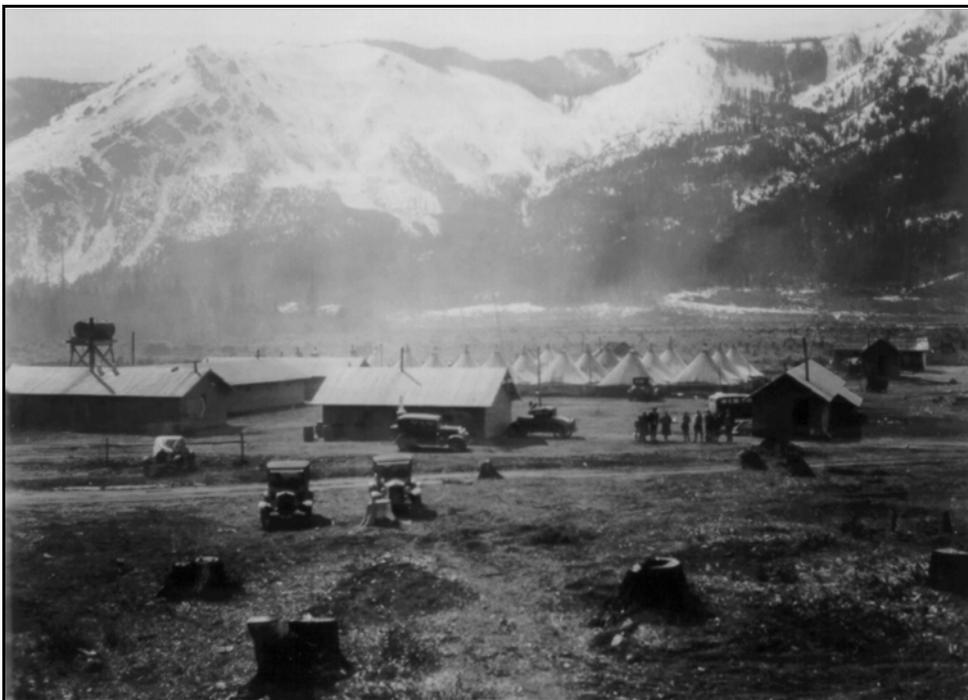
The successful operation of the Roza Division was dependent on completion of the last storage facility built on the Yakima Project, Cle Elum Dam. The earth and rockfill structure is located at the outlet of Lake Cle Elum on the Cle Elum River, about 8 miles northwest of the town of Cle Elum.

The development of storage at Lake Cle Elum for irrigation purposes was first attempted in the early 20th century, when the Union Gap Irrigation Company built a low crib dam at the outlet of the lake. The older Washington Irrigation Company accused the company of interfering with its water rights and retaliated by blowing up the dam in August 1905.

The use of Lake Cle Elum for storage as part of the Yakima Project was included from the start in plans developed by Reclamation. Since most of the land in the reservoir area was owned by the Northern Pacific Railway and various private individuals, it was necessary for

the Federal Government to purchase the property. Negotiations for the acquisition began in 1906 and continued for several years. In 1907, the Federal agency constructed a temporary crib and rockfill dam at the lake to obtain storage of about 26,000 acre-feet. Thereafter, a limited amount of reservoir clearing was performed prior to 1915 and numerous investigations for a permanent dam were carried on intermittently until 1931, when construction began on an earth and rockfill structure. Completion of Cle Elum Dam in 1933 increased the storage capacity of the lake to 356,000 acre-feet.²³⁸

The first construction associated with the permanent dam consisted of a 2½-mile-long transmission line from Ronald, Washington, to the damsite. Installed by Government forces in 1929, the line provided power for the excavation of test pits and for construction of the dam later on. In June 1931, the Government began building a construction camp for its employees on top of a ridge at the northeast end of the dam. Four cottages, a five-room dormitory, mess hall, office, concrete testing laboratory, and two six-car garages formed the camp. Lighting, water, and sewer systems were provided.



Cle Elum Reservoir, Camp of Lahar Construction Company, April 8, 1932.

Bids for constructing the dam and clearing the reservoir area were opened at Yakima on July 10, 1931. Winston Brothers Company of Minneapolis, Minnesota, was awarded the dam construction contract and given notice to proceed on September 9, 1931.

All bids for the reservoir clearing were rejected as too

²³⁸ The description of the construction of Cle Elum Dam is taken from Cle Elum Dam and Reservoir, Final Report, 1938, published by the Bureau of Reclamation. It is located at the National Archives, Denver, RG 115, Box 624, Entry 10.

high, and the work was readvertised on September 18, 1931. This time, a successful bid was submitted by Lahar Construction Company of Booneville, Missouri, and a contract was awarded on October 1, 1931. Under the terms of the contract, the company was required to clear the entire reservoir area, except the immediate vicinity of the damsite. This section was the responsibility of Winston Brothers Company. The Lahar Construction Company made good progress on the job until the fall of 1932, when financial difficulties shut down operations. The final remaining 70 acres were cleared by Government forces.

Winston Brothers Company constructed their residential camp on a bench about 1,500 feet southeast of the damsite. Accommodations for about 285 men included 34 8-man bunkhouses, a mess hall, a clubhouse and commissary, a first-aid station, an office and administrative dormitory for 4 men, 9 frame cottages for families, and 32 garages. The camp was supplied with water, a septic system, and electricity. A construction plant was erected on the west side of the river below the damsite. It consisted of a carpenter shop, truck garage, machine shops, warehouse, tool shed, compressor house, steel bending yard, and concreting plant. The contractor built 800 feet of track off a railroad spur at Jonesville to deliver materials and equipment to the damsite.

With construction preparations completed, work on the dam proceeded. The Government furnished the cement, sand, and aggregate for concrete, as well as reinforcement bars, gates and hoists, operating machinery, and drainpipe. The contractor supplied all other materials such as formwork, and sand and gravel for road surfacing. In October 1931, the last of the old crib dam was removed, and clearing the dam and borrow sites was underway. That same month, work on the diversion scheme began. A 19-foot-diameter tunnel at the south end of the dam site was excavated to divert water during construction of the embankment. Due to considerable water and clay streaks encountered during the digging, the tunnel was lined with concrete to a thickness of 30 inches and heavily reinforced. Upon the dam's completion, the 1,430-foot-long tunnel served as the outlet works to release irrigation water. A concrete trashrack was installed at the upper end of the tunnel, and at midlength, the tunnel was connected to a vertical concrete shaft containing two cylinder gates. Two emergency butterfly valves were placed in the tunnel upstream from the gate shaft.

Construction of the vertical shaft was difficult, due to its depth of 140 feet, the gravel and fine sand through which it had to be sunk, the bell-flare at the bottom, and the transition inlet and gooseneck outlet. Two derricks were used in the careful excavation of the shaft. This was followed by the placement of concrete in an outer and inner shell. The vertical shaft inside the outer lining is 26 feet in diameter, with an inner cylinder 2 feet thick and 14 feet in diameter. The concrete was placed in sections using bottom dump buckets lowered from the same derricks employed in the excavations. The main structure, including the outer shell, was concreted during the spring of 1932 so that diversions could be made. The rest of the shaft,

including the gate control house at the dam crest and the installation of the cylinder gates, was completed in the summer of 1933.

Upon diversion of the river through the outlet tunnel, work was started on the main dam. This consisted of a sprinkled and rolled-filled embankment, 750 feet long on the crest, with a maximum height of 135 feet above the streambed. A cutoff trench was excavated across the upstream length of the dam. The downstream slope of the dam was covered with a mixture of sand, gravel, and cobbles, placed in horizontal layers not more than 8 inches thick after rolling. This part of the embankment varied in thickness from 5 feet at the crest to a much thicker gravel and cobble fill at the downstream toe. A blanket of gravel and cobble was also placed on the streambed and a portion of the side slopes of the canyon below the dam for a considerable distance. The upstream face of the dam was covered with a 12-inch layer of gravel or rock fragments and a 30-inch layer of rock riprap. A protective blanket of earth, varying in thickness from 10 to 40 feet, was spread on the upstream riverbed and north abutment slopes of the dam.

A main borrow pit for the finer material used in the impervious section of the dam was located at the southwest end of the dam. Gravel and cobbles were obtained from the excavation of the new river channel and the lower end of the spillway. Trucks hauled the materials to their specified places. Fill for the rolled embankment was distributed in rows parallel to the axis of the dam. The material was then spread and compacted by a tractor pulling a scraper, followed by a sheepsfoot roller. Layers were compacted to an average thickness of about 6 inches and then sprinkled with water. The rock riprap was obtained from a quarry located less than a mile southwest of the dam and dumped in place from trucks.

The spillway is located at the south abutment of the dam. Originally, it consisted of an uncontrolled open concrete chute measuring 1,050 feet in length. At the end of the chute, a stilling basin was excavated during the summer and fall of 1932. The following year, the basin was lined with concrete.

By June 1933, the embankment was completed to within 1 foot of the finished crest. In addition to the main dam, four earthen dikes were built. The main dike, 850 feet in length with a maximum height of 40 feet, was constructed from the north abutment of the dam parallel to a natural ridge extending in a northeasterly direction from the dam. The upstream face of the dike was covered with a 30-inch-thick layer of riprap on a 12-inch layer of gravel. The downstream slope was protected by a gravel and cobble blanket. Three smaller dikes of similar construction were built across low saddles of the ridge.



Cle Elum Dam, spillway gate structure and gatehouse under construction, June 15, 1933.

Two other features were constructed in association with Cle Elum Dam. A 5½-mile-long road was built along the east side of the reservoir to replace a portion of the State highway that was to be flooded by the enlarged reservoir. This contract was completed by the

end of September 1932. The second feature was a new bridge constructed across the Cle Elum River channel, due to its widening. This work was performed by Government forces in 1932.

The contract with Winston Brothers Company for building the dam was completed on September 5, 1933. Three years later, the capacity of Cle Elum Reservoir was increased to 436,000 acre-feet, when Government forces installed five 37- by 17-foot radial gates in the spillway.



Cle Elum Dam, spillway flowing.

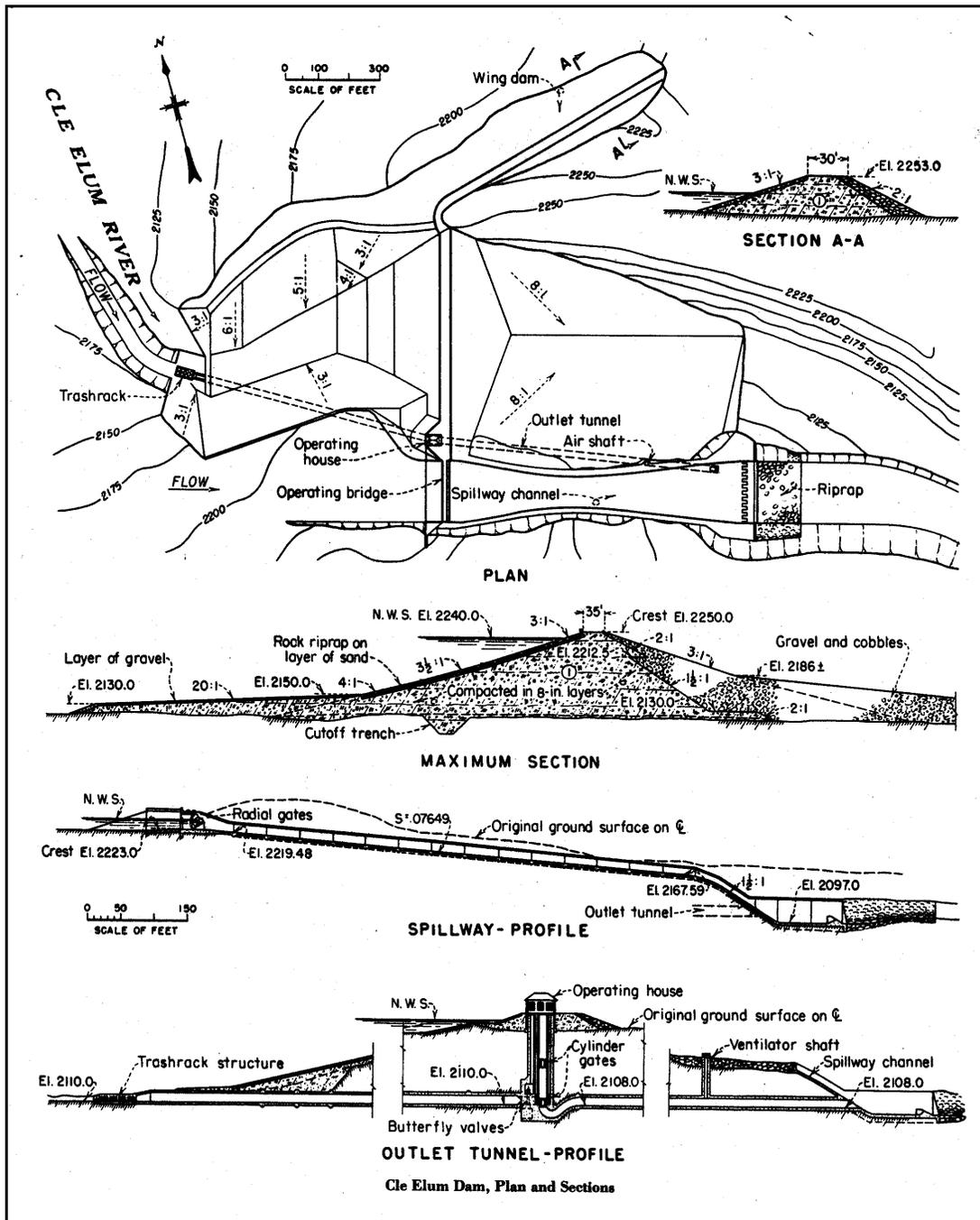


Figure 17.—Cle Elum Dam, plan and sections.

