

HYDROLOGY

Water is used in northwestern Wyoming for irrigation and for public, domestic, and commercial supplies. Most of the irrigated area lies east of the Snake River and south of Buffalo Park in Grand Teton National Park, south of the park in Jackson Hole, and in the Hoback Basin. Additional irrigated lands lie in valleys in mountainous areas south of Yellowstone National Park and near Alta west of the Teton Range. Most of the irrigation water is diverted from streams to hay and pasture lands. Water is pumped from two irrigation wells near Jackson. Water is pumped from wells for public supplies at the town of Jackson and at several facilities in Yellowstone and Grand Teton National Parks. Water is piped from springs and streams for public supplies in the parks and is piped from a spring for a community water system at Alta. Water for a Federal fish hatchery near Jackson is pumped from wells and piped from nearby springs. Ranches, private residences, and tourist facilities use water diverted from springs and small streams and pumped from wells. A few residential developments have central water systems. Use and yield of selected wells in northwestern Wyoming are shown in the table at the right center of the sheet. The well locations are shown on the map.

Water samples have been collected from wells, springs, and streams in northwestern Wyoming. Chemical analyses of water from selected wells and springs are shown in the table at the lower left side of the sheet; those from streams are shown in the table at the lower right side of the sheet. Location of data-collection sites and chemical types of water from wells and springs are shown on the map. The data were selected to show the general chemical quality of water.

Drinking water standards for public carriers and others subject to Federal quarantine regulations have been published by the U.S. Public Health Service (1962) and can be used as guides in evaluating the quality of the water. Recommended maximum concentrations of some substances, summarized from pages 7 and of the above-mentioned report, are:

Substance	Concentration (milligrams per litre)
Chloride (Cl)	250
Fluoride (F)	1.17 to 2.4
Iron (Fe)	10 to 20
Nitrate (NO ₃)	45
Sulfate (SO ₄)	250
Dissolved solids	500

Limits of fluoride vary according to annual average maximum daily air temperature. In northwestern Wyoming, the upper limit is probably 1.17 milligram per litre and the optimum concentration is probably 1.2 milligram per litre. The U.S. Public Health Service (1962, p. 8) states: "Presence of fluoride in average concentrations greater than two times the optimum values ** will constitute grounds for rejection of the supply."

The U.S. Geological Survey, in order to have a uniform policy in classifying water hardness in the United States, uses the following classification:

Hardness range (milligrams per litre)	Adjective rating
0-60	Soft
61-120	Moderately hard
121-180	Hard
More than 180	Very hard

Quality of water in northwestern Wyoming varies with the geologic and hydrologic sources. Most of the water is a calcium bicarbonate type except in the rhyolite areas and in near Yellowstone National Park, where it is generally a sodium bicarbonate type. (See map.)

Water from most of the sources is potable and is satisfactory, as far as chemical quality is concerned, for irrigation and for public, domestic, or commercial supplies. However, water in the rhyolite areas commonly has a concentration of fluoride that exceeds the recommended limit for drinking water. In general, thermal waters are highly mineralized and affect the quality of water in nearby aquifers and streams by adding silica, sodium, chloride, fluoride, boron, and sometimes sulfate.

Hardness of the water varies widely. Water is generally soft in the rhyolite areas and in Grand Teton National Park west of the Snake River. Most of the water in the rest of northwestern Wyoming is moderately hard to very hard.

Streamflow data have been collected for many years at gaging stations in and near northwestern Wyoming. Yearly and monthly mean streamflow at gaging stations in and near northwestern Wyoming for 1968-72 are shown by the streamflow graphs. Selected streamflow characteristics at the gaging stations are shown in the table at the left center of the sheet. Discharge measurements at selected miscellaneous sites in the area are shown in the table at the lower right side of the sheet.

Water levels have been measured intermittently in wells in northwestern Wyoming since the late 1960s. During 1968-72, water levels in wells in Yellowstone and Grand Teton National Parks were measured at approximately monthly intervals during various periods when the wells were accessible and not in levels in selected wells are shown by the water-level graphs. Breaks in the graphs are periods when water levels were not measured. Well locations are shown on the map.

