Irrigation history in the Rathdrum Prairie and Spokane Valley; thirty years of developing water delivery and fifty years of system rehabilitations

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Introduction

The Rathdrum Prairie region in Kootenai County of Idaho's Panhandle is particularly fertile, but with limited summer rainfall. What little agriculture there was from its time of settlement by missionaries in the early 19th century to the late 1890s was mostly stock raising on the bunchgrass prairies and small dry land farm ventures. The advent of irrigation in the region brought wild land speculation, and gambles on a nascent apple industry. The process of developing the irrigation affected not only water rights, but also in how the towns grew. Much of the original irrigation system exists to this day, though the surface water diversion in wood and stave flumes and unlined canals has been replaced by deep wells, pumping stations, water tanks, and steel pipes. A historical view of the water delivery systems can provide useful information for understanding community structure and water projects in the region.

The Rathdrum Prairie and Spokane Valley

The Rathdrum Prairie and the Spokane Valley are outwash glacial plains. Glacial Lake Missoula floods deposited thick layers of boulders, cobbles, and gravel, creating the porous Spokane Valley-Rathdrum Prairie Aquifer that underlies the region (Figure 1). The valley floor that overlays the Spokane Valley-Rathdrum Prairie Aquifer covers approximately 250 square miles in Idaho, including the roughly triangular Rathdrum Prairie. Spokane Valley is contained in about 120 square miles on the Washington side. Both areas share the Spokane River, which flows east to west for 9 miles from Lake Coeur d'Alene to Post Falls, and then into Washington. Only Hangman Creek and Little Spokane River are tributaries to the Spokane River. Other watercourses flow toward the River, but disappear as the waters percolate into the coarse, gravely soil. Except for Hangman Creek and the Little Spokane River, none of the watercourses actually reach the Spokane River because the waters quickly percolate downward and disappear into the coarse, gravely soils (Bashore 1932, MacInnis *et al*. 2009).

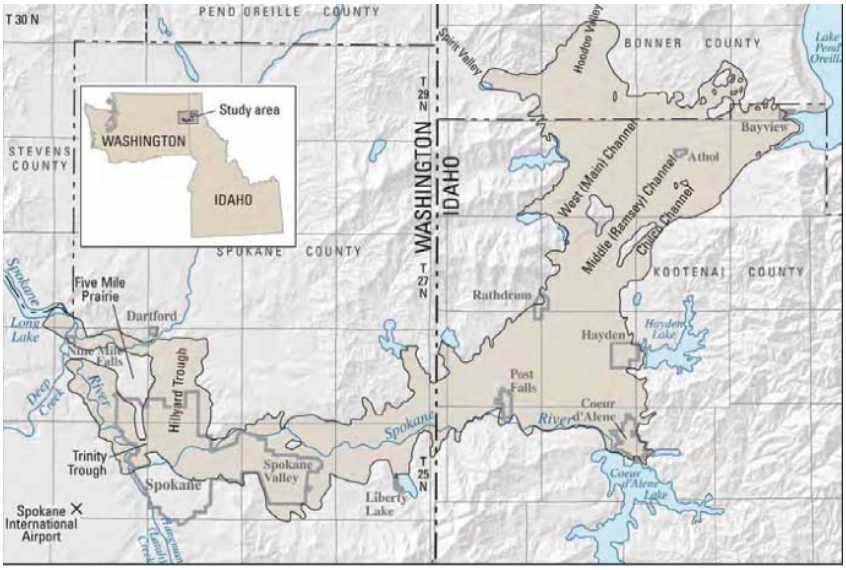


Figure 1. The Spokane Valley-Rathdrum Prairie Aquifer. Source: MacInnis *et al*. 2009.

Several lakes are situated around the borders of the aquifer and contribute water through subsurface flow and irrigation seepage, the larger of which are important to the Rathdrum irrigation story. Idaho's Lake Pend Oreille is

to the extreme northeast of the Rathdrum Prairie. It contributes to the aquifer by subsurface flow only in the Bayview/Farragut State Park area. The lake itself drains to the north, away from the aquifer and the valley. Lake Coeur d'Alene drains into the Spokane River, and was thought to have little subsurface interaction with the aquifer (MacInnis *et al.* 2009). Recent water level observations in nearby wells show seasonal cycles that indicate recharge from the lake into the subsurface, but the magnitude of this flux is still uncertain (Neely, direct communication). Spirit Lake, previously sometimes called Tesemini, is seven miles long and one mile across its widest part. Spirit Lake provides for municipal needs of the city of Spirit Lake and some local irrigation and it was among early water appropriations, but does not otherwise play a large role in area Rathdrum Prairie supplies. Twin Lakes (Fish Lake in early accounts) is three miles south of Spirit Lake, and three miles to the north of Rathdrum. It is five miles long and is formed by two water bodies (Twin High and Twin Low) connected by a narrow channel. Twin Lakes has considerable elevation above the prairie, which made it a logical choice for gravity flow irrigation. The eight mile long Hayden Lake (spelled Heyden in early literature) is seven miles north of Coeur d'Alene, and twelve miles east of Rathdrum (Martin 1903). Hauser Lake was also called Mud Lake, Mudd Lake, and Sucker Lake on old maps, but was renamed after Hauser Junction, a railroad stop built on D.C. Corbin's Spokane Falls and Idaho Railroad. The 13.5-mile branch line from the Northern Pacific Railroad would provide transportation for produce and passengers from Hauser Lake through Post Falls and on to the steamboat docks in Coeur d'Alene (Hauser Lake Watershed Coalition 2007-2014). In Washington, the 1200-acre Newman Lake lies northeast of the Spokane Valley South of the river and east of Spokane Valley is Liberty Lake, whose fairly shallow water covers about 711 acres. Both lakes are only a few miles from the Idaho border.

Early Euro-American settlement in northern Idaho

Euro-Americans from the east were not first to farm in the Spokane Valley-Rathdrum Prairie area. Native Americans lived throughout the Inland Northwest, and there are written accounts of agricultural plots and grain storage in the Spokane Valley area. Two narratives by members of Colonel Wright's 1858 campaign in the Spokane Valley mention Tribal farming on the Rathdrum Prairie. Smith (1916) "noticed some small enclosed fields cultivated by the Indians" between Post Falls and Coeur d'Alene Lake, near the town of Coeur d'Alene. Beall (1917), spelled Buell in Smith's 1916 article, wrote that many of the Indians in the Spokane country raised grain and vegetables and also provided some scale. Near what he called "Horse Slaughter Camp" on the Spokane River, the company found and burned out "fifteen or twenty Indian houses filled with grain" that was "threshed and in Indian sacks" (p. 85). They found additional four or five houses full of grain near Post Falls, which they also burned. Beall also knew of considerable amounts of grain stored in a big Indian village on the Little Spokane River, which had been raised in the vicinity; Colonel Wright's company left this undisturbed because it was out of their way (Beall 1917).

Settlement had very slow beginnings in Kootenai County and the Rathdrum Prairie, and it took sixty years before farming began. David Thompson established the Kullyspel House trading post on Lake Pend Oreille in 1809. Father Pierre-Jean DeSmet built a Jesuit mission at Cataldo, ID in 1842. Washington Territory was established in 1853, with Spokane County encompassing much of northern Idaho. Shoshone County, Idaho, and several northern Washington counties were separated off in 1857-58 (Fargo 1950). The 624-mile Mullan Road was completed from Fort

Benton in Montana to Fort Walla Walla in Washington in 1861, linking Missouri and Columbia River traffic (Idaho Department of Environmental Quality (IDEQ) n.d.). In the same year a trapper named Conners was the first recorded settler, establishing the town of Rathdrum (Bell 1996). With the Idaho Organic Act of 1863, Congress established the Territory of Idaho, which originally encompassed present day Idaho, Montana and Wyoming. A year later the new Territorial legislature created Kootenai County (Martin 1903).