Source: U.S. Department of the Interior, Water and Power Resources, *Project Data*, Denver, U.S. Government Printing Office, 1981.

As the Great Depression gripped the country and drought conditions parched the Western Plains in the early 1930s, farmers across the land faced financial ruin. Many on Reclamation projects were unable to meet repayment and maintenance assessments. As a result, especially on the older projects, the physical infrastructures of irrigation systems fell into disrepair.

In comparison to some other Reclamation undertakings, conditions on the Yakima Project were to be envied. The year 1930 was touted as one of the best-producing in the Yakima Valley's history, with returns totaling \$40,280,000. Fruit crops represented half of that amount. Other successful agricultural products included potatoes, tomatoes, hay, wheat, hops, lambs, wool, eggs, and dairy products.²³⁹ On the Sunnyside and Tieton Divisions, 7 percent and 83 percent of construction charges, respectively, had been repaid by 1935. Only a very small amount was overdue at the time. On the Kittitas Division, production reports were excellent, and no problems with repayment were anticipated.²⁴⁰

The Civilian Conservation Corps

Nonetheless, the Yakima Project was able to benefit greatly by the work accomplished there during the Depression by the Civilian Conservation Corps (CCC). Created by President Roosevelt in 1933, the CCC program put unemployed young men to work on conservation projects throughout the country. Six CCC camps operated on the Yakima Project for varying lengths of time between 1935 and 1942. They were assigned the following numbers: BR-49, BR-50, BR-58, BR-66, BR-67, and BR-86.²⁴¹

BR-49 was established near Clear Lake Dam as a summer camp in 1935. Enrollees stationed there removed dead timber and debris from the reservoir area and then piled and burned it. The youths also completed a general cleanup of the grounds around Tieton Dam and built a new warehouse there. Camp BR-50, opened in July 1935, was located at the lower end of Kachess Dam and was also occupied just in the summer months. Work accomplished by

²³⁹ Reclamation Era, April 1931, p. 81.

²⁴⁰ Washington State Planning Council, Reclamation, A Sound National Policy. An Inquiry into the Effects of Irrigation Development on Local, State, and National Economy As Demonstrated by The Yakima Valley and Other Irrigated Areas in Washington, June 1936, pp. 4-5.

²⁴¹ See The Bureau of Reclamation and the Civilian Conservation Corps, 1933-1942, Christine Pfaff, Bureau of Reclamation, June 2000.

enrollees there was similar to that at Clear Lake. They gathered and burned timber and debris that had collected along the reservoir shoreline.

Camp BR-58 was authorized as a year-round camp and existed from June 1938 through May 1942. Named Sunnyside, the exact location of the camp is unknown, although it was near the center of the Sunnyside Division. During the first year, work projects included excavating and installing 645 lineal feet of 15-inch concrete pipe; collecting 89 pounds of brome grass seed for seeding main canal banks; placing wire fencing around the intake to five siphons, and replacing a 2,000-foot-long section of the old untreated wood stave Mabton Siphon with new creosoted wood stave pipe. Other work included repairing Reclamation buildings, fences, and sewage systems; improving 78 miles of canal operating roads; placing concrete lining and rock riprap; and eradicating poisonous weeds on canal rights-of-way.

CCC enrollees continued with similar projects over the next several years. Among other items, three deteriorated wood-stave siphons in the Orchard Tracts District were replaced with monolithic concrete pipe; the Snipes Mountain Canal was lined with an experimental asphaltic concrete; the Prosser Flume was replaced with a reinforced-concrete siphon; the wood stave Benton Siphon No. 1 was replaced with concrete pipe; and Drop No. 13 on the Sunnyside Main Canal was modified. The varied assignments provided enrollees the

opportunity to become skilled operators of many kinds of heavy machinery and equipment.

Camp BR-66, located at the Tieton Division's headquarters site, operated from July 1938 through May 1942. Enrollees upgraded the Tieton Division by accomplishing numerous improvements. Of the 16 original metal flumes,



Asphaltic concrete lining experimental project, Snipes Mountain Canal, mile 6.21, showing placing of material, November 13, 1939.



Mabton Siphon replacement, placing bands on new 56-inch creosoted wood stave pipe, view looking upstream, March 6, 1941.

10 had been replaced by 1930, and the rest were in poor condition. During the first year, the young men replaced Flumes No. 1 and No. 5 with a concrete bench flume and siphon, respectively; lined 600 lineal feet of canal with concrete; and began work on another reinforced-concrete siphon. They also improved and rebuilt over 3 miles of canal operating roads and cleared weeds and willows from the main lateral system.

Similar types of project work continued over the next several years. A major accomplishment was the replacement of a portion of the Tieton Main Canal that crossed a ravine near Station 137 with an elevated concrete flume. The original section of concrete-lined canal sat on rockfill that had settled a maximum of 10 inches. CCC enrollees constructed a 120-foot-long, rectangular, reinforced-concrete flume supported by reinforced-concrete pedestals. The youths also improved operating roads, installed reinforced-concrete pipe, replaced some 6-inch wood pipe, and resurfaced a portion of the interior of the Tieton Main Canal. During the last year of the camp's existence, enrollees built a reinforced-concrete siphon on Lateral "G" and constructed a reinforced-concrete bench flume on Lateral "C."



Group of enrollees and guest at Camp BR-66 for Christmas dinner. Lieutenant Fred L. Houck, Company Commander, at extreme right in back; Lieutenant Geo. A. Rigley, second in command, at extreme right in front; and F.A. Castle, Camp Superintendent, at extreme left. December 25, 1938.

It appears that the final two camps on the Yakima Project, BR-67 and BR-86, were established either in 1939 or 1940. Enrollees at Camp BR-67, named Bumping Lake, were responsible for removing and burning logs and debris congesting that reservoir. Enrollees at Camp BR-86,

named Zillah, modified Drops No. 4 and No. 6 on the Sunnyside Main Canal, replaced the 46-inch wood stave discharge pipe on the Outlook Irrigation District, installed concrete lining in the Main Lateral of the Granger Irrigation District, placed riprap along the banks of the



Construction of 48-inch monolithic reinforced concrete siphon at station 1216+12 on lateral "G," looking upstream, placing forms and steel, September 6, 1940.

Sunnyside Main Canal, and improved canal operating roads.

The outbreak of World War II brought an end to the CCC program. As the United States geared up its production of arms and ammunition, the unemployment problem dissolved. With the attack on Pearl Harbor, the country's attention was riveted on a new front, and young men left the CCC to join the military.

All CCC camps, including those on the Yakima Project,

were disbanded by July 1942.

As the country was poised for entry into the war, farmers on the Yakima Project could take pride in their accomplishments. The total irrigated area had reached about 319,000 acres, with another 80,000 acres operating under non-Reclamation works. Yakima County could boast of being the sixth richest county in agricultural production in the United States.²⁴²

Wartime Measures

Although seemingly removed from the events of Pearl Harbor, the farmers on the Yakima Project felt the reverberations immediately. Only two days after



Replacement of 46-inch wood stave discharge pipe - Outlook Irrigation District, November 21, 1939.

²⁴² *Building a State*, p. 234.



Modification of Drop 6, Main Canal, mile 10.16, Ca. early 1941.

the attack, C.E. Crownover, Construction Engineer on the Roza Division, sent a letter to Reclamation's Chief Engineer in Denver describing the anxious mood and safety concerns:

"The situation in the Yakima Valley and throughout the Pacific Northwest is very tense. Last night all radio stations west of Salt Lake were silenced and most cities, among them Yakima, were blacked out. At this moment, a

Japanese air squadron is reported off Seattle, and last night similar squadrons were reported in the vicinities of San Francisco and Victoria.

While there are no military objectives in the Yakima Valley, it is particularly vulnerable to acts of sabotage. There are some 900 Japanese in the Valley, about one-half of whom are citizens. All Japanese are being registered and examined, and it is presumed they will be dealt with in accordance with the President's order of today.

It is a source of general satisfaction to everyone, and particularly water users on Federal projects, that within a few hours after the first reports of the attack on Honolulu, Superintendent D.E. Ball had placed all principal Bureau structures under armed guard."²⁴³

The irrigators themselves felt threatened and wrote to Commissioner Page with an urgent appeal that every effort possible be made to protect the features of the Yakima Project.²⁴⁴ As a result of the added security measures, access to Reclamation facilities was significantly

²⁴³ Letter from C.E. Crownover to S.O. Harper, Chief Engineer, dated December 9, 1941, National Archives, RG 115, Entry 7, Box 743.

²⁴⁴ Letter from T. Howell, Yakima County Civil Defense Council, to John C. Page, dated February 3, 1942, National Archives, RG 115, Entry 7, Box 743.

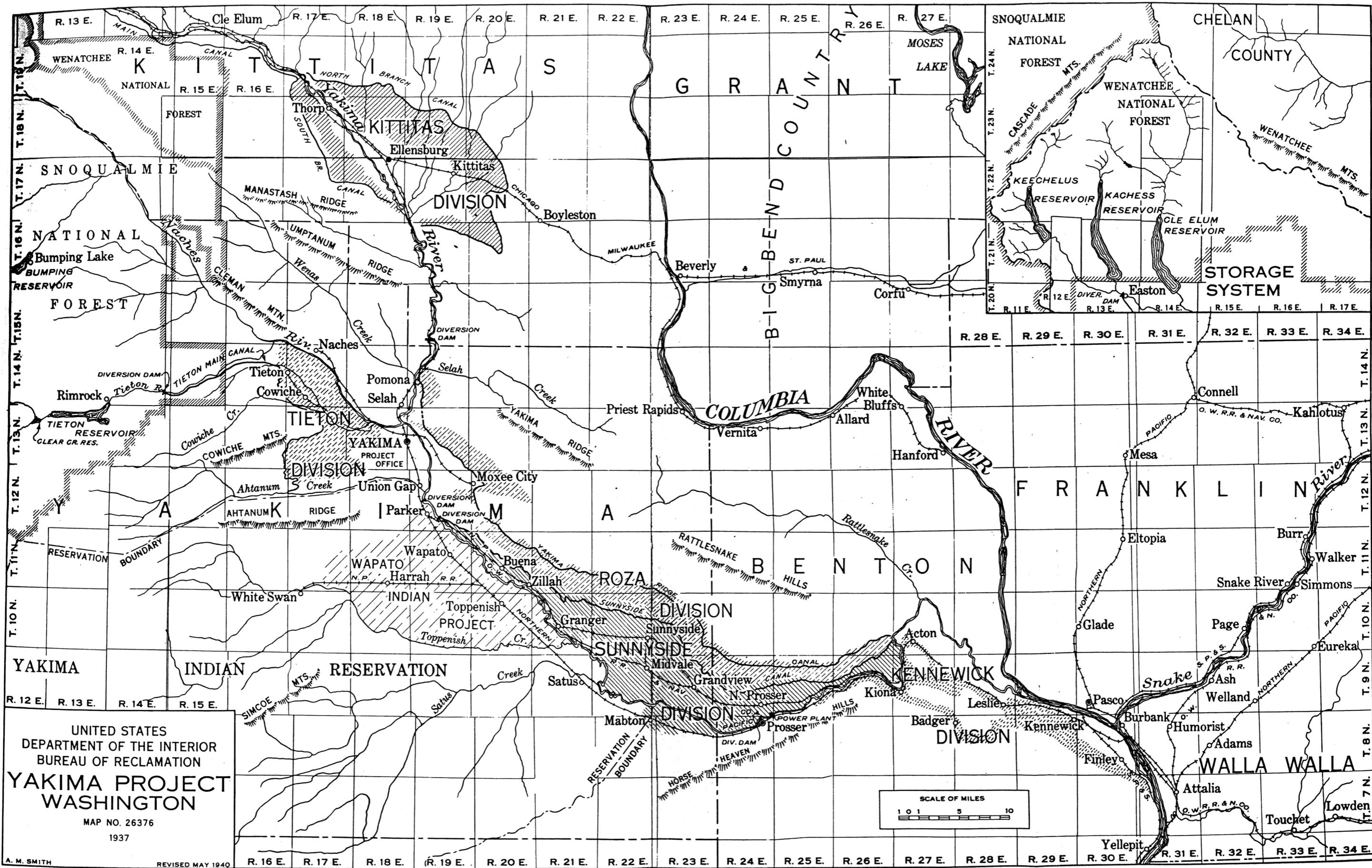


Figure 18

Source: U.S. Department of the Interior. Bureau of Reclamation. Yakima Project, Annual Project History, 1946.



