

Washington Water Supply Outlook Report March 1, 2023



*Freezing Fog covered Pine, Starvation Mtn., Okanogan CO., WA
Photo Credit: Amanda Philipps, NRCS 3/2/2023*

Water Supply Outlook Reports and Federal - State – Private Cooperative Snow Surveys

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How forecasts are made

Most of the annual streamflow in the western United States originates as snowfall that has accumulated in the mountains during the winter and early spring. As the snowpack accumulates, hydrologists estimate the runoff that will occur when it melts. Measurements of snow water equivalent at selected manual snow courses and automated SNOTEL sites, along with precipitation, antecedent streamflow, and indices of the El Niño / Southern Oscillation are used in computerized statistical and simulation models to prepare runoff forecasts. These forecasts are coordinated between hydrologists in the Natural Resources Conservation Service and the National Weather Service. Unless otherwise specified, all forecasts are for flows that would occur naturally without any upstream influences.

Forecasts of any kind, of course, are not perfect. Streamflow forecast uncertainty arises from three primary sources: (1) uncertain knowledge of future weather conditions, (2) uncertainty in the forecasting procedure, and (3) errors in the data. The forecast, therefore, must be interpreted not as a single value but rather as a range of values with specific probabilities of occurrence. The middle of the range is expressed by the 50% exceedance probability forecast, for which there is a 50% chance that the actual flow will be above, and a 50% chance that the actual flow will be below, this value. To describe the expected range around this 50% value, four other forecasts are provided, two smaller values (90% and 70% exceedance probability) and two larger values (30%, and 10% exceedance probability). For example, there is a 90% chance that the actual flow will be more than the 90% exceedance probability forecast. The others can be interpreted similarly.

The wider the spread among these values, the more uncertain the forecast. As the season progresses, forecasts become more accurate, primarily because a greater portion of the future weather conditions become known; this is reflected by a narrowing of the range around the 50% exceedance probability forecast. Users should take this uncertainty into consideration when making operational decisions by selecting forecasts corresponding to the level of risk, they are willing to assume about the amount of water to be expected. If users anticipate receiving a lesser supply of water, or if they wish to increase their chances of having an adequate supply of water for their operations, they may want to base their decisions on the 90% or 70% exceedance probability forecasts, or something in between. On the other hand, if users are concerned about receiving too much water (for example, threat of flooding), they may want to base their decisions on the 30% or 10% exceedance probability forecasts, or something in between. Regardless of the forecast value users choose for operations, they should be prepared to deal with either more or less water. (Users should remember that even if the 90% exceedance probability forecast is used, there is still a 10% chance of receiving less than this amount.) By using the exceedance probability information, users can easily determine the chances of receiving more or less water.

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Washington Water Supply Outlook

March 2023

General Outlook

Cold and dry conditions gripped most of the state last month. With only a hand full of exceptions, monthly precipitation was much below to just near normal. It may seem like it has been wet and snowy and in truth it has been in both the mountains and lowlands. It just hasn't been enough to keep up with what we should be seeing this time of year, causing greater divergence below normal as we go through time.

The most recent forecast through late-March shows a probability for below normal temperatures and equal to slightly above normal precipitation. NWS 3-month (Mar-Apr-May) forecast indicates slightly below normal temperatures and equal chances of above, below, or normal precipitation which is indicative of the Enso La Nina pattern that we have experienced for the 3rd year in a row. The US Drought Monitor shows an expansion of abnormally dry conditions into the south-west part of the state. (See maps on page 4)

Snowpack

The March 1 statewide SNOTEL readings were 97% of normal, a slight increase since February 1. The lowest readings in the state were at 72% of the 30-year median for March 1 in the Status Creek Basin. Omak and Sanpoil creeks recorded the highest percentage of snow with 146% and 142% respectively. Westside medians from SNOTEL included the North Puget Sound River basins with 87% of normal, the Central and South Puget River basins with 102% and 96% respectively, and the Lower Columbia basins with 105% of normal. Snowpack along the east slopes of the Cascade Mountains included the Yakima area with 87% and the Wenatchee area with 88%. Snowpack in the Spokane River Basin was at 94% and the Upper Columbia River basins had 113% of the long-term median.

BASIN	PERCENT OF MEDIAN	LAST YEAR PERCENT MEDIAN
Spokane	95	93
Newman Lake	110	76
Lower Pend Oreille	91	93
Kettle	127	92
Omak	146	73
Methow	100	98
Conconully Lake	132	63
Central Columbia	88	99
Upper Yakima	92	96
Lower Yakima	84	60
Ahtanum Creek	99	73
Walla Walla	98	97
Lower Snake	95	84
Cowlitz	97	95
Lewis	125	96
White	95	114
Green	105	112
Puyallup	110	91
Cedar	103	105
Snoqualmie	102	102
Skykomish	100	102
Skagit	84	105
Nooksack	94	85
Olympic Peninsula	81	80

Precipitation

Precipitation accumulation was below normal across most of the state. Statewide Water-year average increased slightly to 85% of normal as of March 1. Not surprisingly the Central Puget Sound convergence zone saw the highest monthly precipitation at 108% of normal, mostly in the form of snow. Stevens Pass gained 9.9 inches of precipitation, of which 9.2 inches recorded as snow water equivalent. SNOTEL collects all form of precipitation including, rain, snow, sleet, and hail.

RIVER BASIN	FEBRUARY PERCENT OF AVERAGE	WATER YEAR PERCENT OF AVERAGE
Spokane	94	81
Lower Pend Oreille	88	78
Upper Columbia	74	89
Central Columbia	90	81
Upper Yakima	85	81
Naches	81	81
Lower Yakima	70	96
Klickitat	69	90
Walla Walla	82	90
Lower Snake	81	89
Lower Columbia	88	88
South Puget Sound	98	85
Central Puget Sound	108	83
North Puget Sound	105	79
Olympic Peninsula	83	85

Reservoir

Seasonal reservoir levels in Washington can vary greatly due to specific watershed management practices required in preparation for irrigation season, fisheries management, power generation, municipal demands and flood control. March 1 Reservoir storage in the Yakima Basin was 386,300-acre feet, 79% of median for the Upper Reaches and 88% of median for Rimrock and Bumping Lakes. The power generation reservoirs included the following: Coeur d'Alene Lake, 47,000-acre feet, 47% of median and 20% of capacity; and Ross Lake within the Skagit River Basin at 96% of average and 54% of capacity. Recent climate impacts and management procedures may affect these numbers on a daily or weekly basis.

BASIN	PERCENT OF CAPACITY	CURRENT STORAGE AS PERCENT OF MEDIAN
Spokane	20	47
Lower Pend Oreille	36	81
Upper Columbia	59	85
Central Columbia	32	87
Upper Yakima	46	79
Naches	58	88
Lower Snake	57	112
North Puget Sound	54	96
South Puget Sound	N/A	124
Lower Columbia	N/A	57

For more information contact your local Natural Resources Conservation Service office.

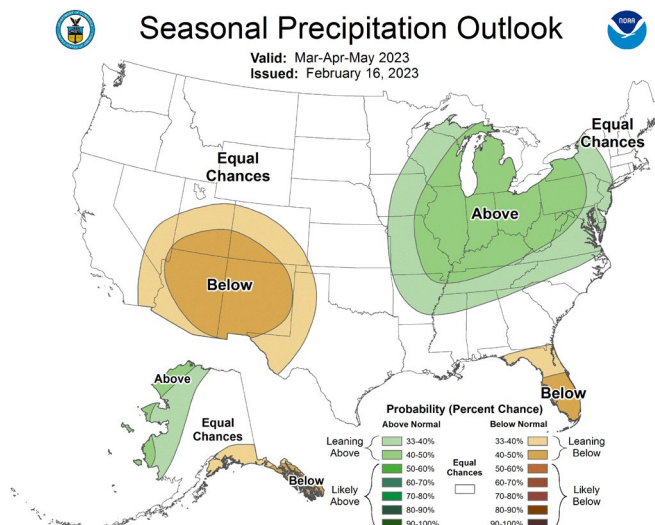
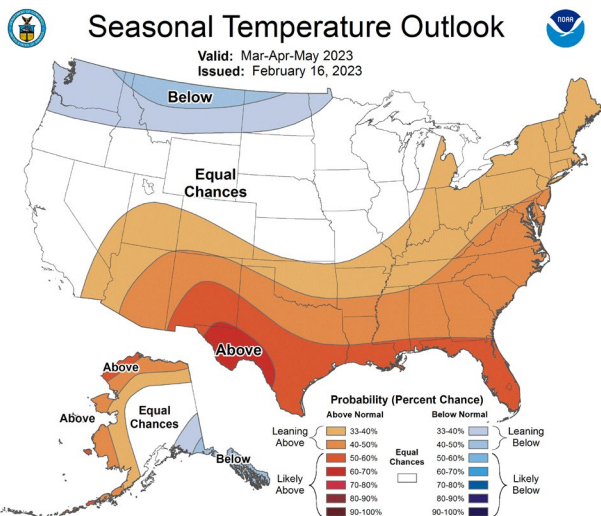
Streamflow

Early winter forecasts for April-September stream flows are never quite as robust as they are later in the season when we know more about the winter climatology. At times only a few degrees warmer or cooler than forecasted can make or break stream flow predictions. Volumetric forecasts are developed using current, historic, and average snowpack, precipitation and streamflow data collected and coordinated by organizations cooperating with NRCS. Caution should be used when using early season forecasts for critical water resource management decisions since governing conditions are likely to change for the better or the worse.

