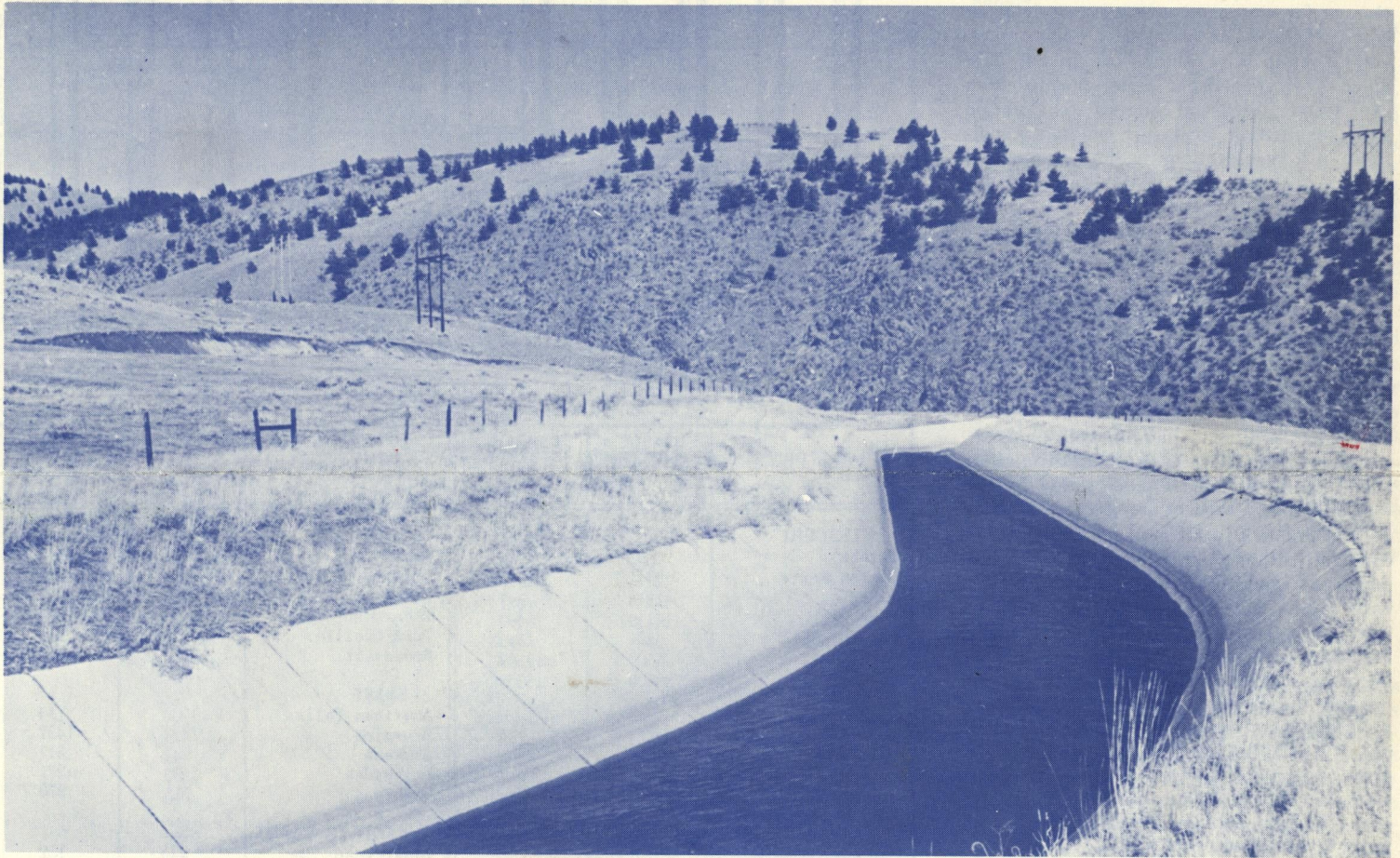


1966 FALL WATER SUPPLY SUMMARY



Irrigation water supplies were generally adequate. There were heavy demands on carryover storage to supplement below average streamflow. Present irrigation storage is generally below average except in the Pacific Southwest.

by

WATER SUPPLY FORECASTING BRANCH
SOIL CONSERVATION SERVICE
PORTLAND, OREGON

Even with below average snow melt season streamflow in 1966, irrigation water demands were reasonably well satisfied. Storage in conservation reservoirs at the start of the irrigation season was generally far in excess of the usual carryover due to the high streamflow year of 1965. The supplemental stored water provided for a generally adequate water supply.