Early Euro-American settlers were slow to begin farming, mostly raising livestock on open prairie grazing, and enough foods to support their families. Early stock raising was begun by fur traders, and continued by missionaries. The first large herds of cattle in the Spokane Valley were recorded in 1854; all of them raised on the bunchgrass prairies of the northern Washington and Idaho territories (Martin 1903, Fargo 1950). Crop agriculture was not begun until 1870, when Fort Sherman was established along the Mullan Road. It created a market to supply 100 army horses and mules with barley, hay and oats (Fahey 1965, Bell 1996). For the next thirty years, agriculture in the fertile Rathdrum Prairie soils remained minimal, with settlers raising some livestock and a little hay, wheat, and flax. In 1880, permanent residents in all of Kootenai County still only numbered 318 Euro-Americans (Martin 1903).

On July 2, 1864 President Abraham Lincoln signed the Northern Pacific Railroad charter for a rail line to run from Duluth, MN to Bismarck, ND, and on to Portland, Oregon. The government gave the railroad 46,000,000 acres of federal lands to pay for construction. Northern Pacific received every other section within a 40-mile corridor on either side of the line, which it sold for $2.60 per acre west of the Missouri River (Act of July 2, 1864, State of North Dakota n.d.). Railroad land sales created great opportunities for land speculation and irrigation development. Railroad lands were preempted by already filed homesteads, but because the 1864 Act contained unclear wording, there were legal headaches that were finally settled in favor of homesteaders by an 1881 Supreme Court ruling. Despite financial and construction difficulties, the line was completed in 1883 (Billings 1012). The Northern Pacific and other later rail lines provided transportation for incoming settlers and mail service, as well as a conduit to market agricultural products.

The first significant population influx of non-Natives to Kootenai County was construction laborers for the Northern Pacific transcontinental railroad, from 1881 to its completion across North Idaho to Spokane Falls in 1883. At the same time, the discovery of gold, silver, and lead in the Coeur d'Alene valley triggered a mining rush. By 1884 the county's permanent population had increased to 2000, driven mostly by the influx of miners. While raising of stock to supply prospectors flourished temporarily, other agriculture in the 1880's was still limited mostly to homestead food supplies and basic truck crops such as hay and wheat (Fargo 1950). A United States land office was established at Coeur d'Alene in 1885, with first land entries dated that December. By the time Idaho received statehood and adopted its constitution in 1890, Kootenai County's population had grown to 4,108 (Martin 1903).

The development of irrigation in the Rathdrum Prairie region

The Homestead Act of 1862 established a three-tiered homestead acquisition process of filing an application, improving the land, and finally filing for the deed of title on 160 acres of Government land. Homesteaders had to live on a land claim, while improving it with a 12-by-14

dwelling and growing crops for five years. Proof of residency and the required improvements were submitted to a local land office to receive a patent or deed of title for the land (Act of May 20, 1862, Potter and Shamel 1997). The first land office was opened at Coeur d'Alene in 1885 (Martin 1903).

The Federal Desert Land of 1894 – more often referred to as the Cary Act – was designed to encourage private firms to develop irrigation systems in semi-arid states, and to profit from the sale of water. By 1914, twenty Carey Act projects had reclaimed 937,645 acres, with some of them in southern Idaho. While northern Idaho may have been suitable for a Carey Act project, it had no bearing in Rathdrum Prairie irrigation development. In fact, none of the 3,580 acres being irrigated at the time were in Carey Act, Bureau of Reclamation, or Bureau of Indian Affairs projects (French 1914). Even following the completion of USBR reclamation projects on the Rathdrum Prairie, all irrigated and non-irrigated croplands in the Idaho Panhandle were privately owned (Idaho Water Resources Board 1976).

Early settlers did not consider irrigation feasible in the porous Rathdrum prairie soils. Newcomers purportedly dug a hole and poured a bucket of water in, which promptly disappeared into the gravely ground (Durham 1912, Fahey 1950). Unfazed, several entrepreneurs formed the Spokane and Idaho Irrigation Company in 1894. They purchased water rights to Hayden Lake and Newman Lake, but never began construction. W.L. Benham purchased the defunct company's water rights, and in 1899, filed for three water rights with Kootenai County's recorder, on Hayden, Twin, and Hauser lakes (Martin 1903, Stephenson 1909, Fahey 1965). Historical details vary, in part, because some waters had multiple names.

Benham, and his associates, Daniel C. Corbin and Austin Corbin II, organized two new companies: the Spokane Valley Land and Water Company, to acquire land and sell it to settlers, and the Spokane Valley Irrigation Company, to construct irrigation systems (Martin 1903; Fahey 1993). From these beginnings, there was a veritable race for irrigation development in the Spokane Valley and Rathdrum Prairie. Various financial backers came and went in irrigation companies, but D.C. Corbin remained a major player throughout the area's irrigation history. Companies were formed and/or restructured with each change in backers. The company names themselves are therefore often very similar and occasionally unclear or even temporally confused in historical accounts. Appendix I is a timeline of major events in irrigation development.

By the original surveys, the ditch from Hayden Lake was to be 15 miles long with a capacity of 500 cubic feet per second (cfs). The proposed canal for Twin Lakes was 20 miles long, likewise with a 500 cfs capacity (Martin 1903), and it was estimated to be sufficient for watering about 5,000 acres (Stephenson 1909). The Hauser Lake ditch was proposed for 200 cfs, and was to go ten miles to irrigate a region southwest of Rathdrum. In 1903, Martin reported that various circumstances had interfered with the completion of these canals, but that the plans had not been materially changed. The Twin Lakes ditch was five miles long and under construction, and Hayden Lake's ditch was also under way. At the same time, the Valley Improvement Company was formed, which proposed to irrigate a tract of over 6,000 acres on the Rathdrum prairie, north of the Spokane, and near the Washington state line. The company proposed to bring its water from Twin Lake through Spokane Valley Irrigation Company's ditch. Liberty Lake's water supply was considered adequate for watering 1,000 acres (Stephenson 1909).

By 1901 the Spokane Valley Irrigation Company had trenched 16 miles of ditches from Liberty Lake to Greenacres, where it platted 1,400 acres for 10-, 20-, and 40-acre farms. This project was begun first because it was considered easier to develop than the others (Stephenson 1909). They were also aided in construction by 1899 session laws in both Washington and Idaho, by which land for right-of-ways could be taken by eminent domain. If a landowner refused passage of a ditch or flume, the irrigator would simply condemn it – a practice, which by multiple accounts, was freely applied (Fahey 1965). The first canal opened to Greenacres in 1900 served 766 acres with small amounts of delivered water. Three thousand acres were open for purchase in 1902. In 1905, 343 acre-feet of water were delivered to 313 acres of irrigated vegetable crops in Greenacres, in addition to watering forty acres of alfalfa. In total, 130 acres of general crops received water at a rate of 15 inches over the entire surface (Waller 1909).

Problems abounded for Greenacres, however, as its ditches and the lake canal were poorly graded. Additionally, the unlined canals lost great amounts of water into the porous soils. The original water contract was for 14 inches in perpetuity from Liberty Lake, but it was only one third of needed amount during the growing season. The entire system had to be redone on a larger scale than previously anticipated. The company also negotiated an Idaho permit for 1,440 cfs from Spirit, Twin, Hayden, and Hauser Lakes (Fahey 1965 and 1993).