Sunnyside Diversion, enlargement of mechanical fish screen below Sunnyside Canal headgates by U.S. Bureau of Fisheries. (Lower retaining wall on upper bank not completed.) Looking upstream, March 15, 1939.

restricted. This caused concern among the Yakima Indians who, for many years, had fished for salmon in the Yakima River at the Sunnyside and Prosser Falls Dams. In March 1942, Reclamation officials met with tribal representatives and agreed to permit Indian fishing as usual, provided the Office of Indian Affairs supplied additional guards. Apparently, such arrangements were made and the fishing continued.²⁴⁵

Fortunately, the war ended with no occurrences of sabotage to the Yakima Project facilities. Servicemen returning to the Yakima Valley found over 5,000 farms benefiting from Yakima Project water supplies. Approximately 252,000 acres were being irrigated in the completed Sunnyside, Tieton, Kittitas, and Wapato Divisions. An additional 27,000 acres were receiving water in the nearly completed Roza Division, and 40,000 acres of private project lands were being irrigated, in part, by Yakima Project water.

²⁴⁵ Letter from M.A. Johnson, Superintendent, to Commissioner of Indian Affairs, dated March 18, 1942. Memo from Acting Commissioner, H. Bashore, to the Commissioner of Indian Affairs, dated August 28, 1942. Both pieces of correspondence in National Archives, RG 115, Entry 7, Box 743.

The same year that finally brought peace to the world also saw the issuance of an important consent decree by the Federal District Court of Eastern Washington for Yakima Project irrigators. Known as Civil Action 21, the document basically set forth the water entitlements for the majority of entities operating under the Yakima Project. Priority was established for those with senior (nonproratable) water rights over those with junior (proratable) rights in years of low water supplies.

The shortages in labor and materials caused by wartime circumstances meant that only minimal maintenance was performed during the war years and immediately thereafter. In 1946, the condition of project features varied, with those on the storage division showing the most wear. Some disintegration of concrete was reported on the outlet works at Kachess, Keechelus, and Bumping Lake Dams and in the spillways at Keechelus and Bumping Lake Dams. Other repairs were needed at Tieton, Cle Elum, and Clear Lake Dams.

While structures on the newer Roza and Kittitas Divisions were reported to be functioning well and in good condition, some features on the older irrigation divisions were in need of replacement. Major improvements at Sunnyside in 1946 included replacing 3,000 lineal feet of wood stave pipe on the Prosser Siphon with reinforced-concrete and replacing 900 feet of the Benton Siphon No. 1 with new woodstave pipe. Operation and maintenance of the Sunnyside Division remained under Reclamation supervision until March 1, 1945, when management was transferred to a Board of Control, consisting of 12 representatives from the various districts and operating units in the division.

On the Tieton Division, major repairs needed after the war were limited to two rockfills and Spillway No. 1. The generally good condition of the distribution system was attributed to ongoing maintenance since its early days. Crews regularly replaced worn out and deteriorated pipelines with new concrete and wood stave pipes. Older wooden turnouts and measuring boxes were gradually being substituted with concrete ones. Fourteen miles of small wooden flumes had also been replaced. Significant improvements to the system since the mid-1920s included:

- Resurfacing an extensive amount of the concrete-lined portion of the Main Tieton Canal
- Replacing a rockfill on the Main Canal with an elevated, rectangular, reinforced-concrete flume (see CCC)
- Installing 3,130 lineal feet of concrete lining on Lateral C
- Replacing three steel flumes with reinforced-concrete pipe siphons on Lateral E

- Replacing a flume on Lateral E with about 1,700 lineal feet of reinforced-concrete-lined ditch and bench flume
- Rehabilitating five large steel flumes on Lateral G, and replacing two others on the same lateral with wood-stave siphons and seven flumes with reinforced-concrete pipe siphons
- Placing concrete lining along nine sections of



Bench flume on Lateral "E," general view of complete flume looking upstream from about Station 8+00. Original flume on left. February 24, 1939.



Tieton Division, transporting trustees of Tieton Water Users Association on trip of inspection over main canal in Ford especially built for maintenance work (left to right: J.S. Moore, Project Superintendent; A.J. Weeber, trustee; Earl Crosier, patrolman; and Clifford Kail, trustee), November 12, 1937.

Lateral G; renewing the siphon below the intake on Lateral B with a wood-stave pipe

- Replacing a wooden box flume with a reinforced-concrete flume on the diversion canal from the South Fork of Cowiche Creek

Another notable improvement was the installation of about 30 miles



Tieton Division, water impounded by the Tieton Dam, view of Tieton Dam, June 23, 1951.

of small underground pipelines in cooperation with individual water users for the elimination of open ditches.²⁴⁶ This enhanced farming efficiency by reducing maintenance needs, allowing for better control of water flows and improving the ability of modern farm machinery to navigate unhindered across fields.

In early 1947, there was great cause for celebration on the Tieton Division. On February 14, the directors of the Yakima-Tieton Irrigation District, representing 1,300 farmers, proudly made the final payment on the district's construction cost obligation. In so doing, it became the first irrigation district to complete repayment to the Federal Government of its irrigation works. With the final check of \$19,630, a total of \$3,597,479 had been returned to the Federal Treasury. The date was marked in Yakima with ceremonies "befitting the event." Secretary of the Interior, J.A. Krug, Reclamation Commissioner, Michael Straus, and Washington Governor, Mon Wallgren, were among the dignitaries invited. In addition to speeches, the festivities included a ritual conducted by the Yakima Indians, in which Krug was adopted into

²⁴⁶ Bureau of Reclamation, Annual Project History, Yakima Project, 1946, National Archives, RG 115, Entry 10, Box 620.

the tribe as an Honorary Chieftain. He was given the name “Chose-We-Oh-Wan-Fe” which means “Man-Who-Brings-Water.” Box loads of Tieton apples, the prized crop on the Tieton Division, were shipped to Washington DC, so that one could be placed on each Congressman’s desk in observance of the occasion.²⁴⁷ On March 1, 1947, the Yakima-Tieton Irrigation District took over operation and maintenance responsibilities of the Tieton Division irrigation system.

²⁴⁷ Fact Sheet, “Celebration Honoring the Yakima-Tieton Irrigation District For Becoming the First Federal Reclamation Project to Complete Repayment of the Cost of Constructing Irrigation Works,” on file at the Upper Columbia Area Office library, 4.005. Bureau of Reclamation, Yakima Project History, Annual Project History, 1947, p. 23.

Completion of the Yakima Project: The Kennewick Division

The last piece to be completed in the complex mosaic of the Yakima Project was the Kennewick Division. Located at the lower end of the Yakima Valley, south of the Yakima River, this division is a combined power and irrigation development. Various schemes to irrigate lands east of the Sunnyside Division had been contemplated since the early days of the Yakima Project; however, the Kennewick Division as it now exists was not authorized by Congress until June 12, 1948.²⁴⁸

Over the years, farmers owning lands in the area now included in the Kennewick Division had their hopes raised and then dashed as they watched the development of other divisions take precedence. The early unrealized Ledbetter and Benton units, conceived of by Reclamation engineers in 1904 and 1909, respectively, would have encompassed acreage in the lower Yakima Valley.²⁴⁹ In 1916, Reclamation undertook investigations for a project limited to lands in Benton County near the mouth of the Yakima River and in the vicinity of Kennewick and Kiona. The proposed irrigation plan would have diverted water from the Yakima River at Prosser and carried it 10 miles down the east bank of the river in a concrete-lined canal to a pumping plant. There, part of the water would have been used to produce hydropower and then returned to the river, while the remainder would have been raised 110 feet by pumps and conveyed to the lands to be irrigated. It was estimated that 35,000 acres of irrigable land could be served by the project.²⁵⁰

In anticipation of a Reclamation project, landowners organized the Kennewick Irrigation District (KID) in 1917. A portion of the area within the project boundaries was already under intensive cultivation and irrigated by a pumping plant. Further surveys were conducted by Reclamation in 1918 and 1919. That year, the agency eliminated the Benton Division and portions thereof were established as the Roza and Kennewick Divisions. Also in 1919, the KID, under a contract with Reclamation, provided the agency \$12,000 to continue surveys and prepare construction plans. Reclamation completed this work and delivered a report to the KID on June 1, 1920. Anxious to move ahead, the KID applied for the purchase of

²⁴⁸ Bureau of Reclamation, Yakima Project, Annual Project History, 1952, p. 4.

²⁴⁹ The Ledbetter and Benton schemes fell under what was sometimes broadly referred to as the High Line Unit.

²⁵⁰ U.S. Reclamation Service, 19th Annual Report, Fiscal Year 1920, Yakima Project.

storage water and on April 7, 1921, signed a contract with the United States for a share in and a deferred charge for storage benefiting all divisions of the Yakima Project.²⁵¹

Hopes that the Kennewick Division would be constructed next ran high in the lower Yakima Valley in 1923. That summer, Secretary of the Interior, Hubert Work, announced there would be money in the 1924 Reclamation Fund to initiate another division of the Yakima Project. M.M. Moulton, Secretary of the KID, was elated with the news and expressed confidence that the Kennewick Division stood an excellent chance of being first in line for construction.²⁵² When the Kittitas Division was, in fact, officially selected in early December 1923, the response from the KID was swift. On December 11, 1923, Moulton wrote to Commissioner Davis that the decision to construct the Kittitas Division in advance of the Kennewick Division had brought about a “critical and well nigh desperate situation here.” Moulton urged Davis to reconsider, based on the fact that the Government had misled Kennewick farmers. It was their understanding that the Kennewick Division would be the next to receive Federal funds.²⁵³

The KID was persistent in its efforts to redirect Reclamation funding for the construction of the Kennewick Division. In January 1924, KID wrote to Secretary of the Interior, Hubert Work, urging him to conduct a thorough economic survey and investigation of the Kennewick Division prior to proceeding with the Kittitas Project. KID members were convinced that such a survey would demonstrate that the Kennewick Division could not only be “developed with complete safety to the government and to the settler but that it can be developed with a greater degree of such safety than can any other unit of the Yakima Project.”²⁵⁴

On May 28, 1925, the KID and Reclamation entered into a contract for the completion of a soil and economic survey to determine the feasibility of the Kennewick Division. The study concluded that while the area was highly productive and would be attractive to new settlers, their initial expenses would be quite high in order to be successful. Low interest loans would need to be made available to farmers to cover their costs.²⁵⁵

²⁵¹ U.S. Reclamation Service, Yakima Project, 19th Annual Report, Fiscal Year 1920. Bureau of Reclamation, Kennewick Division, Yakima Project, Washington, Project Planning Report No. 1-5.35-1, Boise Idaho, July 1947.

²⁵² “This Valley to Get Money for One Unit,” Kennewick Courier Reporter, August 30, 1923.

²⁵³ Letter from M.M. Moulton to D.W. Davis, December 11, 1923, National Archives, RG 115, Entry 7, Box 1139.

²⁵⁴ Letter from M.M. Moulton to Hubert S. Work, dated January 25, 1924, National Archives, RG 115, Entry 7, Box 1139.

²⁵⁵ Bureau of Reclamation, Economic Report, Kennewick Irrigation District (Kennewick Division), Yakima Project, Washington, October 1927, National Archives, RG 115, Entry 7, Box 1139.

As it became clear that construction of the Kittitas Division would proceed, members of the KID changed their tactics and began to pressure Reclamation to develop the Kennewick Division immediately following the Kittitas. Moulton and others corresponded with Commissioner Mead and their congressional delegation. In December 1926, when the Secretary of the Interior presented a tentative construction program for the Yakima Project including commencement of the Kennewick and Roza Divisions in 1934, the directors of KID responded quickly. This time, they decided that a trip to Washington to personally meet with Mead and congressional representatives was in order. Following the visit, Moulton reported to owners of land in the Kennewick Irrigation District that Mead had stated, “the Kennewick Division has been definitely and unqualifiedly selected as the next division of the Yakima project to be constructed.” Mead also indicated that he saw no reason why construction of the division could not proceed earlier than 1934 but cautioned that this was dependent upon congressional appropriations. Lastly, Mead advised Moulton that Reclamation would make a final decision on its construction priorities following a meeting of project superintendents to be held in Denver in March 1927.²⁵⁶

In late 1927, when Reclamation’s chief engineer, Ray Walter, presented his recommendations for the most logical priority for further development of the Yakima Project, he upheld Mead’s choice of the Kennewick Division for several reasons (see construction of Roza Division). Seemingly, things were settled, especially after Mead wrote to Senator, Wesley Jones, on January 12, 1928, recommending that the Kennewick, as well as the Roza Divisions, be initiated in 1931 rather than 1934. In fact, matters were not settled. Further Reclamation investigations in the summer of 1928 raised new questions about the feasibility of the Kennewick Division as contemplated. The rough country through which the canal would be built, in combination with sandy soils requiring a large amount of water to irrigate, added up to an expensive project, both to build and maintain. Mead wrote that the only justification for constructing the Kennewick Division in the near future would be to save the settlers located there who were paying exorbitant rates for irrigation. As tracts of land were going out of cultivation, the rates were steadily increasing on those remaining under irrigation.²⁵⁷

The debate reopened regarding how to proceed with the Yakima Project at the same time that the Reclamation revolving fund was shrinking. On June 14, 1929, Moulton wrote an impassioned letter to Mead, describing the increased desperation of the Kennewick settlers.