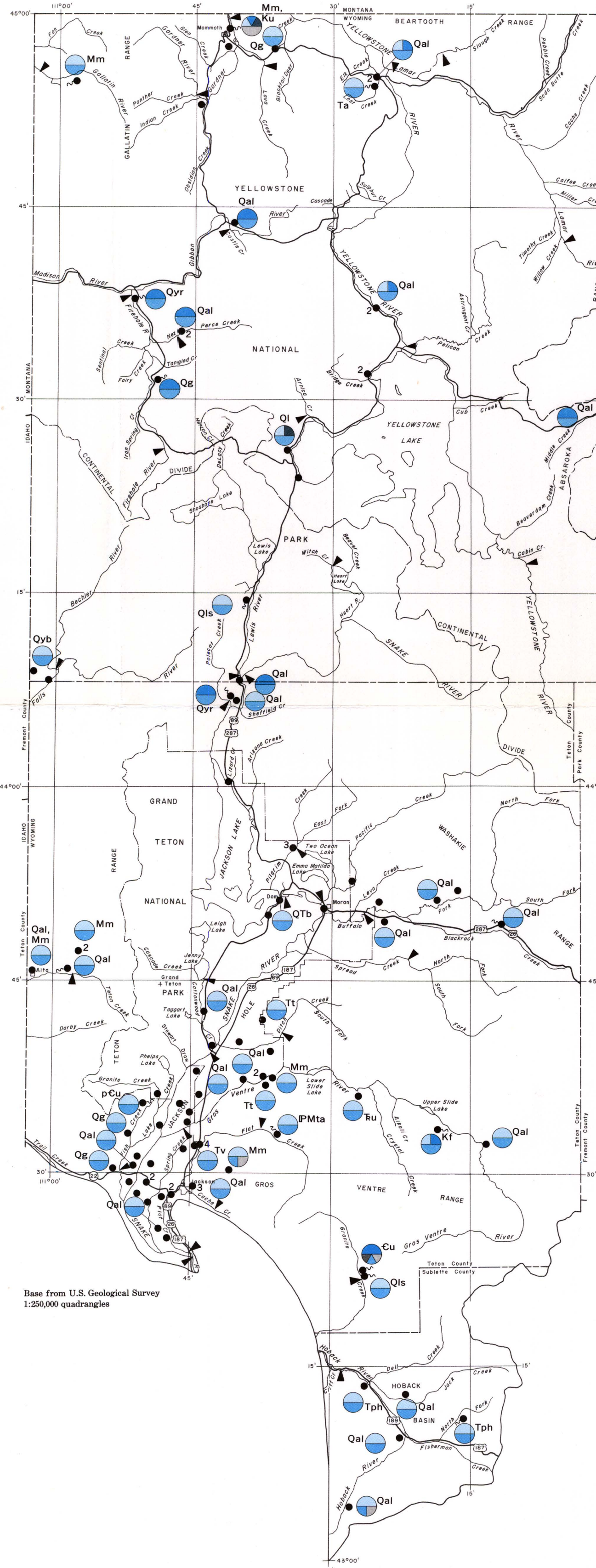
Yields of wells in northwestern Wyoming range from a few gallons per minute from many domestic wells in the area to 2,000 gal/min (7,600 l/min) from two wells near Jackson. Yield and specific capacity (yield divided by drawdown) of selected wells in northwestern Wyoming are shown in the table at the right center of the sheet. Most of the data in the table are reported by the drillers or owners of the wells, and presumably the yields and drawdowns were measured shortly after the wells were completed. Some of the data were obtained during aquifer tests conducted by the Geological Survey.

Yields and specific capacities of wells vary not only with the geologic source but also within the same geologic source. Consequently, the yields and specific capacities specified in the table apply only to the immediate vicinity of the specified well and to the interval tested.

Selected streamflow characteristics at gaging stations

Station name	Drainage area (sq mi)	Years of record	Average discharge (cfs)	Maximum discharge (cfs)	Minimum discharge (cfs)
Yellowstone River at Yellowstone Lake Outlet	1,066	47 (1926-72)	1,312	6,230	230
Yellowstone River at Corwin Springs, Mont.	2,623	68 (1908-72, 1910-72)	3,108	32,000	2,889
Falls River near Squirrel, Idaho	351	60 (1908, 1918-72)	768	6,440	272
Snake River near Moran (flow regulated)	824	70 (1902-72)	1,438	15,100	230
Gardner River near Mammoth	202	23 (1938-72)	220	1,080	233
Madison River near West Yellowstone, Mont.	420	60 (1913-72)	488	2,150	3100
Pacific Creek near Moran	160	20 (1944-72)	269	3,470	122
Buffalo Fork above Lava Creek near Moran	355	8 (1965-72)	593	5,160	182
Cache Creek near Jackson	10	10 (1942-72)	14.8	225	1.7

¹ Daily discharge.
² Instantaneous discharge.
³ Instantaneous discharge.