Snow melt season streamflow was near average only on the upper Columbia and Kootenai watersheds in Canada and the Rio Grande in New Mexico. Winter and spring flow was well above average in Central Arizona. Extreme deficiencies in streamflow were experienced on the upper Colorado River Basin, Missouri River tributaries in Wyoming and Colorado, much of the Interior Basin in Utah and Nevada, and along the Snake River in southern Idaho and eastern Oregon. While water supplies in California were considerably below normal, no unusual problems were experienced. At least one year in four similar water problems are expected.

Even with excessive use of stored water, carryover storage for 1967 is only slightly below average for most irrigation systems. Generally, this represents a substantial decline from a year ago. Exceptions to this general condition include the Snake River system in southern Idaho and eastern Oregon and the North Platte in Colorado where storage is much below average. In addition to these larger systems there are several reservoirs on smaller watersheds where carryover storage is down to minimum levels. With reference to the reservoir storage chart, there is considerable variation in status of reservoir storage within states. The central valley of Arizona has had an excellent water year and prospects for next year, based on carryover storage and mountain soil moisture are excellent.

As of the date of this report, mountain soils tended to be drier than usual for this time of year. Unless there is substantial rainfall before the snow season, more than the usual amount of snow melt will be required to replace deficits in soil moisture. The dry mountain and valley soils are the result of an extended period of below average precipitation since the early spring months.

For the major streams, the flow of the Columbia and Missouri rivers in their downstream reaches have been below average. Summer flow of the Colorado River into Lake Powell was among the lowest years of record, comparable to 1964. There was a net loss in storage in the four large Colorado River reservoirs during the April-September period.

Without the cushion of carryover storage, average or better snowfall will be required during the 1966-67 winter season to assure an average water supply for the 1967 irrigation season. Any serious deficiency in winter snowfall would result in water shortages in parts of Colorado, Utah, Wyoming, Idaho and eastern Oregon as well as isolated areas in other states.

In the following paragraphs the 1966 water conditions by states are briefly reviewed.

ARIZONA

The 1966 water year for surface water supplies was the best since 1941. Storms last winter caused heavy runoff that provided a favorable storage situation at the beginning of the season. Snow melt runoff was

near average on the Verde and well above average on the Gila, Salt and Little Colorado rivers.

The outlook for 1967 is excellent for areas served by stored water. Reservoir storage for consumptive use is nearly three times average for October 1. Most reservoirs contain more water than for any date since 1941. September rains, coupled with cool temperatures and reduced transpiration have resulted in good soil moisture conditions at high elevations in the northern and eastern sections of the state. Based on fall watershed conditions, 1967 streamflow should be better than average if normal precipitation is received.