Figure 2. Headgate # 1 at Post Falls dam. Nancy F. Rank, photo. Source: National Park Service (NPS) 2003

In 1904 Spokane Valley Land and Water Company reached an agreement with the Washington Water Power Company to draw water from the Spokane River behind Post Falls dam (Fahey 1965). The contract was carefully crafted to include right of ways, provisions for how the water could be used, allowable rates, and how the water was measured at the headgate (Figure 2) (National Park Service (NPS) 2003). The Spokane River Canal Company was formed to operate a short canal from the river to feed the main north and south canals. It diverted water at Signal Point into an unlined, 12-foot-wide ditch and a box flume that ran five miles to the state line. Much of the distribution system was "not a ditch but a three-by-five-foot wooden aqueduct that crossed the valley on frame trusses and dipped beneath roads in square concrete ducts" (Fahey 1965, p. 206). There the canal, often locally referred to as Corbin's Ditch, divided into the 12 mile long north branch, and 13 miles of south branch. From its initial completion in 1910 and further development through the mid 1930's, Spokane River Canal eventually delivered water through 125 miles of laterals and many different irrigation districts (Fahey 1993).

Irrigation development progressed very quickly beginning in 1905, with each new addition receiving a name for marketing, and many receiving their water via Corbin's Ditch. Spokane Valley Canal Company opened East Farms Number One near the Idaho border in 1908, East Farms Number Two in 1909, Numbers Three and Four in 1910, and West Farms Irrigated Tracts in 1911. Then it joined the Peyton Investment Company in platting Pasadena Park irrigated farms. Others developed Grandview Acres, Spokane Bridge, Fairacres, Pinecroft, and Liberty Lake Orchards. Modern Land and Irrigation Company developed the 3,000-acre Opportunity project using wells and electric pumps (Fahey 1965). After D.C. Corbin's death, his executor hired Bureau of Reclamation engineer R.K. Tiffany to manage Spokane Valley Land and Canal Company. Tiffany designed a diversion pipe at Spokane Bridge, just west of the Idaho-Washington border to expand the irrigation system. It carried water across the river and opened an additional 1,230 acres of land to irrigation on the south side of the Spokane River (NPS 2003).

Other irrigation areas were served by area lakes, and almost entirely by gravity flow. Arcadia Orchards irrigation system was an 18-mile waterway of tunnels, flumes, pipelines, and open ditches from Loon Lake (in Stevens County, about 30 miles NW of Spokane). Rival Spokane Canal Company used Benham's unexploited water rights on Newman Lake to develop Otis Orchards. Dalton Gardens was a privately built distribution system that drew its water from Hayden Lake beginning in 1905 (USBR Dalton Gardens 1982). Interstate Irrigation Company (later Hayden Lake Irrigation District) platted Hayden Lake Irrigated Tracts in 1910, and likewise sourced its water from Hayden Lake to develop 2,000 acres (Hayden Lake Irrigation District 2010, USBR Rathdrum Prairie 1983). Hayden Lake water also served Avondale beginning in 1908, and Post Falls irrigation in 1910. East Greenacres was planned to irrigate 3,000 acres (later reduced to 1,500 acres) with water from Twin Lakes (USBR Rathdrum Prairie 1983, Bell 1996).

A quote from the Spokesman-Review (n.a., 1909) sums up the resulting image:

> "By this time perhaps fifteen thousand acres were under irrigation in the Spokane Valley, and forty miles of main ditches, some owned by companies other than Corbin's, using water from wells or seven lakes lying in an irregular horseshoe around the valley at a higher elevations than its floor so the water flowed by gravity without pumps, requiring only locks to maintain lake levels."

Successes and failures of irrigation in the Spokane Valley-Rathdrum Prairie

Martin (1903) reported that there were differing opinions among the farmers as to the possibility of irrigating the prairie, but that the valley could speedily become one of the richest areas in the American northwest. Experimental plantings - initially mostly alfalfa – showed promising returns (Fahey 1965). The first growing season at Greenacres achieved spectacular success. Land sales rapidly increased after the second crop produced far beyond expectations of even the members of the irrigation company (Stephenson 1909). By 1903, Martin described Post Falls as the "center of quite an extensive agricultural, stock and fruit region, that is every year becoming more productive" (p. 806).

Land in Greenacres, which Benham had originally purchased for $12.50 an acre, sold first for $50 to $60, but quickly increased to $200, and eventually as high as $1,200 (Fahey 1965 and 1993, Stephenson 1909). In contrast to the only 3,930 acres of land sold in Kootenai County in 1886, sales in 1902 were 124,468 acres, for a total of 1,177,534 acres sold (Martin 1903). Greenacres parcels were sold out by 1905, and East Greenacres plots were gone by 1907. Speculation all over the Spokane valley and Kootenai County went wild, with projects advertised as far away as Philadelphia, Boston, Toronto, and London. Booklets targeted an audience who largely had no experience in growing anything. Local farmers divided their fields into 5-, and 10-acre orchard plots, often retiring on the proceeds. Irrigation companies did not just improve lands with a system of delivery canals and laterals, but they also cleared land, planted apple trees, and cultivated them. In some districts such as Arcadia Orchards, the irrigation company promised to cultivate trees to bearing in four years. Buyers could move onto acreage, and hoped to pay off the contract with profits from apples (Fahey 1993). Orchards were not immediate producers, however. While settlers waited for their apples to mature, they planted other crops between rows of fruit trees such as alfalfa, vegetables, berries, melons, and some corn (Waller 1909). Combined statements from farmers in Greenacres and East Greenacres in the early 1900s reported good yields of strawberries, dewberries, tomatoes, onions, potatoes, table beets, and cauliflower (Stephenson 1909).

The Morrill Act was enacted in 1862 created the Land Grant college system. Its endowment was used for the "support, and maintenance of at least one college where the leading object shall be, without excluding other scientific and classical studies and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts…" (Morrill Act § 4(8)). To this day, the Land Grant schools retain vital scientific research as well as extension services to agriculture. The University of Idaho in Moscow, and Washington Agricultural College and School of Science (now Washington State University), Pullman, supported hydrology, geology, and agricultural studies in the Rathdrum Prairie, as well as such services as inspecting the quality of sugar beets (Billings 2012). This institutional support further encouraged the development of crops in Spokane Valley.

Sugar cane was scarce in the wake of the Civil War, which led to the experimental manufacture of beet sugar in the United States. The first factories were erected in Wisconsin, California, Nebraska and Utah in the 1880s and 1890s. Tests in 1894 by Professor Charles P. Fox of the University of Idaho, and others by Washington State Agricultural College led both schools to recommend beet cultivation in the Spokane area. Colonel Edward H. Morrison, who had already won distinction with his own specialty beet sugar seed in worldwide competition, organized the Waverly Beet Sugar Manufacturing Company in February 1895. D.C. Corbin eventually partnered with Morrison. Their Washington State Sugar Company's three-story factory opened in December 1899 in Waverly. It was served first by the Oregon-Washington Railway and Navigation Company, and after 1906 by a spur from the Spokane and Inland electric line. The first year's factory runs produced about 200 tons of sugar. By 1901 it was approximately 674 tons (Fahey 1965).

Washington State legislature encouraged the production of sugar by putting a one-cent bounty on each pound of sugar produced from sugar beets grown in Washington. The sugar mill had to be built before 1901, and had to pay at a minimum of four dollars per ton of beets. There was a

limit on the payout of $50,000 per year of its three-year sunset (Washington Session Laws, 1899 chapter XVII); the bill was not renewed in 1903 session (Fahey 1965). From 1901-1903, Washington State Sugar Company collected $67,394.02 in bounty money. Corbin gave free beet seed to farmers near Waverly, and seeded 1,400 acres on his own lands in the area. Corbin also was interested in the possibilities of integrating irrigated lands and sugar manufacturing. He dedicated 1,100 acres of his own irrigated lands, 700 acres near Corbin, Idaho, and 400 more in East Farms, to growing beets, using Japanese field hands and a steam plow (Fahey 1965).

