GEOLOGICAL SURVEY CIRCULAR 180

EVALUATION OF STREAMFLOW RECORDS IN YAKIMA RIVER BASIN WASHINGTON

By Hallard B. Kinnison

UNITED STATES DEPARTMENT OF THE INTERIOR
Oscar L. Chapman, Secretary

GEOLOGICAL SURVEY
W. E. Wrather, Director

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EVALUATION OF STREAMFLOW RECORDS IN YAKIMA RIVER BASIN WASHINGTON

ABSTRACT

This report presents data which are, in general, supplementary to the surface-water investigations made in the past by the U. S. Geological Survey. Those have been essentially investigations of the operation of the many gaging stations on the Yakima River and tributaries.

The data presented were obtained from a detailed field investigation of the various factors resulting from the man-made structures that influence the quantity or regimen of flow at the gaging station. These factors include diversions from stream, bypass channels carrying water around the gaging stations, return flow from irrigation or other projects, storage and release of flood waters, and other similar factors. Where feasible, the location, size, effect upon streamflow, periods of use, method of operation, and similar information are given. The information is divided into sections corresponding to areas determined by the location of gaging stations. An index of streamflow records is included.

A section dealing with the adequacy of available water-resources data, including location and period of record, also is included. This information is given in general terms only, and is portrayed mainly by maps and graphs.

INTRODUCTION

Purpose and Scope

Studies of the water supply for a project utilizing surface water are based primarily on streamflow data obtained by operating gaging stations. Project design requires an estimate of the probable future water supply that may reasonably be expected during the life of the project. This can be achieved only through a study of records of past streamflow or other hydrologic events. Records covering a period of many years are necessary to evaluate adequately the effect of vagaries of the weather and to determine the safe yield during drought periods. If during the period of operation of a gaging station, man-made structures have altered the normal regimen of the stream or utilized consumptively a portion of the water supply, the effects of these changes must be considered in analyzing the data to determine the possible future supply.

River discharge determined by gaging stations represents, in each instance, the actual discharge at that particular point. In a basin where natural runoff prevails, these records depict the surface-water yield of the basin at that point. Such records are of great value to the hydrologist or designing engineer, as they are a direct measure of the yield of the drainage basin. When the use of upstream water diverts and depletes the water supply, discharge records no longer serve as a measure of the yield of the basin unless appropriate adjustments are made. If the point of proposed diversion for future use is remote from the gaging station, it is even more important to have complete knowledge of these factors.

The primary purpose of this report is to evaluate each streamflow record in terms of the factors that influence or alter the flow of the Yakima River and tributaries at the gaging station locations. Such factors include diversions, bypass channels carrying water around the gaging stations, consumptive use, regulation by storage, and other factors that alter the natural regimen of the stream or the discharge record obtained at the gaging station.

The scope of this report is confined to indexing facts and material needed for the quantitative evaluation of the surface-water resources. Emphasis is on the factors influencing the runoff regimen and the gaging-station records without attempting a quantitative determination of their effect. For example, diversions are identified by name, location, approximate size, time of occurrence, purpose, and sources of information concerning their use. These data are basic to quantitative water-supply studies and to the evaluation of the resources of the basin. One of the more important items of this information is the reference to the sources of data.

In addition to presenting information for the evaluation of factors influencing basin yield, some attention is given to evaluating the adequacy of the streamflow records, themselves, in time and distribution. This includes: bar graphs picturing the length and distribution of discharge records, maps showing areal distribution of stations and the relative length of records, tables showing stream depletion data, and tables of reservoir storage potentials.

Acknowledgments

Data presented in this report were collected from many sources, including publications and files of the U. S. Geological Survey and U. S. Bureau of Reclamation, files of the U. S. Bureau of Indian Affairs, water companies, watermasters, and many individuals. The assistance of Earl L. Smith of the U. S. Bureau of Reclamation, Yakima, in furnishing data and reviewing parts of this report is greatly appre-

ciated. Valuable information was also furnished by the following: F. E. Moxley, U. S. Bureau of Indian Affairs, Wapato; C. J. Bartholet, Supervisor of Hydraulics, Washington State Department of Conservation and Development; J. S. Moore and George Meek, watermasters, and Wallace Owen, ditchrider, of the same organization.

This report was prepared under the immediate supervision of E. G. Bailey, Hydraulic Engineer, U. S. Geological Survey, Tacoma, Wash. F. M. Veatch, District Engineer, Surface Water Branch, Tacoma, Wash., and C. C. McDonald, Staff Engineer, Technical Coordination Branch, Tacoma, Wash., provided valuable technical assistance.

PHYSICAL FEATURES OF THE BASIN

The Yakima River and its tributaries drain an area roughly triangular in form, situated slightly southeast of the geographic center of the State of Washington and comprising 6,000 sq mi. The area is somewhat larger than the State of Connecticut, represents 9 percent of the total land area of Washington, and is more than twice as large as any other drainage basin wholly within the State.

The western section of the basin is bounded by Wenatchee Basin on the north and Klickitat Basin on the south. The remainder of the adjacent drainage on the east side of the divide is directly tributary to the Columbia River through small intermittent channels.

The Yakima River heads in a section of the Cascade Range in the vicinity of Snoqualmie Pass, where the water collects from numerous small tributaries into Keechelus Lake, which lies at an elevation of 2,454 ft. The river follows a general southeasterly course from Keechelus Lake for approximately 180 river miles to its confluence with the Columbia River near the southern boundary of the State, 12 miles above the mouth of the Snake River.

Altitudes in the Yakima Basin range from 8,200 ft at Goat Rocks to 320 ft at the mouth of the river. At the northern and southern limits of the Cascade divide, where the general elevation of the ridges is about 8,000 ft, glaciers are present along the slopes; however in the central section, where altitudes rarely exceed 5,500 ft, glacial action has ceased. Meltwater from a large glacier covering the slopes of Goat Rocks and adjacent peaks is effective in maintaining runoff in the Naches Basin during the late irrigation season.

Winding down the rugged slopes of the Cascade Range and through the adjoining foothills, the Yakima River cuts across a number of broad, synclinal valleys and anticlinal ridges. These valleys range from 1 to 12 miles in width and contain most of the cultivated area in the basin.

The higher parts of the drainage area are heavily forested below the timber line with yellow pine, fir, hemlock, and cedar. The timber extending along the slopes of the divide is displaced by scrubby pine on the rolling lowlands and merges into the characteristic sagebrush of the Wapato-Sunnyside Valley. Owing to the small amount of precipitation, the lower reaches of the basin lying below the mountainous section produce little natural vegetation except sagebrush.

The soils of the lower valleys are mainly light sandy loams, fertile, and well-adapted to most temperate-climate crops when irrigation water is available. Fruit growing is an especially productive and profitable enterprise. The central and lower portions of the basin are underlain with coarse gravel, which permits a high rate of subsurface flow, making it difficult to transport irrigation water effectively in unlined ditches and canals.

The climate of the Yakima River basin is varied. From the high mountain altitudes to the lower valleys there is a notable range in temperatures with extremes of -32° and 114° noted. Precipitation also varies greatly over the basin; at Snoqualmie Pass annual precipitation may be as much as 100 in., while in the arid lowlands as little as 6.5 in. (at Wapato) has been recorded. The large variation is caused by orographic influences and the prevailing westerly winds. Moisture-laden air from the Pacific, cooled by forced ascent over the Cascade Mountains, drops most of its moisture on the western slopes and near the summit on the eastern slopes. During descent on the eastern side the air is warmed by increasing pressure at lower levels and its capacity for moisture greatly increased, thus favoring clear skies and scant precipitation. The whole basin is in the rain shadow of the Cascades and precipitation is caused by cyclonic or convectional storms. Summers are hot and dry and winters relatively cold and wet, although the nearby Pacific Coast moderates winter temperatures somewhat.

There is no main storm path, although the greatest storms come from the northwest. Other storms come from the northeast, southwest, and the west and often cause complex precipitation patterns in various parts of the basin, owing to the "shadows" of Mt. Adams, Mt. Rainier, and Mt. Baker.

Streams in the Yakima Basin, especially those in the northwest section, combine certain characteristics of coastal streams of the Pacific Northwest with those of streams farther inland. Following the pattern of inland rivers, the greatest flood incidence is in May and June when the snow is melting rapidly at the higher altitudes; but, like the rivers on the western slopes of the Cascades, floods in the fall and winter months are common. These are the rain type and characteristically have high peak flows of short duration; however the danger from both types of flood has been materially lessened in the last 40 yr by the storage reservoirs.

The average annual runoff in the basin varies greatly between the headwaters and the mouth. From a maximum of 60 in., high in the Cascades, the runoff drops to a minimum of less than 1 in. in the downstream or eastern part of the watershed. Most of the water available for irrigation originates in the upper reaches of the watershed.

UTILIZATION OF WATER IN THE BASIN

Irrigation is by far the largest use of water in the Yakima River basin. The Yakima Project is the largest block of irrigated land in the State except for the Columbia Basin Project now under development. In 1946, a total of 439,000 acres were under irrigation in the basin. Consumptive use by irrigation increased from 5 percent of the average flow at Kiona in 1900 to

about 39 percent in 1945. Irrigation in the basin is shown in the small map, figure 1.

Industrial development in the basin is of minor importance from a standpoint of water use because of the adaptability of the area to agriculture; consequently, the density of population is relatively low and there are only a few cities of modest population. A relatively small amount of water is consumed by these municipalities (table 1). Of growing importance is the use of water in this basin by the fruit and vegetable processing industry, essentially a nonconsumptive use. Demands of this industry are large but of short duration--only a few weeks at the end of each growing season.

Some of the earliest irrigation in the Northwest occurred in the Yakima Basin. Settlement by white men occurred as early as 1852, when a Roman Catholic mission was established on Ahtanum Creek. Although it has been questioned that the mission founders practiced irrigation, it is well established that they farmed successfully. If the missionaries did not use supplemental water for their crops, then, perhaps, the first verifiable irrigation by white men in Yakima Valley was that reported by Mr. A. J. Splawn of North Yakima. Mr. Splawn has stated (Libby, A. C., 1913, report on the hydrographic survey of the Yakima River watershed, unpublished, report in files of U. S. Bur. of Reclamation, Yakima, Wash.) that in the year 1864 he saw a garden upstream from the Catholic mission on Ahtanum Creek which was irrigated by a ditch diverting from that stream.

The strong westward migration after the War Between the States stimulated by completion of the transcontinental railroad, brought many settlers into the Pacific Northwest. The growth in population in the Yakima Valley during the latter part of the last century was steady and vigorous. Concurrent with the land settlement was the use of supplemental water for farming. The introduction of money-making crops gave a strong impetus to the irrigation development, and private enterprise was very active during the period on expanding irrigation facilities and promoting new projects. After the passage of the Federal Reclamation Act of 1902, the U. S. Bureau of Indian Affairs (then the U. S. Indian Service) and the U. S. Bureau of Reclamation (then the U. S. Reclamation Service) initiated their very successful irrigation project, which increased the irrigated area from 67,450 acres in 1900 to 335,000 acres in 1925; at present there are about 440,000 acres of land irrigated in the Yakima River basin. (Simons, W. D., 1951, Irrigation and streamflow depletion in Columbia River basin, unpublished report in files of U. S. Geol. Survey, Tacoma, Wash.) Of this acreage about two-thirds is included in projects operated under the supervision of the two federal agencies mentioned. Simons (Simons, W. D., 1951, Irrigation and streamflow depletion in Columbia River basin, unpublished report in files of U. S. Geol. Survey, Tacoma, Wash.) estimated that the annual consumptive use of surface water in this area is about 880,000 acre-ft.

Because of topography, the Yakima Basin may be divided conveniently into five subbasins, each having a key gaging station between it and the next downstream area. These subbasins can be delineated on plate 1 by referring to table 2 for the identifying numbers of the gaging stations cited in the following paragraphs. Substantially all the irrigated land is contained in three of the areas, the Kittitas Valley, the upper Yakima Valley, and the Lower Yakima Valley.

In the area above the gaging station on Yakima River at Cle Elum, there is very little utilization. At present only a few hundred acres of land are irrigated, and most of the area is still heavily forested. Keechelus, Kachess, and Cle Elum Lakes, with a total capacity of 828,000 acre-ft, store water for irrigation downstream, are operated by the U. S. Bureau of Reclamation. One major diversion, the Kittitas High Line Canal, located above this station, is used for irrigation in the Kittitas Valley near Ellensburg.

The Kittitas Valley lies between the gaging stations on Yakima River at Cle Elum and Yakima River at Umtanum. Irrigation in the valley has increased from 27,800 acres in 1900 to 104,640 in 1946, as shown in summary table (p. 5). The greatest increase came immediately after the construction of the Kittitas High Line Canal in 1930 which now irrigates 52,000 acres. The remainder of the area is served by numerous small ditches, the Cascade and the Ellensburg Water Co. canals, all diverting from the Yakima River. The Ellensburg power canal diverts about 700 cfs in the vicinity of Ellensburg which is returned a short distance below point of diversion. There is no storage in this area.

In the basin above the gaging station on Naches River below Tieton River near Naches, only a few hundred acres of land are irrigated at present. The Tieton, Selah Valley (Naches-Selah), and Wapatox Power Canals divert water from the area for use downstream.. Tieton Reservoir and Bumping Lake with a total capacity of 180,000 acre-ft store water for irrigation of lands in the vicinity of Selah and Naches Heights. The Tieton Canal was built in 1910, and the Tieton Reservoir was completed in 1925.

The "Upper Yakima Valley" lies between the gaging stations on Yakima River at Umtanum and Naches River below Tieton River near Naches and the gaging station on Yakima River near Parker. Irrigated area in this section has increased from 21,500 acres in 1900 to 93,870 acres in 1946, as shown in the summary table. The Selah-Moxee Canal and many ditches divert water for use within this area. The Tieton, Selah Valley, and Wapatox power canals bring water into this subbasin from upstream. The Roza Canal, built in 1940, Union Gap, Sunnyside, and New Reservation Canals divert about 3,800 cfs past the gaging station for use downstream. There is no storage in this area except for 1,050 acre-ft in Wenas Reservoir.

The "Lower Yakima Valley" lies between the gaging stations Yakima River near Parker and Yakima River at Kiona. Approximately 225,900 acres are now under irrigation, an increase of 208,000 acres since 1900, as shown in the summary table. Roza, New Reservation, and Sunnyside Canals bring large quantities of water into this area from upstream. There is no storage in the subbasin.

Between the station on Yakima River at Kiona and the mouth of the Yakima River below Richland, approximately 15,000 acres are irrigated, mainly by the Kiona and Columbia Canals. The

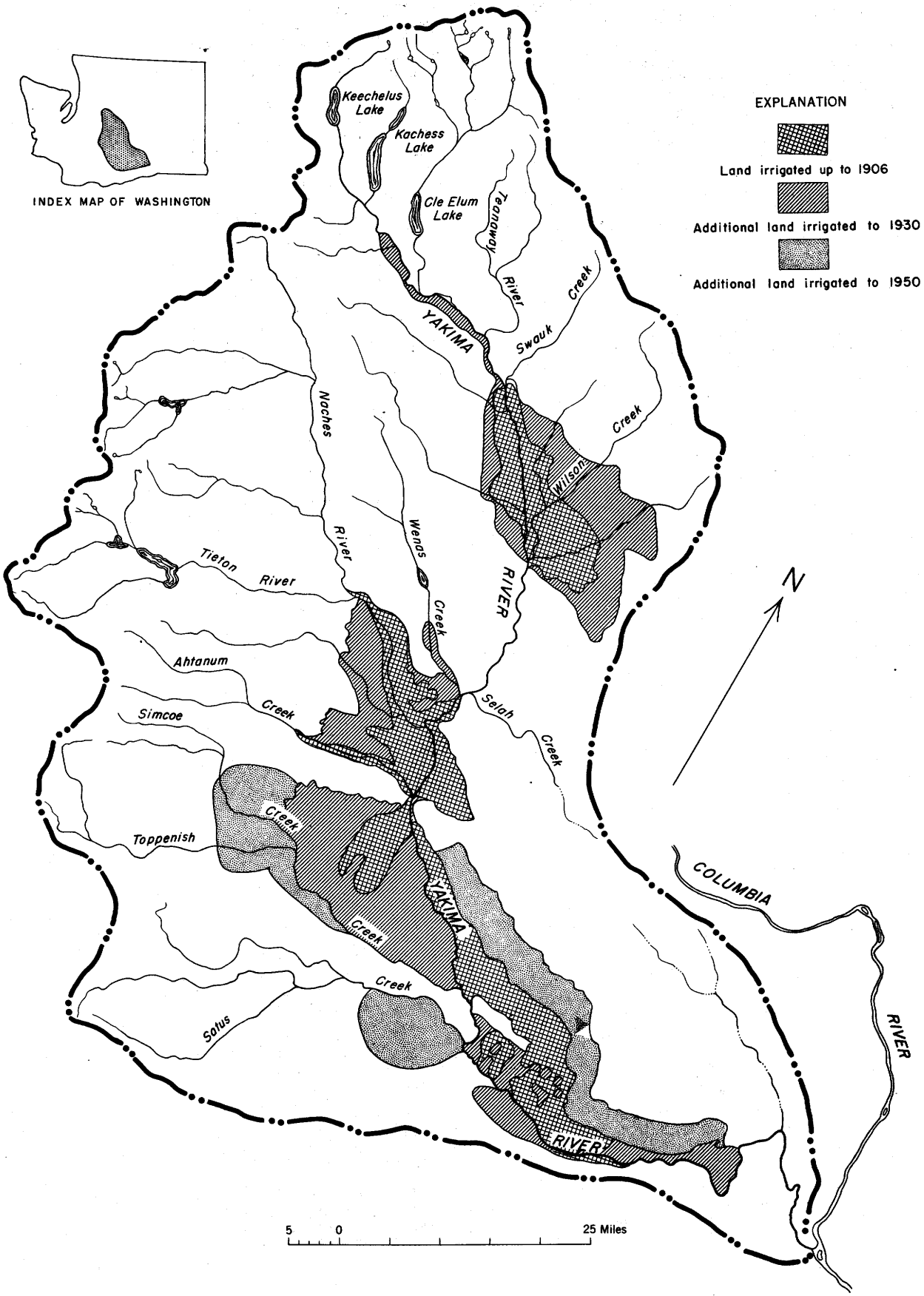

Figure 1.--Map showing development of irrigation in Yakima River basin.