BASIN	PERCENT OF AVERAGE FORECAST (50% CHANCE OF EXCEEDENCE)
Spokane	73-93
Lower Pend Oreille	82-94
Upper Columbia	85-103
Central Columbia	82-87
Upper Yakima	87-94
Lower Yakima	86-118
Naches	84-86
Klickitat	88-94
Lower Snake-Walla Walla	85-97
Lower Columbia	104-112
South Puget Sound	97-108
Central Puget Sound	99-108
North Puget Sound	89-97
Olympic Peninsula	96-106

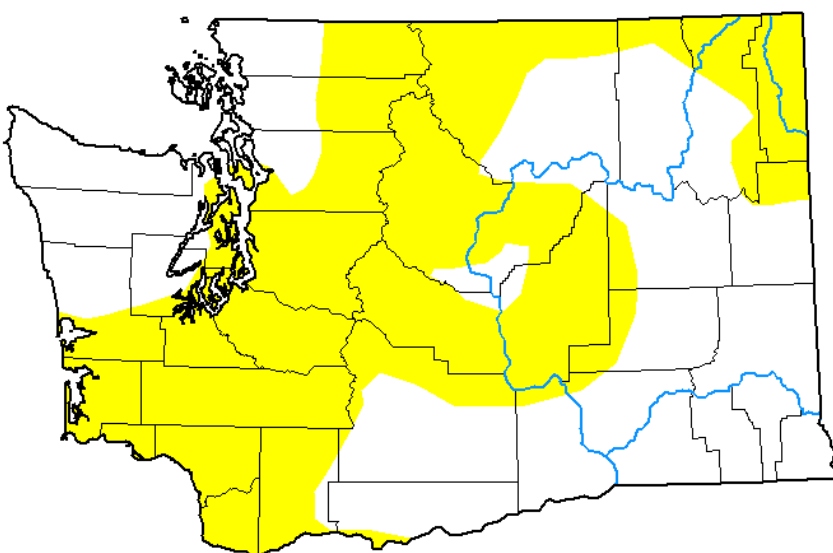
STREAM	PERCENT OF AVERAGE FEBRUARY RUNOFF
Priest River - near Priest River	38
Kettle at Laurier	46
Columbia at Birchbank	75
Spokane at Spokane	39
Similkameen at Nighthawk	48
Okanogan near Tonasket	60
Methow at Pateros	70
Chelan at Chelan	43
Stehekin near Stehekin	46
Wenatchee at Pashastin	43
Cle Elum near Roslyn	51
Yakima near Parker	54
Naches near Naches	48
Grande Ronde at Troy	37
Snake below Lower Granite Dam	50
Columbia River at The Dalles	77
Lewis at Merwin Dam	58
Cowlitz below Mayfield Dam	51
Skagit at Concrete	53
Dungeness near Sequim	47

Climate



U.S. Drought Monitor Washington

February 21, 2023
(Released Thursday, Feb. 23, 2023)
Valid 7 a.m. EST



Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>

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droughtmonitor.unl.edu



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Helpful Internet Addresses

NRCS Snow Survey and Climate Services Homepages

Washington:

<http://www.nrcs.usda.gov/wps/portal/nrcs/main/wa/snow/>

Oregon:

<http://www.nrcs.usda.gov/wps/portal/nrcs/main/or/snow/>

Idaho:

<http://www.nrcs.usda.gov/wps/portal/nrcs/main/id/snow/>

National Water and Climate Center (NWCC):

<https://www.nrcs.usda.gov/wps/portal/wcc/home/>

USDA-NRCS Agency Homepages

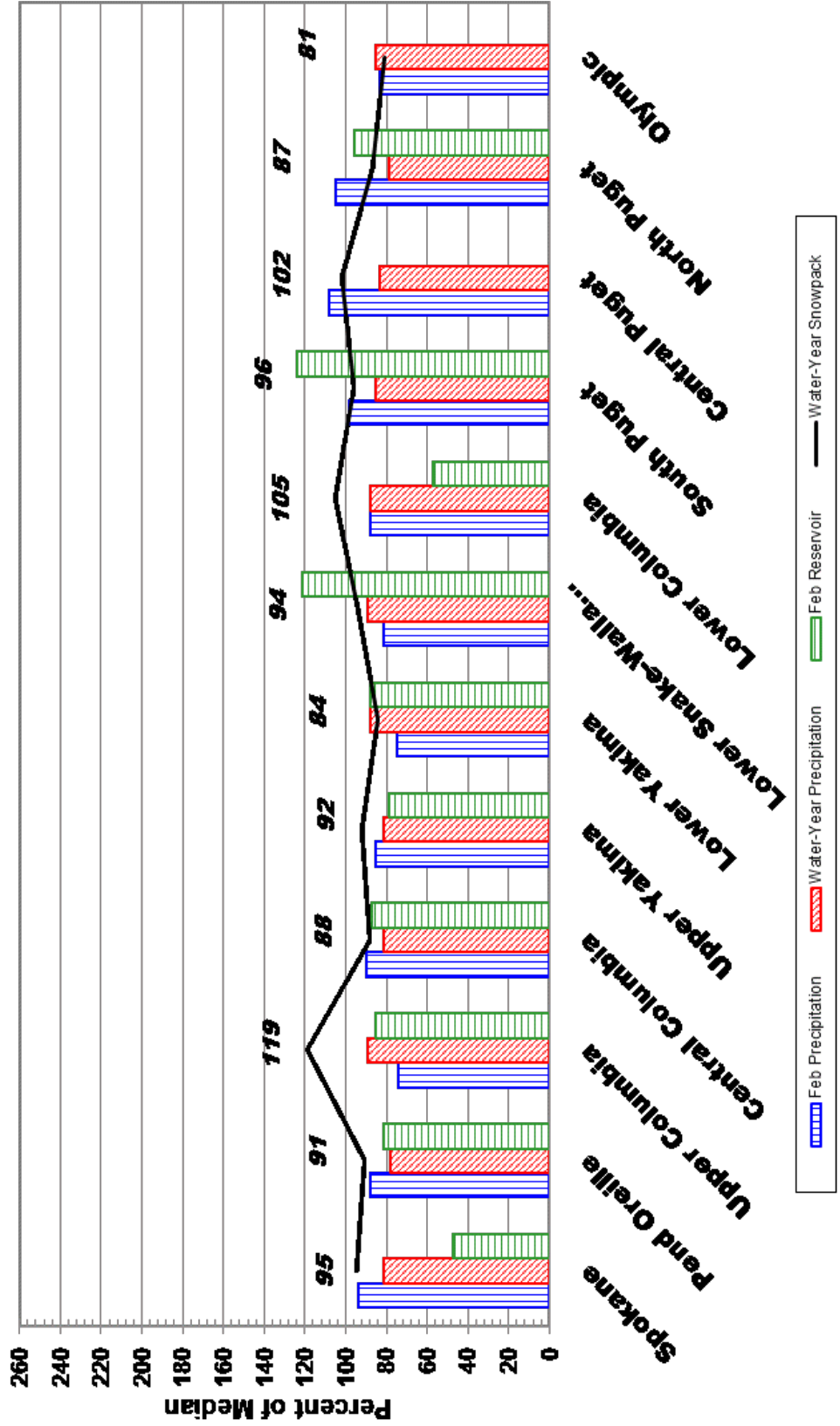
Washington:

<https://www.nrcs.usda.gov/wps/portal/nrcs/site/wa/home/>

NRCS National:

<https://www.nrcs.usda.gov/wps/portal/nrcs/site/national/home/>

March 1, 2023 - Snowpack, Precipitation and Reservoir Conditions at a Glance (Water Year = October 1 - Current Date)



90th Annual Western Snow Conference

April 17-20, 2023

Flagstaff, AZ

Please join us on April 17-20, 2023, for the 90th annual meeting of the Western Snow Conference, to be held in Flagstaff, Arizona on the Northern Arizona University campus. In addition to the in-person conference meeting, a virtual attendance option is being planned to allow for broader participation.

You are invited to submit an abstract of 150 – 300 words for either oral or poster presentation by March 1, 2023. All snow-related research in the context of measurements, modeling, and water supply are welcome. In order to encourage participation in the Conference, all presenters are required to attend in person.

Please see the [Call for Papers](#) for additional information. Abstracts can be submitted online [HERE](#).