But the beet plants were susceptible to blight, required backbreaking maintenance in thinning, weeding, and harvesting, and crop rotation had to be carefully managed. The Waverly factory continued to experience a shortage of beets even as the farmers were learning to grow bigger and more sugary beets. Farmers were easily enticed into growing more reliable and often more lucrative crops – even the newest rage, apples. Acreage of sugar plantation became insufficient to sustain the refinery with beets. Furthermore, the irrigated Rathdrum Prairie soils yielded beets containing stones that damaged the factory's knives (Fahey 1965). Fiscal woes also plagued the sugar refinery. Governor Henry McBride vetoed a bill to renew the state bounty after 1903, thereby removing a lucrative incentive for continued production. Then, in 1909, farmers demanded a twenty-five cent increase per ton of their beets, which Corbin refused to pay. That year, the factory ran only a few days in December, and produced only 35,000 sacks of sugar. The plant was closed in 1910 after one more disappointing season. A campaign by the Spokane Chamber of Commerce to reopen it failed in 1916. The factory was sold and the machinery was eventually shipped to Gunnison Valley Sugar Company in Utah, where it was used for another half century (Fahey 1965).

Apples were the region's biggest gamble. So much so, that Spokane actively courted national apple markets, hoping to make the city a major fruit distribution center. In 1908 Spokane launched the National Apple Show and also hosted 1,800 delegates attending the National Irrigation Congress. Growers planned for selling eventually adopting a model for advertising their brand names and rigorously controlled sizes, varieties, grades and packaging. By 1912 apple production exceeded demand. By 1913 18,000 new acres were bearing fruit, and two million more were expected to come into production in each of the next three years. The market was soon flooded with apples (Fahey 1993).

The apple boom resulted in a market bust. Marginal growers failed, and other growers discovered that their apple varieties could not compete with big, polished, bright varieties from Yakima and Wenatchee, Washington. The rise and fall of demand and prices made it hard for orchardists in the Spokane Valley to pay off their mortgages. Adding to problems from occasional water shortages, were severe frosts in early 1920 and an infestation of apple leaf roller that damaged three quarters of the Spokane area orchards. Many orchards were torn out and replaced, as farmers diversified to more vegetable and berries, chickens, cattle, and rabbits, or reverted to growing truck crops. Large tracts of land were also converted into home sites (Fahey 1965 and 1993).

Troubles with the ditches

Problems would inevitably arise with the rampant development of the Spokane Valley-Rathdrum Prairie area's irrigation systems. Issues included appropriations, variable water deliveries, water

loss through unlined ditches and shortages in dry seasons, and structural problems in the canals themselves. Lake resorts and shoreline owners began suing to maintain water levels in the lakes. Lake levels were already variable from season to season, but drawdowns left docks suspended over the mud bottoms (Fahey 1965 and 1993).

The largest issue by far was structural. Water sank from the unlined canals into the highly permeable valley floor. In the rush to beat out competitors and to save money, some developers lined canals with concrete mixed with native unwashed aggregate, which did not last to the payout period. Wood stave aqueducts (Figure 3) rotted and failed, and the need for repairs and improvements was ongoing on the main canals and laterals. Costs for irrigation increased, and property holders found their livelihoods endangered by collapsing canals and uncertain water supply. As a result, residents began to organize themselves to take control of the irrigation system. Others soon followed suit. Otis Orchards became Spokane County's first irrigation district when Spokane Canal Company became insolvent in 1915 (Fahey 1965 and 1993).

Figure 3. Wood stave irrigation pipes North Idaho Museum photo; Source: Idaho Department of Environmental Quality (n.d.)

Districts continued to experience water shortages, even with water rotation schemes and the gradual conversion to pumping plants. In the early 1920s Hayden Lake's water level fell below the elevation of the inlet to the canal that served the pumping plant. The irrigation district needed to pump water from the lake into the canal in order to get it to the main pumping plant (Bell 1998). Avondale, which also pumped from Hayden Lake, had aging pipelines that leaked and the joints were bursting. Their obsolete pump was worn out and inadequate for the needs. Districts sold bonds to pay for more water rights and for construction of better systems (Bell 1996). Spokane Valley Farms Company lined portions of the main canal with concrete and replaced many of the wooden aqueducts (Simonds 1998). Water delivery issues plagued the growing system, as water rights were not coordinated with irrigation needs. In 1923 Spokane Valley Land and Water Company, under the guidance of R.K.

Figure 4. Concrete lined irrigation canal section of Corbin's Ditch. Nancy F. Rank, photo. Source: NPS 2003

Tiffany, renegotiated the water delivery contract with the power company to solve the seasonal water shortage problems (Fahey 1965, National Park Service 2003). Tiffany also upgraded and reconstructed parts of the main canal in Idaho, completing the project in 1924. The irrigation system that was fed from Corbin's Ditch was operational at least into the mid 1930s (National Park Service 2003).

Water shortages and infrastructure problems continued despite best efforts by irrigation districts to balance needs and contracts, especially with sub-normal rainfall in the late twenties (Bashore 1932). It is unclear how early the United States Bureau of Reclamation (USBR) first took interest in the area, as only projects that are recommended for approval are published in its book of Feasibilities and Authorizations. Several major project options were considered by USBR in the Rathdrum Prairie and Spokane Valley, mostly to assist irrigation districts in rehabilitating their systems. The next section discusses USBR's involvement in stabilizing the area's water supplies.

Solving ongoing issues; the United States Bureau of Reclamation

A plan in 1932 to develop an additional water supply for Rathdrum Prairie did not win approval, but it is worth discussing in context of current day shortages in the region. In subsequent years a completely different project for rehabilitating irrigation for Rathdrum Prairie was authorized and completed, as well as projects for Dalton Gardens, Avondale, and the Spokane Valley. Each of these districts received individual Congressional authorizations and funding, and all were completed on various timelines, with starts, stops, and interruptions, as well as occasional emergency measures. USBR's work is well documented and easily accessed. A review of projects is given below, after an introduction to USBR's legislative authorizations and mandates.

Reclamation Act and legislation affecting USBR projects

President Roosevelt signed into law the Reclamation Act of June 17, 1902 (32 Stat. 388). The Act provided that moneys received from the sale and disposal of public western lands beginning with the fiscal year ending June 30, 1901 be set aside and appropriated as the special "reclamation fund". The funds were to be used in the examination and survey for the construction and maintenance of irrigation works for the reclamation of arid and semi-arid lands. Public lands reclaimed by the United States Reclamation Service – eventually renamed to the USBR - were subject to homestead entry. There was no charge for the land itself, but the settler had to pay for the government's costs of reclaiming the land (French 1914). While there were no USBR projects in the Idaho Panhandle under the original Act, a brief overview of subsequent Congressional authorizations is valuable to understand how many Rathdrum Prairie irrigation systems eventually became USBR projects.

Primary requirements of the original Reclamation Act were (1) feasibility, and (2) a return to the United States by water users, not exceeding 10 annual installments. The Secretary of the Interior (Secretary) had discretion on undertaking a project decided by practicability and advisability based on the size of farms and ability to return the cost of construction. In 1910 Congress modified the feasibility procedure to require that the President approve the authorization on the recommendation of the Secretary. The Warren Act of 1911 (36 Stat. 925) authorized the Secretary to dispose of water in excess of requirements of lands to be irrigated under any project to existing irrigation enterprises (USBR 1957).