CALIFORNIA

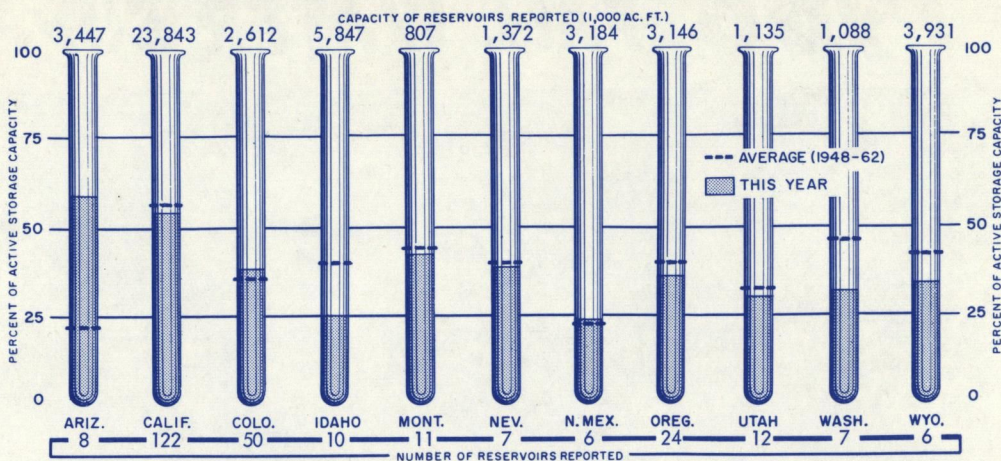
The California Department of Water Resources, coordinating agency for the California Cooperative Snow Survey Program, reports that the water crop of the 1965-66 water year, while considerably below normal, was generally sufficient to meet California's needs. Water shortages precipitated by the long winter and summer drought caused concern in practically all areas of the state -- especially those not serviced by stored supplies. Operations were further complicated when above normal spring temperatures in mountainous watersheds advanced the snow melt season by about one month. However, conditions generally were not of a critical nature and presented no unusual problems to water managers who statistically cope with drier conditions at least once every four years. The impact of this dry year was also tempered by the record carry-over storage and relatively high ground water levels of one year ago.

Statewide precipitation during the past water year was about 75 percent of average with above normal totals being experienced only in Southern California and at scattered North Coastal stations. November and December storms produced the most significant monthly totals, accounting for over 70 percent of the water year precipitation in Southern California and most of the season's snowpack in Sierra watersheds. The importance of these early season storms to the state's water crops became more and more apparent as expected seasonal storms of January, February, March and April failed to materialize. Thus, after December, each successive month brought a further reduction in anticipated spring and summer supplies.

April-July runoff of major snowfed streams was slightly above normal in the north coastal area but was far below normal in other areas of the state. In Central Valley basins, snow melt runoff generally ranged between 60 and 70 percent of normal, although only 25 to 40 percent of normal amounts occurred in low elevation watersheds. Total runoff from California watersheds during the 1965-66 water year was about 85 percent of normal.

At the end of the water year, the storage in 122 of California's major reservoirs was 12,370,000 acre feet or 54 percent of the aggregate capacity. While this is 2,000,000 acre feet less than the record storage of October 1, 1965 it still is about equal to the average carryover storage for the last ten years.

RESERVOIR STORAGE as of OCTOBER 1, 1966



STORAGE IN LARGER RESERVOIRS

NAME OF RESERVOIR	USABLE CAPACITY (1000 A.F.)	USABLE STORAGE (1000 A.F.) OCT. 1, 1966	NAME OF RESERVOIR	USABLE CAPACITY (1000 A.F.)	USABLE STORAGE (1000 A.F.) OCT. 1, 1966
MISSOURI			COLUMBIA		
Boysen	802	585	Chelan	676	592
Canyon Ferry	2043	1333	Coeur d'Alene	238	231
Tiber	1316	597	Flathead	1791	1719
Fort Peck	19410	16460	Hungry Horse	2982	2693
Fort Randall	5800	1343	Pend Oreille	1155	891
Garrison	24500	19569	Roosevelt	5232	5190
Oahe	23600	13354			
PLATTE			SNAKE		
Pathfinder	1011	158	American Falls	1700	14
Seminole	982	336	Brownlee	1427	1437
Colo-Big Thompson	865	377	Jackson	847	517
City of Denver	491	404	Palisades	1202	271
			Owyhee	715	270
ARKANSAS			PACIFIC COAST		
Conchas	600	310	Clear Lake	440	152
John Martin	387	178	Upper Klamath	584	285
			Ross	1203	1180
RIO GRANDE			Trinity	2500	1880
Elephant Butte	2207	262			
COLORADO			CALIFORNIA		
Flaming Gorge	3789	2495	Almanor	1036	628
Navajo	1709	509	Berryessa	1602	160
Powell	28000	8417	Folsom	1010	653
Havasu	619	562	Isabella	570	29
Mead	27207	15000	Millerton	521	162
Mohave	1810	1387	Pine Flat	1013	211
San Carlos	1206	349	Shasta	4500	3263
INTERIOR					
Bear	1421	1046			
Tahoe	732	406			
Utah	1149	447			

COLORADO

Streamflow was less than normal all over Colorado this summer, but due to good carry-over storage crop production was near normal.