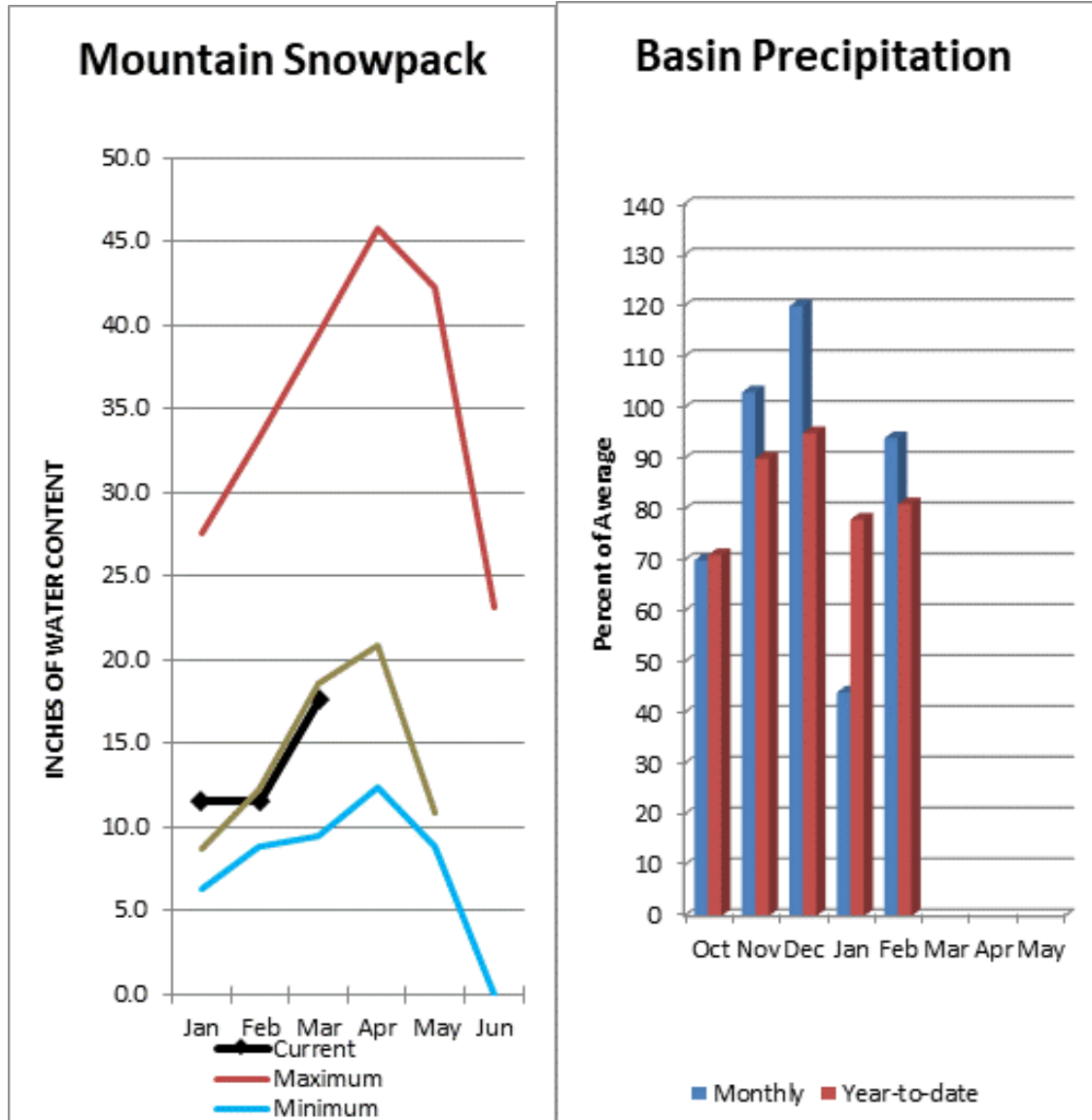
Details of this conference are still being finalized, including formats, platforms, and opportunity for vendor participation.

Teri Smyly
General Chair, WSC

Kevin Richards
Conference Chair

Additional information about the conference will be posted on the WSC web page at <http://www.westernsnowconference.org/>

Also find Western Snow Conference on Facebook



Basin snowpack is 95% of normal and precipitation is 81% of normal for the water year. Precipitation for February was 94% of normal. Reservoir storage is currently at 47% of normal.

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Spokane Streamflow Forecasts - March 1, 2023

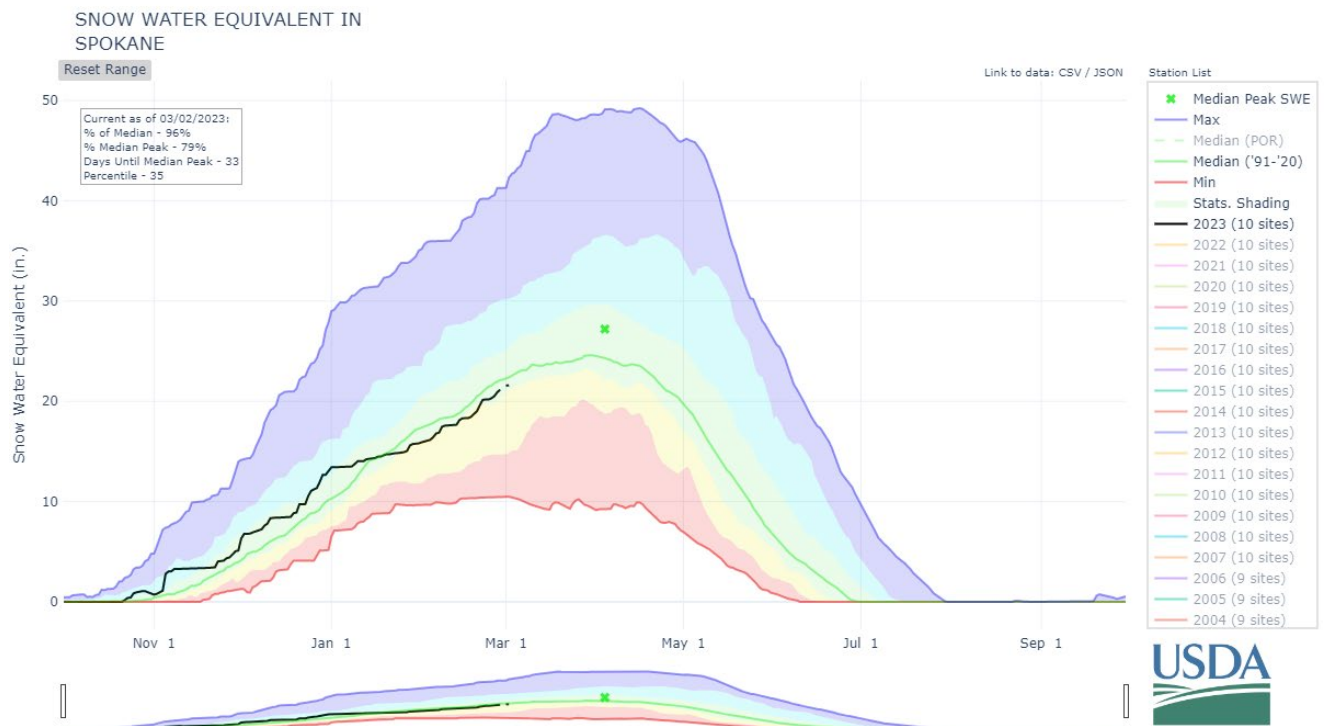
Spokane	Forecast Period	Forecast Exceedance Probabilities For Risk Assessment Chance that actual volume will exceed forecast						
		90% (KAF)	70% (KAF)	50% (KAF)	% Median	30% (KAF)	10% (KAF)	30yr Median (KAF)
NF Coeur d'Alene R at Enaville	APR-JUL	410	560	665	93%	765	920	715
	APR-SEP	440	595	700	93%	805	955	750
Spokane R nr Post Falls ²	APR-JUL	1320	1840	2190	87%	2540	3050	2510
	APR-SEP	1380	1900	2260	88%	2620	3140	2570
St. Joe R at Calder	APR-JUL	610	805	935	89%	1070	1260	1050
	APR-SEP	655	855	995	89%	1130	1330	1120
Chamokane Ck nr Long Lake	MAR-JUL	9	15	19.8	73%	25	35	27
Spokane R at Long Lake ²	APR-JUL	1570	2100	2450	90%	2810	3330	2720
	APR-SEP	1720	2260	2630	92%	2990	3530	2870

1) 90% And 10% exceedance probabilities are actually 95% And 5%

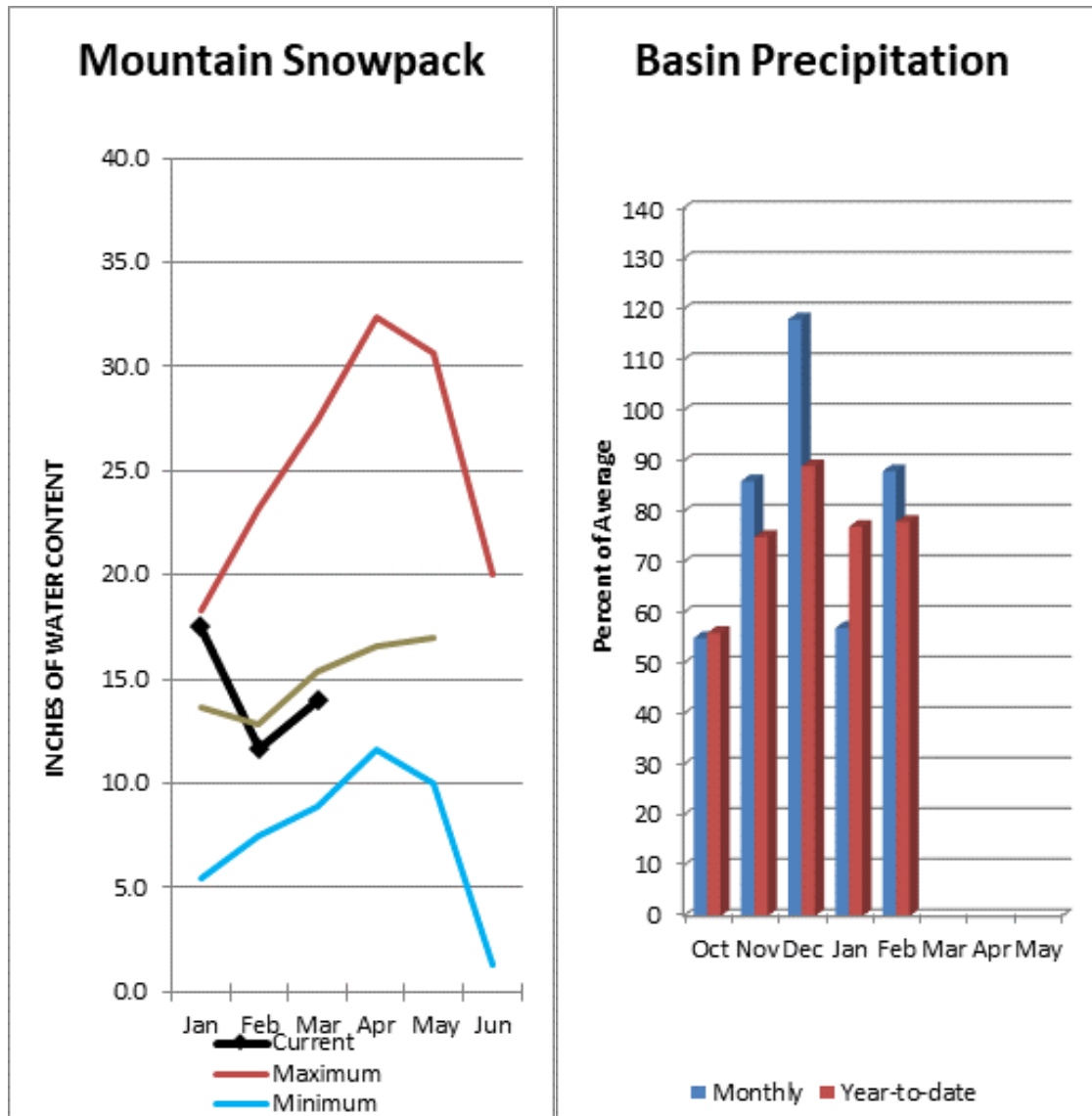
2) Forecasts are For unimpaired flows. Actual flow will be dependent On management of upstream reservoirs And diversions