It soon became evident that ten years was a too short period for repayment. In 1914 Congress extended the returns to 16 installments paid over 20 years (38 Stat. 686). Until 1922, the government looked for its returns on reclamation projects from individual water users. Recovering annual charges was difficult, so Congress authorized the Secretary to contract with irrigation districts in place of the individual water user; however, the payment horizon remained 20 years (42 Stat. 541). In recognition that the relatively short return requirement severely limited projects that could be undertaken, Congress further modified the feasibility requirements with the Fact Finders Act of 1924 (43 Stat. 672). As part of the Act, the Secretary was required to include information on water supply, engineering features, cost of construction, land prices, probable cost of development, and find if the cost could be returned to the United States. In a novel shift, the Act provided that the charges should be paid in annual installments based on the productive power of the land. This crop repayment formula was repealed only two years later in the Omnibus Adjustment Act of 1926 (44 Sta. 636), preventing execution of any further contracts of this type. Instead it created a rigid 40-year limit on repayment (USBR 1957).

It was not until after the Great Depression that feasibility requirements were modified again. With the Act of August 4, 1939 (53 Stat. 1187) Congress again allowed variation in construction charges in accordance with crop values, with a limitation of 40 years. Additionally, it returned the power to approve a finding of feasibility and authorization of project construction to the Secretary, and allowed him to renegotiate repayment contracts on already existing projects to more than 40 years. Another important change was that the Secretary could "enter into contracts to furnish water for municipal water supply or miscellaneous purposes" (at § 9 (c)) (USBR 1957). Since many of the Rathdrum Prairie irrigation works by now served a mix of agricultural and municipal water supply, this opened possibilities for rehabilitation of their systems.

Of the multiple further Congressional acts regarding Reclamation in the next 17 years, a few had particular significance to the Rathdrum Prairie irrigators. The Rehabilitation and Betterment Act of October 7, 1949 (63 Stat. 724) provided funds "for maintenance, including replacements, which cannot be financed currently, as otherwise contemplated by the Federal reclamation laws in the case of operation and maintenance costs". In the Act of July 4, 1955 (69 Stat. 244), Congress further approved financial assistance in the construction of irrigation distribution systems, which could be built by irrigation districts or other public agencies as determined by the Secretary. The act provided for a loan program that included water users organizations (USBR 1957).

Finally, the Small Reclamation Projects Act of 1956 (70 Stat. 1044) encouraged State and local participation in the development of Federal reclamation projects. The act explicitly included rehabilitation and betterment programs for existing irrigation projects. It provided funding for projects whose estimated costs were more than $5 million but less than $10 million. The organization had to show that it already held or could acquire all the lands and interests necessary, and could finance a portion of the project, not in excess of 25 percent of the costs (USBR 1957). This act allowed some of the smaller Rathdrum Prairie irrigation districts to avail themselves of USBR assistance.

USBR's initial investigation for irrigating the Rathdrum Prairie

The first recorded Rathdrum Prairie Project investigation, authorized March 13, 1931, was an attempt to find an alternate water source for the area. At the time about 9,300 acres of land out of an estimated 40,000 irrigable acres in the Rathdrum Prairie were receiving water. There were five major irrigation districts, of which four received their water supply by pumping water from Hayden Lake, and one by gravity from Twin (Fish) Lakes. Subnormal rainfall in preceding years had severely depleted inflow into the lakes, which increased pumping costs. The level of Hayden Lake was undesirably low, and Twin Lakes' outflow had nearly ceased (Bashore 1932).

On request of Idaho Congressman Burton L. French and representatives of irrigated lands, the Commissioner directed USBR to investigate several alternative plans. Engineer H.W. Bashore's 1932 report to USBR addresses two principle alternatives: (1) divert water from Priest Lake, 70 miles to the north, or (2) pump water from Lake Pend Oreille. Consideration was also given to two plans that would divert surplus Spokane River water to irrigate 13,000 acres, using Hayden Lake to aid in storage. Bashore's conclusions, however, were that none of the options resulted in annual costs within indicated allowable limits. He cited both economic uncertainty and uncertainties in the power market as further reasons to scrap the plans (Bashore 1932).

The Priest Lake plan was for complete development of the Rathdrum Prairie with gravity water. The required delivery of 25 percent in the maximum demand months (July and August) would necessitate a canal capacity of 650 cfs. With canal enlargements for distances of 6 and 29 miles, this plan would also present possibilities of power development with waters not needed for irrigation. Priest Lake's historic outflow varied from 231,000 acre-feet in 1930, to 1,277,000 acre-feet in 1913. Bashore wrote that low water years would be insufficient to meet irrigation demands, but a "comparatively inexpensive dam" (p. 9) could be constructed 2 miles below the outlet to provide more effective regulation of the lake's water surface. He estimated annual delivery of approximately 150,000 acre-feet of new water. The injection of this new water source was predicted to raise the water levels at Hayden Lake, but drainage was not anticipated to be a problem because of the gravelly nature of the subsoil (Bashore 1932).

The alternative plan in Bashore's 1932 project report was pumping water from Lake Pend Oreille, with power developed at Cabinet Gorge. Water would be lifted an average of 320 feet up through 1,800 feet of steel discharge pipe. It would then flow through a 7½-mile concrete-lined canal to the proposed summit cut at Athol. The irrigable area and irrigation system below Athol Summit was identical to the Priest Lake plan, as was the estimated delivery of 150,000 acre-feet of water per year (Bashore 1932).

Authorized projects

USBR's rehabilitation of the irrigation systems throughout the Rathdrum Prairie greatly aided local water districts. Without its involvement, the area could arguably have no significant agricultural industry left (Bell 1996). Simonds (1998) lauds USBR's skill, expertise, and adaptability in recognizing that the best solution to the problems was not construction of a new dam or canal system, but targeted rehabilitation of the existing one. The various projects' authorization and construction histories are well documented in various USBR publications, which contain maps and schematics of the district boundaries. IDEQ (n.d.) provided a map of irrigation districts in Kootenai County (Figure 5).

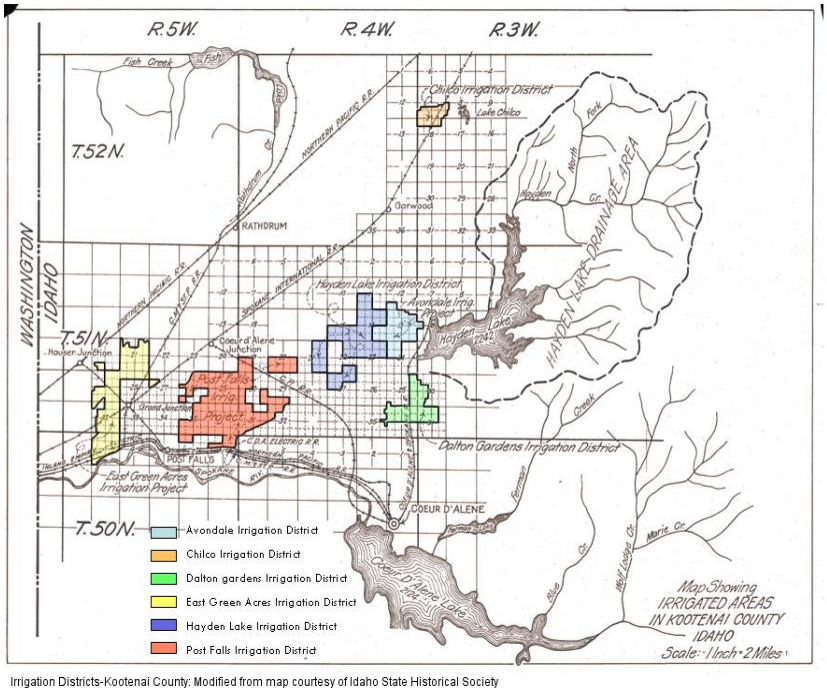


Figure 5. Map of irrigation districts in the Rathdrum Prairie area of Kootenai County, ID. Key, from top: lt. blue Avondale, orange = Chilco, green = Dalton Gardens, yellow = East Green Acres, drk. blue = Hayden Lake, red = Post Falls. Source: IDEQ (n.d.), modified from map courtesy of Idaho State Historical Society.