EXPLANATION

Data-collection sites

Well Spring Data-collection site on stream

Number beside well or number of wells at the site

Chemical types of ground water

Sodium (Na)

Calcium (Ca)

Magnesium (Mg)

Bicarbonate (HCO₃)

Chloride (Cl)

Sulfate (SO₄)

The chemical type of ground water is shown by segments of a colored circle. Segment divisions are diagrammatic with the major cation relation shown in the top half of the circle and the major anion relation shown in the bottom half. Where one ion constitutes 50 percent or more of the total cations or anions in milliequivalents per litre, that cation and anion designate the water type. For example, if calcium is 60 percent of the total cations and bicarbonate is 75 percent of the anions, the water is classified as a calcium bicarbonate type. If no ion constitutes as much as 50 percent of the total cations or anions, the ion with the highest percentage is given the first half of the semicircle and is named first and the ion with the second highest percentage follows. If all three ions are nearly equal in percentage, all are shown and named in order of percentage from left to right.

Geologic source of water (such as Qal) is shown by the following symbols:

Qal Alluvium and glacial-outwash deposits

Qls Landslide deposits

Qll Lacustrine deposits

Qlm Glacial-moraine deposits

Qyr Yellowstone Group, rhyolite

Qyb Yellowstone Group, basalt

Qyb Brouse Formation

Qyb Teton Formation

Qyb Absaroka Volcanic Super-group

Tph Pass Peak and Hoback Formations, undivided

Tv Volcanic rocks, undivided

KF Frontier Formation

Ku Cretaceous rocks, undivided

Tu Triassic rocks, undivided

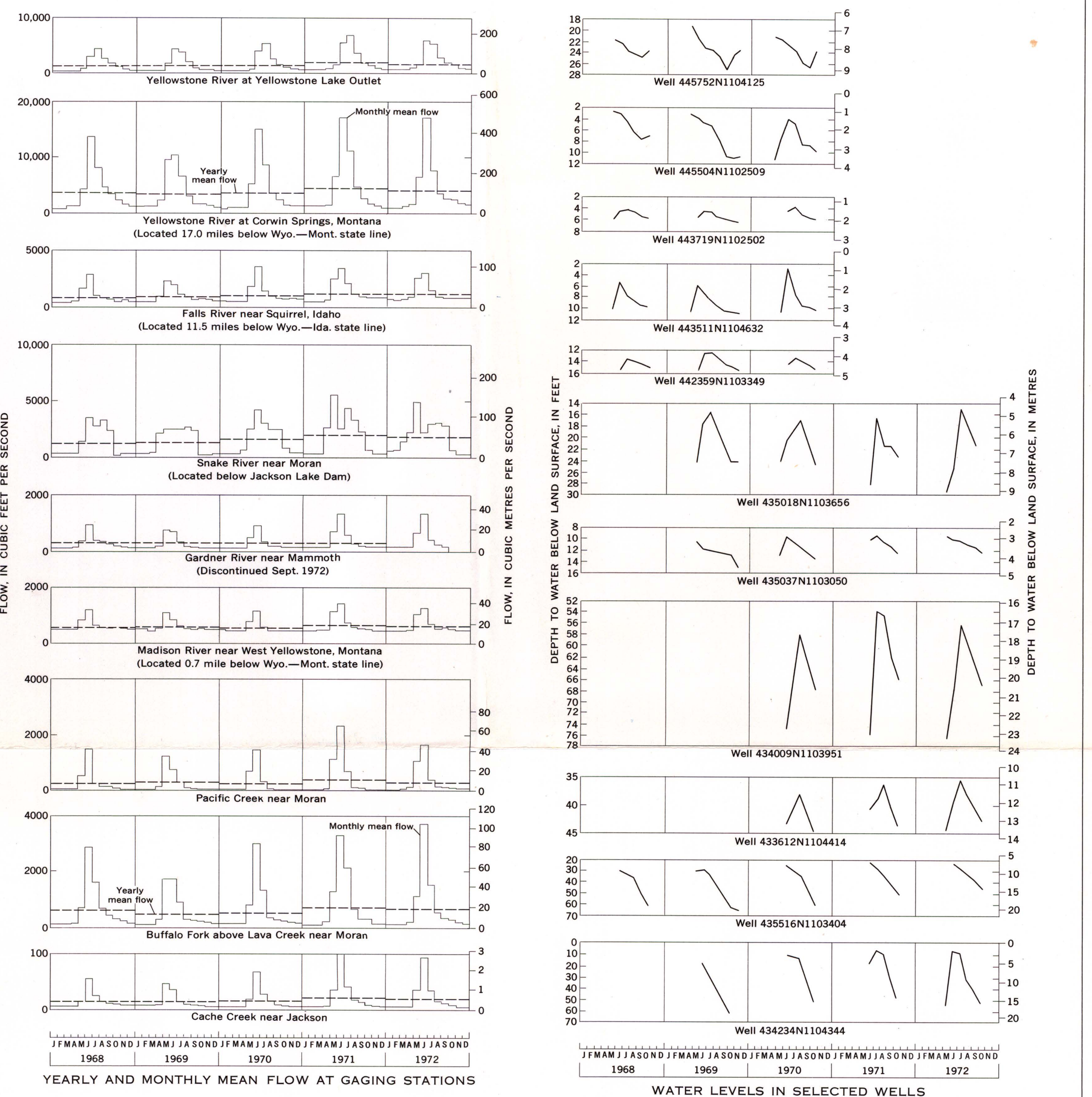
PMta Tensleep Sandstone and Amsden Formation, undivided