Table 1.--Municipal water supplies and wasteways in the Yakima River basin

City	Source of water supply	Average flow	Average output of sewage treatment plant	Access to Yakima River
Cle Elum	Cle Elum River, ½ mile below Cle Elum River near Roslyn gage.	3 cfs	3 cfs	Ditch at south city limits.
Ellensburg	Nanum Creek since 1908 used only as supplemental source, shallow well on bank of Yakima River in the SE¼SE¼ sec. 12, T. 18 N., R. 17 E. Established 1912.	4-5 cfs 5-10 MGD	5 MGD	Wilson Creek (see Wilson Creek at Thrall).
Grandview	Drilled wells	.2 MGD1/	.2 MGD	Drain no. 35.
Moxee City	Drilled wells	.1 MGD1/	.1 MGD	Moxee drain carrying 15 to 30 cfs.
Prosser	Drilled wells	.172 MGD1/	.1-.2 MGD	Ditch 150 yd below bridge south of town.
Richland	Drilled wells Richland Canal	2.5 MGD2/ 190 cfs	3 MGD	Ditch at south end of city.
Roslyn	Dommeric Creek	1.5 MGD2/	5 cfs	Ditch averaging about 10 cfs just below station, Yakima River at Cle Elum.
Selah	Wells	.1 MGD1/	.75 MGD (mostly seepage).	Long ditch discharging in sec. 1, T. 13 N., R. 18 E.
Sunnyside	Wells	.244 MGD1/	.28-.5 MGD	Drain no. 7 already carrying 5-10 cfs.
Toppenish	Wells	.8 MGD1/	.6-2.4 MGD	Ditch to river.
Wapato	Wells	.08 MGD1/	3-5 cfs	Percolates into ground before reaching river.
Zillah	Wells	.2 MGD1/	.065 MGD	To drain with ½-cfs flow at south end of town.

Note.--Unless otherwise noted all data were obtained from respective city water superintendents or by field inspection.

1/ Inventory of Domestic Water and Health Facilities of Washington, 1945, by U. S. Public Health Service.

2/ Rated plant capacity.

Richland Canal, formerly irrigating 10,500 acres, now serves as the municipal supply of Richland. Most of the average flow of 250 cfs carried by the Columbia Canal is used in the vicinity of Kennewick out of the Yakima Basin.

The following summary table lists the area under irrigation in the Yakima River basin by decades.

[From Simons, W. D., 1951, unpublished report on Irrigation and Streamflow Depletion in Columbia River basin, in files of U. S. Geol. Survey, Tacoma, Wash.]

Year	Kittitas Valley (acres)	Upper Valley (acres)	Lower Valley (acres)	Total (acres)
1900	27,800	21,500	18,150	67,450
1910	49,860	53,900	80,530	197,280
1920	54,320	86,800	164,250	322,490
1930	59,810	88,500	179,770	345,230
1940	110,100	90,180	194,860	412,700
1946	104,640	93,870	225,920	439,300

WATER RESOURCES DATA FOR YAKIMA RIVER BASIN

Streamflow Records

Collection of streamflow data began in the Yakima Basin in 1893 when stream gaging stations were established on the Naches River near its mouth and on the Yakima River at Union Gap. Three years later a station was established on the Yakima River at Kiona, which is still in operation today, although the record has not been continuous. Table 2 lists both active and discontinued gaging stations in the basin and graphically shows their period of record. The locations of these gaging stations are shown on plate 1. Numbers shown on table 2 correspond with numbers on plate 1 for each gaging station. Published papers on surface-water supply in the Yakima River basin, containing records from 1899 to 1950, are listed on the following page.

Surface-water supply in the years mentioned

Year	Water-Supply Paper	Year	Water-Supply Paper	Year	Water-Supply Paper	Year	Water-Supply Paper	Year	Paper Supply Paper
1899 a/	38	1910	292	1921	532	1931	722	1941	932
1900 b/	51	1911	312	1922	552	1932	737	1942	962
1901	66,75	1912	332-A	1923	572	1933	752	1943	982
1902	85	1913	362-A	1924	592	1934	767	1944	1012
1903	100	1914	392	1925	612	1935	792	1945	1042
1904	135	1915	412	1926	632	1936	812	1946	1062
1905	178	1916	442	1927	652	1937	832	1947	1092
1906	214	1917	462	1928	672	1938	862	1948	1122
1907-8	252	1918	482	1929	692	1939	882	1949	1152
1909	272	1919-20	512	1930	707	1940	902	1950	1182

a/ Rating tables and index to Water-Supply Papers 35-39 contained in Water-Supply Paper 39. Monthly discharge for 1899 in 21st Annual Report, part 4.
b/ Rating tables and index to Water-Supply Papers 47-52 contained in Water-Supply Paper 52. Monthly discharge for 1900 in 22d Annual Report, part 4.

Although the Geological Survey has carried on a substantial part of the stream gaging in the Yakima Basin, much of it in cooperation with the State of Washington, two other government agencies have done considerable work in this field. The U. S. Bureau of Reclamation and the U. S. Bureau of Indian Affairs have collected streamflow data in connection with their special requirements. These data are summarized in table 3.

Storage Reservoirs

There are five major and two minor reservoirs in the Yakima River basin. The major reservoirs, Keechelus, Kachees, Cle Elum, Tieton, and Bumping, together have sufficient capacity to store 62 percent of the average annual runoff of the tributary areas. Table 4 shows the location, capacity, purpose, and other pertinent data regarding these reservoirs.

Adequate records of water-surface elevations and operations of these reservoirs have been maintained since operations began. Such data are published by the U. S. Geological Survey, or available in the files or reports of the U. S. Bureau of Reclamation.

Adequacy of Data

The Yakima River basin is the most intensively studied basin in the State of Washington in respect to its surface-water resources. Collection of data cooperatively and individually since the 1890's has been undertaken by the U. S. Geological Survey, the State of Washington, the U. S. Bureau of Reclamation, and the U. S. Bureau of Indian Affairs.

The original gaging station network was intended primarily to provide data for the design of the early irrigation projects of the Federal Government. As these irrigation projects were completed or the design definitely established, many of these stations were discontinued; others were retained primarily for purposes of operation of the existing projects. A few stations having long periods provide a measure of the runoff from areas that have remained substantially undeveloped, and consequently the records provide a measure of the fluctuations of the natural yield over a period of many years. An example is Yakima River at Cle Elum, with 45 yr of record, above which consumptive use of water has been very slight. In combination with records of diversion for Kittitas Highline Canal, the records represent substantially natural yield.

A graphic picture of the network of gaging stations in the basin together with a measure of the period of record of each station is shown in figure 2.

At some of the long-term gaging stations, progressive utilization has resulted in substantial consumptive use upstream, large diversions and bypass channels, and underground return flow at points often remote from the point of use. These factors have resulted in the streamflow records not being comparable during the period of operation and not representative of the total flow of the river at that point. Studies to determine the adequacy of water supply available for additional development require adjustment of past streamflow records for these factors. Data regarding these factors often are not available, particularly for early years.

Apparently there has been little coordinated effort to collect and preserve data regarding factors affecting the gaging-station record in a form available to the public. Although complete records of diversions and irrigated area are commonly available for federal projects and organized irrigation companies, such information often is lacking for private projects. Little is known of the movement of ground water in the valley areas, or the reaches of river where an interchange of ground and surface water may occur. Irrigation districts sometimes discard their records after many years on the assumption that such records are no longer of value. Records of utilization other than irrigation frequently are not available and the need for them not recognized until a water shortage or legal controversy occurs. The paucity of such data has been brought out in this investigation.

Except for deficiencies in the type of data noted above, much of which is closely related to the present gaging-station network, the stream-gaging program is considered fairly adequate for present requirements. Additional expansion of irrigation or other projects for water use, however, may necessitate the development of tributary streams, many of which are now ungaged.

A summary of the status of each gaging-station record in the basin with respect to the natural yield at that point is shown in table 5.

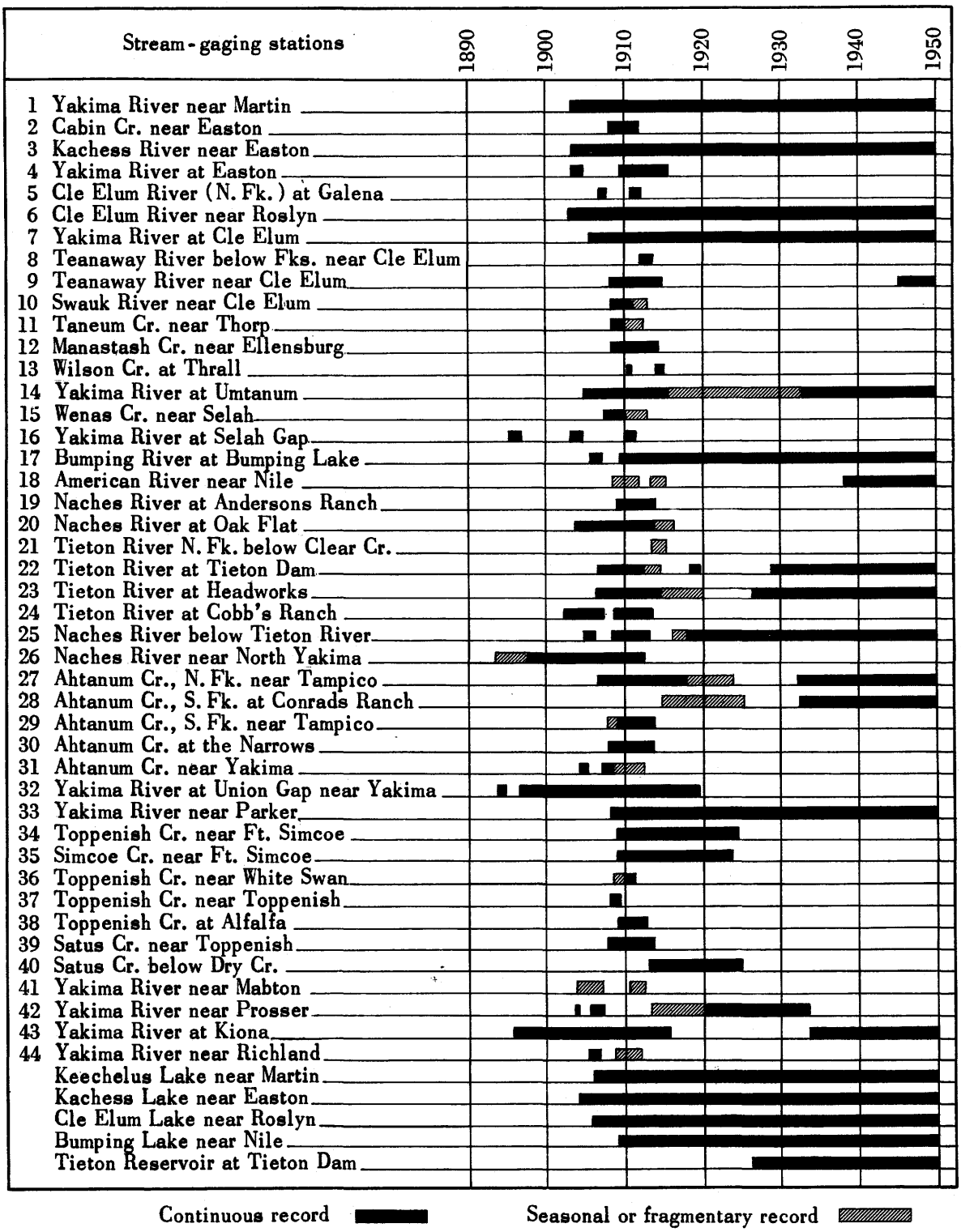

Table 2.--Index of streamflow records in Yakima River basin

Table 3.--Streamflow records collected by other agencies in Yakima River basin

Name	Location	Period of record	Collecting agency	Where found and remarks
Cabin Creek near Easton	Sec. 9, T. 20 N., R. 13 E.	1909-15	Bureau of Reclamation	Bureau of Reclamation office, Yakima, unpublished, 1911-15; prior to 1911 published by Geological Survey.
Yakima River at Easton	Sec. 11, T. 20 N., R. 13 E.	1904, 1910-15, 1940-50.	-----do-------	Bureau of Reclamation office, Yakima, unpublished since 1915; prior to that date published by Geological Survey.
Yakima River near Thorp	20 ft upstream from county bridge above Thorp.	1937-40 (fragmentary).	-----do-------	Bureau of Reclamation office, Yakima. Unpublished.
Yakima River at Ellensburg.	Center sec. 10, T. 17 N., R. 18 E.	1937-50	-----do-------	Do.
Wilson Creek near Ellensburg (at Standly Ranch).	1 mile above Cherry Creek in sec. 19, T. 17 N., R. 19 E.	1924 (incomplete).	-----do-------	Do.
Nanum Creek near Ellensburg.	¼ mile below intake of Ellensburg water supply just below mouth of canyon.	Irrigation season of 1924.	-----do-------	Do.
Yakima River at Umtanum	NW¼ sec. 20, T. 16 N., R. 19 E.	1915-33	-----do-------	Bureau of Reclamation office, Yakima, 1915-33 unpublished (fragmentary); 1906-15, 1933-50 published by Geological Survey.
Wenas Creek below dam near Selah.	¼ mile below dam in sec. 10, T. 15 N., R. 15 E.	1925-27	-----do-------	Bureau of Reclamation office, Yakima. Unpublished.
Rattlesnake Creek near Nile.	Sec. 3, T. 15 N., R. 15 E., at mouth.	1922-23	-----do-------	Do.
Naches River at Nelson Bridge near Yakima.	NW¼ sec. 9, T. 13 N., R. 18 E.	Irrigation seasons of 1912-14.	-----do-------	Do.
Cowiche Creek near Yakima.	At mouth, in sec. 10, T. 13 N., R. 18 E.	Irrigation seasons of 1912-14.	-----do-------	Do.
Wide Hollow Creek at Union Gap.	Sec. 8, T. 12 N., R. 19 E., at highway bridge.	1911-15 and 1922-33.	-----do-------	Do.
Reservation Drain near Alfalfa.	SW¼ sec. 29, T. 10 N., R. 21 E.	1912-50	Bureau of Indian Affairs	Bureau of Indian Affairs office, Wapato, unpublished, 1923-50; prior to 1923 published by Geological Survey.
Toppenish Creek near Fort Simcoe.	Sec. 35, T. 10 N. R. 16 E.	1909-50	-----do-------	Bureau of Indian Affairs office, Wapato, unpublished, 1924-50; prior to 1924 published by Geological Survey.
Satus Creek near Toppenish.	Sec. 24, T. 9 N., R. 19 E.	1913-50	-----do-------	Do.

Table 3.--Streamflow records collected by other agencies in Yakima River basin--Continued

Name	Location	Period of record	Collecting agency	Where found and remarks
Satus Creek near Satus	NW¼SW¼ sec. 7, T. 9 N., R. 21 E.	1932-50	Bureau of Indian Affairs.	Bureau of Indian Affairs office, Wapato, unpublished.