USBR authorized multiple projects in the Spokane Valley-Rathdrum Prairie area, beginning with a completely different Rathdrum Prairie Project (RP) Project. The RP project contained the Post Falls Unit, Hayden Lake Unit, and East Greenacres Unit, with a total of 10,244 irrigated acres. Rehabilitation of the wood-stave pipelines and pumping system in the Post Falls Unit was first authorized under the terms of the Water Conservation and Utilization Act of August 11, 1939. Construction was approved in 1944 and completed in April 1946, with a combination of wood-stave pipe siphon and concrete lined canal. Twenty-five years later, the wooden discharge line again needed critical repairs. Its replacement was authorized in 1973. Hayden Lake Unit's pipes and pumping plant were rehabilitated in several phases between 1948-1958, with new pipelines, wells and elevated steel storage tanks (Bell 1998, USBR Pacific Northwest (PNW) Region 1983c). Hayden Lake Irrigation District (2010) writes that it constructed a well in 1978, but used lake water source throughout the eighties. It stopped using lake water after two additional wells were drilled into the aquifer in 1989; there is now a fourth well in the District. Prior to 1977, East Greenacre's water supply came from Twin Lakes. Conflicts developed when the District maximized the lake's drawdown in dry years. An Idaho District Court ruling in 1969 limited drawdown to four feet, which was upheld by the Idaho Supreme Court in 1970. The East Greenacres Unit was redesigned and reconstructed beginning in 1972 and finally ending in December 1976. Now deep well pumping plants draw from the aquifer, the water is stored in reservoir tanks and conveyed through new pipelines, allowing Twin Lakes to be used for recreation and fish and wildlife enhancement (East Greenacres Irrigation District n.d.). All three units have experienced ongoing and expensive emergency and maintenance repairs, but USBR declined further action both in 1976 and again in the early eighties (Bell 1998, USBR Pacific Northwest (PNW) Region 1983c). The excerpt of USBR's (PNWR 1983) RP project map (Figure 6) shows well sites in the East Greenacres Unit and trunk lines in the system's Hayden Lake and Post Falls Units.

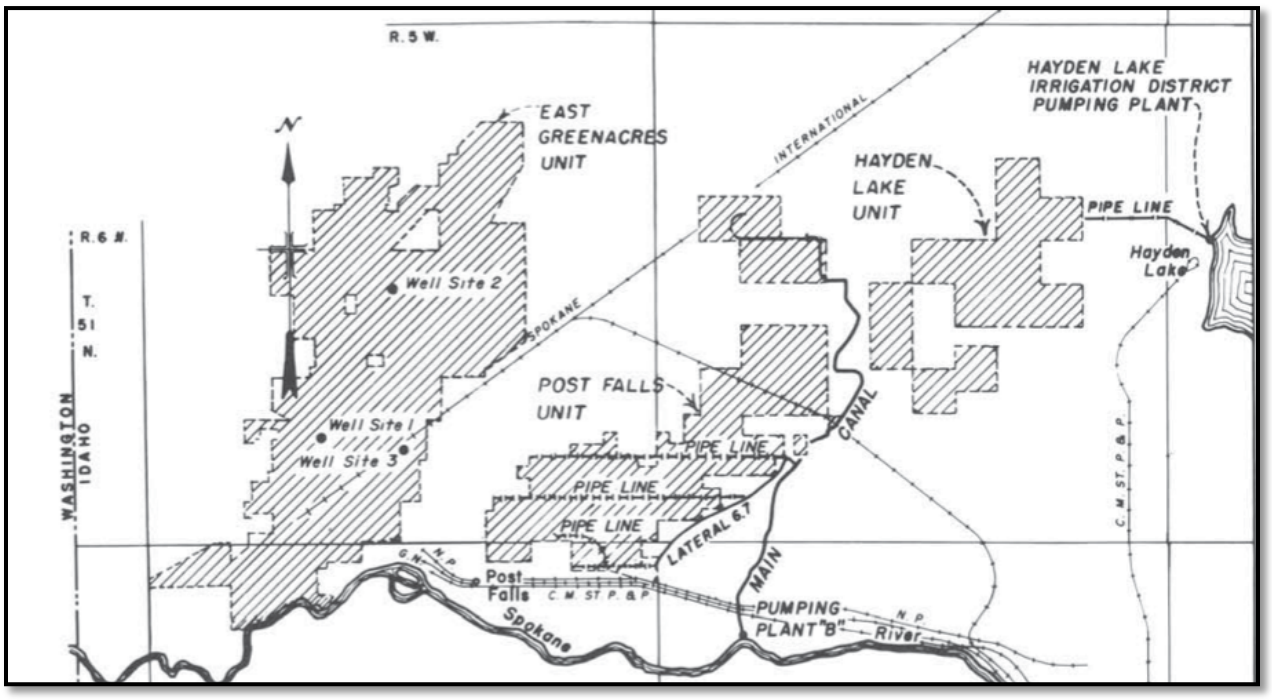


Figure 6. Map of Rathdrum Prairie irrigation project, with East Greenacres, Hayden Lake, and Post Falls units. Shaded area is irrigable acres. Source: USBR PNWR 1983c.

Dalton Gardens Irrigation Districts' 981 irrigated acres were initially considered for an Eastern Division of the RP Project, along with Avondale Project and Hayden Lake Project, because they all sourced their water from Hayden Lake. In 1953 all three districts submitted their own separate reconstruction plans, and USBR agreed, believing it would be easier to appropriate Congressional funding with the smaller projects. Hayden Lake was eventually lumped in with the RP Project. The rehabilitation of Dalton Gardens' irrigation works was authorized in 1953 and completed in 1955. Except for the pumphouse structure that was remodeled into a new pumping plant, Dalton Gardens received a new equalizing reservoir, main line, and distribution system (Figure 7). The old system was abandoned when the new facilities were placed into operation. In 1959 USBR uncovered and examined a 50-foot section of pipe in a routine biennial exam of the area's projects. The pipe was severely corroded and perforated in several places. Emergency pipe rehabilitation was authorized in 1961 and finished in 1964 at Dalton Gardens Project, Hayden Lake Irrigation District of the RP Project, and Avondale Project, as the same contractor had installed the same type of distribution pipe at all three locations (Bell 1996 and 1998, USBR PNWR 1983b).

Like the other districts, Avondale Irrigation District (Figure 7) experienced frequent system failures, with leaky pipelines and bursting joints on a network that served its 860 irrigated acres. Additionally, the worn out pump was not only inadequate for the needs, but also so obsolete that the district could no longer find replacement parts. Unlike the other projects, the Avondale Project received emergency construction and rehabilitation funding through direct Congressional action in 1953. Further emergency rehabilitation was authorized twice more, in 1954 and 1961.