Reservoir Storage End of February, 2023	Current (KAF)	Last Year (KAF)	Median (KAF)	Capacity (KAF)
Lake Coeur d' Alene	47.4	62.4	101.2	238.5

Watershed Snowpack Analysis March 1, 2023	# of Sites	% Median	Last Year % Median
Spokane	20	97%	93%
Newman Lake	5	109%	76%



Lower Pend Oreille River Basins



March 1 snow cover was 91% of normal in the Pend Oreille Basin River Basin and precipitation during February was 88% of normal, bringing the year-to-date precipitation at 78% of normal. Reservoir storage in the basin, including Lake Pend Oreille and Priest Lake was 81% of normal.

For more information contact your local Natural Resources Conservation Service office.

Lower Pend Oreille River Basin

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Lower Pend Oreille Streamflow Forecasts - March 1, 2023

Forecast Exceedance Probabilities For Risk Assessment
Chance that actual volume will exceed forecast

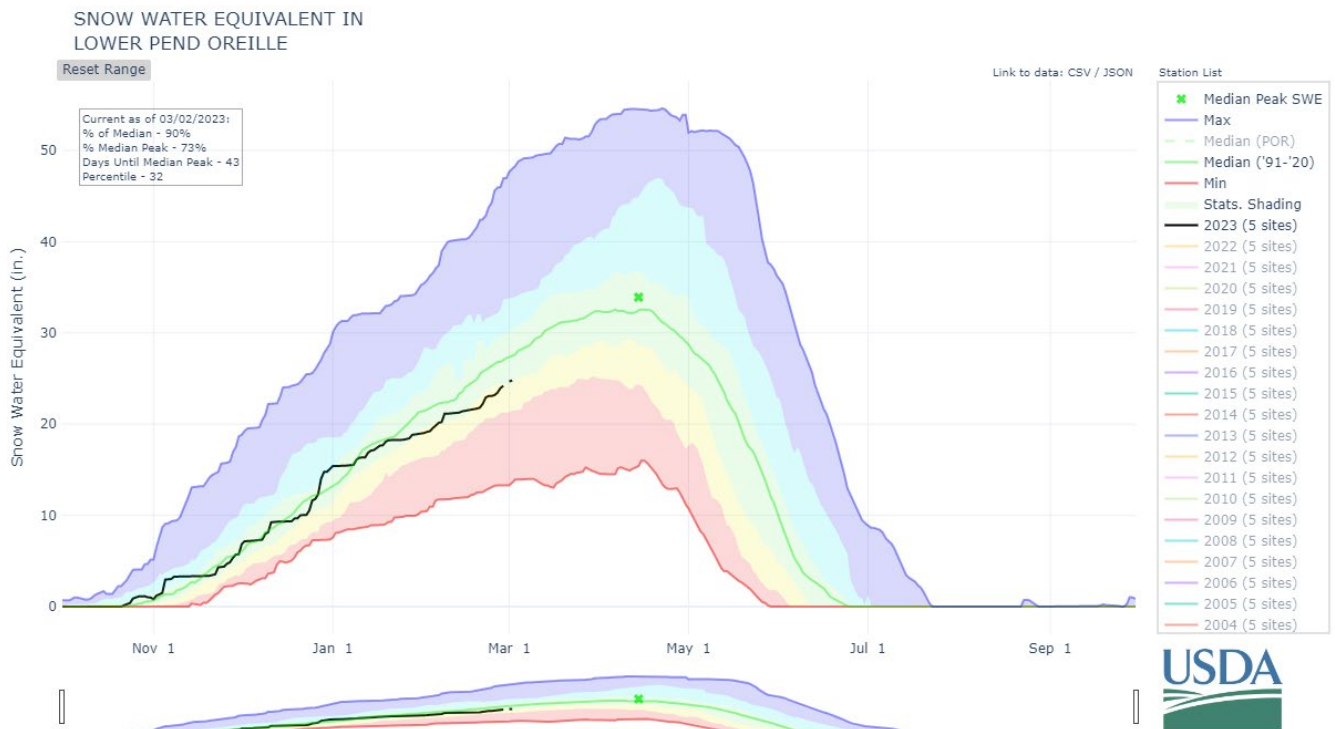
Lower Pend Oreille	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Median	30% (KAF)	10% (KAF)	30yr Median (KAF)
Priest R nr Priest River ²	APR-JUL	460	595	685	82%	780	915	840
	APR-SEP	490	630	725	82%	820	960	880
Pend Oreille Lake Inflow ²	APR-JUL	7930	9720	10900	93%	12100	13900	11700
	APR-SEP	8560	10500	11800	94%	13100	15100	12600
Pend Oreille R bl Box Canyon ²	APR-JUL	8160	9910	11100	95%	12300	14000	11700
	APR-SEP	8790	10700	12000	94%	13300	15200	12700

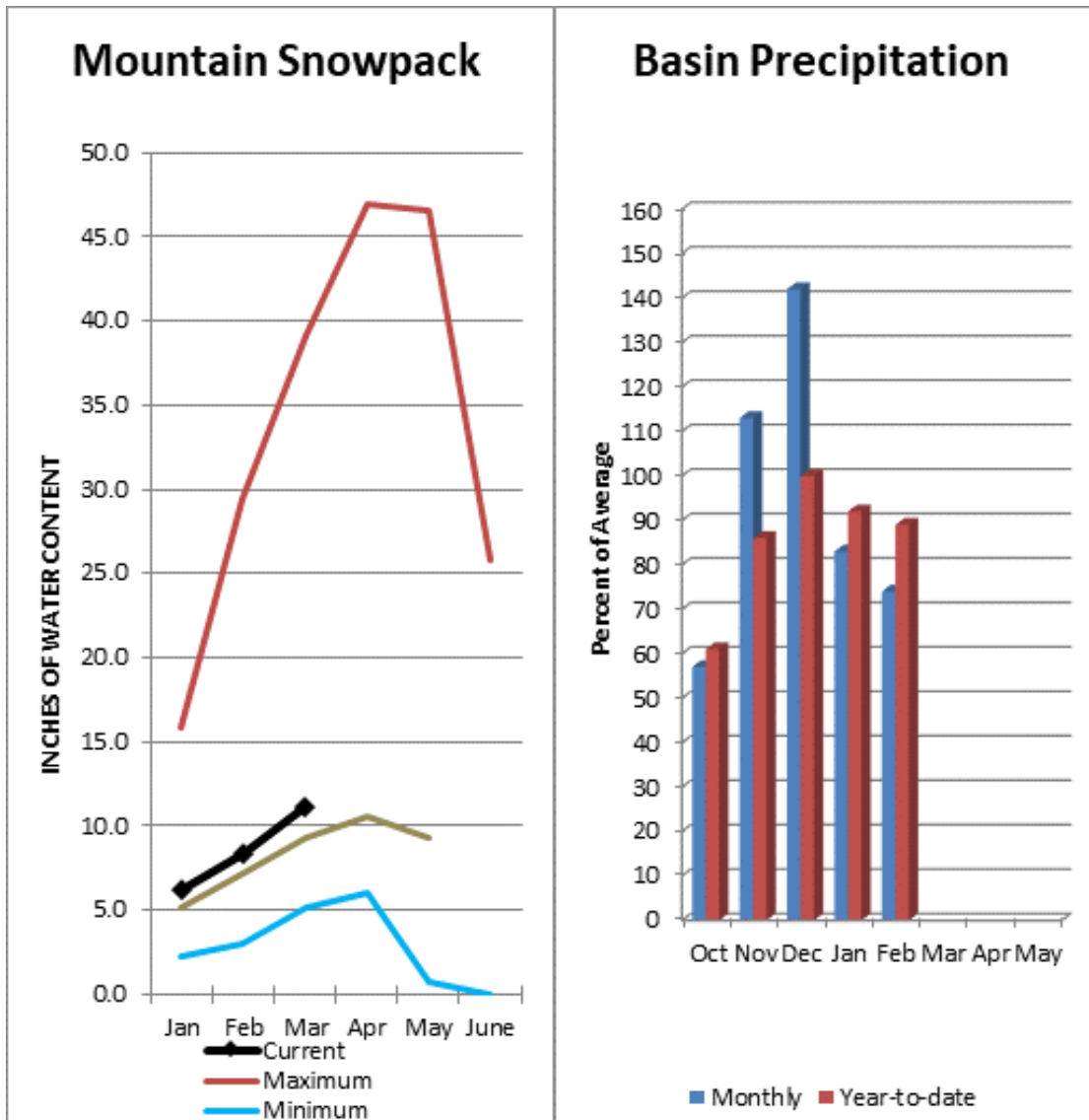
1) 90% And 10% exceedance probabilities are actually 95% And 5%

2) Forecasts are For unimpaired flows. Actual flow will be dependent On management of upstream reservoirs And diversions

Reservoir Storage End of February, 2023	Current (KAF)	Last Year (KAF)	Median (KAF)	Capacity (KAF)
Lake Pend Oreille	552.6	554.4	682.0	1561.3
Priest Lake	47.1	48.0	55.8	119.3

Watershed Snowpack Analysis March 1, 2023	# of Sites	% Median	Last Year % Median
Lower Pend Oreille	16	91%	93%
Sullivan	1	82%	91%





March 1 snow cover on the Upper Columbia basins was 113% of normal and February precipitation was 74% of normal, with precipitation for the water year at 89% of normal. Combined storage in the Conconully Reservoirs was 85% of normal.