Table 4.--Storage Reservoirs in Yakima River basin

Name	Location	Period of operation	Usable capacity		Remarks
			Acre-feet	Percent annual runoff	
Keechelus Lake	Staff gage in the NE¼ sec. 12, T. 21 N., R. 11 E. at outlet of Keechelus Lake, 9½ miles northwest of Easton.	1906-50	153,000	64.3 (approx.)	Reservoir is formed on natural lake by earth and gravel fill dam. Crib dam storing 19,000 acre-ft used 1906-14. Reservoir not filled to its present capacity until 1920. 1/
Kachess Lake	Staff gage in the SW¼ sec. 34, T. 21 N., R. 13 E. at outlet of Kachess Lake and 2½ miles northwest of Easton.	1905-50	239,000	115 (approx.)	Reservoir is formed on natural lake by earth and gravel fill dam completed in 1912. Crib dam, storing 21,000 acre-ft, used 1905 to 1911. 1/
Cle Elum Lake	Staff gage in the NE¼ sec. 10, T. 20 N., R. 14 E. at outlet of Cle Elum Lake 4 miles northwest of Roslyn, Wash.	1906-50	436,000	66.8 (approx.)	Reservoir is formed on natural lake by earth and gravel fill dam completed in 1933. Crib dam, storing 25,000 acre-ft, used 1906-33. 1/
Bumping Lake	Staff gage in the SW¼ sec. 33, (unsurveyed) T. 16 N., R. 12 E. at outlet of Bumping Lake, 11½ miles above American River and 19 miles west of Nile.	1910-50	33,800	15.9 (approx.)	Reservoir is formed on natural lake by earth fill dam completed in 1910. 1/
Clear Creek	Sec. 12 (unsurveyed), T. 13 N., R. 12 E., 1 mile west of Tieton Reservoir.	1915-25	5,300	-	Reservoir has not been operated since 1925 when Tieton Reservoir was completed, except for occasional dry periods.
Tieton Reservoir	Staff gage in the SW¼ sec. 31 (unsurveyed), T. 14 N., R. 14 E. on spillway of Tieton Dam, 22 miles southwest of Naches.	1925-50	147,000	45.3 (approx.)	Reservoir is formed by earth and gravel fill dam completed in 1925. 1/
Wenas Creek Reservoir.	SE¼ sec. 3, T. 15 N., R. 17 E., 18 miles northwest of Yakima.	1912-50	1,050	-	Reservoir used to extend the irrigation season of many ranches and farms below. Reservoir being surveyed at this date (May, 1951) to determine if enlargement of capacity is practicable. Also being surveyed now as a potential site on the North Fork of Wenas Creek.

1/ No consistent operating plan is used in the storage of water by the reservoir. The rate at which the reservoir is filled depends upon data from snow surveys, amount of early runoff, etc., and time to achieve maximum storage at the end of the high runoff period, which usually occurs during June. Flood control is practiced when needed insofar as it does not interfere with the primary purpose of storing water for irrigational uses.

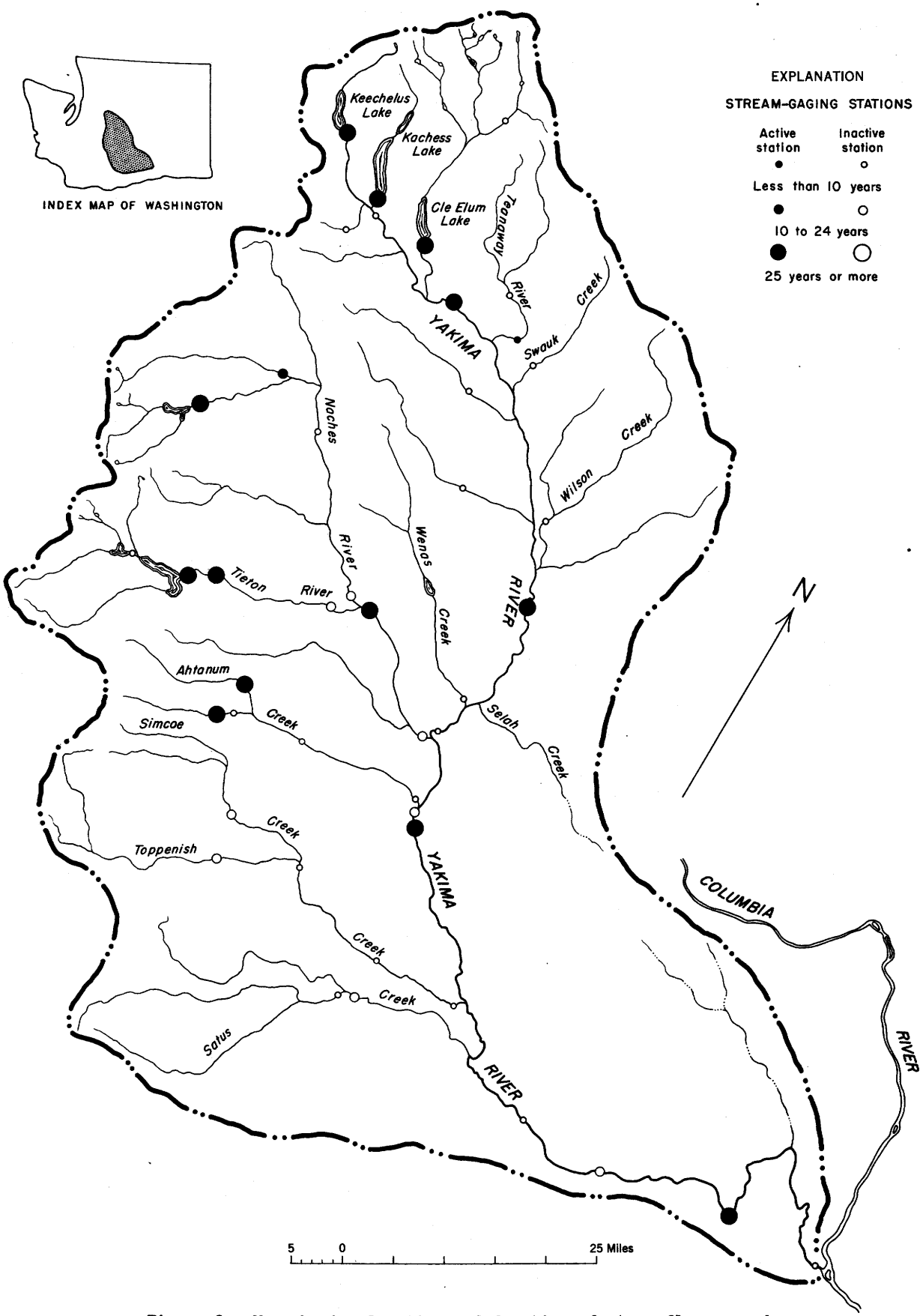

Figure 2.--Map showing location and duration of streamflow records.

Table 5.--Streamflow records in relation to natural yield

[For details of regulation, diversion, and other exceptions to natural yield see station descriptions beginning on page 13]

No.	Gaging station	Upstream regulation and depletion
1	Yakima River near Martin	Regulation and storage by Keechelus Lake.
2	Cabin Creek near Easton	None of consequence.
3	Kachess River near Easton	Regulation and storage by Kachess Lake.
4	Yakima River at Easton	Storage and regulation by two reservoirs; one major diversion.
5	North Fork Cle Elum River at Galena	None of consequence.
6	Cle Elum River near Roslyn	Regulation and depletion by Cle Elum Lake.
7	Yakima River at Cle Elum	Storage and regulation by three reservoirs; one major and several small diversions.
8	Teanaway River below Forks near Cle Elum	Numerous small diversions; ground-water bypass flow.
9	Teanaway River near Cle Elum	Do.
10	Swauk Creek near Cle Elum	Numerous small diversions.
11	Taneum Creek near Thorp	One diversion.
12	Manastash Creek near Ellensburg	None of consequence.
13	Wilson Creek at Thrall	Numerous small diversions; considerable ground-water return flow in area.
14	Yakima River near Umtanum	Storage and regulation by three reservoirs; seven major and many minor diversions.
15	Wenas Creek near Selah	Storage and regulation by Wenas Reservoir; Numerous small diversions; ground-water bypass flow.
16	Yakima River at Selah Gap, near North Yakima.	Storage and regulation by three major reservoirs; nine major and many minor diversions.
17	Bumping River (at Bumping Lake) near Nile.	Regulation and storage by Bumping Lake.
18	American River near Nile	None of consequence.
19	Naches River at Anderson ranch, near Nile.	Regulation and storage of one reservoir; diversion of two small ditches.
20	Naches River at Oak Flat, near Nile	Regulation and storage of one reservoir; diversion of numerous small ditches; ground-water bypass flow.
21	North Fork Tieton River below Clear Creek, near Naches.	None of consequence, except for infrequent storage and regulation of Clear Creek Reservoir.
22	Tieton River at Tieton Dam, near Naches	Storage and regulation of one major reservoir (Tieton).
23	Tieton River at Headworks of Tieton Canal, near Naches.	Storage and regulation of one major reservoir; one major diversion.
24	Tieton River at Cobb ranch, near Naches	Storage and regulation of one major reservoir; one major and several small diversions; considerable ground-water bypass flow.
25	Naches River below Tieton River, near Naches.	Storage and regulation by two major reservoirs; three major diversions, all bypassing station, and several minor diversions; ground-water bypass flow.
26	Naches River near North Yakima	Storage and regulation by two major reservoirs; seven major and many minor diversions; ground-water bypass flow.

Table 5.--Streamflow records in relation to natural yield--Continued

No.	Gaging station	Upstream regulation and depletion
27	North Fork Ahtanum Creek near Tampico	None of consequence.
28	South Fork Ahtanum Creek at Conrad ranch, near Tampico.	Two minor diversions.
29	South Fork Ahtanum Creek near Tampico	Several minor diversions; considerable ground-water bypass flow.
30	Ahtanum Creek at the Narrows, near Tampico.	Numerous minor diversions.
31	Ahtanum Creek near Yakima	Many minor diversions; considerable ground-water bypass flow.
32	Yakima River at Union Gap, near Yakima	Storage and regulation by five major reservoirs; many diversions.
33	Yakima River near Parker	Do.
34	Toppenish Creek near Fort Simcoe	None of consequence.
35	Simcoe Creek (above and below Spring Creek) near Fort Simcoe.	Several minor diversions; minor ground-water bypass flow.
36	Toppenish Creek near White Swan	Numerous diversions.
37	Toppenish Creek near Toppenish	Numerous diversions; ground-water bypass flow.
38	Toppenish Creek near Alfalfa	Do.
39	Satus Creek near Toppenish	Several diversions; ground-water bypass flow.
40	Satus Creek near Toppenish (below Dry Creek).	Do.
41	Yakima River near Mabton	Storage and regulation by five major reservoirs; many diversions.
42	Yakima River near Prosser	Do.
43	Yakima River at Kiona	Do.
44	Yakima River near Richland	Do.

SYLLABUS OF GAGING STATION RECORDS

Explanation of Data

The data presented in the following pages apply to the physical and hydrologic setting at and above the gaging stations. Location, records available, and bypass channels refer to the gaging station and the records of discharge at that site. Data on diversions, return flow, and utilization refer to the area between that gaging station and the next gaging station upstream. Drainage area refers to all above the station site.

Gaging stations on the stream are presented in downstream order from headwater to mouth, with stations on tributaries to that stream being inserted in the order in which the tributaries enter that stream. Diversions and return flows are listed in the same downstream order. The relative rank of the tributaries is indicated in the table of contents by indention.

The "location" paragraph shows the location of the gaging station with respect to latitude and longitude or to land subdivisions, as well as with respect to the nearest town or prominent feature of the stream.

"Drainage area" refers to the entire drainage area above the gaging station. Where this information is not available the paragraph has been omitted.

"Records available" indicates the term for which discharge records are known to be available. Unless another source is shown, these records are published by the Geological Survey in its series of annual Water-Supply Papers (see p. 6).

"Bypass channels" are those carrying surface flow which bypasses the gaging station and which, therefore, is not measured at the station and may or may not be included in the station record. In this report most such channels are canals or ditches that carry water past the station, or past several stations in succession, for use downstream. Any unusual circumstances in connection with the bypass flow are explained. At certain stations the flow of the canal is, or can be, added to that of the gaging station to give the total surface flow at that site; however, for most bypassing canals a certain part of the water originally diverted is used upstream or lost through seepage and the amount actually bypassing the station is less than that diverted.

"Diversion" applies to water removed from the natural channel by artificial means such as a ditch, canal, pipe, or pump. Here, "location" refers to the headgate or point at which water is caused to leave the stream. Although the larger canals and ditches have continuous water-stage recorders in operation during the irrigation season or a staff gage read by an observer, the accurate flow of most diversions is not known. Therefore, an "approximate normal flow" is given as an approximation of the quantities of water involved. From necessity most such values are estimates. If a reliable estimate is not possible, the amount of the water right is given, even though this amount may not always be equal to the amount used. When dates of establishment of canals and ditches are not available, an approximation is made with relation to the establishment of the gaging station. Although the capacities of ditches and canals are not given, some indication as to size may be obtained from the "maximum recorded flow", which has been included where available. The purpose of the diversion is usually shown. Diversions for irrigation usually occur only during the irrigation season, generally from April through September. During the remainder of the year there may be little or no water used for this purpose.

"Return flow" refers to water returning to the stream from irrigated tracts, by over-land flow within the area indicated. Location of wasteways, their approximate flow, and source of the flow are listed if known. Some large amounts of subsurface flow are mentioned, although data in this report usually are confined to surface conditons.

"Storage and regulation" refers to operation of reservoirs or other structures that affect the normal regimen of flow at the particular gaging station. So considered, regulation is the alternate storage and release of water, excluding withdrawals by diversion from the stream channel. Regulation at the station also may be caused by structures in areas above successive upstream gaging stations, but such regulation is mentioned only in the records of the gaging station immediately below the structure.

"Utilization" is the use of water in the area indicated, regardless of the ultimate source of that water. Changes in utilization from its beginning to the present are given if known.

Gaging-Station Records

1.--Yakima River near Martin, Wash.

Location.--Water-stage recorder, lat 47°19'10", long. 121°20'10", just downstream from dam at outlet of Keechelus Lake, 3½ miles northwest of Martin and 12 miles upstream from Easton.

Drainage area.--55 sq mi.

Records available.--October 1903 to September 1950.

Bypass channels.--Spillway from Keechelus Lake bypasses gage. Discharge is computed by weir formula and added to flow measured at gaging station to obtain total flow released from lake.

Diversions.--None.

Return flow.--None.

Storage and regulation.--Since 1906, water stored in Keechelus Lake for irrigation (see table 4). Water-Supply Papers give monthly flow adjusted for change in contents of the lake, as measure of natural water yield.

2.--Cabin Creek near Easton, Wash.

Location.--Vertical staff gage in sec. 9, T. 20 N., R. 13 E., at Northern Pacific Railway bridge, half a mile above mouth and 2 3/4 miles west of Easton.

Drainage area.--32 sq mi.

Records available.--May 1909 to December 1910.

Bypass channels.--None.

Diversions.--A 6-in. pipeline diverted water three-fourths mile above gage to Northern Pacific Railway shop for locomotives and domestic use at Easton. This pipeline was discontinued in 1945. No known records of diversion.

Return flow.--None.

Storage and regulation.--None.

Utilization.--Until 1944, Easton obtained water during the summer from Northern Pacific Railway water-supply system. Small amount of water used for steam locomotives until 1945.

3.--Kachess River near Easton, Wash.

Location.--Water-stage recorder, lat 47°15'30", long. 121°11'50", in the NE¼ sec. 3, T. 20 N., R. 13 E., three-quarters of a mile downstream from Kachess Lake and 2 miles northwest of Easton.

Drainage area.--64 sq mi.

Records available.--October 1903 to September 1950.

Bypass channels.--None.

Diversions.--None.

Return flow.--None.

Storage and regulation.--Since 1905, water stored in and released from Kachess Lake for irrigation downstream (see table 4). Water-Supply Papers give monthly flow adjusted for change in contents of the lake, as a measure of natural water yield.

Utilization.--None.

4.--Yakima River at Easton, Wash.

Location.--Staff or chain gages in sec. 11, T. 20 N., R. 13 E., at highway bridge at Easton, 1½ miles downstream from Kachess River.

Drainage area.--184 sq mi.

Records available.--May to November, 1904, February 1910 to October 1915 in records of Geological Survey. December 1940 to September 1950 in files of Bureau of Reclamation, Yakima.

Bypass channels.--Kittitas Highline Canal bypasses station to irrigate land downstream. Published records of flow at station do not include bypass.

Drainage area between Yakima River at Easton and next station upstream

Diversions.--Kittitas Highline Canal diverts in the SE¼NW¼ sec. 11, T. 20 N., R. 13 E. Entire flow bypasses gaging station and is used to irrigate about 54,000 acres downstream in the vicinity of Ellensburg. Operation of canal began in April, 1930; canal used during irrigation season only, usually April to September; some stock water of negligible quantity at other times of the year. Maximum flow, 805 cfs; approximate normal flow, 700 cfs. Record of this diversion on file with Bureau of Reclamation, Yakima. No other known diversion above station.

Return flow.--None.

Storage and regulation.--None, except as noted for stations upstream.

Utilization.--No irrigation above station. Minor amount of domestic use during summer.

5.--North Fork Cle Elum River at Galena, Wash.

Location.--Staff gage, a quarter of a mile north of Galena, 25 miles north of Roslyn and 28 miles north of Cle Elum.

Records available.--June to December 1907, June to September 1911 (gage heights only).

Bypass channels.--None.

Diversions.--None.

Return flow.--None.

Storage and regulation.--None.

Utilization.--None.

6.--Cle Elum River near Roslyn, Wash.

Location.--Water-stage recorder, lat 47°14'00", long. 121°03'30", in the SW¼ sec. 11, T. 20 N., R. 14 E., 1,000 ft downstream from dam at Cle Elum Lake and 4 miles northwest of Roslyn.

Drainage area.--202 sq mi.

Records available.--October 1903 to September 1950.

Bypass channels.--None.

Diversions.--None.

Return flow.--None.