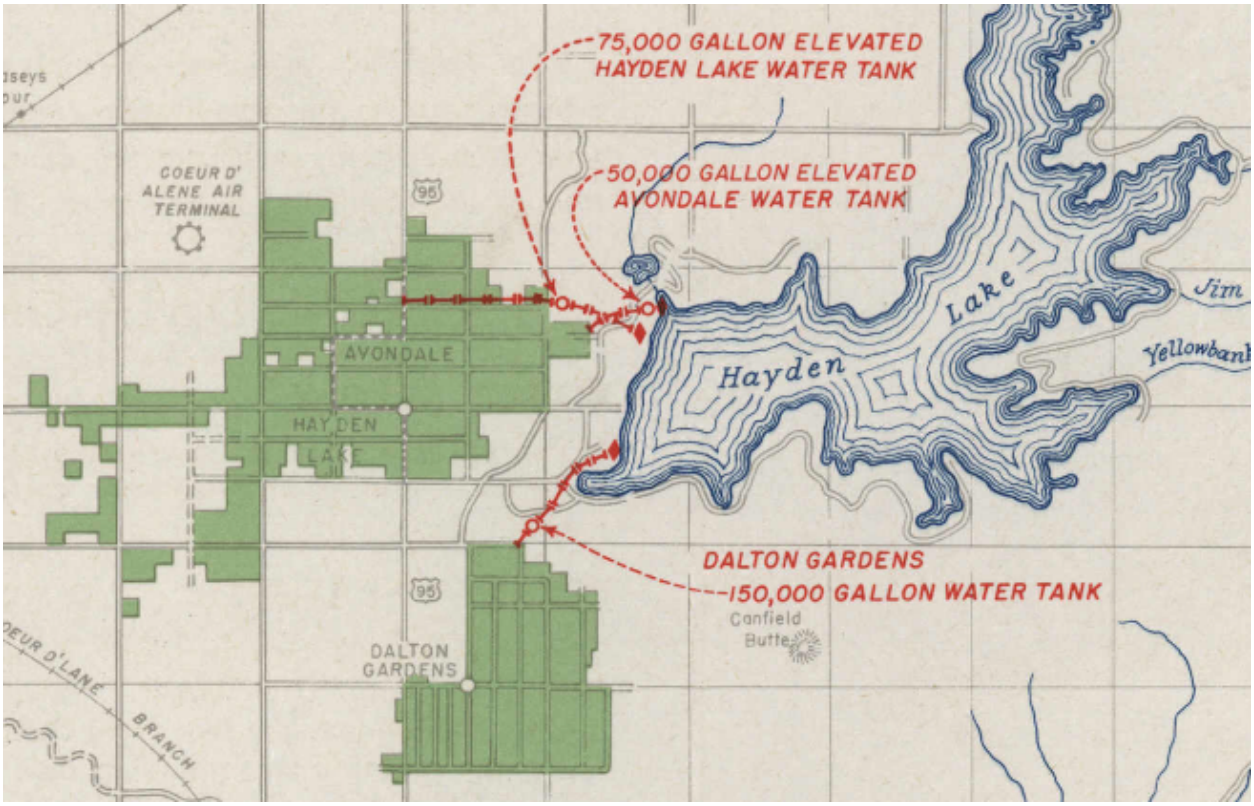


Figure 7. Dalton Gardens, Hayden Lake, and Avondale Units project works area, showing pumping units (red diamonds), water tanks (red circles), and pipelines (hatched red lines). Source: USBR Region 1 (1957) aggregate project maps.

The 1961 measure, as with Dalton Gardens, was to replace corroded bare steel pipeline with corrosion-resistant pipe. Ultimately, Avondale Project's rehabilitation consisted of a new pumping plant with new pumping equipment, steel intake pipeline, and cement-mortar lining and subsequent sterilization of the steel discharge line to an elevated steel reservoir. About 10 miles of supply lines, laterals, and turnouts were replaced with buried steel pipelines. In the late sixties and again in 1971 to 1972, the district made various modifications to the pumping plant units, to address failures caused mostly by low water levels in Hayden Lake. Finally, in the late 1970s, an Idaho court decree stated that the level of Hayden Lake was not to be allowed to fall below 2,230 feet above sea level. In 1977 Avondale Irrigation District was able to fund on its own the construction of three deep wells to tap the aquifer instead of the lake (Bell 1996, USBR PNW 1983a). A fourth deep well was acquired in the early nineties as part of an annexation, and the district added another storage reservoir in the spring of 1990 (USBR n.d.).

The Spokane Valley Project covers only 100 acres in Idaho, with a balance of approximately 7,100 acres of land in Washington (Figure 8). The project lands are divided into six areas, which were previously served with river water from Post Falls via the Spokane Canal (Corbin's Ditch): Carder, Greenacres, and Corbin are on the south side of the river, while Otis Orchards, West Farms and East Farms are to the north. These areas are formed, by agreement, from various earlier irrigation projects of irrigated districts, under the Spokane Valley Farms Company in Idaho, and the Spokane Valley Joint Control Board in Washington. Repairs to the ailing

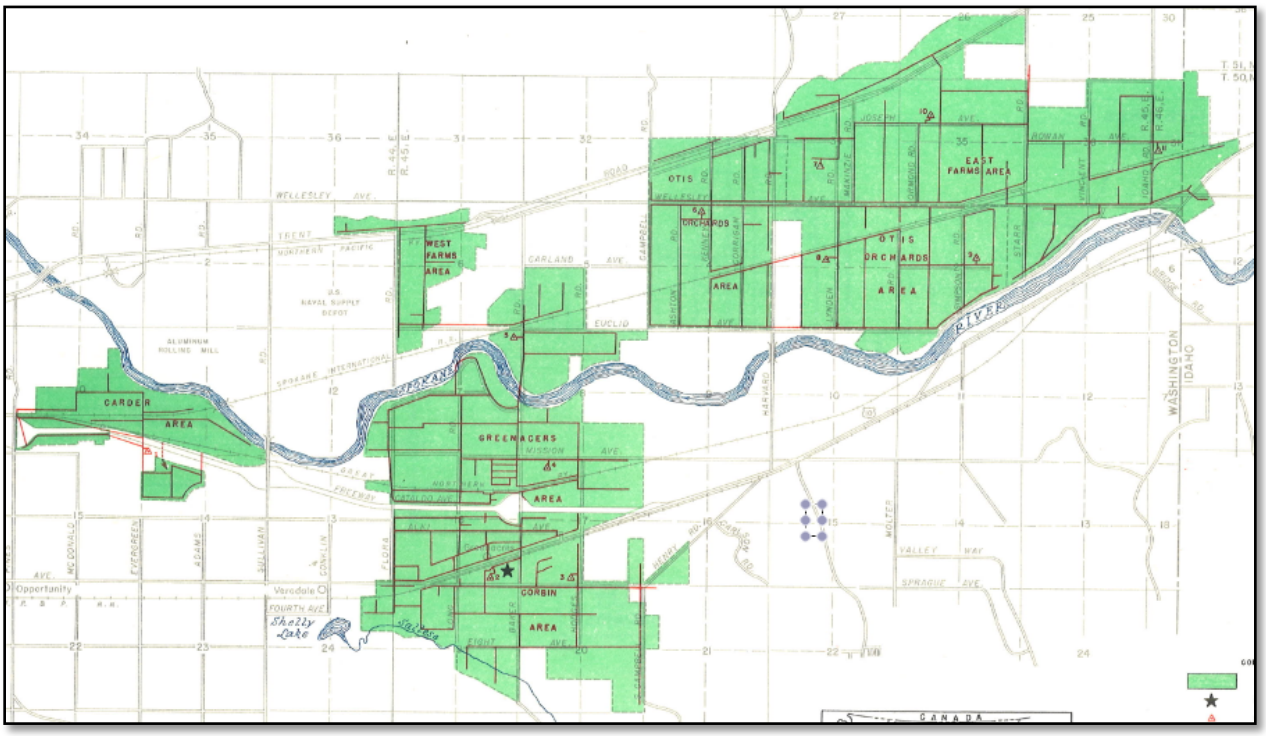


Figure 8. USBR Spokane Valley Project areas. The Spokane River flows from east to west, with Greenacres, Corbin and Garder areas to its south; East Farms, West Farms and Otis Orchards, areas are to its north. The Washington-Idaho border cuts through the extreme eastern (right) edge of East Farms. The star marks project headquarters, red triangles are completed well sites with pumps and elevated tanks; red lines denote sprinkler-main pipelines. Source: USBR Region 1 (1967).