²⁵⁶ Statement to Owners of Land in Kennewick Irrigation District, enclosed with letter from M.M. Moulton to Dr. Elwood Mead, dated February 16, 1927, National Archives, RG 115, Entry 7, Box 1139.

²⁵⁷ Letter from Commissioner, Elwood Mead, to Chief Engineer, Denver, dated August 1, 1928, National Archives, RG 115, Entry 7, Box 1139.

“More than ten years ago, out of necessity, due to insufficient water at too high a cost, and encouraged by the Director of Reclamation, he acting in the best of faith, we commenced this fight to bring about the construction of this unit. Had it not been for the fact that three or four men, buoyed up by occasional favorable signs, carried on the struggle constantly and continuously in the face of ever recurring discouragement, the present improved area under this unit known as the Kennewick Highlands, would have been abandoned long ago. . . . Some of the original settlers are still here, while scores of others have been forced out by insolvency, or have, out of complete hopelessness, abandoned everything or have been forced to exchange their holdings for worthless equities. . . .With the foregoing situation in mind, I desire, on behalf of these people, to again urge that some way be found by which sufficient funds may be included in the budget for the initiation of this unit.”²⁵⁸

Despite the continuous and compelling efforts of Moulton and others from KID, construction of the Kennewick Division was postponed as first Cle Elum Dam and then the Roza Division were completed. Landowners in the lower Yakima Valley waited through the Great Depression and World War II before their turn finally came. Finally, on June 12, 1948, Congress authorized construction of the multiple-purpose Kennewick Division. Even so, Reclamation did not complete a definite plan for the combined irrigation and power development project until 1952, the same year construction finally started. On July 22, 1953, the KID entered into a contract with the United States for building hydroelectric power generation, pumping, and irrigation works. The KID agreed to repay \$4,887,900 of the estimated \$13,768,157 in construction costs. Power revenues would be used to repay \$7,838,857, and the remaining \$1,041,400 would be provided by Reclamation for nonreimbursable fish and wildlife benefits. KID was authorized to divert up to 109,275 acre-feet of water from the Yakima River annually.

The final plan for the Kennewick Division was designed to supply irrigation water to 19,171 acres of land, all within the boundaries of the KID. Of that total, 4,637 acres near Kennewick had been irrigated since about 1910, and the rest were previously unirrigated lands. Water would be diverted from the Yakima River, near the town of Prosser at the existing Prosser Dam, into the Chandler Power Canal. The latter, about 10 miles long and with a capacity of 1,500 cubic feet per second, would be constructed by enlarging the existing

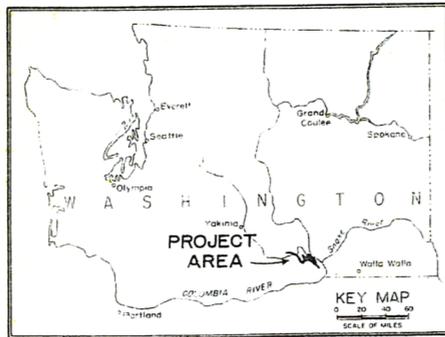
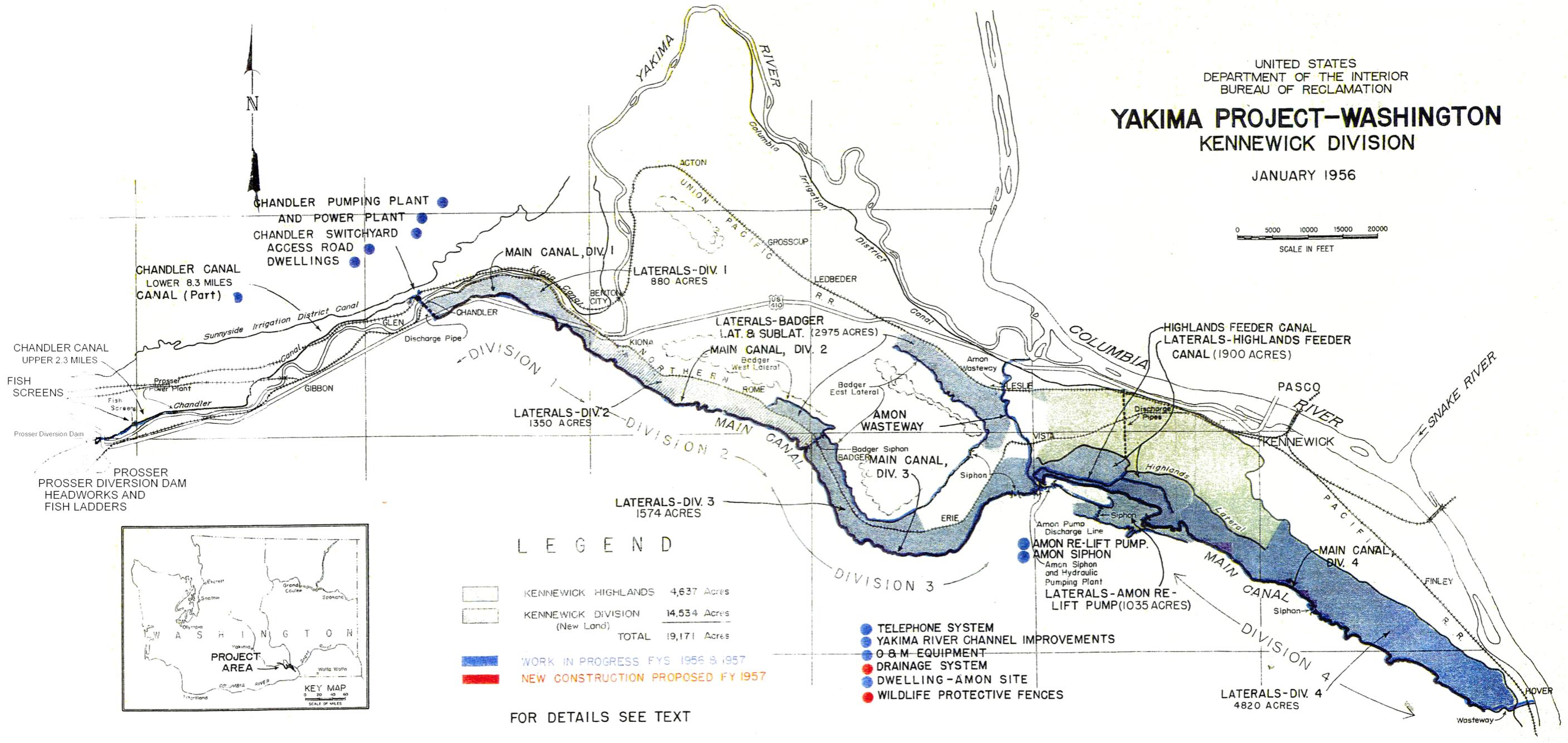
²⁵⁸ Letter from M.M. Moulton to Dr. Elwood Mead, dated June 14, 1929, National Archives, RG 115, Entry 7, Box 1139.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

YAKIMA PROJECT—WASHINGTON KENNEWICK DIVISION

JANUARY 1956

0 5000 10000 15000 20000
SCALE IN FEET



YAKIMA-KENNEWICK

Source: U.S. Department of the Interior. Bureau of Reclamation. Yakima Project, Annual Project History, 1956.

power canal from Prosser Dam to Prosser Powerplant and extending it another 8 miles or so.²⁵⁹ The Chandler Power Canal would terminate on the north side of the Yakima River at the Chandler Power and Pumping Plant, containing two hydraulic pumps and two generators with a combined capacity of 12,000 kilowatts. Since most water would be used for irrigation in the summer months, the bulk of the



General view of pumping and power house site construction, showing nearly completed wasteway chute right of center. Excavated section in center foreground is for discharge line to Kennewick Canal, Yakima River in center, June 24, 1954.

energy would be produced between the months of October and March. Two hydraulic turbines would drive both pumps and generators.

By means of the pumps, irrigation water from the Chandler Canal would be pumped through a pipeline crossing beneath the Yakima River to the head of the Kennewick Main Canal. This canal would extend on the south side of the Yakima River for about 24 miles to the Amon Siphon and Hydraulic Pumping Plant, and Amon Wasteway. The wasteway would head north to the confluence of the Yakima and Columbia Rivers. The heading of two laterals, the Badger East (17 miles long) and Badger West (3 miles long) would be located at mile 14.5 of the Kennewick Main Canal. At the Amon Siphon and Pumping Plant, the Main Canal would

²⁵⁹ In 1932, Reclamation acquired the Prosser Diversion Dam from the Pacific Power and Light Company and constructed the Prosser Powerplant and a canal from the diversion dam to the powerplant. The plant supplied power for irrigation pumping and for commercial use. With completion of the Chandler Powerplant, Prosser Powerplant was no longer needed and was retired in 1955. Bureau of Reclamation, Kennewick Division, Yakima Project, Washington, Project Planning Report No. 1-5.35-1, July 1947, p. 6.



Distant view of completed section along Chandler Canal. Dark line across canal in center of photo is uncompleted County bridge at station 239±, June 24, 1954.

split into the Amon Pump Laterals, the Highlands Feeder Canal and laterals, and the Division IV Main Canal (18 miles long). The latter would end at the Hover wasteway, which delivers water to the Columbia River.

The first construction contract for the

Kennewick Division was opened on December 17, 1952, and a contract for 8.6 miles of the Chandler Power Canal was awarded to J.A. Terteling and Sons on January 6, 1953. Another two construction contracts were entered into that year, both with the A.J. Cheff Construction Company. One contract, amounting to \$1,960,000, was awarded on July 7, 1953, for erection of the Chandler Power and Pumping Plant. The other contract, awarded on November 25, 1953, was for building 2.2 miles of main irrigation canal at an estimated cost of \$272,547. Supply contracts covering generators, turbines, pumps, and other equipment were awarded through the Chief Engineer's Office.²⁶⁰ Other contracts followed and, by the spring of 1957, construction was far enough along that the first water deliveries could be made. The production of commercial power at the Chandler Power and Pumping Plant had begun the previous winter.

Over 40 years after its inception, the Kennewick Division was finally completed in 1958, at a cost of about \$15 million. Operation and maintenance of the irrigation facilities were

²⁶⁰ Bureau of Reclamation, Yakima Project, Annual Project History, 1953, p. 8, National Archives, RG 115, Entry 10, Box 622.

officially transferred to the KID on January 2, 1958. The creation of the new division brought the total irrigable area of the Yakima Project to 474,000 acres, only slightly less than the 500,000-acre project contemplated in 1905.²⁶¹

Table 2.—Summary of major facilities of irrigation divisions¹

Division	Location	Major facilities	Source of stored water	Operating entity
Sunnyside	Lower Yakima Valley, east of river	Sunnyside Diversion Dam, Sunnyside Canal, pumping plants	All reservoirs	Sunnyside Valley Irrigation District and others ²
Tieton	Upper Yakima Valley	Tieton Diversion Dam, Tieton Canal	Rimrock	Yakima-Tieton Irrigation District
Roza	Lower Valley, north of Sunnyside Division	Roza Diversion Dam, Ridge Canal, pumping plants	Keechelus, Kachess, Cle Elum	Roza Irrigation District
Kittitas	Kittitas Valley, near Ellensburg	Easton Diversion Dam, Main Canal, North and South Branch Canals	Keechelus, Kachess	Kittitas Reclamation District
Kennewick	Extreme Lower Yakima Valley, Benton County	Prosser Diversion Dam, Chandler Canal, pumping plants, Kennewick Main Canal	Return flows	Kennewick Irrigation District
Wapato ³	Lower Yakima, Valley west of river	Wapato Diversion Dam, Main Canal, drainage works	All reservoirs	Bureau of Indian Affairs

¹ Source: Bureau of Reclamation, Draft Final Biological Assessment Yakima Project Operation and Maintenance, May 2000.

² Includes Outlook, Granger, Snipes Mountain, Grandview, Benton, Home, Zillah Irrigation Districts; Piety Flat Irrigation Company; Konnewock Water Users; Special Warren Act Lands; and the cities of Sunnyside, Grandview, and Prosser.