Storage and regulation.--Since 1906, water stored in and released from Cle Elum Lake for irrigation downstream (see table 4). Water-Supply Papers give monthly flow adjusted for change in contents of the lake, as a measure of natural water yield.

Utilization.--None.

7.--Yakima River at Cle Elum, Wash.

Location.--Water-stage recorder, lat 47°11'20", long. 120°56'40", in sec. 27, T. 20 N., R. 15 E., at highway bridge at Cle Elum, just upstream from Roslyn Creek and 7 miles upstream from Teanaway River.

Drainage area.--500 sq mi.

Records available.--August 1906 to September 1950.

Bypass channels.--Kittitas Highline Canal bypasses station. Discharge figures since 1930 have been adjusted to show natural flow at stations.

Drainage area between Yakima River at Cle Elum and next stations upstream

Diversions.--

1 Negligible amount pumped from Yakima River in Easton for supplying few remaining Northern Pacific steam locomotives.

2. Negligible amount diverted from Silver and Hambright Creeks for Easton municipal supply.

3. Big Creek Adjudication Decree of 1924 allocates one miners inch per acre for irrigation of 1,143 acres. Water supply believed inadequate, except for the early part of the irrigation season.

4. Town of Cle Elum diverts for municipal use an average flow of about 3 cfs from Cle Elum River half a mile below station on Cle Elum River near Roslyn.

5. Municipal water supply of 1 or 2 cfs for town of Roslyn is diverted from Domerie Creek.

6. Several small diversions for irrigation of a few hundred acres above station.

Return flow.--No surface flow.

Storage and regulation.--None, except as noted for stations upstream.

Utilization.--Water supplies of Roslyn and Cle Elum, utility supply for Northern Pacific Railway, and small amount for local irrigation, as stated above.

8.--Teanaway River below forks, near Cle Elum, Wash.

Location.--Staff gage, located in the NE¼ sec. 9, T. 20 N., R. 16 E., 1 mile below forks and 5 miles northeast of Cle Elum.

Drainage area.--177 sq mi.

Records available.--June 1911 to June 1912 (gage heights only).

Bypass channels.--None.

Diversions.--Adjudication Decree of 1921 for Teanaway River considered 1,158 acres above gage irrigable and alloted water rights of one miners inch per acre. No known records of diversions above station. Except for drought years, there has been ample water for all lands. In recent years water users may have been obtaining up to twice the alloted amount without impairing the rights of those downstream (according to an oral report from George Meek, Kittitas County Watermaster).

Return flow.--Many of the above users divert the entire flow of the stream. Return flow is sufficient to satisfy downstream requirements.

Storage and regulation.--None.

Utilization.--Irrigation, as noted under "Diversions".

9.--Teanaway River near Cle Elum, Wash.

Location.--Water-stage recorder, lat 47°12', long. 120°47', in the SW¼ sec. 25, T. 20 N., R. 16 E., 4 miles upstream from mouth, and 8 miles east of Cle Elum.

Drainage area.--200 sq mi.

Records available.--October 1946 to September 1950. April 1909 to September 1914, chain gage at site 3½ miles downstream.

Bypass channels.--None.

Drainage area between Teanaway River near Cle Elum and next station upstream

Diversions.--Adjudication Decree of 1921 for Teanaway River classified 1,107 acres as irrigable between site of present gaging station and that of Teanaway River below Forks near Cle Elum. Allocation of one miners inch per acre was made. No known records of amount diverted above station. See "Diversions" for station, Teanaway River below Forks near Cle Elum.

Return flow.--Much of the water diverted above the station returns to the stream by seepage.

Storage and regulation.--None.

Utilization.--No utilization other than irrigation indicated under "Diversions."

10.--Swauk Creek near Cle Elum, Wash.

Location.--Staff gage in the SE¼ sec. 5, T. 19 N., R. 17 E., 2½ miles above mouth and 12 miles east of Cle Elum.

Drainage area.--88 sq mi.

Records available.--April 1909 to September 1911.

Bypass channels.--None.

Diversions.--A high line ditch diverts total flow of First Creek into Reeser Creek by way of Green Canyon, from which a diversion is made for irrigation (according to an oral report from George Meek, Kittitas County Watermaster). Small amounts diverted from Swauk Creek for mining and local irrigation.

Return flow.--Probably small amount of return flow from local irrigation.

Storage and regulation.--None.

Utilization.--Local irrigation and small scale mining as indicated above.

11.--Taneum Creek near Thorp, Wash.

Location.--Staff gage, sec. 6, T. 18 N., R. 17 E., at De Shazer ranch, 6 miles northwest of Thorp, and 1½ miles above mouth of Taneum Canyon.

Drainage area.--76 sq mi.

Records available.--April 1909 to December 1909, March 1910 to November 1910.

Bypass channels.--Bruton Canal bypasses station. Discharge records do not include flow of canal.

Diversions.--Bruton Canal, constructed in 1874, diverts one-third of total flow (by decree) at a point 300 ft upstream during irrigation season. Canal carries about 40 cfs during early part of season. About June the diversion decreases, and is finally abandoned, water being drawn from the Kittitas Highline Canal thereafter (according to oral report from A. V. Harrell, Secretary Taneum Ditch Co.). No records of flow available.

Return flow.--None.

Storage and regulation.--None.

Utilization.--None above station. Bruton Canal, which bypasses station, delivers water to about 500 acres in and adjacent to sec. 34, T. 19 N., R. 17 E., downstream from station.

12.--Manastash Creek near Ellensburg, Wash.

Location.--Staff gage, sec. 15, T. 17 N., R. 17 E., at Sackett ranch 1½ miles above mouth of Manastash Canyon, 2 miles below North Fork, and 8½ miles west of Ellensburg.

Drainage area.--76 sq mi.

Records available.--April 1909 to September 1914.

Bypass channels.--None.

Diversions.--None.

Return flow.--None.

Storage and regulation.--The development of a few hundred acre-ft of storage in Manastash Lake was attempted prior to 1915, but the project was found impractical and abandoned after 2 or 3 seasons (according to oral report from George Meek, Kittitas County Watermaster).

Utilization.--None.

13.--Wilson Creek at Thrall, Wash.

Location.--Vertical staff-gage in the SE¼ sec. 30, T. 17 N., R. 19 E., at highway bridge, half a mile east of Thrall, and 5 miles southeast of Ellensburg.

Records available.--August to October 1911 (gage heights only).

Bypass channels.--None.

Diversions.--

1. Wilson Creek Adjudication Decree (Kittitas Superior Court Decree, Jour. 2, p. 143) allocates one miners inch per acre for 2,738 acres. Most of this area lies below the Kittitas Highline Canal and has obtained water from it since its construction in 1930. Small farms not mentioned in the decree lying above the highline canal now take all remaining flow of Wilson Creek, which is not sufficient for their needs. (Oral report by George Meek, Kittitas County Watermaster).

2. The Bull Canal has diverted from Wilson Creek in sec. 11, T. 17 N., R. 18 E., since 1926. Prior to this time the canal had diverted from the Yakima River since the '90's. Part of the flow of Bull Canal is made up of ground-water seepage from irrigation above. Discharge averages about 20 cfs, and the maximum recorded flow is 37 cfs. (Records in files of Bur. Reclamation, Yakima, Wash.) It irrigates 1,300 acres. (Records in files of Washington State Dept. Conservation and Development) Records available, 1909-14, 1922-50, in files of Bureau of Reclamation, Yakima.

3. Tjossem small power ditch, diverting in center of sec. 13, T. 17 N., R. 18 E., carries an average of 3 cfs and has a maximum recorded flow of 12.6 cfs. (Records in files of Bur. Reclamation, Yakima, Wash.) Since 1920 when power plant was abandoned, it has been used for the irrigation of an estimated 100 acres. Records available in files of Bureau of Reclamation, Yakima, for 1914, 1924-50, as miscellaneous measurements.

4. Farrell ditch no. 1, diverting in the SW¼SE¼ sec. 13, T. 17 N., R. 18 E., carries an average flow of 7 cfs and has a maximum recorded flow of 16 cfs. (Records in files of Bur. Reclamation, Yakima, Wash.) An estimated 250 acres are irrigated. Records available in files of Bureau of Reclamation, Yakima, for 1914, 1924-50, as miscellaneous measurements.

5. Coleman Creek Adjudication Decree (Kittitas Superior Court, Jour. 21, p. 13) allocates one miners inch per acre for 2,850 acres. Most of this area lies below the Kittitas Highline Canal and has obtained water from this source since its construction in 1930. Small farms not mentioned in the decree lying above the highline canal now take all remaining flow of Coleman Creek, which is not sufficient for their needs. (Oral report by George Meek, Kittitas County Watermaster.)

6. Nanum Creek Adjudication Decree (Kittitas Superior Court, Jour. 12, p. 413) allocates one miners inch per acre for 5,730 acres. Most of this area lies below the Kittitas Highline Canal and has obtained water from this source since its construction in 1930. Small farms lying above the highline canal and not mentioned in the decree now take all remaining flow of Namum Creek, which is not sufficient for their needs. (Oral report by George Meek, Kittitas County Watermaster.) The City of Ellensburg occasionally diverts 4 to 5 cfs as a standby municipal supply. Diversion periods irregular. (Oral report by Ellensburg City Engineer.) No records available.

Return flow.--The flow of Wilson Creek, its tributaries and diversions are augmented by considerable ground-water seepage in the areas irrigated by the Kittitas Highline Canal. The City of Ellensburg sewage treatment plant since 1938 has wasted about 8 cfs into Wilson Creek in the SW¼ sec. 2, T. 17 N., R. 18 E. (Oral report by Ellensburg City Engineer.) Tjossem's power waste is also returned to Wilson Creek in sec. 13, T. 17 N., R. 18 E.; the approximate flow was 65 cfs and the maximum recorded flow 109 cfs, but since mill burned in 1943, average flow has been 10 cfs. Records are found in files of Bureau of Reclamation, Yakima, for 1923-50.

Storage and regulation.--None.

Utilization.--Ellensburg municipal water supply as shown above and irrigation of several thousand acres in the Kittitas Valley. There has been little change in the irrigated area since 1930 when the Kittitas Highline Canal was constructed for the irrigation of 54,000 acres.

14.--Yakima River at Umtanum, Wash.

Location.--Water-stage recorder, lat 46°51'45", long. 120°28'30", in the NW¼ sec. 20, T. 16 N., R. 19 E., at Umtanum, half a mile upstream from Umtanum Creek and 10 miles south of Ellensburg.

Drainage area.--1,620 sq mi.

Records available.--August 1906 to September 1950 (fragmentary October 1915 to March 1931).

Bypass channels.--None.

Drainage area between Yakima River at Umtanum and next stations upstream

Diversions.--Diversions are listed in table 6. Diversions average 1,020 cfs for irrigating 39,000 acres. Not included in the table are the following:

1. Between the station on Teanaway River near Cle Elum and the confluence with Yakima River, the Adjudication Decree of 1921 for Teanaway River, considered 1,641 acres irrigable and allotted 1 miners inch per acre. See "Diversions" under Teanaway River below Forks near Cle Elum (no. 8).

2. Manastash Creek, a tributary of Yakima River, according to Adjudication Decree, irrigates 6,134 acres for which an allocation of 1 miners inch per acre was made. In an average year about 4,000 acres are irrigated. (Oral report by George Meek, Kittitas County Watermaster.)

Return flow.--Waste from town of Roslyn, together with local seepage (about 5 cfs), reaches the Yakima River just below the station Yakima River at Cle Elum. At its mouth the drain carries about 10 cfs, according to season. Waste from Cle Elum municipal sewage plus local seepage averages about 3 cfs. Waste from Ellensburg Mill & Feed canal reaches Yakima River through Wilson Creek. During irrigation season most of Wilson Creek flow is diverted for irrigation (see "Return flow", Wilson Creek at Thrall). Waste from Mills & Sons power canal returned to river in the SE¼ sec. 12, T. 18 N., R. 17 E.; no known records of amount. Waste from Ellensburg power canal reaches Yakima River in sec. 32, T. 18 N., R. 18 E.

Regulation and storage.--None, except as noted for stations upstream.

Utilization.--Irrigated area is estimated at 97,000 acres (from information furnished by Bureau of Reclamation) which includes area served by the tributaries in this section of the basin. Ellensburg power plant diverts from the Yakima River.

Table 6.--Diversions in Yakima River basin, above Yakima River at Umtanum, Wash.
[Diversions in this table are those located between this station and the next upstream station, Yakima River at Cle Elum]

Name	Point of diversion	Date of establ.	Approx. normal flow (cfs)	Purpose	Remarks
Younger ditch	NW¼NE¼ sec. 35, T. 20 N., R. 15 E.	1898	10	Irrigation	Daily discharge records 1912-14, misc. measurements 1923-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 24 cfs. Irrigated area, 280 acres.
Frazier ditch	NW¼SE¼ sec. 31, T. 20 N., R. 16 E.	Prior to 1906.	3	----do----	Daily discharge records 1912-14, misc. measurements 1923-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow 12.4 cfs. Irrigated area, 100 acres. 1/
O'Conner ditch	NW¼SE¼ sec. 31, T. 20 N., R. 16 E.	Prior to 1906.	12	----do----	Daily discharge records 1912-14, misc. measurements 1923-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 26 cfs. Irrigated area, 400 acres. 1/
DuBinsky pump	NW¼NE¼ sec. 14, T. 19 N., R. 16 E.	1900	1.5	----do----	Misc. discharge measurements 1924-50. Maximum recorded flow, 2.2 cfs. Irrigated area, 50 acres. 1/
Cascade Canal	NW¼NW¼ sec. 28, T. 19 N., R. 17 E.	1902	105	----do----	Misc. discharge measurements 1905, 1909-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 138 cfs. Irrigated area, 12,500 acres.
Garrison ditch	Sec. 28, T. 19 N., R. 17 E.	1900	3	----do----	Misc. discharge measurements 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 8.6 cfs. Irrigated area, 100 acres. 1/
Ellison and Bruton ditch.	SW¼NW¼ sec. 34, T. 19 N., R. 17 E.	Prior to 1906.	5	----do----	Misc. discharge measurements 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 12.6 cfs. Irrigated area, 180 acres. 1/
West Side Canal	SE¼SE¼ sec. 35, T. 19 N., R. 17 E.	Prior to 1906.	70	----do----	Misc. discharge measurements 1905, 1914, 1919-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 100 cfs. Irrigated area, 7,000 acres. 2/
Taneum Ditch Co. ditch.	Sec. 5, T. 18 N., R. 17 E. diverting from Taneum Creek.	Prior to 1906.	No record.	----do----	Allocated 2/3 total streamflow by decree. Quantity diverted decreases with discharge until sometime in June when flow ceases to be adequate. Water from Kittitas Highline Canal

Table 6.--Diversions in Yakima River basin, above Yakima River at Umtanum, Wash.--Continued

Name	Point of diversion	Date of establ.	Approx. normal flow (cfs)	Purpose	Remarks
					is then substituted. Irrigated area, 3,700 acres. 3/
Hutchinson ditch no. 1	SE¼NE¼ sec. 3, T. 18 N., R. 17 E.	Prior to 1906.	3	Irrigation	Misc. discharge measurements 1925-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 5.5 cfs. Irrigated area, 100 acres. 1/
Mills and Son power canal.	SE¼NE¼ sec. 3, T. 18 N., R. 17 E.	1880	45	----do----	Discharge records 1912-15, 1923-50, in files of Bureau of Reclamation, Yakima. Burns, Thorp, Hutchinson no. 2, and Beal ditches divert a total average flow of 7 cfs to irrigate approx. 250 acres. 1/ Mill burned in 1949, not rebuilt.
Ellensburg Water Co. canal.	NE¼SE¼ sec. 12, T. 18 N., R. 17 E.	1885	100	----do----	Discharge records 1904, 1909-15, 1922-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 124 cfs. Irrigated area, 10,000 acres. 2/
Olson ditch	NE¼SE¼ sec. 12, T. 18 N., R. 17 E.	1875	15	----do----	Discharge records 1905, 1909-14, 1922-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow 27 cfs. Irrigated area, 1,200 acres. 2/
Stein & Stevens ditch	SW¼SW¼ sec. 7, T. 18 N., R. 18 E.	Prior to 1906.	9	----do----	Misc. discharge measurements 1914, 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 18 cfs. Irrigated area, 360 acres. 1/
Ellensburg municipal water supply.	SE¼SE¼ sec. 12, T. 18 N., R. 17 E.	1912	12	Water supply.	Flow varies between 8 and 16 cfs according to season. 4/
Archer ditch	SW¼NW¼ sec. 18, T. 18 N., R. 18 E.	Prior to 1906.	2	Irrigation	Misc. discharge measurements 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 7.7 cfs. Irrigated area, 80 acres. 1/
Ellensburg power canal	NE¼SE¼ sec. 18, T. 18 N., R. 18 E.	1902	550	Power	Discharge records 1912-15, 1923-50 in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 739 cfs. Enlarged canal in 1947-48.
Thomas ditch	NW¼SE¼ sec. 18, T. 18 N., R. 18 E.	Prior to 1906.	8	Irrigation	Misc. discharge measurements 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 21 cfs. Irrigated area, 340 acres. 1/
Reed ditch	SW¼SW¼ sec. 29, T. 18 N., R. 18 E.	Prior to 1906.	3	----do----	Misc. discharge measurements 1913-14, 1922-50, in files of Bureau of Reclamation. Maximum recorded flow, 6.1 cfs. Irrigated area, 100 acres. 1/
Ellensburg Mill and Feed Canal.	SW¼SW¼ sec. 29, T. 18 N., R. 18 E.	Prior to 1906.	25	----do----	Misc. discharge measurements 1912-15, 1923-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 48 cfs. Irrigated area, 442 acres.