Upper Columbia Streamflow Forecasts - March 1, 2023

 Forecast Exceedance Probabilities For Risk Assessment
 Chance that actual volume will exceed forecast

Upper Columbia	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Median	30% (KAF)	10% (KAF)	30yr Median (KAF)
Columbia R at Grand Coulee-NWS ²	APR-JUL	34900		45000	86%		54400	52600
	APR-SEP	41800		53300	88%		65300	60600
Similkameen R nr Nighthawk	APR-JUL	770	935	1050	83%	1160	1330	1260
	APR-SEP	855	1030	1150	86%	1270	1450	1340
Kettle R nr Laurier	APR-JUL	1320	1630	1850	101%	2070	2380	1840
	APR-SEP	1450	1780	2000	103%	2220	2550	1950
Colville R at Kettle Falls	APR-JUL	48	86	112	97%	138	177	115
	APR-SEP	53	95	123	99%	152	194	124
Okanogan R nr Tonasket	APR-JUL	825	1110	1300	86%	1490	1780	1520
	APR-SEP	875	1190	1400	86%	1610	1920	1620
Methow R nr Pateros	APR-JUL	550	700	800	89%	900	1050	895
	APR-SEP	595	750	855	89%	960	1110	965
Okanogan R at Malott	APR-JUL	830	1120	1330	86%	1530	1820	1550
	APR-SEP	880	1210	1430	85%	1650	1970	1680

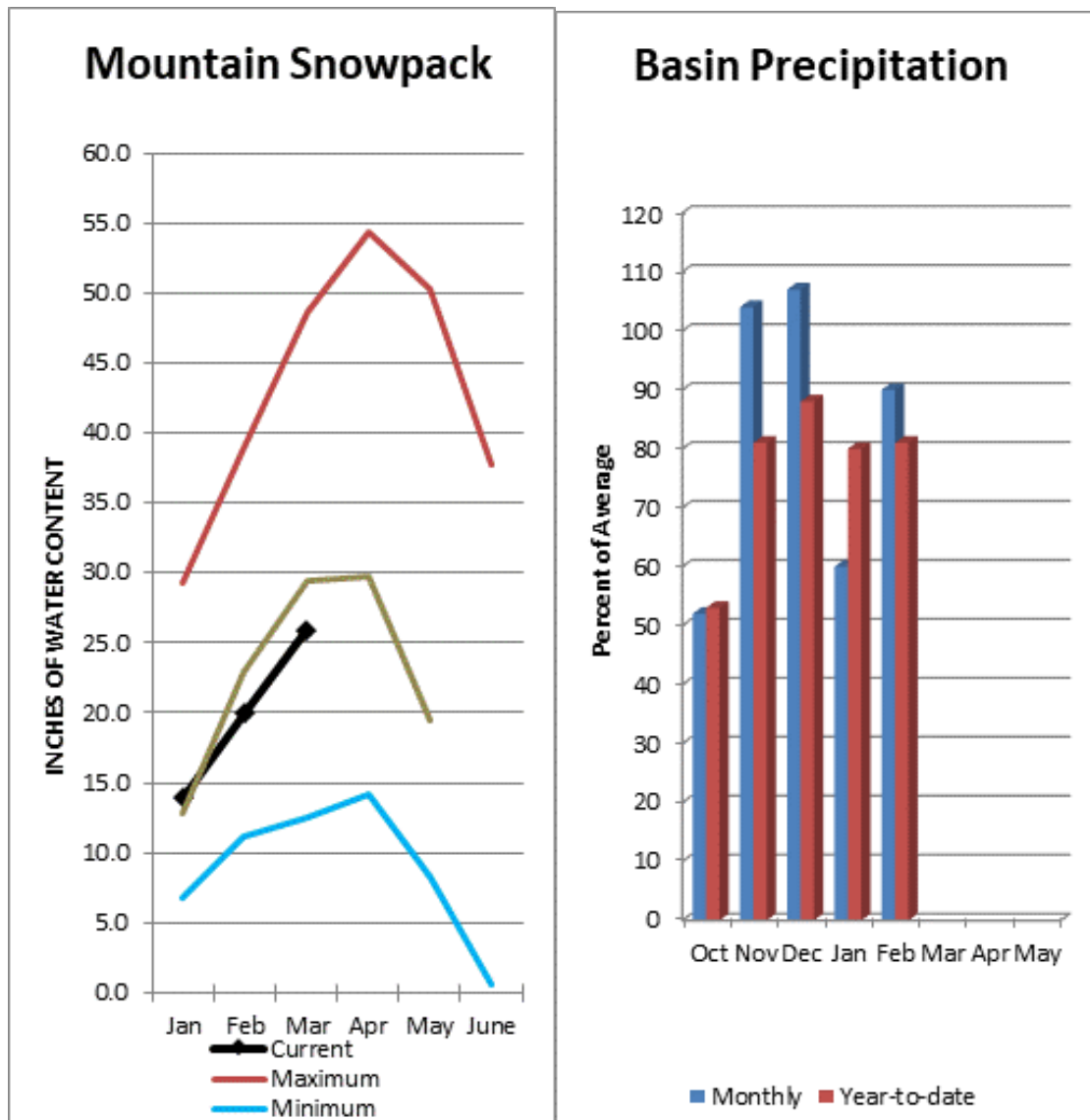
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Reservoir Storage End of February, 2023	Current (KAF)	Last Year (KAF)	Median (KAF)	Capacity (KAF)
Conconully Reservoir	7.4	5.5	8.7	13.0
Conconully Lake (Salmon Lake Dam)	6.5	3.3	7.8	10.5

Watershed Snowpack Analysis March 1, 2023	# of Sites	% Median	Last Year % Median
Upper Columbia	54	112%	87%
Toats Coulee	3	128%	96%
Sanpoil	5	142%	71%
Omak	5	146%	73%
Methow	7	100%	98%
Kettle	13	123%	87%
Concully Lake	1	132%	63%
Colville	2	90%	82%

Central Columbia River Basins



March 1 snowpack in the Central Columbia River basins was 88% of normal. Precipitation during February was 90% of normal in the basin and 81% for the year-to-date. Reservoir storage in Lake Chelan was 87% of the median.

For more information contact your local Natural Resources Conservation Service office.

Central Columbia River Basins

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Central Columbia Streamflow Forecasts - March 1, 2023

Forecast Exceedance Probabilities For Risk Assessment
Chance that actual volume will exceed forecast

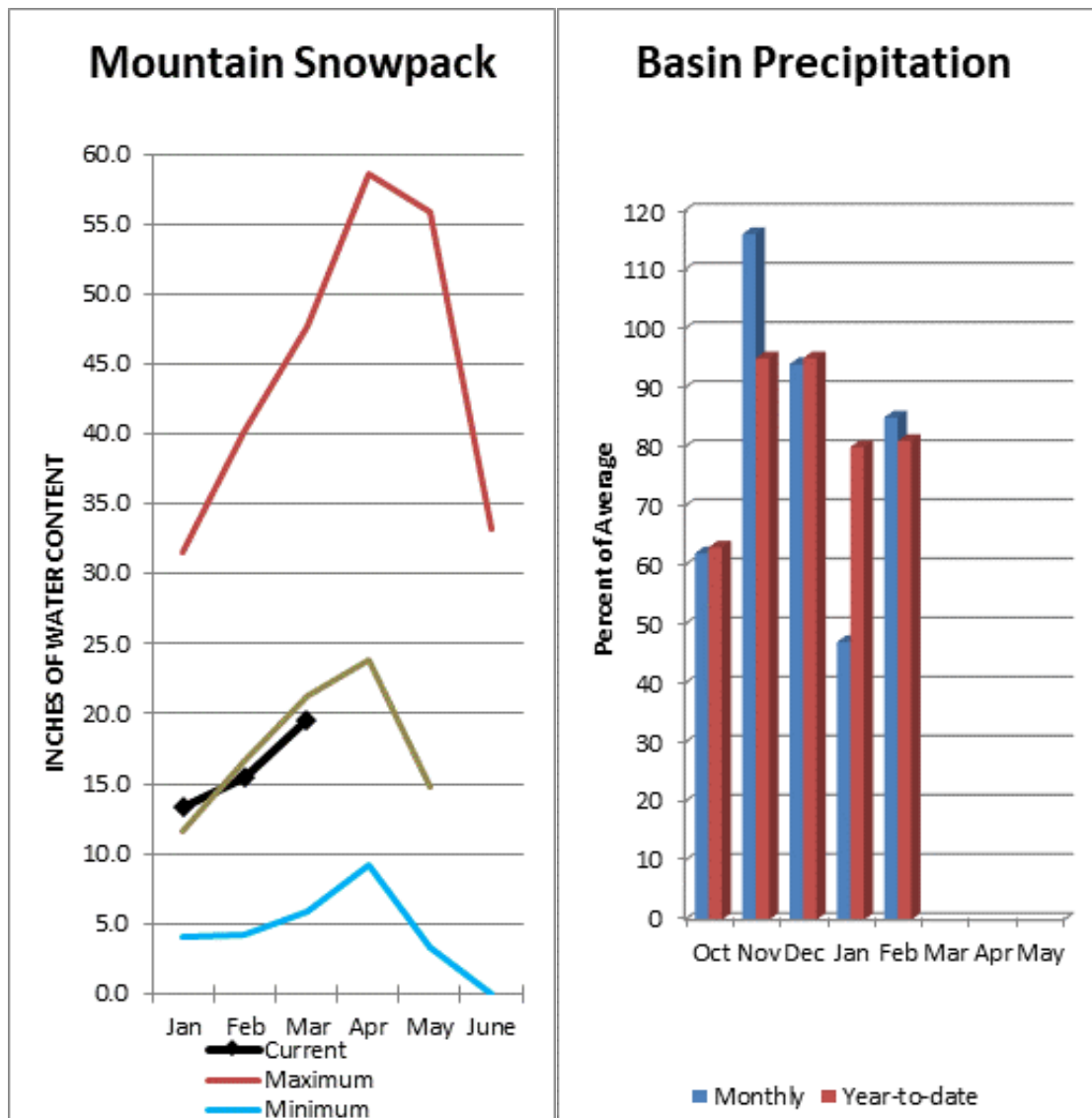
Central Columbia	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Median	30% (KAF)	10% (KAF)	30yr Median (KAF)
Entiat R nr Ardenvoir	APR-JUL	126	157	178	81%	199	230	220
	APR-SEP	136	170	192	82%	215	250	235
Columbia R bl Rock Island Dam-NWS ²	APR-JUL	37200		48700	85%		60100	57600
	APR-SEP	44300		57400	87%		71500	65800
Wenatchee R at Peshastin	APR-JUL	910	1080	1190	83%	1310	1470	1440
	APR-SEP	980	1160	1290	84%	1420	1600	1540
Stehekin R at Stehekin	APR-JUL	490	570	625	87%	680	760	715
	APR-SEP	565	655	715	86%	775	860	835
Chelan R at Chelan ²	APR-JUL	710	830	915	88%	995	1120	1040
	APR-SEP	785	920	1010	86%	1100	1240	1170
Icicle Ck nr Leavenworth	APR-JUL	172	210	235	81%	265	305	290
	APR-SEP	184	225	255	82%	285	330	310
Wenatchee R at Plain	APR-JUL	665	795	880	82%	970	1100	1070
	APR-SEP	715	855	955	82%	1050	1200	1160