³ Ahtanum and Toppenish-Simcoe Units (a small percentage of the total acreage of the Wapato Irrigation Project) are not dependent on Yakima Project storage.

²⁶¹ “Yakima Federal Irrigation Project,” no author, no date, Ca. 1960, on file at the Upper Columbia Area Office library (4.005).

Even before the last unit of the Yakima Project was completed, there were rumblings that, despite the agricultural success of the project, the original design of the system had flaws. A 1950 report for the President's Water Resources Policy Commission observed that, "Deficiencies in construction of irrigation facilities were relatively few, but viewing the project from the standpoint of operating experience, it is believed that, had the requirements for flood control, fish migration, power development, and recreational facilities been foreseen, some of the storage works of the project could have been designed to include these multiple features." The environmental toll of the dams on migratory fish was recognized as the most serious damage caused by the project. Although no fish protection facilities existed at any of the storage dams, it was believed that the construction of fish ladders on diversion structures had "substantially corrected" the problem.²⁶² Fifty years later, the issue of fish passage continues to be central in the debate over Yakima Project operations.

While there was some discussion about the possibility of increasing storage, in particular at Bumping Lake, plans did not advance very far, due to the ample water supply available in the 1950s and 60s. During that time, farmers never had to worry about obtaining adequate water for their crops, and irrigation continued to deliver prosperity. Attention during those decades was primarily focused on project maintenance needs.

In September 1952, a 3-year rehabilitation and betterment program that cost approximately \$720,000 was completed at the storage reservoirs. Work included repair and improvements on the spillways at Tieton and Keechelus reservoirs, concrete lining of the outlet channel at Kachess Reservoir, and repair of the gate structure at Bumping Lake. In 1960, major repairs were made to the spillway section at Bumping Lake. This work consisted of the replacement of wood flooring and joists. In 1973, the road crossing the spillway at Bumping Lake Dam was replaced and a new concrete T-beam bridge was installed to replace the wood-truss bridge.

Clear Creek Dam was rehabilitated in 1964 by placing new concrete in the arch section between elevation 2,991 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. At Keechelus Dam, total rehabilitation of the outlet works and control tower

²⁶² Bureau of Reclamation. "Report on Yakima Project for the President's Water Resources Policy Commission." June 14, 1950. On file at UCAO library, 4.005.



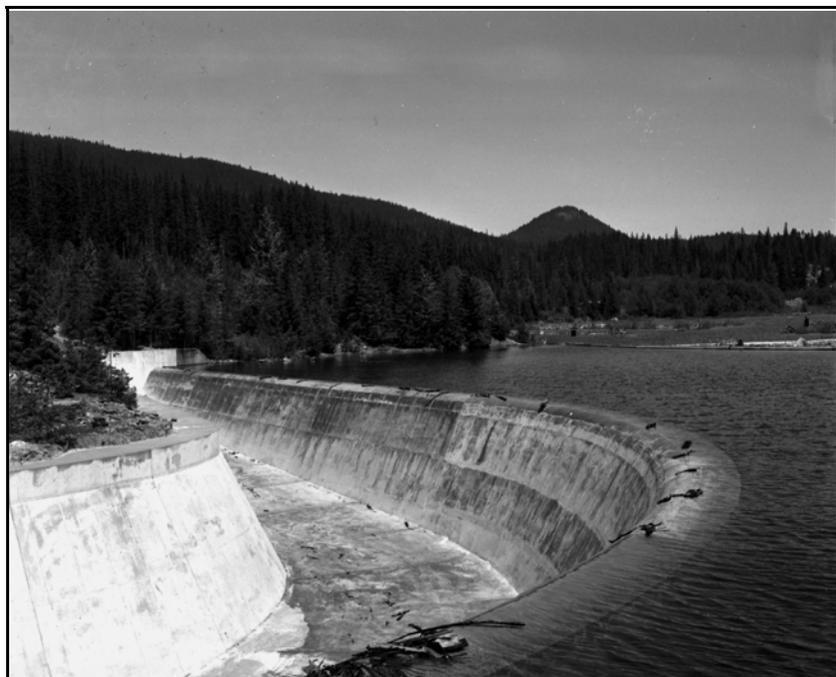
Storage Division rehabilitation, Keechelus Reservoir, looking upstream at right wall of completed spillway channel from access bridge, September 12, 1952.

Goodrich Lineweaver, was on hand to praise the district and accept the final check.

Ongoing maintenance on the Sunnyside Division consisted of replacing deteriorated sections of wood stave pipes and flumes. A major concern developed during the 1950s as farmlands became subject to seepage damage, attributed to excess water from irrigating the higher elevation Roza lands. In 1952, a 1-mile-long

was started in 1976. The two original cylinder gates were replaced by a single 8.5-square-foot, hydraulically operated slide gate, and a new 156-foot-long concrete chute and stilling basin were constructed.

On the Sunnyside Division, a highlight of this period was the ceremony marking the complete repayment of construction costs by the Sunnyside Valley Irrigation District. The June 19, 1952, festivities coincided with the 50-year anniversary celebration held by the city of Sunnyside. Reclamation's Assistant Commissioner,



Storage Division, view shows first flow of water over rehabilitated Keechelus Spillway, completed in September 1952. Concrete crest is 2 feet higher than old spillway. June 22, 1954.



Sunnyside Diversion Dam, Yakima Project, Washington. Aerial view, May 3, 1966.

drainage ditch and pipeline was constructed east of Grandview to intercept surface drainage and dump it into the Sunnyside Canal. Drainage problems continued to plague the Sunnyside Division, however, and caused considerable controversy. In 1957, an agreement was reached between the two divisions to jointly construct a system of outlet drains. The Roza Division consented to pay 60 percent of the cost and the Sunnyside Division 40 percent. Construction of the Roza-Sunnyside Outlet Drain System took place between 1958 and 1962 at a cost of \$600,000. The existing drain channel system was upgraded, and new surface and pipe drains were installed.²⁶³ In the midst of the rehabilitation project, on January 1, 1961, Reclamation turned over the operation of the Roza distribution system, except for the dam, power canal, and powerplant, to the Roza Irrigation District.

On the Tieton Division, some major rehabilitation work was performed beginning in 1960. Flumes No. 1, 2, 3, and 4 on Lateral G were replaced with concrete siphons, and the Yakima-

²⁶³ Roza Irrigation District, Comprehensive Water Conservation Plan, prepared for the Bureau of Reclamation, June 1998, p. 4.

Tieton Irrigation District invested heavily in continuing the installation of concrete pipeline to replace open ditches.

At the end of the 1960s, farmers in Yakima continued to rank among the most productive in the nation. In addition to growing fruit, they specialized in raising hops, mint and alfalfa seed, potatoes, asparagus, and sugar beets. Dairying and livestock production also continued to be lucrative. Changes to irrigation practices on the Yakima Project were on the horizon,



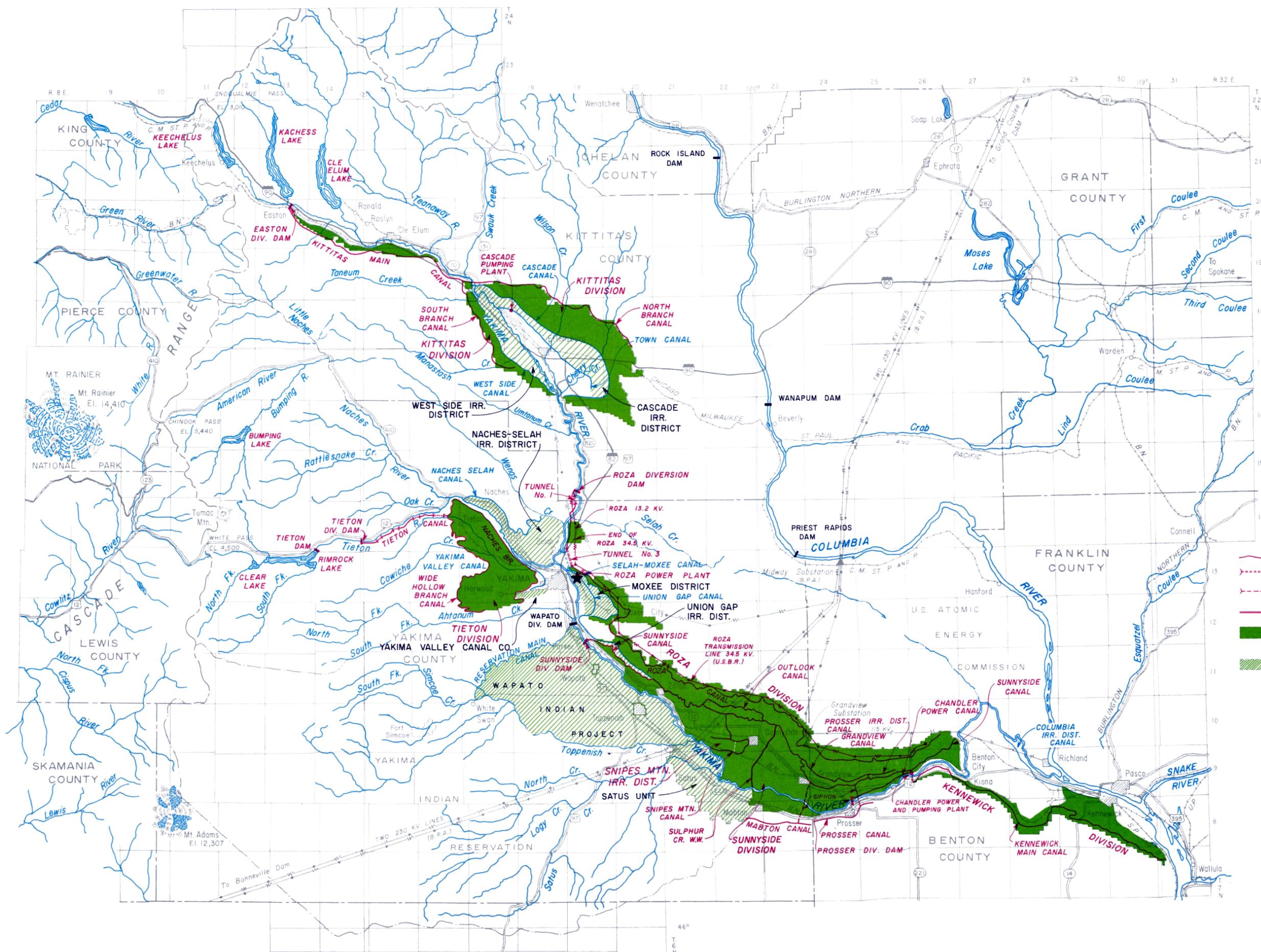
Cle Elum Dam and Spillway, June 28, 1960.

however, and were ushered in with the passage of the National Environmental Policy Act of 1969, followed by the Clean Water Act in 1972. Under the new legislation, the negative impacts of project operations on fishery resources were brought to the

forefront. Two decrees issued by Judge Boldt in the 1970s provided Indians with half of the salmon catch off-reservation and required the protection of salmon habitat in the watershed. Compounding the issue was a change in weather conditions, culminating in the shortest water year ever recorded in the Yakima Basin in 1977. Farmers, who used 98 percent of the water in the basin for irrigation, were forced to make adjustments and cut back on use.²⁶⁴ Large acreages were left idle, and high water use crops were substituted with lower use ones.

Beginning that extremely dry year, the Washington Department of Ecology initiated a formal adjudication of surface water rights in the Yakima Basin in Superior Court in Yakima. The

²⁶⁴ Pacific Northwest River Basins Commission, The Yakima Basin Level B Study, prepared by the Washington State Study Team, May 1977, p. 3.



EXPLANATION
BUREAU OF RECLAMATION
COMPLETED AND AUTHORIZED WORKS

CANAL	TRANSMISSION LINE
TUNNEL	PUMPING PLANT
SIPHON AND COVERED CONDUIT	SUBSTATION
PENSTOCK	POWER PLANT
AREA BENEFITED BY PROJECT WORKS CONST. BY U.S.B.R.	PROJECT HEADQUARTERS
AREAS UNDER YAKIMA PROJECT WATER CONTRACTS	

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
YAKIMA PROJECT
WASHINGTON
(PACIFIC NORTHWEST REGION)
MAP NO. 9003-100-135



REV. SEPT. 1982

Figure 20

intent was to prioritize all water claims to establish firm water rights. By September 1981, over 2,100 claims had been filed with the Supreme Court. Fifteen years later, only the Native American claims had been settled. In addition to quantifying the Yakima Tribe's irrigation water rights, the judge determined that the tribe held a reserved right in the Yakima River to maintain its fishery. This reserved right, which pre-dates all irrigation rights, was quantified as "the minimum instream flow necessary to maintain anadromous fish life in the river, according to prevailing conditions."²⁶⁵ It is anticipated that final adjudication will be resolved within the next year or so.