Table 6.--Diversions in Yakima River basin, above Yakima River at Umtanum, Wash.--Continued

Name	Point of diversion	Date of establ.	Approx. normal flow (cfs)	Purpose	Remarks
Suver ditch	SE¼NW¼ sec. 33, T. 18 N., R. 18 E.	Prior to 1906.	2	Irrigation	Misc. discharge measurements 1912-14, 1924-50, in files of Bureau of Reclamation. Maximum recorded flow, 4.8 cfs. Irrigated area, 80 acres. 1/
Grinrod and Doughty Canal.	NW¼NW¼ sec. 3, T. 17 N., R. 18 E.	1884	8	----do----	Misc. discharge measurements 1913-14, 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 34 cfs. Irrigated area, 300 acres. 1/
Dyer ditch	NW¼SE¼ sec. 10, T. 17 N., R. 18 E.	Prior to 1906.	2	----do----	Misc. discharge measurements 1914, 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 5.1 cfs. Irrigated area, 80 acres. 1/ No river water diverted after 1930 when return flow seepage from Kittitas Highline became sufficient for needs.
Stonebreaker ditch	NW¼NW¼ sec. 15, T. 17 N., R. 18 E.	Prior to 1906.	1	----do----	Misc. discharge measurements 1921-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 3.5 cfs. Irrigated area, 40 acres. 1/ No river water diverted after 1930 when return flow seepage from Kittitas Highline became sufficient for needs.
Clark ditch	NW¼SW¼ sec. 13, T. 17 N., R. 18 E.	Prior to 1906.	5	----do----	Misc. discharge measurements 1913-14, 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 15.6 cfs. Irrigated area, 200 acres. 1/
Steen-McLeod ditch	NW¼SW¼ sec. 13, T. 17 N., R. 18 E.	Prior to 1906.	6	----do----	Misc. discharge measurements 1913-14, 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 13.2 cfs. Irrigated area, 200 acres. 1/
Burkholder ditch	Center sec. 14, T. 17 N., R. 18 E.	Prior to 1906.	.5	----do----	Misc. discharge measurements 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 3 cfs. Irrigated area, 20 acres. 1/
Harris ditch	Center sec. 14, T. 17 N., R. 18 E.	Prior to 1906.	3	----do----	Misc. discharge measurements 1913-14, 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 11.4 cfs. Irrigated area, 100 acres. 1/
Vertrees ditch	Center sec. 14, T. 17 N., R. 18 E.	1895	7	----do----	Misc. discharge measurements 1913-14, 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 19.5 cfs. Irrigated area, 250 acres. 1/
Macomber ditch	NE¼NW¼ sec. 23, T. 17 N., R. 18 E.	Prior to 1906.	4	----do----	Misc. discharge measurements 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 9 cfs. Irrigated area, 160 acres. 1/

Table 6.--Diversions in Yakima River basin, above Yakima River at Umtanum, Wash.--Continued

Name	Point of diversion	Date of establ.	Approx. normal flow (cfs)	Purpose	Remarks
					No river water divertedafter 1930 when return flow seepage from Kittitas Highline became sufficient for needs.
Stegel ditch	NE¼NW¼ sec. 23, T. 17 N., R. 18 E.	Prior to 1906.	3	Irrigation	Misc. discharge measurements 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 9.1 cfs. Irrigated area, 100 acres. 1/ No river water diverted after 1930 when return flow seepage from Kittitas Highline became sufficient for needs.
Tjossem's power canal	SE¼SW¼ sec. 11, T. 17 N., R. 18 E.	Prior to 1906.	85	Power and irrigation	Misc. discharge measurements 1912-15, 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 121 cfs. Irrigated area, 20 acres. Tjossem's irrigation ditch diverts an average 3 cfs from canal, irrigating about 100 acres. 1/ Since 1943, when mill burned, the diversion has averaged 12 cfs.
Farrel no. 2 ditch	NW¼NE¼ sec. 25, T. 17 N., R. 18 E.	1910	4	Irrigation	Misc. discharge measurements 1914, 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 17 cfs. Irrigated area, 160 acres. 1/ Headgate washed out in 1948, not used since.
Farrel no. 3 ditch	NW¼NE¼ sec. 25, T. 17 N., R. 18 E.	1910	.2	----do----	Misc. discharge measurements 1926-48, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 5.5 cfs. Irrigated area, 80 acres. Headgate washed out in 1948, not used since.
Lewis ditch no. 1	E½ sec. 25, T. 17 N., R. 18 E.	1910	.2	----do----	Misc. discharge measurements 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 4.7 cfs. Irrigated area, 10 acres. 1/
Lewis ditch no. 2	E½ sec. 25, T. 17 N., R. 18 E.	1910	.2	----do----	Misc. discharge measurements 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 6.3 cfs. Irrigated area, 10 acres. 1/
Ringer Canal	W½ sec. 30, T. 17 N., R. 19 E.	Prior to 1906.	1	----do----	Misc. discharge measurements 1913-14, 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 5.4 cfs. Irrigated area, 40 acres. 1/

1/ Estimated from information furnished by Bureau of Reclamation, Yakima.
2/ Wash. State Dept. Conservation and Development.
3/ Harrel, A. V., Secretary, Taneum Ditch Co., oral report.
4/ Ellensburg City Engineer, oral report.

15.--Wenas Creek near Selah, Wash.

Location.--Staff gage, in the SE¼ sec. 18, T. 14 N., R. 19 E., half a mile upstream from mouth and 3½ miles northwest of Selah.

Drainage area.--192 sq mi.

Records available.--April to December 1909.

Bypass channels.--None.

Diversions.--Entire flow is diverted for irrigation each summer, and creek becomes dry at points below sec. 13, T. 15 N., R. 17 E. According to adjudication of the stream in 1921, it was decreed there were 9,491 irrigable acres, with entitlement of one miners inch per acre. No known records of individual diversions except fragmentary information in following table 7.

Return flow.--None except ground-water seepage.

Storage and regulation.--Wenas Reservoir, in SW¼ sec. 2, T. 15 N., R. 17 E., constructed in 1912 for irrigation, has a capacity of 1,050 acre-ft. (Information in files of Conservation Branch, Geological Survey, Tacoma.)

Utilization.--During an average year the supply of water is sufficient for about 850 acres throughout the season. Accordingly the figure of 9,491 irrigable acres as recognized in 1921 is probably greater than is presently irrigated. This implies that little or no new lands have been developed in the last 30 yr, and that the present area under irrigation is about 9,000 acres.

Table 7.--Flow and estimated capacity, in cubic ft per second, of ditches from Wenas Creek, July 26, 1898
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Locality	Flow	Estimated capacity
Quinn ditch, NE¼SE¼ sec. 13, T. 15 N., R. 17 E.	0.83	2.5
Wenas Creek at crossing of county road, southeast corner sec. 13	dry	---
Wenas Creek at forks, NE¼ sec. 13, T. 15 N., R. 17 E., on Mrs. Chambers' Ranch.	.81	---
Mrs. Chambers ditch (Wenas west fork stopped by dam)	dry	5.0 - 7.0
Mrs. Chambers ditch (Wenas west fork stopped by dam)	dry	6.0
"Tom Taylor's" ditch, stopped by dam	dry	2.5
New "R. Smith", SW¼ sec. 12, T. 15 N., R. 17 E.	.826	2.5
Old "R. Smith", NE¼ sec. 24, T. 15 N., R. 17 E.	dry	2.5
Mrs. Chambers, SW¼ sec. 12, T. 15 N., R. 17 E.	.110	---
D. N. Pollard, sec. 12, T. 15 N., R. 17 E.	.35	---
S. Longmire, sec. 12, T. 15 N., R. 17 E.	1.28	4.0
Kiser, sec. 11, T. 15 N., R. 17 E.	.837	2.0
Kiser, sec. 2, T. 15 N., R. 17 E.	.623	2.0
Sherman, sec. 3, T. 15 N., R. 17 E.	.38	2.0
Sherman, sec. 3, T. 15 N., R. 17 E.	.188	.5
Justus (right bank), sec. 33, T. 16 N.. R. 17 E.	3.62	7.0
Wenas Creek, middle of sec. 33, T. 16 N., R. 17 E.	3.80	---
Justus (left bank), sec. 33, T. 16 N., R. 17 E.	.45	2.0
Milton Burge, sec. 29, T. 16 N., R. 17 E.	.465	1.25
Milton Burge, sec. 29, T. 16 N., R. 17 E.	.78	2.0
Goodwin, sec. 29, T. 16 N., R. 17 E.	dry	.40
Goodwin, sec. 20, T. 16 N., R. 17 E.	dry	.40
Burge and Pressey, sec. 30, T. 16 N., R. 17 E.	dry	.70
F. Candle, sec. 24, T. 16 N., R. 17 E.	dry	1.00
Longmire & Moore, secs. 13 & 24, T. 16 N., R. 16 E.	.872	4.0
W. W. Dickinson, sec. 14, T. 16 N., R. 16 E.	.36	1.5 - 2.0
Jack, secs. 11 and 14, T. 16 N., R. 16 E.	.42	.75
Jack, secs. 11 and 14, T. 16 N., R. 16 E.	1.2	2.5
Rd. Sisk, secs. 11 and 14, T. 16 N., R. 16 E.	.27	.75
Purdin Company ditch, sec. 24, T. 15 N., R. 17 E.	dry	4.0
R. Smith, sec. 24, T. 15 N., R. 17 E.	dry	.45
R. Smith, sec. 24, T. 15 N., R. 17 E.	dry	.50

16.--Yakima River at Selah Gap, near North Yakima, Wash.

Location.--Wire and staff gages in NW¼ sec. 12, T. 13 N., R. 18 E., at Selah Gap, a quarter of a mile upstream from Naches River, and 1½ miles north of North Yakima.

Drainage area.--2,150 sq mi (revised).

Records available.--1897, 1904, 1911, 1912 (irrigation seasons only).

Bypass channels.--Roza Canal and Selah-Moxee Canal bypass station. Published records for station do not include flow of these canals.

Drainage area between Yakima River at Selah Gap near North Yakima and next stations upstream

Diversions.--

1. Roza Canal, diverting in the SW¼NW¼ sec. 33, T. 15 N., R. 19 E., for irrigation of land below station, has maximum recorded flow of 1,700 cfs and normal flow of approximately 700 cfs during irrigation season. Discharge records since 1941 on file with Bureau of Reclamation, Yakima. Constructed in 1940.

2. Selah-Moxee Canal, diverting in the NW¼NE¼ sec. 17, T. 15 N., R. 19 E., mostly for use on land downstream, has maximum recorded flow of 93 cfs and normal flow of approximately 76 cfs during irrigation season, 12 cfs of which is used to irrigate an estimated 450 acres above station. Discharge records for 1905, 1909 to 1915, 1919 to 1950 on file with Bureau of Reclamation, Yakima.

3. Taylor Canal, diverting in the NE¼SW¼ sec. 19, T. 14 N., R. 19 E., has maximum recorded flow of 55 cfs. Normal flow of approximately 17 cfs during summer season irrigates 1,635 acres above station. Discharge records for 1909-12, 1923-50 on file with U. S. Bureau of Reclamation, Yakima.

Return flow.--Some ground-water seepage from irrigated lands.

Storage and regulation.--None, except as noted for stations upstream.

Utilization.--Irrigation of 1,635 acres under Taylor Canal and 450 acres from Selah-Moxee Canal at present time.

17.--Bumping River (at Bumping Lake) near Nile, Wash.

Location.--Water-stage recorder, lat 46°52', long. 121°18', a quarter of a mile downstream from spillway of Bumping Lake Dam and 19 miles west of Nile.

Drainage area.--68 sq mi.

Records available.--June and July 1906, April 1909 to September 1950.

Bypass channels.--None.

Diversions.--None.

Return flow.--None.

Storage and regulation.--Since 1910 flow regulated by Bumping Lake Reservoir (table 4). Water Supply Papers give monthly flow adjusted for change in contents of the lake, as a measure of natural water yield.

Utilization.--None.

18.--American River near Nile, Wash.

Location.--Water-stage recorder, lat 46°58'30", long. 121°10'10", in the SW¼ sec. 12, T. 17 N., R. 13 E., 300 ft upstream from Bumping Lake road crossing, three quarters of a mile upstream from mouth and 16 miles northwest of Nile.

Drainage area.--79 sq mi.

Records available.--April 1909 to September 1911, July 1913 to September 1915 (fragmentary), October 1939 to September 1950.

Bypass channels.--None.

Diversions.--None.

Return flow.--None.

Storage and regulation.--None.

Utilization.--None.

19.--Naches River at Anderson ranch, near Nile, Wash.

Location.--Staff gage in sec. 35, T. 17 N., R. 14 E., half a mile below Lost Creek, 7 miles below Bumping River, and 11 miles northwest of Nile.

Drainage area.--394 sq mi.

Records available.--April 1909 to September 1914.

Bypass channels.--Anderson ditch bypasses station (see below). Published records for station do not include flow of this ditch.

Drainage area between Naches River at Anderson ranch near Nile and next stations upstream

Diversions.--

1. Fontaine ditch diverts water 1 mile upstream from Lost Creek for irrigation of land above station. Ditch was built in 1910, has maximum recorded flow of 3.8 cfs and normal flow of approximately 1.5 cfs during irrigation season. Discharge records consisting of several miscellaneous measurements during each irrigation season made by Bureau of Reclamation and are on file at Yakima for the years 1913, 1924-50. No other known records.

2. Anderson ditch, diverting one-half mile upstream from Lost Creek, was established prior to 1909. It has a maximum recorded flow of 9.3 cfs and a normal flow of approximately 3 cfs during irrigation season. Several miscellaneous measurements made during irrigation seasons in 1913, 1924-50 by Bureau of Reclamation, Yakima.

Return flow.--No surface flow, but probably some seepage from irrigated lands above station.

Storage and regulation.--None, except as noted for stations upstream.

Utilization.--Water diverted by Fontaine ditch and probably some of Anderson ditch used to irrigate an estimated 100 acres above station.

20.--Naches River at Oak Flat, near Nile, Wash.

Location.--Water-stage recorder in the NW¼ sec. 34, T. 15 N., R. 16 E., just above Oak Flat, 3/4 mile above intake of Selah Valley Canal, 2 miles above Tieton River, and 8 miles southeast of Nile. Staff or catilever chain gage, read once or twice daily, prior to September 20, 1911.

Drainage area.--640 sq mi.

Records available.--June 1904 to November 1915, April to October 1916, April to October 1917.

Bypass channels.--None.

Drainage area between Naches River at Oak Flat near Nile and next station upstream

Diversions.--Fourteen small irrigation ditches divert a total average flow of about 40 cfs during irrigation season (see table 8).

Return flow.--Some ground water seepage from irrigated land upstream.

Storage and regulation.--None, except as noted for stations upstream.

Utilization.--Water diverted to irrigate about 785 acres above station.