1) 90% And 10% exceedance probabilities are actually 95% And 5%

2) Forecasts are For unimpaired flows. Actual flow will be dependent On management of upstream reservoirs And diversions

Reservoir Storage End of February, 2023	Current (KAF)	Last Year (KAF)	Median (KAF)	Capacity (KAF)
Lake Chelan	215.9	354.6	248.2	677.4

Watershed Snowpack Analysis March 1, 2023	# of Sites	% Median	Last Year % Median
Central Columbia	12	88%	99%
Wenatchee	8	86%	100%
Stemilt	1	105%	76%
Lake Chelan	3	82%	97%
Entiat	1	122%	101%
Colckum	1	132%	75%



March 1 snowpack was 92% of normal. Precipitation was 85% of normal for February and 81% for the water-year. March 1 reservoir storage for the Upper Yakima reservoirs was 79% of normal.

Upper Yakima River Basin

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Upper Yakima Streamflow Forecasts - March 1, 2023

Forecast Exceedance Probabilities For Risk Assessment
Chance that actual volume will exceed forecast

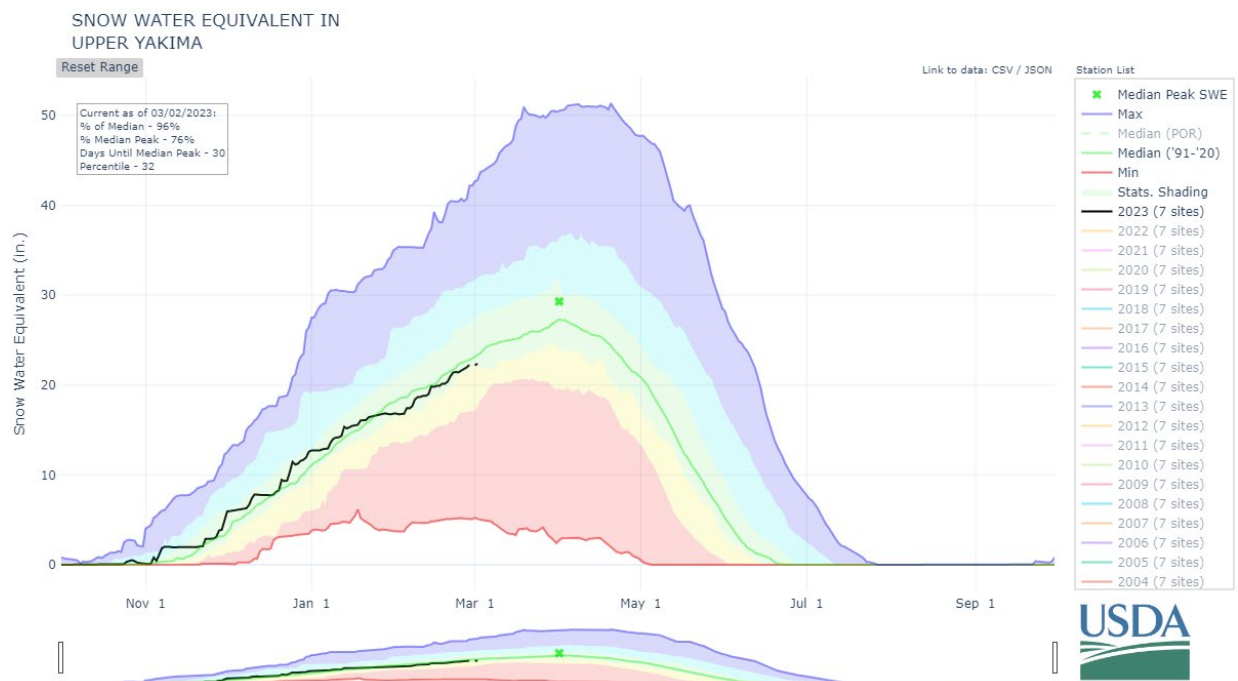
Upper Yakima	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Median	30% (KAF)	10% (KAF)	30yr Median (KAF)
Teanaway R bl Forks nr Cle Elum	APR-JUL	69	96	114	87%	132	159	131
	APR-SEP	71	98	117	87%	135	163	134
Kachess Reservoir Inflow ²	APR-JUL	63	80	92	93%	104	121	99
	APR-SEP	71	89	101	94%	113	131	108
Keechelus Reservoir Inflow ²	APR-JUL	70	92	106	95%	120	142	112
	APR-SEP	79	101	116	92%	131	154	126
Cle Elum Lake Inflow ²	APR-JUL	260	310	345	90%	380	430	385
	APR-SEP	285	340	375	89%	410	465	420

1) 90% And 10% exceedance probabilities are actually 95% And 5%

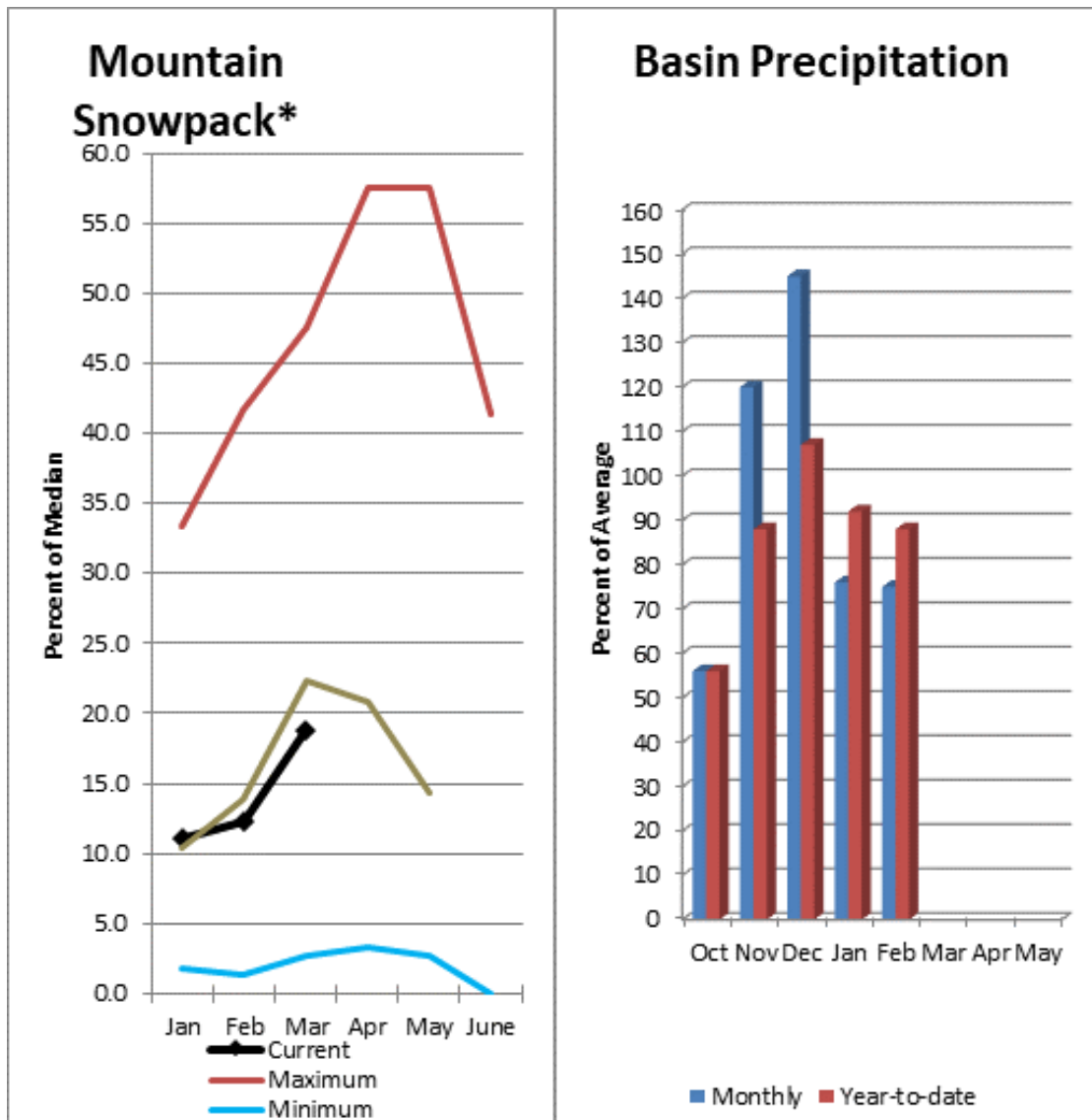
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Reservoir Storage End of February, 2023	Current (KAF)	Last Year (KAF)	Median (KAF)	Capacity (KAF)
Kachess	141.3	192.2	151.8	239.0
Cle Elum	182.0	292.6	235.6	436.9
Keechelus	63.0	125.6	102.4	157.8