Mm Madison Limestone

Cu Cambrian rocks, undivided

Pc Precambrian rocks, undivided

Base from U.S. Geological Survey 1:50,000 quadrangles



YEARLY AND MONTHLY MEAN FLOW AT GAGING STATIONS

WATER LEVELS IN SELECTED WELLS

Use of well: C, commercial; D, domestic; F, fish hatchery; I, irrigation; P, public supply; U, unused.
Source of data: A, McCreedy and Gordon, 1964; B, Lovry and Gordon, 1964; C, Cox, 1973; D, Gordon and others, 1962; E, reported by driller or owner.

Well	Geologic source	Depth (ft)	Length of well open (ft)	Diameter (in)	Use of well	Yield (gal/min)	Drawdown (ft)	Specific capacity (gal/min per ft of drawdown)	Duration of test (hrs)	Source of data
430918N102212	Qal	49	6	9	D	40	-----	-----	-----	R
431338N102605	Tph	106	(*)	8	D	20	7	2.9	1.5	R
432452N104723	Qal	35	(*)	6	D	22	10	2.2	1	R
432754N104906	Qal	230	---	20	I	2,000	---	---	---	R
432758N104818	Qal	92	9	6	P	60	20	3.0	24	R
432822N104644	Qal	56	---	6	P	60	0	---	---	R
432824N105039	Qal	41	(*)	6	D	10	0	---	---	R
432826N104649	Qal	150	38	12	C	1,700	21	81	12	R
432848N104441	Qal	201	28	20	P	1,100	3	370	48	R
432859N104440	Qal	202	115	20	P	1,500	23	65	48	R
432902N104935	PMta	217	21	8	P	210	142	1.5	24	R
432907N104440	Qal	200	46	20	P	825	39	21	51	R
432908N105012	Tv	209	(*)	9	D	10	10	1.0	22	R
432915N105142	Qal	26	4	6	D	30	3	10	3	R
433003N105333	Qe	345	35	8	D	20	---	---	---	R
433008N104054	Mm	112	---	8	D	720	5	140	3	R
433106N104914	PMta	180	75	6	D	40	---	---	336	R
433120N105015	Qal	69	(*)	6	D	15	2	7.5	3	R
433135N104603	Qal	39	(*)	6	D	10	0	---	---	R
433202N104356	Qal	136	70	18	F	2,000	47	43	46	R
433209N104354	Qal	50	---	F	250	---	---	---	---	R
433214N104354	Qal	90	54	14	F	1,540	25	62	4	R
433216N104416	Tv	143	(*)	8	D	22	28	1.8	1	R
433230N104334	PMta	246	24	---	F	250	130	1.9	6.5	R
433315N105122	Qe	152	50	6	D	13	0	---	5	R
433338N104806	Qal	60	4	8	D	100	0	---	2	R
433344N104513	Qal	101	11	12	C	800	2	400	12	R
433458N104521	Qal	55	(*)	8	D	20	0	---	1	R
433538N104559	Qal	40	(*)	7	D	25	2	12	1	R
433601N104818	Qe	37	(*)	6	D	5	25	2	3	R
433613N104408	Qal	67	(*)	6	C	900	0	---	1	R
433627N102658	Tu	45	5	8	D	12	0	---	2	R
433708N103645	Tc	185	76	8	D	15	10	1.5	1	R
433716N103926	Qal	150	30	8	P	200	0.4	500	6	R
433718N103725	Qal	60	(*)	---	D	7	6	1.2	2	R
433720N102620	Mm	197	8	4	D	6	30	2	10	R