Table 8.--Diversions in Naches River basin, above Naches River at Oak Flats near Nile, Wash.
[Diversions in this table are those located between this station and the next station upstream, Naches River at Anderson ranch near Nile]

Name	Point of diversion	Date of establ.	Approx. normal flow (cfs)	Purpose	Remarks
Emrich ditch	Center sec. 1, T. 16 N., R. 14 E., unsurveyed.	Prior to 1905.	2	Irrigation	Misc. discharge measurements 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 4.6 cfs. Irrigated area, 10 acres.
Benton ditch	SE¼SE¼ sec. 17, T. 16 N., R. 15 E.	Prior to 1905.	1.5	----do----	Misc. discharge measurements 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 9.5 cfs. Irrigated area, 50 acres. 1/
Valentine ditch	Center sec. 21, T. 16 N., R. 15 E.	1892	1	----do----	Misc. discharge measurements 1913, 1924-50 in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 5.5 cfs. Irrigated area 35 acres. 1/
Markell ditch	SW¼SE¼ sec. 21, T. 16 N., R. 15 E.	1908	6	----do----	Misc. discharge measurements 1912-13, 1924-50 in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 11 cfs. Irrigated area, 200 acres. 1/ Washed out in 1948; not rebuilt.
Lindsey Canal	SE¼SE¼ sec. 21, T. 16 N., R. 15 E.	Prior to 1905.	8	----do----	Misc. discharge measurements 1912-13, 1924-50 in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 17.5 cfs. Irrigated area, 300 acres. 1/
Palmer ditch	SE¼NW¼ sec. 34, T. 16 N., R. 15 E.	Prior to 1905.	2	----do----	Misc. discharge measurements 1924-26, 1930-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 9.3 cfs. Irrigated area, 80 acres. 1/

Table 8.--Diversions in Naches River basin, above Naches River at Oak Flats near Nile, Wash.--Continued

Name	Point of diversion	Date of establ.	Approx. normal flow (cfs)	Purpose	Remarks
Carmack and Parker ditch.	SW¼SW¼ sec. 2, T. 15 N., R. 15 E.	Prior to 1905.	2	Irrigation	Misc. discharge measurements 1913, 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 7 cfs. Irrigated area, 80 acres. 1/
Fredricks and Hunting Canal.	SE¼SW¼ sec. 2, T. 15 N., R. 15 E.	1888	3	----do----	Misc. discharge measurements 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 6.4 cfs. Irrigated area, 100 acres. 1/
Griffen Canal	NW¼SE¼ sec. 11, T. 15 N., R. 15 E.	Prior to 1905.	.5	----do----	Misc. discharge measurements 1913, 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 2.7 cfs. Irrigated area, 20 acres. 1/
Stevens ditch	NW¼SE¼ sec. 11, T. 15 N., R. 15 E.	1888	5	----do----	Misc. discharge measurements 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 22 cfs. Irrigated area, 180 acres. 1/
Meloy ditch	SE¼NW¼ sec. 18, T. 15 N., R. 16 E.	1892	1.5	----do----	Misc. discharge measurements 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 4.3 cfs. Irrigated area, 50 acres. 1/
Krober ditch	SW¼SW¼ sec. 17, T. 15 N., R. 16 E.	Prior to 1905.	.5	----do----	Misc. discharge measurements 1913, 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 1.6 cfs. Irrigated area, 20 acres. 1/
Fechter and Janeck no. 1.	SE¼SE¼ sec. 28, T. 15 N., R. 16 E.	Prior to 1905.	.5	----do----	Misc. discharge measurements 1931-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 3.3 cfs. Irrigated area, 20 acres. 1/
Fechter and Janeck no. 2.	NE¼NW¼ sec. 34, T. 15 N., R. 16 E.	Prior to 1905.	6	----do----	Misc. discharge measurements 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 11 cfs. Irrigated area, 200 acres. 1/

1/ Estimated from information furnished by Bureau of Reclamation, Yakima.

21.--North Fork Tieton River below Clear Creek, near Naches, Wash.

Location.--Staff gage, in SE¼ sec. 12, T. 13 N., R. 12 E., a quarter of a mile below Clear Creek, 7 miles above South Fork, and 30 miles southwest of Naches.

Drainage area.--61 sq mi.

Records available.--May to October 1914, July to September 1915.

Bypass channels.--None.

Diversions.--None.

Return flow.--None.

Storage and regulation.--From July 1915 until 1925 flow slightly controlled by regulation in Clear Creek Reservoir; use of reservoir discontinued subsequently except for occasional dry periods.

Utilization.--None.

22.--Tieton River at Tieton Dam, near Naches, Wash. (formerly called at McAllister Meadows, near Naches and at Rimrock)

Location.--Water-stage recorder, lat 46°39'30", long. 121°07'20", 900 ft upstream from Wild Cat Creek, 1,200 ft downstream from Tieton Dam, 19 miles upstream from Oak Creek, and 22 miles southwest of Naches.

Drainage area.--187 sq mi.

Records available.--August 1908 to September 1914 (fragmentary), October 1918 to March 1919, and April 1925 to September 1950 in reports of Geological Survey. September 1908 to December 1913 and July 1914 to September 1920 in State Water-Supply Bulletin 5.

Bypass channels.--None.

Drainage area between Tieton River at Tieton Dam near Naches and next station upstream

Diversions.--None.

Return flow.--None.

Storage and regulation.--Flow regulated by Tieton Reservoir since 1925 (see table 4). Water-Supply Papers give monthly flow adjusted for change in contents of the lake, as a measure of natural water yield.

Utilization.--None.

23.--Tieton River at headworks of Tieton Canal, near Naches, Wash.

Location.--Water-stage recorder, lat 46°40'10", long. 121°00'20", in sec. 30, T. 14 N., R. 15 E. (unsurveyed), just downstream from intake of Tieton Canal, 12 miles upstream from Oak Creek, and 16 miles southwest of Naches.

Drainage area.--240 sq mi.

Records available.--April to September 1906 (fragmentary gage-height records), July 1907 to September 1950.

Bypass channels.--Flow of Tieton Canal bypasses gaging station. Monthly records are published for combined flow of canal and river at this station. Daily discharge records do not include flow of canal.

Drainage area between Tieton River at headworks of Tieton Canal near Naches and next station upstream

Diversions.--Tieton Canal, constructed in 1910, diverts 500 ft above station. Maximum recorded flow of 336 cfs and normal flow of approximately 240 cfs during irrigation season. Records of flow in files of Bureau of Reclamation, Yakima.

Return flow.--None.

Storage and regulation.--None, except as noted for station upstream.

Utilization.--None.

24.--Tieton River at Cobb's ranch, near Naches, Wash.

Location.--Staff or chain gages in the SE¼ sec. 3, T. 14 N., R. 16 E., 200 ft downstream from Oak Creek, 2 miles upstream from mouth, and 5 miles west of Naches; for period March 1906 to September 1907, above Oak Creek (drainage area, 264 sq mi).

Drainage area.--297 sq mi.

Records available.--July 1902 to February 1906; October 1908 to November 1913. March 1906 to September 1907 at site above Oak Creek.

Bypass channels.--Tieton Canal bypasses station. Records for station do not include flow of canal.

Drainage area between Tieton River at Cobb's ranch near Naches and next station upstream

Diversions.--A few small ditches divert an insignificant amount of water for local irrigation along Oak Creek. Four ditches divert an average of 5 cfs from Tieton River during irrigation season (see table 9).

Return flow.--No surface flow, some seepage from local irrigation upstream.

Storage and regulation.--None except as noted for stations upstream.

Utilization.--Irrigated area above station estimated at about 200 acres, according to Bureau of Reclamation records at Yakima.

25.--Naches River below Tieton River, near Naches, Wash.

Location.--Water-stage recorder, lat 46°44'40", long. 120°46'00", in the SW¼NE¼ sec. 36, T. 15 N., R. 16 E., half a mile downstream from Wapatox power canal, three-quarters of a mile downstream from Tieton River, and 3½ miles northwest of Naches. Datum of gage is 1,550 ft above mean sea level.

Drainage area.--943 sq mi.

Records available.--August to October 1905, November 1908 to October 1912, and May 1915 to September 1950 in reports of Geological Survey. September 1905 and October 1908 to September 1912 (mean monthly discharge) in State Water-Supply Bulletin 5.

Bypass channels.--Tieton, Selah Valley (Naches-Selah), Wapatox Canals, and Oak Flat diversion, all bypass gage. Daily discharge records do not include flow of these canals. Monthly discharges adjusted for diversions of Tieton and Selah Valley (Naches-Selah) Canals, Oak Flat diversion since 1929, and Wapatox power canal since 1936, in Geological Survey Water-Supply Papers.

Drainage area between Naches River below Tieton River near Naches and next station upstream

Diversions.--Oak Flat diversion, Selah Valley canal, and Wapatox power canal divert water from Naches River and two small ditches divert from the lower Tieton River, all above station. An average of 537 cfs is diverted as shown in table 10.

Return flow.--No surface return flow.

Storage and regulation.--None, except as noted above upstream stations.

Utilization.--Irrigation of about 220 acres on Tieton River above station.

Table 9.--Diversions in Tieton River basin, above Tieton River at Cobb's Ranch near Naches, Wash.
[Diversions in this table are those located between this station and the next upstream station, Tieton River at headworks of Tieton Canal near Naches]

Name	Point of diversion	Date of establ.	Approx. normal flow (cfs)	Purpose	Remarks
Gnavaugh North Side ditch.	NW¼SW¼ sec. 8, T. 14 N., R. 16 E.	1913	1	Irrigation	Misc. discharge measurments 1912-14, 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 3.7 cfs. Irrigated area, 40 acres. 1/
Gnavaugh South Side ditch.	NE¼SW¼ sec. 8, T. 14 N., R. 16 E.	Prior to 1905.	1	----do----	Misc. discharge measurements 1912-14, 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 3.3 cfs. Irrigated area, 40 acres. 1/
Upper Cobb South Side ditch.	SW¼NW¼ sec. 9, T. 14 N., R. 16 E.	Prior to 1905.	.5	----do----	Misc. discharge measurements 1912-14, 1922-44, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 1.2 cfs. Irrigated area, 20 acres. 1/ Abandoned in 1944.
Cobb Upper Side ditch	SE¼NW¼ sec. 9, T. 14 N., R. 16 E.	Prior to 1905.	1	----do----	Misc. discharge measurements 1913, 1922-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 3.6 cfs. Irrigated area, 40 acres. 1/
Sinclair and Cobb ditch.	SE¼NW¼ sec. 10, T. 16 N., R. 16 E.	1902	2	----do----	Misc. discharge measurements 1921-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 6.4 cfs. Irrigated area, 80 acres. 1/

1/ Estimated from information furnished by Bureau of Reclamation, Yakima.

Table 10.--Diversions in Lower Tieton River and Naches River basins, above Naches River below Tieton River near Naches, Wash.
[Diversions in this table are those located between this station and the next stations upstream, Tieton River at Cobb's Ranch near Naches, and Naches River at Oak Flat near Nile]

Name	Point of diversion	Date of establ.	Approx. normal flow (cfs)	Purpose	Remarks
Oak Flat Diversion	NW¼ sec. 34, T. 15 N., R. 16 E.	1929	13	Yakima municipal supply.	Daily discharge records available from city of Yakima Water Superintendent 1929-50.
Naches-Selah Canal	SW¼NW¼ sec. 35, T. 15 N., R. 16 E.	1904	100	Irrigation	Daily discharge records, 1905, 1909-14, 1920-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 139 cfs. Irrigated area, 10,000 acres.
Sinclair and Parmentier ditch.	NE¼SE¼ sec. 3,, T. 14 N., R. 16 E.	Prior to 1905.	.6	----do----	Misc. discharge measurements 1922-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 5.3 cfs. Irrigated area, 20 acres. 1/
Tennant ditch	NE¼SE¼ sec. 36, T. 15 N., R. 16 E.	Prior to 1905.	6	----do----	Misc. discharge measurements 1912-13, 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 15.2 cfs. Irrigated area, 200 acres. 1/

Table 10.--Diversions in Lower Tieton River and Naches River basins, above Naches River below Tieton River near Naches, Wash.--Continued

Name	Point of diversion	Date of establ.	Approx. normal flow (cfs)	Purpose	Remarks
Wapatox power canal	SE¼NW¼ sec. 36, T. 15 N., R. 16 E.	Prior to 1905.	430	Power and irrigation.	Daily discharge records 1904-5, 1909-50 in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 709 cfs. Irrigated area, below power house it becomes Lower Wapatox Canal, irrigating 1,200 acres above Gleed; 2,000 acres irrigated by canal above power house.

1/ Estimated from information furnished by Bureau of Reclamation, Yakima.

26.--Naches River near North Yakima, Wash.

Location.--Staff or cantilever chain gage in sec. 12, T. 13 N., R. 18 E., 800 ft above Northern Pacific Railway bridge, half a mile above mouth of river, and 2 miles northwest of North Yakima.

Drainage area.--1,120 sq mi.

Records available.--August 1893 to February 1897 (fragmentary), March 1898 to September 1912.

Bypass channels.--None.

Drainage area between Naches River near North Yakima and next station upstream

Diversions.--Twenty-two ditches and canals divert an average of 60 cfs above station as shown in table 11. The adjudication decree of Cowiche Creek (1922) denotes 1,369 acres as irrigable, with an entitlement of one miners inch per acre. Due to inadequacy of water supply during the late summer months, this land is mostly irrigated only during periods of the spring snow melt. During the early part of the irrigation season water is diverted also from Cowiche Creek by Yakima Tieton Irrigation District for use on Naches Heights farms, averaging 2,000 acre-ft annually. District was organized in 1910. The headgate is located in the NE¼ sec. 11, T. 13 N., R. 17 E. Records available in files of Yakima Tieton Irrigation District office, Yakima.

Return flow.--A drain returns 1 to 15 cfs to Naches River above station in the SE¼ sec. 14, T. 14 N., R. 17 E. Two 12 in. drains return up to 6 cfs each above station in the SE¼ sec. 23, T. 14 N., R. 17 E. One drain returns up to 6 cfs above station in SW¼ sec. 25, T. 14 N., R. 17 E. (Records of Yakima County Engineer, 1921, 1922.)

Prior to 1942, when power operation ceased, the Fruitvale Power Waste discharged an average of 45 cfs into Cascade Lumber Co. mill pond and thence into the Yakima River in center sec. 18, T. 13 N., R. 19 E; since 1942 it has averaged only 10-15 cfs. Groundwater seepage from irrigated area in lower Naches valley probably enters Yakima River below Naches River.

Storage and regulation.--None except as noted for station upstream.

Utilization.--The Tieton Canal irrigates 24,640 acres, the Selah Valley canal irrigates 10,000 acres. (U. S. Bureau of Reclamation files, Yakima.) The small ditches as listed irrigate about 20,000 acres.

Table 11.--Diversions in Naches River basin, above Naches River near North Yakima, Wash.
[Diversions in this table are those located between this station and the next station upstream, Naches River below Tieton River near Naches]

Name	Point of diversion	Date of establ.	Approx. normal flow (cfs)	Purpose	Remarks
Johncox ditch	NE¼NE¼ sec. 6, T. 14 N., R. 17 E.	Prior to 1893.	5	Irrigation	Daily discharge records 1922-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 12 cfs. Irrigated area, 926 acres. 1/
Clark ditch	NW¼NW¼ sec. 5, T. 14 N., R. 17 E.	Prior to 1905.	4	----do----	Daily discharge records 1905, 1908-11, 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 11 cfs. Irrigated area, 274 acres. 2/

Table 11.--Diversions in Naches River basin, above Naches River near North Yakima, Wash.--Continued

Name	Point of diversion	Date of establ.	Approx. normal flow (cfs)	Purpose	Remarks
Lowry Canal	Center sec. 5, T. 14 N., R. 17 E.	Prior to 1893.	9	Irrigation	Daily discharge records 1909-14, 1921-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 28 cfs. Irrigated area, 300 acres. 3/
Kelly Canal	Center sec. 5, T. 14 N., R. 17 E.	Prior to 1893.	10	----do----	Daily discharge records 1909-14, 1921-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 47 cfs. Irrigated area, 375 acres. 2/
Upper Scott ditch	SE¼SW¼ sec. 4, T. 14 N., R. 17 E.	Prior to 1893.	18	----do----	Daily discharge records 1905, 1909-14, 1921-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 41 cfs. Irrigated area, 280 acres. 4/
LaFortune ditch	NE¼NE¼ sec. 9, T. 14 N., R. 17 E.	Prior to 1893.	16	----do----	Daily discharge records 1905, 1909-14, 1921-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 32 cfs. Irrigated area, 325 acres. 4/
Powell ditch (Lower Scott).	NE¼NE¼ sec. 9, T. 14 N., R. 17 E.	Prior to 1893.	8	----do----	Daily discharge records 1905, 1910-14, 1921-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 31 cfs. Irrigated area, 500 acres. 4/
Basket Ford ditch	Center sec. 14, R. 14 N., R. 17 E.	Prior to 1893.	12	----do----	Irrigated area, 400 acres. 4/
Gleed ditch	SW¼NW¼ sec. 24, T. 14 N., R. 17 E.	Prior to 1893.	50	----do----	Daily discharge records 1909-14, 1923-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 92 cfs. Irrigated area, 1,800 acres. 5/
Morrisey ditch	SE¼SW¼ sec. 24, T. 14 N., R. 17 E.	Prior to 1893.	6	----do----	Misc. discharge measurements 1905, 1909, 1912-13, 1921-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 16 cfs. Irrigated area, 214 acres.
Congdon Canal	SW¼NW¼ sec. 25, T. 14 N., R. 17 E.	Prior to 1893.	47	----do----	Daily discharge records 1904-5, 1911-14, 1919-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 69 cfs. Irrigated area, 4,300 acres. 1/
Schuller and Rodenbeck ditch.	SW¼SE¼ sec. 25, T. 14 N., R. 17 E.	Prior to 1893.	3	----do----	Misc. discharge measurements 1909-10, 1923-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 12 cfs. Irrigated area, 120 acres.
White and Leach ditch	NW¼NW¼ sec. 36, T. 14 N., R. 17 E.	Prior to 1893.	3	----do----	Misc. discharge measurements 1909, 1921, 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 11 cfs. Irrigated area, 240 acres.
McCormick and Long ditch.	SW¼NW¼ sec. 37, T. 14 N., R. 18 E.	Prior to 1893.	3	----do----	Misc. discharge measurements 1905, 1909-11, 1921-50, in

Table 11.--Diversions in Naches River basin, above Naches River near North Yakima, Wash.--Continued