Watershed Snowpack Analysis March 1, 2023	# of Sites	% Median	Last Year % Median
Upper Yakima	10	92%	96%
Upper Yakima	10	92%	96%



Lower Yakima - Naches River Basin



March 1 combined basin snowpack was 84% of normal. February precipitation was 70% of normal and 96% for the water-year. March 1 reservoir storage for Bumping and Rimrock reservoirs was 88% of the median.

For more information contact your local Natural Resources Conservation Service office.

Lower Yakima – Naches River Basins

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Lower Yakima Streamflow Forecasts - March 1, 2023

Forecast Exceedance Probabilities For Risk Assessment
Chance that actual volume will exceed forecast

Lower Yakima	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Median	30% (KAF)	10% (KAF)	30yr Median (KAF)
Ahtanum Ck at Union Gap	APR-JUL	14.2	24	31	119%	38	48	26
	APR-SEP	16.3	26	33	118%	40	50	28
Yakima R nr Parker ²	APR-JUL	970	1270	1480	86%	1690	1990	1730
	APR-SEP	1080	1400	1620	86%	1840	2160	1890

1) 90% And 10% exceedance probabilities are actually 95% And 5%

2) Forecasts are For unimpaired flows. Actual flow will be dependent On management of upstream reservoirs And diversions

Watershed Snowpack Analysis March 1, 2023

	# of Sites	% Median	Last Year % Median
Lower Yakima	3	84%	60%
Simcoe-Toppenish	1	98%	70%
Satus	1	60%	42%
Ahtanum	2	99%	73%

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Naches Streamflow Forecasts - March 1, 2023

Forecast Exceedance Probabilities For Risk Assessment
Chance that actual volume will exceed forecast

Naches	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Median	30% (KAF)	10% (KAF)	30yr Median (KAF)
American R nr Nile	APR-JUL	59	75	85	85%	95	111	100
	APR-SEP	63	80	91	84%	103	120	108
Bumping Lake Inflow ²	APR-JUL	66	83	95	83%	107	124	114
	APR-SEP	71	90	103	84%	116	135	122
Naches R nr Naches ²	APR-JUL	390	520	605	84%	695	820	720
	APR-SEP	425	570	665	86%	765	905	775
Rimrock Lake Inflow ²	APR-JUL	127	152	168	87%	185	210	194
	APR-SEP	151	180	200	85%	220	250	235

1) 90% And 10% exceedance probabilities are actually 95% And 5%

2) Forecasts are For unimpaired flows. Actual flow will be dependent On management of upstream reservoirs And diversions

Reservoir Storage End of February, 2023

	Current (KAF)	Last Year (KAF)	Median (KAF)	Capacity (KAF)
Bumping Lake	14.3	19.6	15.3	33.7
Rimrock	120.6	155.9	138.5	198.0

Watershed Snowpack Analysis March 1, 2023

	# of Sites	% Median	Last Year % Median
Naches	9	84%	89%
Naches	9	84%	89%

Klickitat Streamflow Forecasts - March 1, 2023

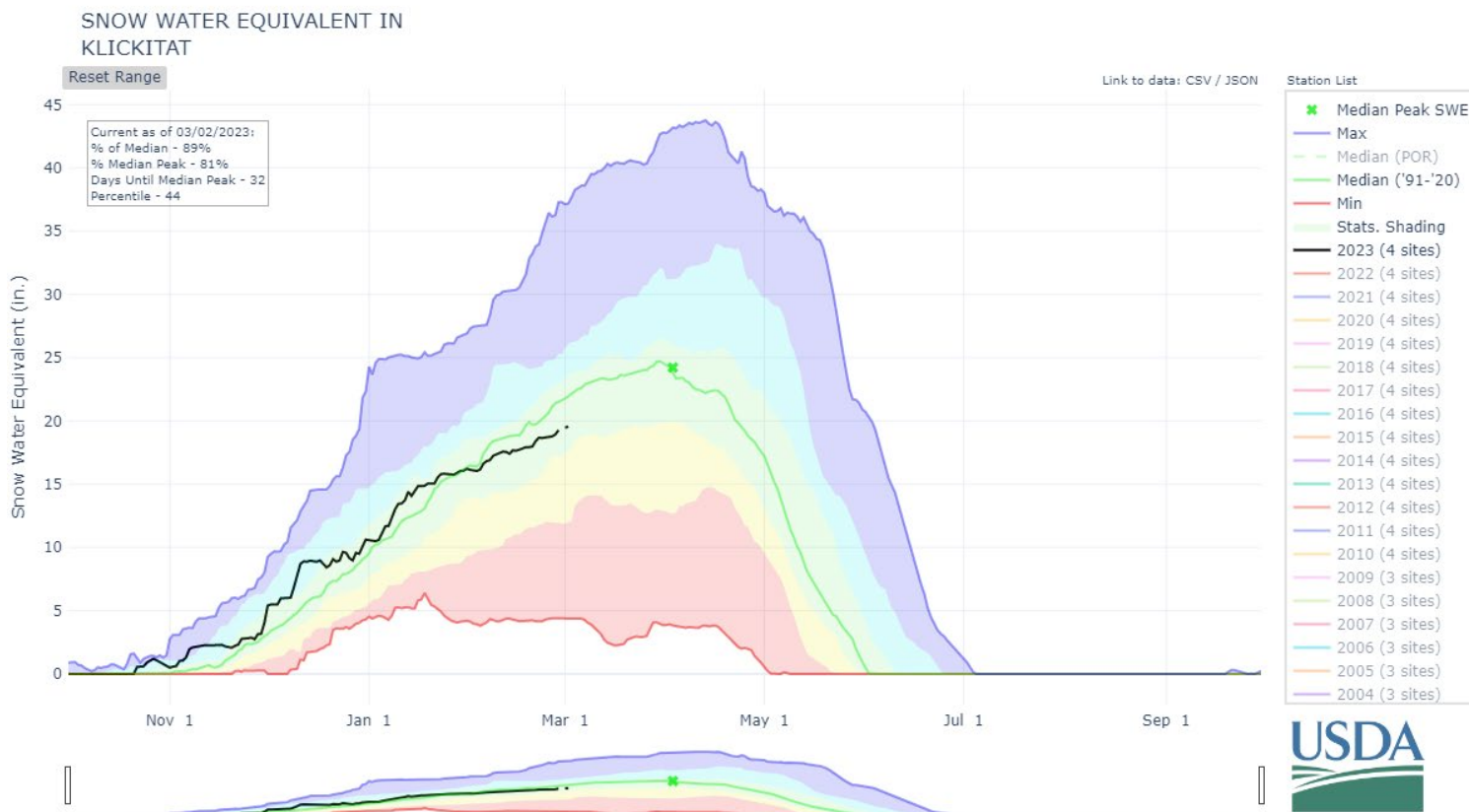
Forecast Exceedance Probabilities For Risk Assessment
Chance that actual volume will exceed forecast

Klickitat	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Median	30% (KAF)	10% (KAF)	30yr Median (KAF)
Klickitat R nr Pitt	APR-JUL	285	365	420	92%	480	560	455
	APR-SEP	360	450	510	94%	575	665	545
Klickitat R nr Glenwood	APR-JUL	80	101	116	88%	131	152	132
	APR-SEP	89	112	128	88%	143	166	145