Another action initiated as a result of the late 1970s drought was passage of the Yakima River Basin Water Enhancement Act in 1979. The legislation directed the Department of the Interior to study the water resources of the basin with four objectives. These included: enhancing the anadromous fishery by increasing instream flows, providing water to junior users to supplement irrigation supplies during water shortages, providing water for new irrigation development on the Yakima Indian Reservation, and developing a comprehensive water management plan for the basin to improve water use efficiency.

As an outgrowth of the Yakima River Basin studies, Phase I of a program to improve fish passage and protective facilities on the Yakima River was initiated in 1984. About \$56 million were spent on enhancements between Easton Diversion Dam and Horn Rapids. Two types of features were constructed: fish ladders on diversion dams and screens at canal entrances to prevent juvenile fish from becoming trapped in the distribution systems.²⁶⁶

Phase II of the Yakima River Basin Water Enhancement Project was authorized under Title XII of Public Law 103-434, enacted October 31, 1994. Once again, a primary objective was the enhancement of fishery conditions, this time by increasing instream flows through water conservation measures, by purchasing water for fish and wildlife, and by changing the operating regime of the Yakima Project. Indicative of the changing times was the inclusion in Public Law 103-434 of language to expand the original purpose of the Yakima Project to include fish, wildlife, and recreation. These purposes were not to impede the delivery of irrigation water, however.

By the early 1980s, many features of the Yakima Project were showing signs of age. Irrigation requirements and methods had changed over the years, and deteriorated original facilities were no longer economical to maintain. Additionally, conditions at several of the

²⁶⁵ MacDonnell, Lawrence, From Reclamation to Sustainability: Water, Agriculture, and the Environment in the American West, Niwot, Colorado, University Press of Colorado, 1999, pp. 205-206.

²⁶⁶ Perala, Onni, no title, edited by Marilyn Collins, February 1990, on file at Sunnyside Valley Irrigation District. This work was completed in 1989.

older dams created safety concerns. A number of rehabilitation and Safety of Dams projects were initiated in the 1980s and 90s to address the deficiencies.

Recent Storage Division Modifications

Bumping Lake Dam underwent a series of modifications between 1994-1997 under Reclamation's Safety of Dams Program. These changes included installing an interceptor drain at the downstream toe of the dam, constructing downstream and upstream stability berms, replacing the concrete spillway, installing a steel liner in the outlet tunnel, and replacing the outlet channel lining. The outlet gates, gate house, and gate operators were replaced in the early 1990s.

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

Investigations at Clear Creek Dam in 1987-1989 revealed horizontal bands of deteriorated concrete in the section replaced in 1964. Due to the possibility of sudden dam failure, the water level of Clear Lake was immediately lowered. Early in 1990, two holes were cut through the dam to allow even more water to drain from the lake. A strong expression of public support for reconstructing the dam and returning Clear Lake to its original condition led to substantial modifications to the structure. Local, State, and Federal funding were used to convert 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 to permit discharge whenever the lake was below the spillway crest. The purpose of the reservoir is now primarily recreation.

Kachess Dam underwent rehabilitation in the 1990s under Public Law 103-434 and Reclamation's Operations and Maintenance Modifications Program. In 1996, sediment was removed from the inlet channel, and a new channel was excavated along the existing inlet tunnel. In addition, a new intake structure was constructed, the steel bridge from the dam to the intake structure was replaced, and the outlet works conduit was lined with a minimum of 4-inch-thick, reinforced concrete overlay.

Safety deficiencies at Keechelus Dam that could lead to failure were identified in 1998. Without taking corrective actions, the potential for piping and/or internal erosion of embankment materials was present. A reservoir operating restriction to elevation 2510 was

imposed, together with increased monitoring and surveillance pending modifications. These are to begin in the year 2002 and will involve removing and rebuilding a significant portion of the dam.

Some changes at Tieton Dam are currently in the planning stage. The valve house is to be replaced to accommodate hydroelectric generators.

Distribution System Modifications

On the Sunnyside Division, the Main Canal headworks at the diversion dam have been modified. The Main Canal itself is still mostly earthen; only a small portion has been lined. Over the years, SVID has actively been replacing old wooden turnout structures with precast-concrete ones. Some other types of structures, such as drops and wooden bridges, are also gradually being updated. A few of the latter features still exist. The only remaining section of above-ground, wood-stave siphon can be found crossing Snipes Creek; more sections of buried wood-stave piping are still intact. An aggressive program of piping smaller laterals has been ongoing for the past 20 years or so. The Prosser Lateral has been completely piped through the town of Prosser. On the open laterals, early measuring devices, such as Cippoletti weirs, still prevail.²⁶⁷

The Tieton Division has been subject to extensive modernization during the past several decades. Replacement of the entire 320-mile distribution system with a closed pressurized pipe system was completed in 1986, at a cost of \$78 million under a Rehabilitation and Betterment Project. This enabled about 85 percent of the Yakima Tieton Irrigation District's service area to receive gravity pressure service. The remaining 15 percent of the area is provided pressure service by three small pumping plants. Most of the open laterals were abandoned and filled in when the piping was installed. On the Main Canal, two of the original five wasteways were abandoned sometime prior to 1980, and all of the original overhead flumes have been replaced.

A reregulating reservoir, French Canyon Reservoir, with a total capacity of 670 acre-feet, was constructed at the end of the Tieton Main Canal on the North Fork of Cowiche Creek. The reservoir was necessary to allow for fluctuations in water use and to manage water efficiently. The reservoir also creates head to pressurize the delivery system. Two small hydroelectric plants, Cowiche and Orchard Avenue, were constructed in 1986. The facilities generate

²⁶⁷ Conversation with Don Schramm, Assistant Manager, Sunnyside Valley Irrigation District, February 1, 2001.

electricity to power the pumping plants and serve as pressure-reducing stations for the pipeline distribution system.²⁶⁸ In 1990, the Tieton Diversion Dam was modified to allow for improved fish protection. The downstream timber apron was replaced with a 3-foot-high concrete ramp. This reduced the vertical drop from the dam crest from 5 feet to 2 feet. The existing sluiceway at the south side of the dam was also altered to include a fish ladder.

On the Roza Division, the Board of Directors of the Roza Irrigation District approved a long-term rehabilitation program of the district's conveyance facilities in 1984. In 1988, the fish ladder at the Roza Diversion Dam was modified to allow it to function properly when the pool was drawn down for winter screen maintenance. That same year, the first of three proposed reregulation reservoirs was constructed at Wasteway 6. In 1994, a second reregulation reservoir was built at Wasteway 7. Extensive piping of laterals has been part of ongoing modifications to the system. On the Roza Canal, a number of check structures have been added.²⁶⁹

²⁶⁸ Conversation with Rick Dieker, Yakima-Tieton Irrigation District, January 30, 2001. See also Bureau of Reclamation, Draft Final Biological Assessment, Yakima Project Operation and Maintenance, May 2000; and Bureau of Reclamation's Yakima Project Dataweb at <<http://dataweb.usbr.gov>>.

²⁶⁹ Conversation with Onni Perala, Roza Irrigation District, February 1, 2001. See also Roza Irrigation District, Handbook, Information, Policy, and Rules, Ca., 1995.

Construction of the Yakima Project successfully transformed vast tracts of sagebrush to some of the most productive agricultural lands in the Nation. A tremendous sense of pride in this accomplishment is evident in early local journal and newspaper articles. Although there were ups and downs throughout the construction period of the project, an overriding sense of optimism prevailed that irrigation would lead to prosperity. The Yakima Project exemplified Reclamation's mission of "making the arid West bloom," and those who benefited from its waters readily concurred with C.H. Burbank's assessment that "Paradise is in the geographic center of the State of Washington."

Today, the Yakima Project is a vast integrated network of reservoirs, canals, drains, pumping plants, and power facilities that all serve to store and deliver water. The complexities of distributing water to nearly 500,000 acres are magnified by current competing fishery and recreational interests. Managing the system is a balancing act, requiring the participation and cooperation of many different entities. A changing agricultural economy is also affecting conditions on the project. Over the past few years, farming has taken a serious downturn; in 1999, income dropped 50 percent from the previous year. Apple prices plummeted, and farmers started pulling trees out of orchards. Competing agricultural markets overseas have forced some to declare bankruptcy and quit the business. Interestingly though, this adversity has not squelched the optimism of earlier times. The headline of a newspaper article describing the current circumstances reads: "Downturn May Work to Yakima's Advantage, Economist says lower labor and living costs could lure companies."²⁷⁰ The role irrigation will play in Yakima's future remains to be seen. There is no doubt that the precious water stored in Reclamation's mountain reservoirs will continue to play a determining hand.

²⁷⁰ Harrell, Dori, "Downturn May Work to Yakima's Advantage," Yakima Herald-Republic, January 30, 2001, p. 1.

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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 *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 *Kittitas Division* provides water to about 59,000 acres of land. The water is diverted from the Yakima River into the Main Canal by the Easton Diversion Dam near Easton, Washington. The Main Canal carries the water along the south side of the Yakima 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 diversion to irrigate lands lying south of the river.

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. Eighteen pumping plants serve about 27,000 acres.

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

¹ Taken from Bureau of Reclamation, DataWeb site, see <<http://dataweb.usbr.gov/html/yakima>>.

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.

Another 45,000 acres not included in the six irrigation divisions are irrigated by private interests under water supply contracts with Reclamation.

Appendix

B

Description of Property Types

Property types identified on the Yakima Project consist of structures built for the collection, storage, distribution, and power development of water. In addition, there are property types associated with the ongoing operation and maintenance of irrigation projects. Because of the long period of construction of the Yakima Project, extending from the initiation of the Sunnyside Division in 1907 to the completion of the Kennewick Division in 1958, the system presents an evolution of construction techniques and engineering technology.

The following descriptions are based on research and interviews; field investigations were not within the scope of this study. Also, because the purpose of the document is to provide an historic overview, detailed research on specific features was not conducted. The information provided, therefore, is considered preliminary and will, no doubt, be modified and enlarged upon as features are identified during on-the-ground surveys and further research. Most likely, very few original features associated with the project canals and laterals still remain; numerous rehabilitation projects over the years have upgraded and modernized the system. It is also doubtful whether there are intact features associated with the construction camps.

I. Property Type: Storage and Diversion Structures

Description

A. Dams

Dams built on the Yakima Project can be divided into two basic types according to their function: storage and diversion.

1. Diversion dams divert water into a conveyance system and also may serve to impound water for later use. On the Yakima Project, there are five dams that divert natural streamflows into the project canal systems. They are Sunnyside Diversion Dam, on the Yakima River near Parker; Prosser Diversion Dam, on the Yakima River near Prosser; Tieton Diversion Dam, on the Tieton River about 16 miles southwest of Naches; Easton Diversion Dam, on the Yakima River near Easton; and Roza Diversion Dam, located 10 miles north of Yakima. The dams are all of the concrete weir type. An additional five

diversion dams were constructed on the Tieton Division at the outlet of the North Fork Tunnel to divide water into eight main laterals. The diversion dams are all small earthen structures.

2. Storage dams impound surplus runoff and floodflow waters and store them for long-term use. Such dams can be built to serve one or more purposes. On the Yakima Project, six dams were constructed between 1909 and 1931 to store water for irrigation. The reservoirs created by the dams have a total active capacity of 1,070,700 acre-feet. The dams include Bumping Lake, Kachess, Keechelus, Clear Creek, Tieton, and Cle Elum.

With the exception of Clear Creek Dam, the dams are all earthfill structures of varying heights. At the time of its completion in 1925, Tieton Dam was touted as the highest earthfill dam in the world. At 321 feet high, the structure stood 21 feet taller than all others of its type. Kachess, Keechelus, and Cle Elum Dams are of zoned earthfill construction. Tieton Dam has a concrete core wall diaphragm, and Bumping Lake Dam has a puddled core wall. Clear Creek Dam is a concrete thin-arch structure. Spillways and outlet works are incorporated in all of the dams.

B. Dikes

Dikes are provided to fill in low-lying areas to create reservoirs or to increase capacity. On the Yakima Project, the only dikes constructed were two small ones southeast of Clear Creek Dam. They were added when the dam was raised in 1918.

C. Reservoirs

Associated with storage dams are the reservoirs created behind them. These reservoirs range in size from a capacity of 5,300 acre-feet (Clear Lake) to 436,900 acre-feet (Cle Elum Lake). In addition to providing storage for Yakima Project irrigators, the reservoirs also serve recreational users.

Significance

Since the primary purpose of the Yakima Project is to collect water in the Yakima Basin and divert it for irrigation purposes, the associated storage and diversion facilities are central features. Without these key components of the system, the Yakima Project could not exist.

The significance of Tieton Dam is compounded by the engineering distinction it acquired as the world's highest earthfill dam. Dikes play a secondary role to dams in creating storage reservoirs.