Name	Point of diversion	Date of establ.	Approx. normal flow (cfs)	Purpose	Remarks
					files of Bureau of Reclamation, Yakima. Maximum recorded flow, 12 cfs. Irrigated area, 200 acres.
Long ditch	SE¼SE¼ sec. 31, T. 14 N., R. 18 E.	Prior to 1893.	1.5	Irrigation	Misc. discharge measurements 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 4.8 cfs. Irrigated area, 60 acres. 3/
Glaspey ditch	NW¼NW¼ sec. 5, T. 13 N., R. 18 E.	Prior to 1893.	2	----do----	Misc. discharge measurements 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 6.5 cfs. Irrigated area, 80 acres. 3/ River water not diverted for many years, as there is sufficient return flow seepage for needs.
Chapman and Leach ditch.	NW¼NW¼ sec. 5, T. 13 N., R. 18 E.	Prior to 1893.	3	----do----	Misc. discharge measurements 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 8.5 cfs. Irrigated area, 180 acres. River water not diverted for many years, as there is sufficient return flow seepage for needs.
Nelson ditch	SW¼NE¼ sec. 5, T. 13 N., R. 18 E.	Prior to 1893.	3	----do----	Misc. discharge measurements 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 6.2 cfs. Irrigated area, 150 acres. River water not diverted for many years, as there is sufficient return flow seepage for needs.
Small Nelson ditch	SW¼NE¼ sec. 5, T. 13 N., R. 18 E.	Prior to 1893.	.5	----do----	Misc. discharge measurements 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 3 cfs. Irrigated area, 30 acres. River water not diverted for many years, as there is sufficient return flow seepage for needs.
Jacobson ditch	NW¼SE¼ sec. 5, T. 13 N., R. 18 E.	Prior to 1893.	2	----do----	Misc. discharge measurements 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 4.4 cfs. Irrigated area, 80 acres. 3/ River water not diverted for many years, as there is sufficient return flow seepage for needs.
Naches-Cowiche Canal	SE¼NW¼ sec. 9, T. 13 N., R. 18 E.	Prior to 1904.	32	----do----	Daily discharge records 1909-14, 1923-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 50 cfs. Irrigated area, 2,000 acres. 1/
Nelson and Hess ditch.	NW¼SE¼ sec. 9, T. 13 N., R. 18 E., from Cowiche Creek.	Prior to 1893.	2.5	----do----	Daily discharge records 1913-14, misc. measurements 1925-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 6 cfs. Irrigated area, 90 acres. 3/

Table 11.--Diversions in Naches River basin, above Naches River near North Yakima, Wash.--Continued

Name	Point of diversion	Date of establ.	Approx. normal flow (cfs)	Purpose	Remarks
City meter	SE¼SE¼ sec. 9, T. 13 N., R. 18 E.	Prior to 1905.	25	Irrigation	Daily discharge records 1910-14, 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 62 cfs. Irrigated area, 2,380 acres. Used for irrigation of lawns and other municipal uses in city of Yakima.
Fruitvale power canal.	NW¼SW¼ sec. 10, T. 13 N., R. 18 E.	Prior to 1893.	100	Primarily irrigation.	Daily discharge records 1904-5, 1910-15, 1923-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 308 cfs. Irrigated area, 550 acres. 1/
Old Union Canal	NE¼NE¼ sec. 15, T. 13 N., R. 18 E.	Prior to 1904.	45	Irrigation	Daily discharge records 1904-5, 1910-15, 1923-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 77 cfs. Irrigated area, 3,750 acres. 1/
Broadway Canal	From Wide Hollow Creek at south city limits.	-	3	----do----	Daily discharge records 1922-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 6.4 cfs. Irrigated area, 275 acres. Discharge is return flow seepage.

1/ Washington State Department of Conservation and Development.
2/ Department of Agriculture Bulletin 158.
3/ Estimated from information furnished by Bureau of Reclamation, Yakima.
4/ Department of Agriculture Bulletin 188.
5/ Geological Survey, Technical Coordination Branch, Tacoma.
Note.--Unless otherwise specified, all data from records of Bureau of Reclamation, Yakima.

27.--North Fork Ahtanum Creek near Tampico, Wash.

Location.--Water-stage recorder, lat 46°33'40", long. 120°55'10", in the NW¼ sec. 2, T. 12 N., R. 15 E., 100 ft downstream from Nasty Creek, 3½ miles upstream from Tampico and confluence with South Fork, and 20 miles west of Yakima.

Drainage area.--69 sq mi.

Records available.--August 1907 to September 1924 (incomplete), March 1931 to September 1950.

Bypass channels.--None.

Diversions.--Water diverted above station is insignificant.

Return flow.--None.

Storage and regulation.--None.

Utilization.--Fifteen acres under irrigation in accordance with the adjudication decree of 1925.

28.--South Fork Ahtanum Creek at Conrad ranch, near Tampico, Wash.

Location.--Staff gage, lat 46°30'30", long. 120°54'50", in W½ sec. 23, T. 12 N., R. 15 E., at Conrad ranch, 2½ miles upstream from confluence with North Fork, 2¾ miles southwest of Tampico, and 20 miles southwest of Yakima.

Drainage area.--24.5 sq mi.

Records available.--March 1915 to September 1924 (fragmentary), March 1931 to September 1950.

Bypass channels.--None.

Diversions.--About 1 cfs diverted from "flood waters" only, in accordance with adjudication decree of 1925.

Return flow.--Small amount of seepage from irrigation above station.

Storage and regulation.--None.

Utilization.--Approximately 55 acres irrigated above station.

29.--South Fork Ahtanum Creek near Tampico, Wash.

Location.--Staff gage, sec. 24, T. 12 N., R. 15 E., at Shannafelt ranch, 1 mile above North Fork and 2 miles southwest of Tampico.

Drainage area.--28 sq mi.

Records available.--January, February, May 1908 to February 1915.

Bypass channels.--None.

Drainage area between South Fork Ahtanum Creek near Tampico and next station upstream

Diversions.--Several small ditches divert as much as 2 cfs total, from "flood waters", in accordance with adjudication decree of 1925.

Return flow.--Small amount of ground water seepage from irrigation.

Storage and regulation.--None.

Utilization.--Approximately 86 acres irrigated in this area.

30.--Ahtanum Creek at "The Narrows", near Tampico, Wash.

Location.--Staff gage in sec. 15, T. 12 N., R. 16 E., at "The Narrows", 3 miles below junction of North and South Forks, and 3½ miles east of Tampico.

Drainage area.--121 sq mi.

Records available.--June 1908 to September 1913.

Bypass channels.--Johncox ditch bypasses station. Discharge records do not include flow in Johncox ditch.

Drainage area between Ahtanum Creek at The Narrows near Tampico and next station upstream

Diversions.--Water rights for 841 acres granted by adjudication decree of 1925, in the amount of one miners inch per acre. (Oral report by Wallace Owen, ditch rider.) In addition, Johncox ditch diverts 7 to 8 cfs in the NW¼SW¼ sec. 7, T. 12 N., R. 16 E., to irrigate farm lands just below station. Because water rights are junior to others under the decree, the ditch carries water only during the early irrigation season.

Return flow.--No surface drains. Considerable ground-water seepage from irrigation upstream.

Storage and regulation.--None.

Utilization.--A total of 841 acres irrigated above station; however only 188 acres receive adequate water supply during normal year.

31.--Ahtanum Creek near Yakima, Wash.

Location.--Staff gage in the SW¼ sec. 8, T. 12 N., R. 19 E., at Northern Pacific Railway bridge, 500 ft above mouth, and 1 mile southeast of Yakima.

Drainage area.--212 sq mi.

Records available.--May to December, 1904, August 1907 to October 1910, April 1911 to September 1912.

Bypass channels.--None.

Drainage area between Ahtanum Creek near Yakima and next station upstream

Diversions.--By the adjudication decree of 1925, 9,381 acres were considered irrigable and an allotment of one miners inch per acre was made. Included are the 926 acres served by the Johncox ditch which bypasses the station on Ahtanum Creek at the Narrows when water is plentiful. According to Mr. Wallace Owen, ditch rider at Ahtanum Creek, of the 9,381 acres only 2,600 acres are irrigated under water rights adequate to insure water supply throughout the irrigation season of an average year.

This area is served by a maze of small ditches, many of which are interconnected, and individual tabulation appears impracticable. Although no quantitative records of water use are available, irrigation has been practiced for many years in this valley. The first irrigation in Yakima River basin was in Ahtanum valley, beginning in 1864.

The Yakima Indian Reservation to the south is entitled to a quarter of the total flow of Ahtanum Creek, by court decree. Most of this water is carried by the Main Ahtanum Canal, built in 1908, diverting at the center of the E½ sec. 14, T. 12 N., R. 16 E., and carrying an average flow of 30 cfs during the irrigation season. The maximum recorded flow is 92 cfs. It irrigates about 1,000 acres. (Information from files of U. S. Indian Service at Wapato) Available record 1909-13 fragmentary, 1913-24, and 1926-50. The Lower Ahtanum Canal diverting in center of the NE¼SE¼ sec. 7, T. 12 N., R. 18 E., carries an average flow of 14 cfs. The flow is ground-water seepage mostly, from the Main Canal. (Information from files of U. S. Indian Service at Wapato) It was an old Indian ditch originally which was taken over and rebuilt in 1918 by the Indian Service.

Return flow.--No surface drains. Considerable ground-water seepage from irrigation upstream.

Utilization.--The 9,381 irrigable acres recognized in 1925 probably are more than presently irrigated, because of the limited water supply. This implies that little or no new lands have been developed in the last 25 yr, and that the present area under irrigation is probably about 9,000 acres.

32.--Yakima River at Union Gap, near Yakima, Wash.

Location.--Prior to July 29, 1912, staff gages read once or twice daily; thereafter, Stevens water-stage recorder in sec. 17, T. 12 N., R. 19 E. at Union Gap, 600 ft below Ahtanum Creek, 600 ft above New Reservation Canal, and 1 mile south of Yakima.

Drainage area.--3,550 sq mi (revised).

Records available.--October 1893 to March 1894 (fragmentary), August 1896 to September 1919. (For method of discharge determination see footnote, W.S.P. 492, pp. 221.)

Bypass channels.--Station bypassed by Union Gap and Roza Canals, flow of which is not included in station records. Water-Supply Papers give monthly flow adjusted for storage, diversion, and seepage return, as a measure of natural water yield.

Drainage area between Yakima River at Union Gap near Yakima and next stations upstream

Diversions.--Fourteen ditches and canals divert a total average flow of 108 cfs as shown in table 12. All water diverted is used for irrigation above gage, except for about 50 cfs in the Union Gap Canal.

Return flow.--Waste from the city of Yakima municipal water and sewage treatment system is discharged into the river in sec. 29, T. 13 N., R. 19 E., near the south city limits. According to the Water Superintendent of Yakima, amount varies from 8 cfs in winter to 26 cfs during irrigation season. The Moxee drain ditch, which discharges in the NW¼SW¼ sec. 9, T. 12 N., R. 19 E., drains all of the area around Moxee City, including the city's municipal waste. The total flow averages from 15 to 30 cfs depending on the season, according to the Moxee City Marshall.

Storage and regulation.--None, except as noted for stations upstream.

Utilization.--An estimated 6,700 acres are irrigated at present, according to data supplied by Bureau of Reclamation. This acreage is comparable with that irrigated when the station was discontinued.

Table 12.--Diversions in Yakima River basin, above Yakima River at Union Gap, Wash.
[Diversions in this table are those located between this station and the next station upstream Yakima River at Selah Gap]

Name	Point of diversion	Date of establ.	Approx. normal flow (cfs)	Purpose	Remarks
Moxee Company ditch	SE¼SE¼ sec. 7, T. 13 N., R. 19 E.	Prior to 1893.	11	Irrigation	Daily discharge records 1904-5, 1909-14, 1921-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 27 cfs. Irrigated area, 3,410 acres. 1/
Hubbard Canal	SW¼NE¼ sec. 17, T. 13 N., R. 19 E.	Prior to 1893.	19	----do----	Daily discharge records 1909-14, 1921-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 46 cfs. Irrigated area, 700 acres. 2/
Granger ditch	SW¼NE¼ sec. 17, T. 13 N., R. 19 E.	Prior to 1893.	6	----do----	Daily discharge records 1909-14, and misc. measurements 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 20 cfs. Irrigated area, 200 acres. 2/
Bott ditch no. 1	SW¼NE¼ sec. 17, T. 13 N., R. 19 E.	Prior to 1893.	3	----do----	Discharge records as misc. measurements 1912-14, 1921-27, 1946-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 5.6 cfs. Irrigated area, 100 areas. 2/
Union Gap Canal	NW¼NW¼ sec. 17, T. 13 N., R. 19 E.	1885	50	----do----	Daily discharge records 1909-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 80 cfs. Irrigated area, 4,000 acres below gage.
Normanden ditch	SW¼NE¼ sec. 17, T. 13 N., R. 19 E.	-	.8	----do----	Misc. discharge measurements 1941-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 1.5 cfs. Irrigated area, 30 acres. 2/
Rich ditch no. 1	SW¼NE¼ sec. 17, T. 13 N., R. 19 E.	Water rights 1892.	.6	----do----	Misc. discharge measurements 1926-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 3.8 cfs. Irrigated area, 20 acres. 2/
Richartz Canal	Center sec. 17, T. 13 N., R. 19 E.	Prior to 1893.	18	----do----	Misc. discharge measurements 1912-13, 1921-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 24 cfs. Irrigated area, 700 acres. 2/

Table 12.--Diversions in Yakima River basin, above Yakima River at Union Gap, Wash.--Continued

Name	Point of diversion	Date of establ.	Approx. normal flow (cfs)	Purpose	Remarks
Scudder ditch	Center sec. 21, T. 13 N., R. 19 E.	Prior to 1893.	5	Irrigation	Misc. discharge measurements 1912-13, 1922-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 8.5 cfs. Irrigated area, 200 acres. 2/ Discharge made up of return flow from Richartz Canal and Blue Slough.
Parrish ditch no. 1	SW¼SE¼ sec. 28, T. 13 N., R. 19 E.	Prior to 1893.	.4	----do----	Misc. discharge measurements 1913, 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 2.9 cfs. Irrigated area, 15 acres. 2/ Discharge made up of return flow from Richartz Canal and Blue Slough.
Parrish ditch no.2	SW¼NE¼ sec. 33, T. 13 N., R. 19 E.	Prior to 1893.	.1	----do----	Misc. discharge measurements 1924-36, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 0.5 cfs. Irrigated area, 10 acres. 2/ Discharge made up of return flow from Richartz Canal and Blue Slough.
Parrish ditch no.3	SW¼NE¼ sec. 33, T. 13 N., R. 19 E.	Prior to 1893.	.3	----do----	Misc. discharge measurements 1940-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 5.5 cfs. Irrigated area, 10 acres. 2/ Discharge made up of return flow from Richartz Canal and Blue Slough.
Harter ditch	SW¼NE¼ sec. 33, T. 13 N., R. 19 E.	Prior to 1893.	2	----do----	Misc. discharge measurements 1913, 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 10 cfs. Irrigated area, 70 acres. 2/ Discharge made up of return flow from Richartz Canal and Blue Slough.
Price ditch	NE¼NW¼ sec. 4, T. 12 N., R. 19 E.	1886	2	----do----	Misc. discharge measurements 1913, 1924-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 9.6 cfs. Irrigated area, 70 acres. 2/ Discharge made up of return flow from Richartz Canal and Blue Slough.

1/ Washington State Dept. of Conservation and Development, Olympia.
2/ Estimated from information furnished by Bureau of Reclamation, Yakima.

33.--Yakima River near Parker, Wash.

Location.--Water-stage recorder, lat 46°29'40", long. 120°26'10", in sec. 28, T. 12 N., R. 19 E., just downstream from Sunnyside diversion dam, 1½ miles east of Parker, and 3 miles downstream from Ahtanum Creek.

Drainage area.--3,560 sq mi.

Records available.--April 1908 to September 1921, October 1931 to September 1950. Records October 1921 to September 1931, monthly and annual only, published in W.S.P. 870, furnished by Bureau of Reclamation.

Bypass channels.--Roza, Union Gap, New Reservation, Old Reservation, and Sunnyside Canals bypass station to irrigate large acreage downstream. Records for station do not include the flow of these canals. Monthly discharges adjusted for these flows in Water-Supply Papers, as a measure of natural yield.

Drainage area between Yakima River near Parker and next station upstream

Diversions.--Three large canals and one small ditch divert an average of 3,175 cfs during the irrigation season, as shown in table 13.

Return flow.--No surface return flow, possibly some seepage from irrigation upstream.

Storage and regulation.--None, except as noted for stations upstream.

Utilization.--Thirteen acres irrigated under Goldsmith ditch. Irrigation of two or three hundred acres from Old and New Reservation canals above station. In the entire Yakima basin above this station the irrigated area has increased from 141,120 acres in 1920 to 198,510 acres in 1946. (Simons, W. D., Irrigation and Streamflow Depletion in Columbia River basin, unpublished: Geological Survey, Tacoma, 1951.)