irrigation system were temporary and costly; even the 1948 rehabilitation would only add a few years. In 1952 the districts requested a USBR study and project consideration. An initial report concluded that the existing system was best replaced with a system of deep wells, pumping plants, and distribution pipelines. All seven irrigation districts within the project area supported the plan, so USBR initiated a feasibility study. Congress authorized construction of a project to serve just over 10,000 acres, but the repayment contract negotiations caused dissent in the group. Two districts requested that their lands be removed; the remaining districts asked USBR to reevaluate the project to serve just over 7,200 acres. A condition of Congressional reauthorization was that there must be a single contract entity. The Consolidated Irrigation District was formed, and Congress approved the revised project in 1962. Construction on the Spokane Valley Project began in 1963 and was completed in 1967, to benefit almost 7,500 acres of irrigable land. The rehabilitated system supplied groundwater from 34 wells, using eleven elevated steel tank regulating reservoirs, and 104 miles of asbestos-cement pressure pipelines. The Consolidated Irrigation District No. 19 has operated and maintained the project since January 1, 1968. To meet the growth and increased demand for domestic water, it has constructed two additional 2 million gallon storage tanks, and a booster pump station with additional regulating reservoirs. When old asbestos-concrete pipes fail they are replaced with modern materials. The installation of meters for all users between 1986 and 1992 has helped reduce water usage in the district (Simonds 1998, USBR PNWR 1983d)

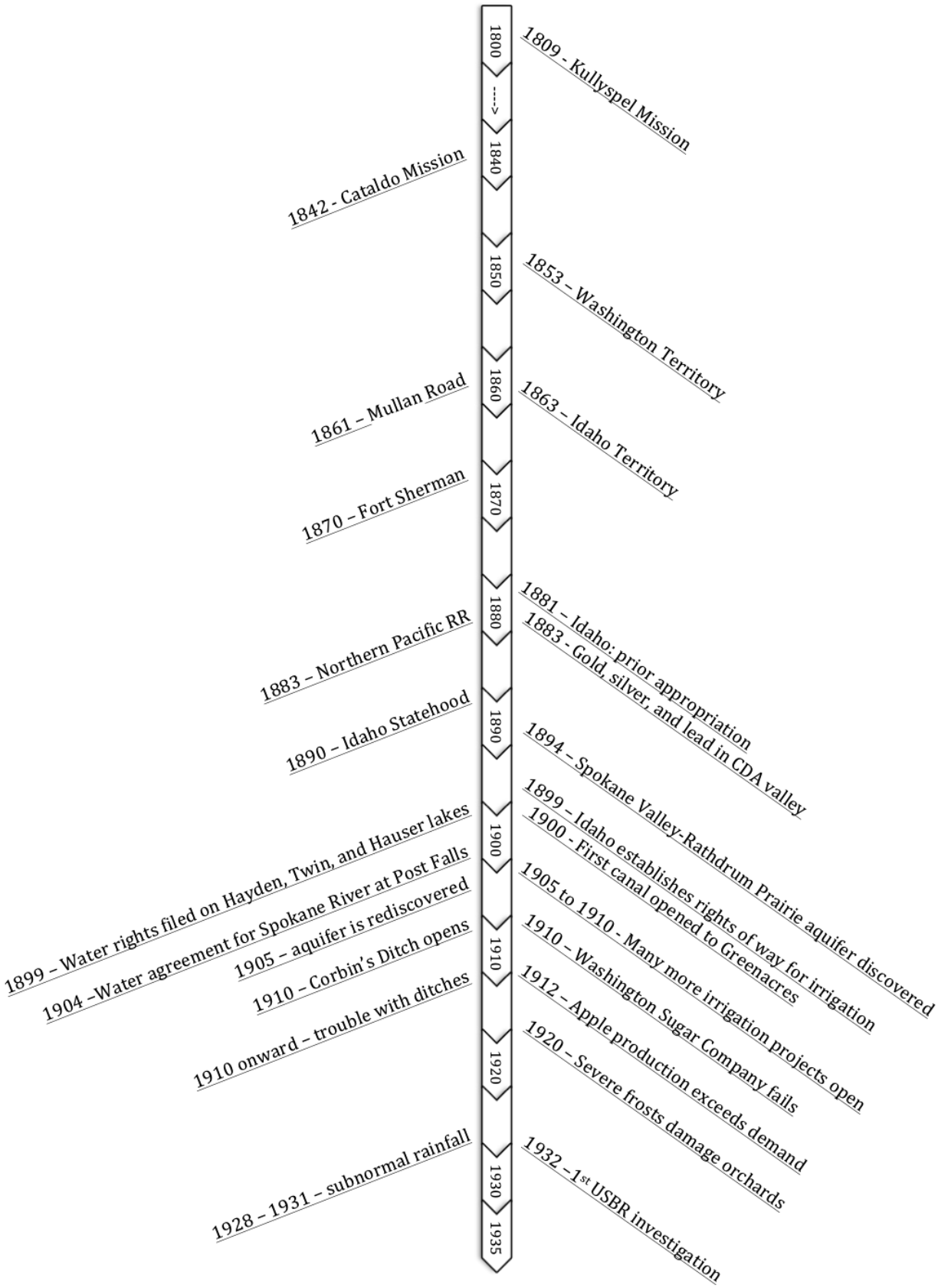
In essence, the USBR assisted in rehabilitating the systems for all of the irrigation districts in the Spokane Valley Project by rebuilding pumping plants, constructing new pumping plants, and drilling new deep wells. Water was pumped to "equalizing reservoirs," elevated steel tanks that were sited in various places. Infrastructure of canals and laterals were also completely rebuilt, with asbestos cement pipelines ranging in diameter from 6 to 24 inches, sectionalized turnout valves, steel pipes, and service connection accessories (USBR PNWR 1983 all). There were emergency pipe rehabilitations in Dalton Gardens, Avondale, and Rathdrum Prairie projects in the early sixties (USBR PNWR 1983a-c). The Spokane Valley Project ended its water withdrawals from the Spokane River at Post Falls, switching completely to a system of deep wells in the Spokane Valley, and serving the irrigated land through pressure pipeline systems (USBR PNWR 1983d).

Conclusion

The Rathdrum Prairie and Spokane Valley have become increasingly urbanized. Some farms persist in the area however, along with attendant processing plants and feed mills. The irrigation districts still deliver water for the mostly small, often part-time operated farms. Farm tracts within the Avondale Project, for example, range mostly from one to ten acres of land (Bell 1996). Besides family food sources, some farm units are large enough to produce marketable crops. These include hay crops, alfalfa, wheat, other grains, beans, potatoes, and berries. Some larger farm units produce specialty cash crops such as small fruits and vegetables. Land is also used for dairy farming and pasture for other livestock (USBR PNWR 1983 all, Bell 1996 and 1998, Simonds 1998).

The development of irrigation systems is at the root of farming and community in the Spokane Valley and Rathdrum Prairie region. Any investigation of these communities' infrastructures must include an awareness of the history of its water delivery systems. Water appropriations and land sales originally shaped irrigation districts. The apple industry is only a vague memory reflected in place names, and sugar beets are virtually forgotten. Remains of Corbin's ditch were placed in historical preservation at Post Falls in 2003, and old sections of the canals are visible around the region. However, the irrigation systems are still there, serving other types of crops on small farms, along with growing domestic demands. How and where the original irrigation systems were placed over one hundred years ago shape community structure to this day.

APPENDIX I
Timeline of irrigation history, 1800-1935



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