Registration Requirements

The period of significance for dams begins in 1907, with the construction of Sunnyside Diversion Dam, and ends in 1939, with completion of the Roza Diversion Dam. All of the storage and diversion dams play an important role in the operation of the Yakima Project, and, therefore, contribute to the system. Individually eligible dams should meet the following:

Criterion A: They are demonstrably associated with the social, economic, or recreational development of the region; they created major storage reservoirs associated with the Yakima Project.

Criterion B: They are associated with the lives of significant Reclamation engineers or significant State/national personages.

Criterion C: They embody the distinctive characteristics of a certain type of dam or method of construction; they embody the work of a significant engineer or builder; they represent the evolving technology of dam design or an innovative design solution.

Dams require continual maintenance and periodic repairs to keep them operating safely and efficiently. Often, parts such as gates or hoisting mechanisms are replaced, due to wear or improved technology. Considerations of integrity must take this into account. For a dam to be eligible for the *National Register of Historic Places*, it obviously must retain integrity of location. The overall design, workmanship, and materials must remain intact; if elements have been altered, they cannot change the character, functioning, or design to the extent that the original is no longer readily apparent. The present setting should embody the same overall character as the historic setting, with minimal visual or physical intrusions. If the elements of design, workmanship, materials, and setting are intact, then integrity of feeling and association will also likely be maintained.

Dikes are normally secondary elements and would not be considered individually eligible unless they meet the criteria described above. Reservoirs are also considered secondary and could be nominated in conjunction with a dam.

II. Property Type: Canals

Description

The distribution of water to irrigate lands that extend for 175 miles along both sides of the Yakima River required construction of an extensive system of canals and laterals. In a few instances, such as the Sunnyside Main Canal, existing canals were enlarged and extended. About 420 miles of canals and 1,697 miles of laterals deliver water to project lands. Additionally, there are about 144 miles of drains. The main canals vary in capacity from 347 cubic feet per second in the Tieton Canal to 2,200 cubic feet per second in the Roza Canal. The canals are of two general types of cross-sections: lined and unlined. On the Tieton Main Canal, the use of precast concrete sections to line the canal during original construction was unusual for the time. During the 1930s and early 1940s, enrollees of the Civilian Conservation Corps stationed on the Sunnyside and Tieton Divisions installed stretches of canal lining.

Significance

In conjunction with storage and diversion dams, canals form the backbone of the Yakima Project. They provide the means to transport and deliver water throughout the system and ultimately, to the water users. These linear components, along with associated features such as tunnels and siphons, are the connectors between the complex array of structures that form the Yakima Project. Stretching for miles along both sides of the Yakima River, the Yakima Project canals form a significant feature of the landscape and define the geographical limits of the project. Piping of sections of canal and laterals has been undertaken to increase efficiency and reduce maintenance. On the Tieton Division, replacement of the entire 320-mile distribution system with a closed pressurized pipe system was completed in 1986 under a Reclamation Rehabilitation and Betterment Project.

Registration Requirements

The period of significance for Yakima Project canals begins with the extension of the Sunnyside Canal in 1907 and ends with completion of the Kennewick Main Canal in 1956. Canals not yet 50 years old cannot be considered individually eligible, unless they have exceptional significance. The need for continual maintenance and repairs to canals makes the issue of integrity somewhat problematic. Irrigation systems are constantly evolving as features are upgraded, repaired, or replaced. Alterations made to canals during the period of

significance, and even subsequent to that, may not dismiss eligibility if the canals retain certain basics. These include integrity of location and overall design configuration (depth, width). It is not uncommon for canal lining to be replaced or for previously unlined segments to be lined. Such canals may be eligible if the changes do not diminish the canals' historical associations or the overall design, setting, and feeling of the original canal. If an entire canal is piped, on the other hand, it would no longer convey its historical association and would not be eligible. Partial piping may not preclude eligibility if a large percentage of the original remains intact. Even abandoned canals may be eligible if the original alignment remains visible and the feature still conveys historical association with the Yakima Project.

Canals with sufficient integrity are considered individually eligible for the *National Register of Historic Places* for the following reasons:

Criterion A: They have had a significant impact on the settlement, agricultural economy, or development patterns of an area; they have been a defining element in the development of the cultural landscape.

Criterion B: They are the result of the direct efforts of a prominent individual associated with the Yakima Project and are the most prominent feature associated with that individual.

Criterion C: They represent the distinctive characteristics of Reclamation canal design and/or methods of construction employed on the Yakima Project; they involved challenging engineering design problems due to topography, grade, natural obstacles, and resulted in complex or innovative solutions; they represent a major water delivery feature of the project whose components may lack individual distinction; they embody the work of a significant engineer or builder

III. Property Type: Appurtenant Canal Structures

Description

In association with the project canals, numerous other types of features were constructed that play an integral role in the operation of the conveyance system. These features can be broken down into four categories based on their function: conveyance, regulating, water measurement, and protective. For the most part, the features derive significance as

contributing elements to the operation of a canal. In some unusual cases, however, they merit individual consideration due to significant design, engineering characteristics, or historical association.

A. Conveyance Structures

Siphons.—Numerous siphons were incorporated in the canal system to convey water across natural drainage channels, small streams, ravines, or the Yakima River. These siphons varied in length all the way up to the nearly 1-mile-long crossing the Yakima River on the Kittitas Division. Other major siphons were built beneath the Yakima River as part of the Sunnyside Division (Mabton unit) and the Kennewick Division. Siphons were also utilized on the Tieton and Roza Divisions. Construction materials varied; many of the early siphons, such as the Mabton siphon, were of wood stave while, later on, concrete or steel pipe was utilized. The Yakima River siphon on the Kittitas Division was constructed of riveted steel pipe supported on concrete piers and crossed the river on a high steel bridge. Only one remaining section of above-ground wood stave siphon was identified during research: it is located on the Sunnyside Division at Snipes Creek. Apparently, sections of buried wood stave piping still exist on that division. All wood stave siphons on the Tieton Division have been removed.

Tunnels.—Tunnels were provided where their use would eliminate a sufficient length of canal to compensate for their greater cost or where their use would furnish a safe substitute for hazardous construction on a steep or unstable contour location. Numerous tunnels were required on the Yakima Project, due to the difficult terrain in places. A major component of the Tieton Division's Main Canal was the six tunnels along steep hillsides. Tunnels were also dug on the Kittitas and Roza Divisions.

Flumes.—Flumes were constructed throughout the project where the terrain made it too difficult to build open canal. The early flumes on the Sunnyside and Tieton Divisions were made of wood or steel. On the latter division, the use of the new steel Hess flumes was part of the original construction. Later, an elevated flume and bench flume were incorporated in the Kittitas Division, and concrete flumes were constructed on the Roza Division. Over time, many if not all of the early flumes have been replaced with concrete pipe.

Drop Structures.—Drop structures were constructed on the Yakima Project to convey water from higher to lower elevations and to dissipate excess energy resulting from this drop. Early drop structures were of concrete, and at least one, at the end of the Sunnyside Canal, was wood; later on, they were made only of concrete. Gates on the early drop structures were of wood or cast iron. On the Sulphur Creek Wasteway (Sunnyside

Division), the original concrete drop structures were considered to be of “rather unusual design” due to the half hexagon shape of the upper weir wall.

B. Protective Structures

Protective structures protect the canal system and adjacent property from damage that would occur from uncontrolled storm runoff or drainage water, or an uncontrolled excess of flow within the canal. This category includes features such as culverts, overchutes, drainage inlets, siphon spillways, and wasteways. It appears that culverts and wasteways are the most common structure of this category to be found on the Yakima Project. Further research is required to identify the locations of any overchutes, siphon spillways, or drain inlets.

Wasteways.—A wasteway is an overflow or gate structure, in combination with a drop or chute, and a wasteway channel. The overflow and gate structures are frequently combined. On the Yakima Project, wasteways are found on all of the divisions. The Zillah and Sulphur Creek Wasteways on the Sunnyside Division were the first ones constructed. Both had concrete drop-headworks structures with cast-iron gates. On the Tieton Main Canal, two original automatic wasteways, designed by Ensign, were experimental and proved successful.

Culverts.—Culverts serve as protective structures when they carry storm runoff or drainage water under a canal. Numerous culverts were built on the Yakima Project. It is known that concrete culverts were included in the original design of the Sunnyside and Tieton Divisions. On the latter, both box and pipe culverts are mentioned.

C. Water Measurement Features

Water measurement structures are used to gauge waterflow and ensure its equitable distribution. A variety of types exist, and more research is needed to determine the range of those used on the Yakima Project. Cippoletti weirs were commonly used during the original construction of the Tieton Division. These weirs are trapezoidal, with the sides inclining outward. Concrete Cippoletti weirs were installed at the end of the Tieton Main Canal and at the head of all the main laterals. On the Sunnyside Division, “standard” measuring boxes on the Mabton laterals were constructed of wood. Further research is required to identify other types of measuring devices used throughout the system.

D. Regulating Structures

Regulating structures are used to raise, lower, or control the release and volume of the waterflow. Regulating structures that are located at the source of the water supply are called

headworks. They control the release of water into a canal and, on the Yakima Project, are located at the diversion dams, since no canals take out from the storage dams. Structures located at the turnouts to the main laterals on the Yakima Project were also called headworks.

Along the course of a canal, regulating structures include turnouts, checks, check-drops, and division structures. The smaller regulating structures, such as checks and turnouts, are basic components of an irrigation system and are numerous.

Headworks.—Canal headworks on the Yakima Project are located at the various diversion dams and are gated structures. On the Sunnyside and Tieton Divisions, the original headworks to the Main Canals were concrete structures with hand-operated, cast-iron gates. The headworks to the Mabton and Snipes Mountain Laterals off of the Main Sunnyside Canal were of similar construction. At the head of the Prosser Lateral, a wooden headgate/turnout structure was installed. The later divisions had more advanced headworks; both the Kittitas and Roza Canal structures incorporated radial gates. The latter canal headworks also included revolving fish screens.

Turnouts.—There are numerous turnout structures on the Yakima Project that supply water to laterals and sublaterals. The various design types and construction materials employed need further research. Original Reclamation-built turnouts on the Sunnyside Main Canal were concrete, while on the Mabton laterals, the standard turnouts were of wood. On the Tieton Division, the turnouts from the main laterals to the sublaterals consisted of concrete pipe through the canal embankment with wooden gates. It is unknown whether any of the original turnouts still exist on the early divisions; over the years, rehabilitation projects have included their replacement with more modern concrete and steel structures.

Checks.—There are undoubtedly numerous check structures on the canal system but further research is required to identify types and locations.

E. Miscellaneous Canal Structures

Description

Bridges.—Several different types of bridges were constructed on the Yakima Project to cross roads, canals, and wasteways. Wooden Howe-truss, pony truss, and stringer bridges were constructed at various locations on the Sunnyside Division. The Prosser Lateral

pipeline was carried over the Yakima River on a four-span steel bridge. On the Tieton Division, timber bridges were constructed where laterals crossed highways. The incidence and types of bridges on the other divisions is unknown.

Significance

Located at various points along canals, the above-described appurtenant features are integral to the operation of the water delivery system. Although most are small in scale and were constructed from standard designs, they are instrumental to the functioning of the canals. Due to the constant ongoing maintenance required of canals and associated structures, many of the original features are upgraded, altered, or even replaced over time. As a result, those that remain with integrity are significant contributing elements. In some cases, these features may be rare surviving examples, or of unique or innovative engineering design, and have individual significance.

Registration Requirements

The period of significance for miscellaneous appurtenant canal structures begins with the construction of the Sunnyside Main Canal in 1907 and ends with completion of the Kennewick Main Canal in 1956. Appurtenant canal features that are less than 50 years old cannot be considered individually eligible unless exceptional significance can be demonstrated. Integrity of a structure's historic materials, workmanship, and design is essential for *National Register* eligibility under any criterion. Because location is of primary importance under Criterion A, a structure will rarely qualify under this criterion if it does not remain on its historic site along its associated canal. Location can also have importance under Criterion C, but this association is less vital.

Appurtenant canal structures that have retained sufficient integrity are considered individually eligible for the *National Register* for the following reasons:

Criterion A: They are directly associated with important events that occurred along canals.

Criterion B: They are a major achievement of an important individual.

Criterion C: They are among the best or a rare surviving example of a distinctive type of appurtenant canal feature; they represent the evolving technology in the design of

appurtenant canal features; they represent a unique design solution developed in response to a difficult engineering challenge; they were identified during the construction period as an individually significant feature.

IV. Property Type: Powerplants

Description

In addition to the primary purpose of supplying water for irrigation purposes, the Yakima Project also utilizes the power potential of the water to generate a limited amount of electricity. The production of power was incorporated in both the Roza and Kennewick Divisions. In August 1958, Reclamation placed the Roza Powerplant in operation. This 11,250-kilowatt hydroelectric plant, located east of the city of Yakima, was built to provide power for the 17 pumping plants on the Roza Division. Excess power is marketed through the Bonneville Power Administration. Completed in 1956, the Chandler Powerplant on the Kennewick Division produces 12,000 kilowatts at two generators. The electricity feeds into the BPA transmission system. Two smaller hydropower plants, Cowiche and Orchard Avenue, were constructed on the Tieton Division in 1986 and are operated by the Yakima Tieton Irrigation District. The facilities generate electricity to power six pumping plants and serve as pressure-reducing stations for the pipeline distribution system.