Table 13.--Diversions in Yakima River basin, above Yakima River near Parker, Wash.
[Diversions in this table are those located between this station and the next station upstream, Yakima River at Union Gap]

Name	Point of diversion	Date of establ.	Approx. normal flow (cfs)	Purpose	Remarks
Goldsmith ditch	SE¼SW¼ sec. 17, T. 12 N., R. 19 E.	Prior to 1908.	0.5	Irrigation	Misc. measurements 1931-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 1 cfs. Irrigated area, 13 acres.
New Reservation Canal.	SW¼SW¼ sec. 17, T. 12 N., R. 19 E.	1903	1,700	----do----	Daily discharge records 1904-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 2,320 cfs. Irrigated area under Old and New Reservation Canals, 106,659 acres at present.
Old Reservation Canal.	Center sec. 28, T. 12 N., R. 19 E.	Prior to 1904.	25	----do----	Daily discharge records 1904-50, in files of Bureau of Reclamation, Yakima. Maximum recorded flow, 381 cfs. From 1 to 10 cfs flow during year used for stock water. Flow averaged 175 cfs or more until 1923 when water from New Reservation Canal began to irrigate land previously irrigated by Old Reservation Canal. In 1930, 1,920 acres were irrigated. About 100 cfs are diverted at present, except during the irrigation season when flow is reduced to 8 to 10 cfs. 1/
Sunnyside Canal	NW¼SE¼ sec. 28, T. 12 N., R. 19 E.	About 1902.	1,300	----do----	Daily discharge records 1904-50, in files of Bureau of Reclamation, Yakima. Land under irrigation in 1906 was 40,000 acres; at present 82,000 acres.

1/ Files of Bureau of Indian Affairs, Wapato.

34.--Toppenish Creek near Fort Simcoe, Wash.

Location.--Staff gage, lat 46°18'40", long. 120°46'50", in sec. 35, T. 10 N., R. 16 E., at Olney Ranch, 30 ft. above headworks of Toppenish Feeder Canal, and 3 miles south of Fort Simcoe. Prior to Aug. 19, 1915, chain and staff gages about 1 mile downstream, Aug. 19, 1915 to Sept. 30, 1922, water-stage recorder 1¼ miles downstream.

Drainage area.--124 sq mi.

Records available.--February 1909 to September 1924.

Bypass channels.--None.

Diversions.--Nicol, or Abe Lincoln, ditch diverting from 3 to 20 cfs depending on time of year, about 2 miles upstream from station, was built prior to 1900, and abandoned in 1921. The diversion was measured from April 1920 to May 1921.

Return flow.--None except ground-water seepage from irrigation upstream.

Storage and regulation.--None.

Utilization.--Small acreage irrigated by Abe Lincoln ditch from prior to 1909 to 1921.

35.--Simcoe Creek (above and below Spring Creek) near Fort Simcoe, Wash.

Location.--Chain and staff gage lat 46°23'30", long. 120°48'20", in sec. 34, T. 11 N., R. 16 E., at site of a proposed reservoir just above Spring Creek, 4 miles northeast of Fort Simcoe, used prior to November 20, 1915. Water-stage recorder just below Spring Creek used thereafter.

Drainage area.--77 sq mi.

Records available.--February 1909 to September 1923.

Bypass channels.--Flow of Simcoe lateral combined with discharge at station after 1920 in Geological Survey Water-Supply Papers.

Diversions.--Sincoe lateral, built in 1920, diverts from 0.1 to 6 cfs at a point in the NE¼SW¼ sec. 34, T. 11 N., R. 16 E. The maximum diversion occurs in May. (Information from records in files of Bureau of Indian Affairs, in Wapato.) Other small diversions above station. No record of amount diverted.

Return flow.--Small amount of seepage for local irrigation upstream.

Storage and regulation.--None.

Utilization.--Small amount of local irrigation above gage at the present time.

36.--Toppenish Creek near White Swan (Wapato), Wash.

Location.--Chain gage on line between secs. 6 and 7, T. 10 N., R. 18 E., 1,000 ft below Simcoe Creek and 5 miles east of White Swan.

Drainage area.--360 sq mi.

Records available.--March 1909 to September 1911 (fragmentary).

Bypass channels.--None.

Drainage area between Toppenish Creek near White Swan and next stations upstream

Diversions.--Toppenish feeder canal, diverts in sec. 35, T. 10 N., R. 16 E., 30 ft below gaging station on Toppenish Creek near Fort Simcoe. According to F. E. Moxley of the U. S. Indian Service at Wapato, during the winter it carries an average of about 10 cfs, and as much as 50 cfs during the summer, for irrigation of 1,757 acres above station. Discharge records available in files of Bureau of Indian Affairs, Wapato.

Return flow.--None.

Storage and regulation.--None.

Utilization.--According to Mr. Moxley, 806 acres irrigated by Simcoe lateral above station at present time.

37.--Toppenish Creek near Toppenish, Wash.

Location.--Chain gage in the NE¼ sec. 36, T. 10 N., R. 19 E., 4 miles southwest of Toppenish and 200 yd below highway bridge.

Records available.--November 1908 to February 1909.

Bypass channels.--None.

Drainage area between Toppenish Creek near Toppenish and next station upstream

Diversions.--Rentchler ditch, diverting in sec. 21, T. 10 N., R. 18 E., carries an average flow of 6 cfs. (Estimated by F. E. Moxley, Wapato.) Flow on May 24, 1951 estimated at 12 cfs.

Return flow.--None.

Storage and regulation.--None

Utilization.--About 300 acres above station are irrigated by Rentchler ditch at present.

38.--Toppenish Creek at Alfalfa, Wash.

Location.--Staff gage is sec. 32, T. 10 N., R. 21 E., at highway bridge 300 ft above Northern Pacific Railway crossing, 1 mile southeast of Alfalfa and 2½ miles above mouth.

Drainage area.--560 sq mi.

Records available.--March 1909 to September 1912.

Bypass channels.--Water diverted for Satus Irrigation Project as noted below, bypasses station and returns to the Yakima River above the gaging station on Yakima River near Mabton.

Drainage area between Toppenish Creek at Alfalfa and next station upstream

Diversions.--Durham lateral, constructed prior to 1904, diverts from Toppenish Creek in the NE¼NE¼ sec. 31, T. 10 N., R. 21 E., carrying an approximate average flow of 10 to 20 cfs, the maximum flow occurring in May or June. Records of flow available in files of Bureau of Indian Affairs, Wapato. Toppenish Creek in its lower reaches serves as a drain channel for reservation farm land (see Lower Toppenish Drain, table 14). Water is diverted from Main Drain into Toppenish Creek in sec. 26, T. 10 N., R. 20 E. About 3 miles downstream in sec. 32, T. 10 N., R. 20 E., water is diverted into the Satus Gravity Unit no. 1, irrigating 4,410 acres, and Satus Low Lift Pumping Unit no. 2, which irrigates 5,478 acres. A major portion of water diverted, during April, May and June is natural flow; therefore it consists of drainage and seepage from upstream irrigation. Additions are to be completed in the near future to no. 2 Unit which will increase the irrigated area by 1,800 acres, and to Unit no. 3, partly fed by Satus Creek, which will irrigate some 10,000 acres, the southern end of which will be near Mabton.

Return flow.--No known surface return flow; considerable ground water seepage from irrigation upstream.

Storage and regulation.--None.

Utilization.--530 acres are irrigated by Durham Lateral above station in 1950. Probably little change since station was discontinued. Considerable water diverted to serve 9,888 acres (1950) downstream as noted in "Diversions" paragraph. After present construction is complete irrigated area will be doubled.

39.--Satus Creek near Toppenish, Wash.

Location.--Staff gage in sec. 26, T. 9 N., R. 19 E., 1 mile above Dry Creek and 10 miles southwest of Toppenish.

Drainage area.--254 sq mi.

Records available.--November 1908 to June 1913.

Bypass channels.--None.

Diversions.--According to F. E. Moxley of the U. S. Indian Service at Wapato, during July and August the entire flow of Satus Creek, about 5 to 10 cfs, is diverted above Lazy Creek for irrigation. No records of diversions.

Return flow.--No surface drains, but stream above gage receives ground-water seepage from irrigation.

Storage and regulation.--None.

Utilization.--Several hundred acres above station irrigated from Satus Creek.

40.--Satus Creek below Dry Creek near Toppenish, Wash.

Location.--Water-stage recorder, lat 46°15'00", long. 120°22'50", in sec. 24, T. 9 N., R. 19 E., at dam site 1 mile below Dry Creek and 9 miles southwest of Toppenish.

Drainage area.--427 sq mi.

Records available.--June 1913 to September 1924.

Bypass channels.--None.

Drainage area between Satus Creek below Dry Creek near Toppenish and next station upstream

Diversions.--None.

Return flow.--None.

Storage and regulation.--None.

Utilization.--None.

41.--Yakima River near Mabton, Wash.

Location.--Staff gage in sec. 35, T. 9 N., R. 23 E., at Rocky Fork, 4 miles below Mabton and 8½ miles above Prosser.

Records available.--Irrigation seasons of 1904, 1906, 1911, and 1912.

Note.--Because of the short period of record and the proximity to the next downstream station, no subdivision has been made for this station. See data for station on Yakima River near Prosser, Washington, no. 42.

42.--Yakima River near Prosser, Wash.

Location.--Water-stage recorder, lat 46°13'00", long. 119°45'00", in the SE¼ sec. 36, T. 9 N., R. 24 E., 1¼ miles northeast of Prosser. Prior to Oct. 13, 1906, chain and staff gages read once or twice daily.

Drainage area.--5,340 sq mi.

Records available.--April to October, 1904, February to October, 1906, August 1913 to February 1933 (no winter records 1916-19) October 1922 to September 1926 furnished by Bureau of Reclamation, Yakima.

Bypass channels.--Roza, Sunnyside and Prosser power canals bypass gage. Published station records not adjusted for flow of canals.

Drainage area between Yakima River near Prosser and next station upstream

Diversions.--

1. Snipes and Allan ditch diverting in the SE¼NW¼ sec. 17, T. 11 N., R. 20 E., carries an approximate average flow of 20 cfs. Maximum recorded flow is 59 cfs. (Files of Bureau of Reclamation, Yakima.) 500 acres irrigated. (Washington State Department Conservation and Development, Olympia.) Records available: 1923, 1927-29 daily discharges; 1930-50 miscellaneous measurments. (Files of Bureau of Reclamation, Yakima.)

2. The Shearer Canal diverts in the NW¼ sec. 13, T. 9 N., R. 20 E., from lower Satus Creek, 1 to 5 cfs during the irrigation season for use on about 580 acres in and about sec. 3, T. 9 N., R. 21 E. (Files of Bureau of Indian Affairs, Wapato.) Figures for Shattuck ditch diverting from it are included.

3. The Satus feeder canal diverting in the NW¼SW¼ sec. 7, T. 9 N., R. 21 E., is a part of Satus Low Lift Pumping Unit no. 2 and carries from 1 to 90 cfs during the irrigation season with maximum flow usually in May. See "Diversions" Toppenish Creek at Alfalfa. (Files of Bureau of Indian Affairs, Wapato.)

4. The Prosser power canal, diverting directly opposite the town of Prosser, carries an average flow of 1,000 cfs (Files of Bureau of Reclamation, Yakima) to its power house 1½ miles downstream from station. Constructed in 1932.

5. Prosser Falls irrigation canal diverting in vicinity of Prosser irrigated 4,000 acres until 1910 when it was taken over by Bureau of Reclamation. Since then water has been obtained from Sunnyside Canal. (Files of Bureau of Reclamation, Yakima.)

Return flow.--Seven main drains carry seepage from the Reservation varying from a total average flow of 550 cfs during winter to 950 cfs during irrigation season as shown in table 14. Eight main drains carry seepage and waste water to the river from the east, total winter flow averaging 64 cfs and summer flow averaging 192 cfs as shown in table 15. The municipalities of Wapato, Toppenish, Zillah, and Sunnyside discharge wastes into Yakima River as shown in table 1. The Prosser sewage treatment plant discharges 0.1 to 0.3 cfs into the Yakima River 150 cfs below bridge at south end of town. (Prosser sewage treatment plant operator, oral report.)

Storage and regulation.--None except as noted for stations upstream.

Utilization.--No breakdown of land area under irrigation showing that portion above station was found. From information supplied by the Bureau of Reclamation, Yakima, the irrigated area is estimated to be between 110,000 and 130,000 acres exclusive of the Indian Reservation.

Table 14.--Flow, in cubic feet per second, into Yakima River from Indian Reservation drains

Drain	Location of mouth	Maximum recorded	Winter	Irrigation season
East Toppenish Drain	SW¼NW¼ sec. 11, T. 10 N., R. 20 E.	200	11	35
Sub Drain 35	Center sec. 21, T. 10 N., R. 21 E.	98	25	85
Main Drain	NW¼NE¼ sec. 28, T. 10 N., R. 21 E.	1,500	290	460
Lower Toppenish Creek	NW¼SE¼ sec. 27, T. 10 N., R. 21 E.	1,600	100	155
Coulee Drain	SW¼NW¼ sec. 6, T. 9 N., R. 22 E.	48	12	23
Lower Satus (Satus Cr.)	SW¼SE¼ sec. 18, T. 9 N., R. 22 E.	2,500	105	180
South Drain	NE¼NE¼ sec. 19, T. 9 N., R. 22 E.	800	9	11

Note.--All information obtained from files of Bureau of Indian Affairs, Wapato.

Table 15.--Average flow, in cubic feet per second, from drains to Yakima River, in lower Yakima County, 1921-22

Drainage District	Location of mouth	Winter	Irrigation season
No. 2	Center sec. 21, T. 10 N., R. 21 E.	15	35
No. 25			
No. 7	Center sec. 21, T. 9 N., R. 22 E.	5	30
No. 12	Center sec. 22, T. 9 N., R. 22 E.	2	12
No. 31	SE¼SE¼ sec. 25, T. 9 N., R. 22 E.	.5	5
No. 35	SE¼SE¼ sec. 29, T. 9 N., R. 23 E.	.5	3
No. 27	NW¼ sec. 21, T. 10 N., R. 21 E.	.2	2.5
No. 32	SE¼ sec. 14, T. 14 N., R. 17 E.	1	15
Sulphur Creek	NW¼NW¼ sec. 26, T. 9 N., R. 22 E.	40	90

Note.-- All data from files of Yakima County Engineer, Yakima.

43.--Yakima River at Kiona, Wash.

Location.--Water-stage recorder, lat 46°15'10", long. 119°28'50", in sec. 19, T. 9 N., R. 27 E., at highway bridge at Kiona, 3½ miles downstream from intake of Kiona Canal and 25 miles upstream from mouth.

Drainage area.--5,520 sq mi.

Records available.--August 1896 to March 1915, February 1933 to September 1950.

Bypass channels.--About half of the flow of Kiona Canal bypasses gage.

Drainage area between Yakima River at Kiona and next station upstream

Diversions.--The Kiona Canal, diverting in sec. 10, T. 9 N., R. 26 E., 5 miles west of Kiona, carries an average of 32 cfs with a maximum recorded flow of 54 cfs. It was started prior to 1904 and has records for 1904, 1909-14, 1923-50 available in files of Bureau of Reclamation, Yakima.

Return flow.--Total flow of Prosser power canal returned to river above station, 3 miles below Prosser.

Storage and regulation.--None, except as noted above upstream stations.

Utilization.--Present irrigated area is estimated at about 25,000 acres, from data supplied by Bureau of Reclamation. Included is approximately 2,400 acres irrigated by the Kiona Canal above station which represents very little change in the irrigated area in the past 30 yr. Total irrigated area in Yakima Basin above station has increased from 305,370 aeres in 1920 to 424,430 acres in 1946. (Simons, W. D., 1951, Irrigation and Streamflow Depletion in Columbia River basin, unpublished report in files of U. S. Geol. Survey, Tacoma.)

44.--Yakima River near Richland, Wash.

Location.--Staff gage at highway bridge 1 mile upstream from mouth and 2 miles southeast of Richland. Gage used in 1906 at Richland Ferry at Richland.

Drainage area.--5,970 sq mi.

Records available.--Irrigation seasons 1906, 1909-11.

Bypass channels.--Columbia and Kennewick Canals bypass gate site. Records as published in Geological Survey Water-Supply Papers do not include flow of canals.

Drainage area between Yakima River near Richland and next station upstream

Diversions.--

1. The Richland and Columbia Canals, using the same diversion dam, located in sec. 3, T. 10 N., R. 27 E., divert an average flow of 190 and 250 cfs, respectively, while the maximum recorded flow for Richland Canal is 303 cfs and for the Columbia Canal, 324 cfs. Available records for Columbia Canal are 1904-5, 1910-14, 1923-50, and for Richland Canal, 1905, 1909-14, 1923-50. (Information from files of Bureau of Reclamation at Yakima.)

2. The Amon Canal (Benton Water Co.), built in 1905, diverted water for irrigation of 1,500 acres, (Department of Agriculture Bulletin No. 214) just above gage until it was abandoned about 1925. No record of flow available.

Return flow.--Waste from Richland sewage treatment plant, about 4 to 5 cfs, flows back into river upstream from gaging station. (Richland Sewage Treatment Plant Operator.) Points of re-entry of seepage from irrigation above station not established.

Storage and regulation.--None, except as noted for stations upstream.

Utilization.--Richland Canal, built in 1904 has been used for municipal supply of City of Richland since 1943. If formerly irrigated about 10,500 acres. The Columbia Canal and the Kennewick Canal, diverting from it, serve a total of 11,600 acres, mostly below station. (Wash. State Department, Conservation and Development, Olympia.) Kiona Canal serves approximately 1,100 acres above station. Present irrigated area above gage estimated at about 3,500 acres.

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