Summer rains were very beneficial in the lower Arkansas drainage. Most of the Colorado River drainage had less than normal summer precipitation while other areas of the state had near average precipitation.

Reflecting the summer rains, the lower reaches of the Arkansas drainage report good soil moisture conditions as does the headwaters area. Soils in the South Platte drainage are reported in fair to good condition.

The Colorado drainage had low streamflow and summer precipitation, and also re-

ports poor to fair soil moisture conditions.

Considerable reservoir storage was used this summer to offset the deficient streamflow. Most of the reservoirs of the state contained far less water than last year at this time. Overall storage remains near average for this date.

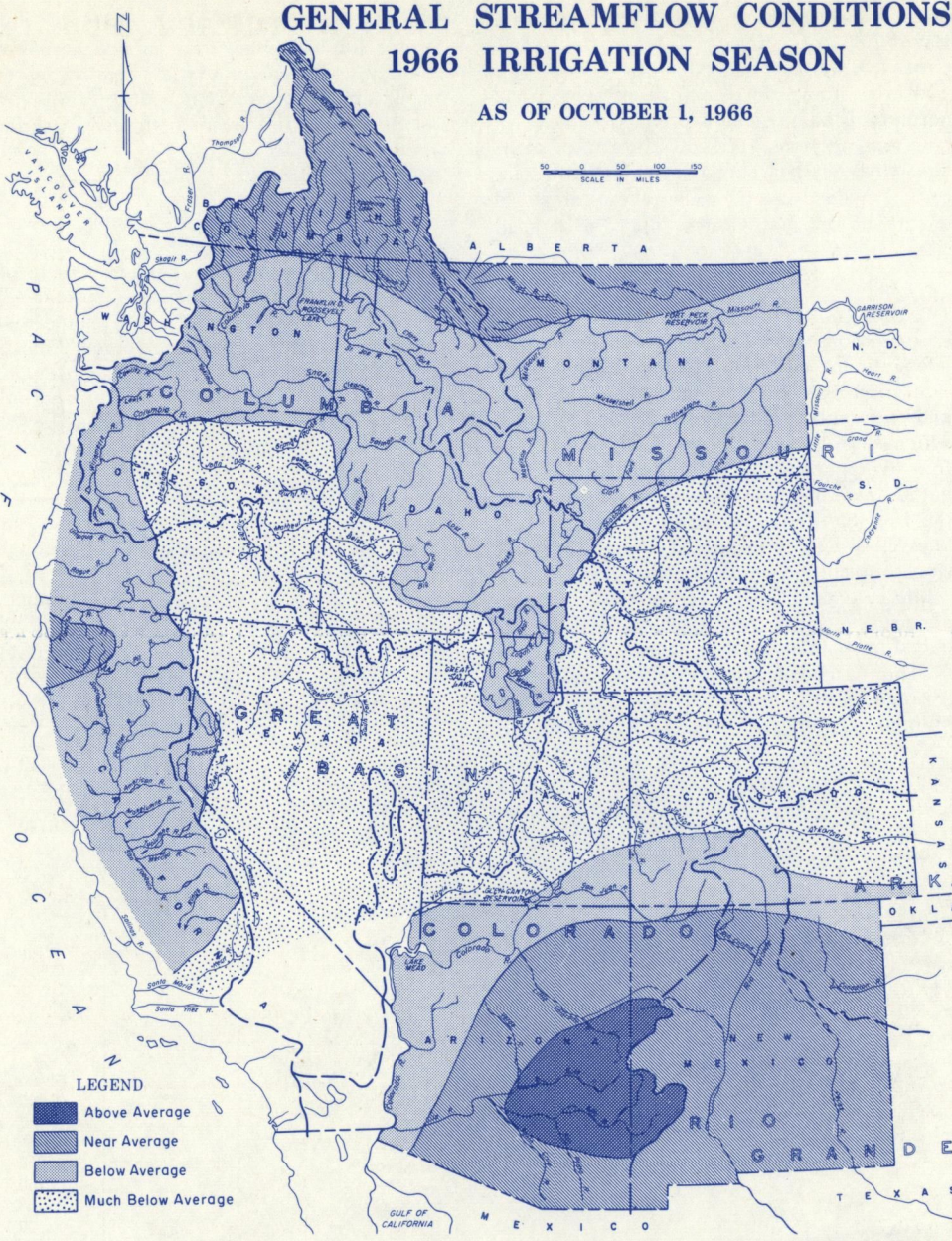
A bumper crop of snow in the high mountains is necessary this winter to assure adequate water next summer.