433729N103720	Qal	60	10	7	D	17	2	8.5	1	R
433755N1040430	Qal	30	(*)	7	D	14	1	14	1	R
433933N103649	Tc	353	80	6	I	120	0	---	---	R
433971N104252	Qal	37	(*)	6	D	22	3	7.3	1	R
434149N103732	Tc	75	55	6	D	50	0	---	24	R
434530N110206	Qal,Mm	307	40	16	P	466	70	6.7	8	R
434720N105725	Mm	670	582	6	C	30	100	3	15.5	R
434721N105729	Mm	676	(*)	6	C	60	40	1.5	5	R
434952N102410	Qal	30	9	7	P	25	2	12	5	R
435018N103656	Qe	206	4	6	P	118	11	11	18.5	A
435077N103050	Qal,Ql	55	2	6	P	30	11.2	2.7	15	A
435058N102508	Qal	50	(*)	7	D	10	2	5.0	1	R
435114N101837	Qal	83	38	9	D	30	1	30	24	R
435153N101622	Qal	96	(*)	9	D	13	5	2.6	1	R
435255N102800	Qal	40	10	9	D	33	2	16	1	R
435311N103358	Qal	152	28	6	U	15.0	1.5	10.0	24	A
Do	Qal	201	65	10	P	270	5	54	4	A
440008N104128	Qal	101	4	6	P	96	5	19	17	A
440808N110048	Qal	153	50	6	U	10	38	3	24	B
440828N103946	Qal	29	6	4	U	59	3.6	16	24	C
442359N103349	Ql	118	48	6	U	36	71	5	48	D
442920N100010	Ql	98	11	6	U	128	5.3	24	6	C
443207N102620	Ql	60	16	6	P	46	27	1.7	24	B
443212N102620	Ql	95	10	6	P	30	70	4	24	B
443510N104633	Qal	49	6	4	U	108	2.8	39	24	C
443718N102502	Qal	35	6	4	U	87	6.6	13	24	C
444354N104419	Qal	20	5	4	U	20	5.6	3.6	24	C
445318N104418	Qal	31	(*)	6	P	40	30	1.3	30	R
445305N102510	Qal	28	6	4	U	9	2.7	3.3	10	C

(*) Water enters through bottom open end of casing.

LOCATION OF DATA-COLLECTION SITES AND CHEMICAL TYPES OF GROUND WATER

Location number	Date of collection	Depth of well (see map)	Geologic source	Temperature (°C)	Dissolved Calcium (Ca) (mg/l)	Dissolved Magnesium (Mg) (mg/l)	Dissolved Sodium (Na) (mg/l)	Dissolved Potassium (K) (mg/l)	Dissolved Bicarbonate (HCO ₃) (mg/l)	Dissolved Chloride (Cl) (mg/l)	Dissolved Sulfate (SO ₄) (mg/l)	Dissolved Fluoride (F) (mg/l)	Dissolved Nitrate (NO ₃) (mg/l)	Dissolved Boron (B) (mg/l)	Dissolved Sum of constituents (mg/l)	Dissolved Solids as CaCO ₃ (mg/l)	Specific conductance (micro-mhos at 25°C)	pH (units)			
430417N102806	7-30-73	Qe	8.5	5.6	20	82	13	5.4	0.9	168	0	130	1.1	0.2	0.5	20	319	260	540	8.0	
430936N102212	8-1-73	Qal	9.5	6.7	30	110	13	8.6	1.9	297	0	96	1.4	2	1	20	382	320	630	7.6	
431053N101600	7-31-73	(a)	Tph	6.5	8.7	50	86	27	1.6	1.6	400	0	30	1.8	2	0	20	367	320	640	8.2
431244N102154	10-1-73	(a)	Qal	6.5	5.8	0	71	9.9	2.1	1.7	175	0	73	1.5	3	1	10	250	220	415	8.3
431338N102605	8-1-73	106	Tph	9.5	6.0	20	89	12	0.4	3.5											