Significance

None of the powerplants are yet 50 years old; therefore, unless outstanding significance can be demonstrated, they do not qualify for individual listing in the *National Register*.

At such time that the plants are considered for individual eligibility, the following criteria should be applied.

Registration Requirements

Hydroelectric powerplants are individually eligible for the *National Register* for the following reasons:

Criterion A: They are significant in the social, economic and industrial development of the region or State.

Criterion B: They are significant examples of hydroelectric plants designed by renowned Reclamation engineers.

Criterion C: They are significant in the history of hydroelectric generation engineering and electric transmission technology, in the history of hydroelectric design principles, or in the development of construction techniques; they are a rare example of a type of hydroelectric powerplant; they are a significant representative example of a Reclamation-designed hydroelectric powerplant.

Powerplants are like dams and canals in that they require constant maintenance and repair. In some cases, equipment is replaced due to malfunction, deterioration, or evolving technology. This is part of the ongoing evolution of a powerplant and does not necessarily preclude eligibility. Numerous components are associated with a power plant. These can include, among other things, forebays, penstocks, generating equipment, transformers, and outlet structures. Eligible plants will retain integrity of most components so that the significance of the total system is well represented. Loss of some components will not irreversibly compromise the integrity of a plant if the surviving features are well-preserved and: (1) convey a discrete significance on their own; or (2) satisfactorily convey the significance of the total system. Some replacement in kind or new construction is acceptable if the essential character of the plant is preserved. If the significance of a plant is based on a specific piece(s) of equipment that has been removed, the plant would no longer be eligible.

V. Property Type: Pumping Plants

Description

Pumping plants are required where water must be lifted to a higher elevation to serve a desired purposes. On the Yakima Project, there are 30 pumping plants in operation. The earliest of these pumping plants were constructed on the Sunnyside Division. Small reinforced concrete buildings housed the pumping units. The present condition of these structures is unknown. More than half of the pumping plants (18) are located on the Roza Division; just one is in place on the Kittitas Division. The Chandler Pumping Plant on the Kennewick Division, which contains two hydraulic pumping units, also produces power at its two generators. The designs of pumping plants typically incorporate intake structures, discharge pipes, pumps, motors, and control equipment.

Significance

Without the use of pumping plants to elevate water, it would not have been possible to irrigate many of the lands that are served by the Yakima Project. As such, the pumping plants are significant for the critical role they play in the overall operation of the system.

Registration Requirements

The period of significance for pumping plants begins with the installation of hydraulic pumps on the Snipes Mountain Lateral of the Sunnyside Division in about 1912 and ends with completion of the Chandler Pumping Plant in 1957. Pumping plants less than 50 years old cannot be considered individually eligible unless they demonstrate exceptional significance.

Pumping plants are individually eligible for the *National Register* for the following reasons:

Criterion A: They are significant in the social, economic, and industrial development of the region or State.

Criterion B: They are significant examples of pumping plants designed by renowned Reclamation engineers.

Criterion C: They are significant in the history of pumping plant engineering, in the history of pumping plant design principles, or in the development of construction techniques; they are a rare or unique example of a type of pumping plant; they are significant representative examples of a Reclamation-designed pumping plant.

Pumping plants are like dams and canals in that they require constant maintenance and repair. In some cases, equipment is replaced due to malfunction, deterioration, or evolving technology. This is part of the ongoing evolution of a pumping plant and does not necessarily preclude eligibility. Eligible plants will retain integrity of most components so that the significance of the total facility is well represented. Loss of some components will not irreversibly compromise the integrity of a plant if the surviving features are well-preserved and: (1) convey a discrete significance on their own; or (2) satisfactorily convey the significance of the total plant. Some replacement in kind or new construction is acceptable if the essential character of the plant is preserved. If the significance of a plant is based on a specific piece (s) of equipment that has been removed, the plant would no longer be eligible.

VI. Property Type: Auxiliary Construction Works

Description

This property type encompasses auxiliary features required for the construction of the Yakima Project. This may include, among other things, Government and contractor residential camps, construction plants, new and relocated roads, quarry sites, and telephone lines.

A. Residential Construction Camps

Construction of the Yakima Project was accomplished by both Government force and contractors, and thousands of men were employed. Because of the remote location of much of the project, housing had to be provided for many of the workers near the construction activities. Residential construction camps were quickly erected and then dismantled upon completion of specific features. Further research is required to identify the number and locations of all Yakima Project camps. It is known that the first two camps were built at the site of the Sunnyside Diversion Dam. Others undoubtedly were erected in conjunction with the Sunnyside Canal. On the Tieton Division, at least 12 different camps were established along the Main Canal route. Camps were most likely established for the Roza, Kittitas, and Kennewick Divisions as well, but information on them is not included in this report. The construction of the storage dams also required accommodations for many workers. Typically, these camps included a range of structures such as frame bunkhouses, tents, mess halls, kitchens, shops, offices, and, at the earlier dam sites, horse corrals. By the time Cle Elum Dam was constructed in the early 1930s, garages replaced corrals. At Bumping Lake Dam, some of the buildings were made of lumber harvested and milled onsite. Later, at the Tieton Dam government camp, facilities included individual homes for married employees, an excellent water supply, sewerage system, fire protection network, garbage disposal service, and central heating plant. The camp had the appearance of a small town and was even given a name, Rimrock. It is unknown whether any of the temporary camp sites have potential to yield archaeological evidence.

B. Roads

In addition to the miles of roadways constructed along the banks of canals for operation and maintenance purposes, numerous access roads were constructed to reach remote areas such as Tieton Canyon or the Bumping Lake dam site. In at least one instance, at Keechelus Dam, a stretch of existing State highway had to be relocated.

C. Construction Camps/Plants

Construction of the major project features, in particular the dams, required large amounts of equipment, machinery, and construction-related facilities at the site. These included concrete mixing and batching plants, aggregate plants, machine repair shops, and offices. None of these construction camps remain; they were all dismantled following completion of project features. In some cases, such as at Kachess Dam and Clear Creek Dam, heavy equipment was shipped to other construction sites for use there.

The earliest construction plant noted in this report was for the manufacture of concrete lining for the Main Tieton Canal. The contractor, Theodore Weisberger, established a plant site near the canal. Also on the Tieton Division, a plant was established to manufacture concrete pipe for use on the distribution system. Much larger construction facilities were required for building the storage dams. At Clear Creek Dam, the camp included a concrete mixing plant, a steam pumping plant, and a small electric light plant. At Cle Elum Dam, facilities consisted of a carpenter shop, truck garage, machine shops, a warehouse, tool shed, compressor house, steel bending yard, and concreting plant.

It is unknown whether the construction camp sites would yield information.

D. Quarries and Borrow Areas

The use of concrete, earthfill, and riprap in the construction of many project features required sources for the materials. To the extent possible, quarries and borrow areas were located as close to the construction site as possible. It is known, for example, that borrow pits adjacent to the dam sites were located at Bumping Lake, Kachess Lake, and Keechelus Lake.

E. Telephone Lines

Because of the remote and undeveloped locations of many project features, it was necessary to build telephone lines in order to establish communications. This was accomplished as early as 1907-12 on the Sunnyside Division; a telephone line was strung between Sunnyside and the District Engineer's Office in North Yakima. On the Tieton Division, telephone lines were installed to connect the various camps along the Main Tieton Canal to the office in North Yakima. Likewise, a telephone line was built to the Bumping Lake Dam site in 1908.

Significance

Successfully accomplishing the construction of an enormous irrigation project such as Yakima required an array of support and ancillary facilities. Although typically not permanent, and not of the scale and engineering significance of the primary structures, these secondary features were instrumental. Construction camps were significant for their role in providing temporary housing for thousands of workers in oftentimes remote locations. The camps also represent “microcosm” communities, usually offering services and amenities in addition to just housing. Other ancillary features are significant in that they contribute to telling the “whole story” of the project and, in some instances, represent significant physical features added to the landscape. Such is the case with roads or telephone lines.

Registration Requirements

The period of significance for auxiliary construction works begins in 1906 and continues up through 1958, the date of completion of the Kennewick Division. Construction-related features less than 50 years old cannot be considered individually eligible unless exceptional significance can be demonstrated.

Integrity of historic materials, workmanship, and design of a structure associated with a residential camp/construction plant is required for individual *National Register* eligibility. Integrity of location, setting, feeling, and association are also essential in most cases. Under both Criteria A and C, a structure will rarely qualify if it has been moved from its historic site (this could include a site to which a structure was moved by Reclamation/contractor for additional use during the period of significance). This is due to the fact that the significance of camp structures/buildings is not so much related to architecture, but to being part of a larger complex specifically designed and laid out to support project construction. Because of the temporary nature of both residential camps and construction plants, it is unlikely that any intact structures remain. Therefore, the possibility of archeological sites yielding information would need to be assessed.

Quarries, borrow areas, telephone lines, and roads are unlikely candidates for individual eligibility. Some particular engineering significance may justify an exception. Such features may, however, qualify as contributing elements to a district that includes other Yakima Project features.

Auxiliary construction works that have sufficient integrity are considered individually eligible for the following reasons:

Criterion A: They had a unique and significant function related to the construction of the Yakima Project, such as the administrative headquarters for construction oversight; they were the site of a significant event associated with the Yakima Project.

Criterion B: Not applicable.

Criterion C: They are the best or only surviving representative example of a primary type of structure associated with the construction of the Yakima Project, such as a camp bunkhouse; they are of unique design or construction; or they have engineering significance.

VII. Property Type: Ongoing Support Features

Description

This property type encompasses features that were constructed for the ongoing operation and maintenance of the irrigation system once it was placed in service. Features previously identified under Auxiliary Works, such as residential camps and quarry sites, can be included if they continued to be used for the operation and maintenance of the system. This property type also includes structures such as damtenders' and ditchriders' housing, project offices, and service yards.

A. Project Offices

Project offices serve as the ongoing administrative headquarters for project oversight. During initial construction of the Yakima Project, the District Engineer's headquarters were established in North Yakima in a building designed and built by Reclamation specifically for that purpose. It is not known how long the building served this function; the project office is now in newer quarters. Separate operation and maintenance offices were established on the various divisions. On the Sunnyside Division, headquarters were at first in Zillah, but were moved sometime between 1907-12 to Sunnyside. There, a new office, barn, and warehouses were constructed. A headquarters complex for the Tieton Division was established on the site of a construction camp. An office, three houses, a barn, and several buildings made up the complex. Further research is needed to locate other original project offices.

B. Service Yards

Service yards contain the buildings and equipment necessary to provide ongoing support, maintenance, and repairs to project machinery and features. Typically, service areas contain warehouses, storage buildings, machine shops, repair shops, and garages. These buildings are utilitarian and industrial in appearance. It is not known whether any historic service yards associated with the Yakima Project exist.

C. Damtenders' and Ditchriders' Housing

Housing for ditchriders and damtenders is common to older irrigation projects, and the Yakima Project is no exception. For example, research revealed that there were seven patrol houses originally constructed along the Tieton Main Canal. According to Rick Dieker of the Yakima-Tieton Irrigation District, four patrol houses still exist, one of which is located on the grounds of the district headquarters. An historic irrigation district manager's house is located on the same grounds. A gatekeeper's house was built at the Tieton Diversion Dam; its status is unknown. Historic damtenders' residences and outbuildings are still in place at Easton Diversion and Cle Elum Dams. A residence was also constructed at the Wippel Creek Powerplant. Housing was most certainly built elsewhere on the system, but additional research is required to determine locations.

Significance

A variety of maintenance and office facilities are essential to the ongoing operations of the Yakima Project. Constant and extensive upkeep involves an array of equipment requiring storage and work space. The "hands-on" labor involved in maintaining an irrigation system, especially in earlier days, required that ditchriders and damtenders be housed close to project facilities. Although typically not of the scale or significance of primary engineering features, the ongoing support facilities collectively have an important role. Typically, these structures are inexpensively constructed, utilitarian, and very plain. Sometimes, they are of standard Reclamation design.

Registration Requirements

The period of significance for ongoing support structures spans from 1906 through the completion of the Kennewick Division in 1958. With the exception of project office

headquarters, ongoing support buildings would most likely be contributing rather than individually eligible.

To be individually eligible, ongoing support structures must have integrity of location, association, design, workmanship, and materials. They maybe eligible for the following reasons:

Criterion A: They had a unique and significant function related to the ongoing operation and maintenance of the Yakima Project, such as the project administrative headquarters; they were the site of a significant event associated with the Yakima Project.

Criterion B: Not applicable.

Criterion C: They are the best or only surviving representative of a type of support structure found on the Yakima Project; they are of unique design or construction; or they are a good representative example of a standardized Reclamation design.