IDAHO

With the use of good carryover storage from the 1965 irrigation season, Idaho had an almost normal water year even with low streamflow during the irrigation season. Reservoir storage at this time is much below normal and a year ago. Total water de-

GENERAL STREAMFLOW CONDITIONS 1966 IRRIGATION SEASON

AS OF OCTOBER 1, 1966



mands have been high. Soil moisture on the high mountainous watersheds throughout the entire state of Idaho is unusually dry and in many cases the driest of record. The dry soils could take up as much as 10 to 20 percent of a normal snowpack to prime the soil mantle. Special soil moisture and snow course measurements will be made early in the 1967 season to determine if any changes have occurred in the dry trend that characterized 1966.

Forecasts made in April this year were for below normal snow melt flow on practically all rivers. Because of the dry and hot spring and summer, actual river flow was below the forecasts.

An above average snow pack will be required to provide adequate water next year and to restore reservoirs to normal operating levels.

MONTANA

April through September streamflow was below average for all streams except for the Kootenai River. East of the Continental

Divide snow melt season flow ranged from between 60 and 85 percent of average with the highest flows on the Milk River. Irrigation demands were high because of lack of rainfall during the main growing season. Many streams were 'dried up' by irrigation diversions. Demand on stored water was high. Reservoir storage was good at the beginning of the season. Carryover storage for 1967 for irrigation is less than average except for the northern tributaries to the Missouri where storage is more favorable. Power and multipurpose reservoirs are near average for this date.

West of the Divide, the runoff of the Bitterroot and Upper Clark Fork ranged from 60 to 70 percent of average which resulted in some shortages of irrigation water. Late season flows were especially low on all streams.

With near average snowfall next winter, water supplies for 1967 will be adequate. However, a less than average snowfall could result in varying degrees of shortage especially along smaller streams in the Missouri Basin.

NEVADA

Water supplies in 1966 were adequate for irrigated areas with storage. Irrigated areas along streams without storage had a short supply.

The build-up of snowpack in early season through January and the first part of February indicated near average streamflow at that time. The lack of precipitation during the late winter and spring months caused forecasts to be reduced each month as the season progressed. A continued lack of precipitation during the summer months caused the May through July flows to be less than expected.

Total reservoir storage is near average for this date. Smaller reservoirs such as Wildhorse, Boca, Topaz and Bridgeport contain less than half of average storage and have little carryover. Storage in Lake Tahoe and Rye Patch is slightly above average for this date. A warm summer placed more than usual demands on the above average storage available at the beginning of the season.

Mountain and range soils are dry except for the top few inches wetted by recent rains. Several inches of moisture from the snowpack will be required to wet this soil before runoff can begin next spring.

NEW MEXICO

While most of the western states was experiencing below normal runoff from its snow-fed streams, New Mexico had near normal to above normal runoff. The Rio Grande flow was close to its 1948-62 average while the Canadian and Pecos drainages had above normal runoff. Summer rains caused flooding in some places.

Reports indicate soils are wet over much of New Mexico; however, the Albuquerque area is reporting only fair soil moisture conditions.

Reservoir carryover storage is up from a year ago and slightly better than average. The only major reservoir that was lowered during the summer was Elephant Butte. It now contains 261,800 acre feet while a year ago at this time it contained nearly 300,000 acre feet.

OREGON

Oregon reservoirs clearly demonstrated their value this year providing adequate irrigation water supplies to most of 425,000 thirsty acres surrounded by drought-ridden lands with little drop in crop production. Nine out of twenty-four reservoirs have little or no carryover at the end of this season but twelve reservoirs closed the year with carryover 80 percent of average or better. Water year precipitation was near normal in the Cascades and western Oregon but fell off rapidly to about half normal in far eastern Oregon. Precipitation in the growing season (April 1 - September 1) was far below normal with records of 50 percent down to 27 percent normal scattered throughout the state.

Streamflow east of the Cascades was below normal all winter and dropped rapidly to extreme lows following an early and deficient spring runoff. Records at key streams

indicate summer flows at approximately record low conditions on several eastern Oregon watersheds.

Watershed soils have received a surface wetting this fall but the underlying soils are relatively dry as they usually are on this date. Rain is needed. Winter conditions of snow accumulation will have to be well above average to produce adequate streamflow next season.

UTAH

As anticipated last spring, water supplies have been adequate this summer for water users served by reservoirs. For much of the state, water for natural flow rights has been very short, with some areas in central Utah reporting record low streamflow. Reservoirs have experienced heavy drawdown, as indicated by the fact that present storage is only 67 percent of last year at this date.

Early fall storms have begun to replenish mountain soil moisture, which had been severely reduced during the dry summer months. In northern Utah, the mountain soil moisture is now approaching an average condition, while in the Uintah mountains it is above average. However, in southern areas it is

still below average, but much improved. Base flow of streams follows this same pattern.

While storage in reservoirs of central and northern Utah is near average or above, in southern sections it is 69 percent of average. Heavier than normal snowfall this winter is needed in these southern areas to assure an adequate water supply next summer.

WASHINGTON

Irrigation water supplies were generally adequate for the 1966 season. Summer precipitation was deficient throughout the state and particularly during July and August which were hot and dry. Streamflow was below average and slightly less than anticipated from the below average snowpack of the 1965-66 season. Rainfall returned in late September but the extended drought has left mountain soils very dry. Unless much more rainfall occurs before the snowfall starts to accumulate, next year's runoff will be reduced to replace soil moisture.

The extended drought period and below average runoff placed heavy demands on storage. Reservoirs used for irrigation all

have well below normal amounts of stored water for carryover. For an adequate water supply next year, above average amounts of mountain snow pack and valley rainfall will be necessary this coming winter and spring.

WYOMING

Water supply was reasonably adequate except for small streams east and west of the Bighorn mountains. This was made possible by depletion of reservoir storage. The flow of the North Platte into Seminole reservoir was about one-half of average. Demands were high on this stream and storage is down to near minimum levels. There were also substantial declines in storage on the Wind River and the lower Bighorn and its tributaries.

Summer flows of the Green River and upper Snake in western Wyoming were also much below average but not as low as that of the North Platte.

Soils in mountain and valley areas are dry. Better than average snowfall this coming season will be required to provide enough water to meet usual demands in 1967. The North Platte watershed has more limited prospects than for other watersheds.



The Soil Conservation Service coordinates snow surveys during the winter and spring months conducted by its staff and many cooperators, including the Bureau of Reclamation, Forest Service, Geological Survey, other federal agencies, various departments of the several states, irrigation districts, power companies, and others. The California Department of Water Resources, which directs snow surveys in that state, contributed information on California water supply as a part of this report. The Water Resources Service, British Columbia Department of Lands, Forests, and Water Resources has charge of snow surveys in that province.

This report was prepared by the Water Supply Forecasting Branch, Engineering Division, Soil Conservation Service, Portland, Oregon. Data and information used in this report were received from the above mentioned agencies and from State Snow Survey Supervisors of the Soil Conservation Service in Arizona, Colorado-New Mexico, Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming; and the Chief, Hydrologic Division, Water Resources Service for British Columbia; and the Chief, Water Supply Forecast and Snow Survey Unit, Department of Water Resources for California.