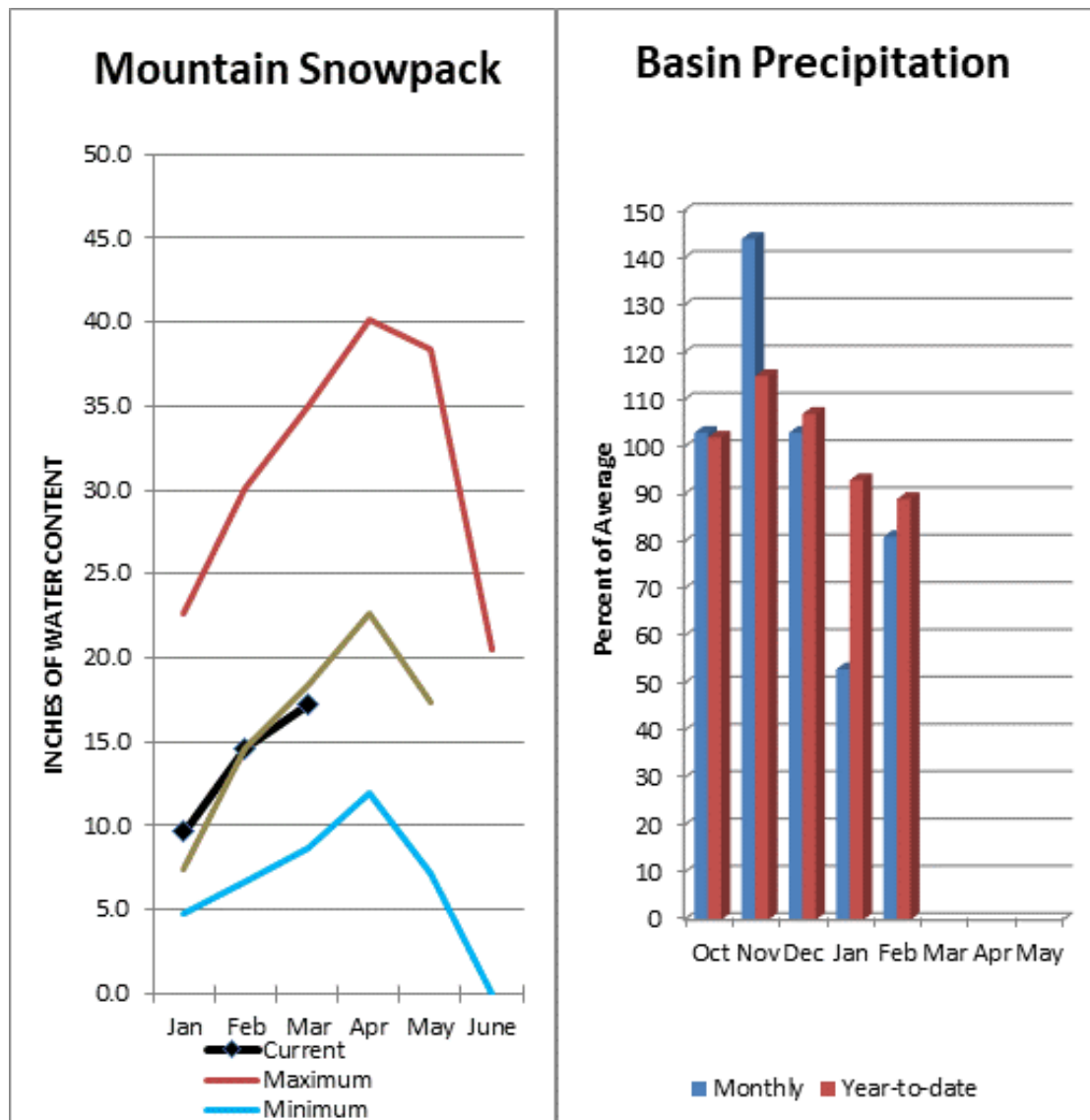
1) 90% And 10% exceedance probabilities are actually 95% And 5%

2) Forecasts are For unimpaired flows. Actual flow will be dependent On management of upstream reservoirs And diversions

Watershed Snowpack Analysis March 1, 2023		# of Sites	% Median	Last Year % Median
Klickitat		4	89%	75%
Klickitat		4	89%	75%



Lower Snake – Walla Walla River Basin



March 1 snowpack readings were 94% of normal. February precipitation was 81% of normal, bringing the year-to-date precipitation to 89% of normal. Reservoir storage was 121% of the median.

For more information contact your local Natural Resources Conservation Service office.

Lower Snake – Walla Walla River Basin

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Lower Snake-Walla Walla Streamflow Forecasts - March 1, 2023

Forecast Exceedance Probabilities For Risk Assessment
Chance that actual volume will exceed forecast

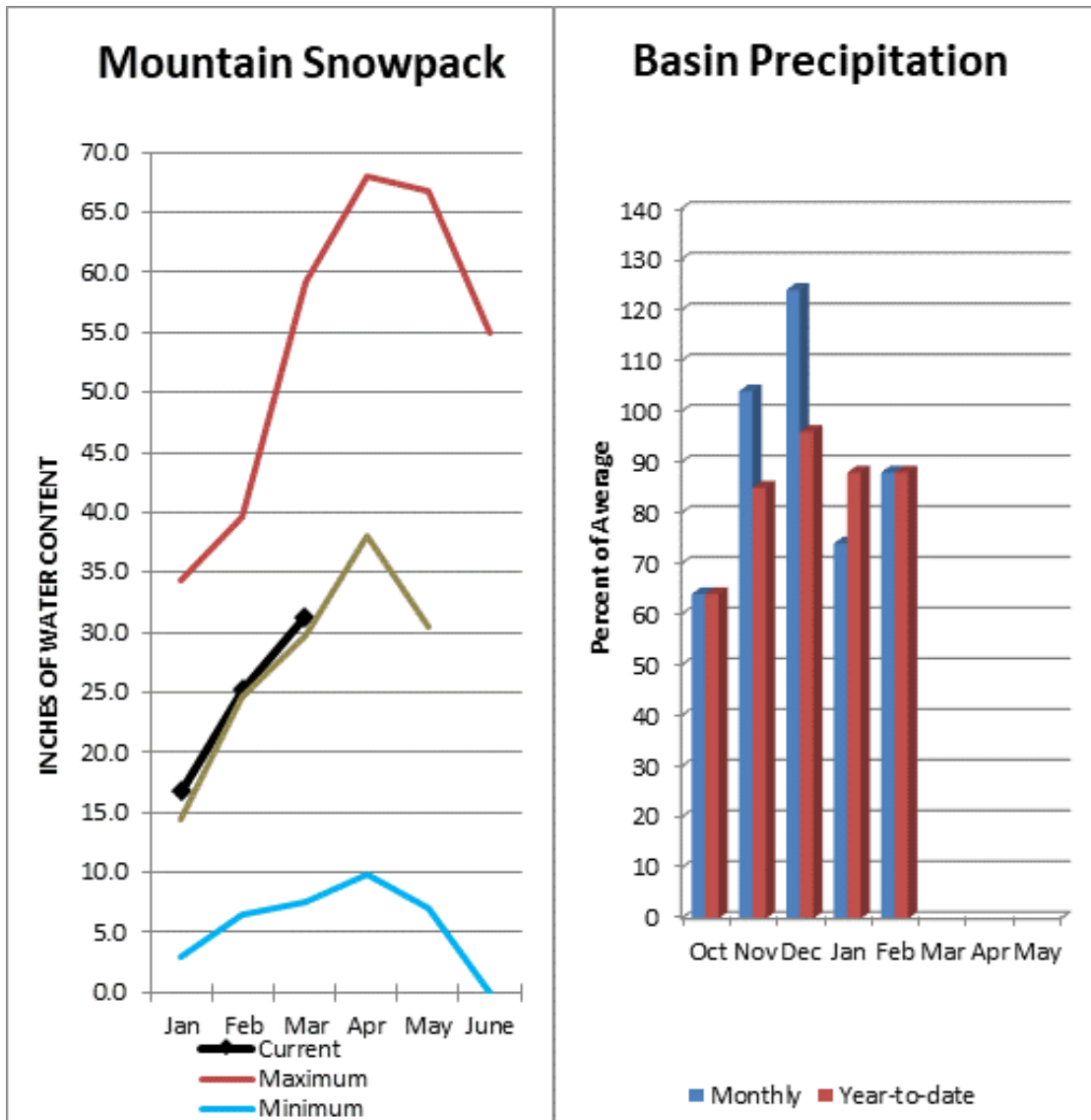
Lower Snake-Walla Walla	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Median	30% (KAF)	10% (KAF)	30yr Median (KAF)
SF Walla Walla R nr Milton-Freewater	MAR-JUL	53	63	70	99%	77	87	71
	APR-SEP	53	62	68	97%	74	83	70
Snake R bl Lower Granite Dam-NWS ²	APR-JUL	11900		16200	82%		23100	19700
	APR-SEP	14000		18500	85%		26000	21800
Lostine R nr Lostine	APR-JUL	84	94	101	90%	108	119	112
	APR-SEP	89	100	108	90%	116	127	120
Mill Ck nr Walla Walla	APR-JUL	14.2	20	25	100%	29	35	25
	APR-SEP	17.7	24	28	97%	33	39	29
Catherine Ck nr Union	APR-JUL	40	51	59	91%	67	79	65
	APR-SEP	43	55	63	91%	71	83	69
Asotin Ck at Asotin	APR-JUL	16.8	23	28	85%	34	43	33
	APR-SEP	153	205	245	89%	280	335	275
Grande Ronde R at Troy	MAR-JUL	930	1180	1350	85%	1530	1780	1580
	APR-SEP	765	1000	1170	87%	1330	1570	1350
Bear Ck nr Wallowa	APR-JUL	41	53	61	94%	69	80	65
	APR-SEP	43	55	63	93%	71	83	68

1) 90% And 10% exceedance probabilities are actually 95% And 5%

2) Forecasts are For unimpaired flows. Actual flow will be dependent On management of upstream reservoirs And diversions

Reservoir Storage End of February, 2023	Current (KAF)	Last Year (KAF)	Median (KAF)	Capacity (KAF)
Wallowa Lake	21.4	15.4	17.6	37.5

Watershed Snowpack Analysis March 1, 2023	# of Sites	% Median	Last Year % Median
Lower Snake-Walla Walla	20	95%	84%
Walla Walla	5	98%	97%
Grande Ronde	18	94%	85%
Asotin	2	76%	126%



March 1 snow cover for Lower Columbia was 105% of normal. February precipitation was 88% of normal and the water-year was 88%. Reservoir storage was 57% of normal.

Lower Columbia Streamflow Forecasts - March 1, 2023

 Forecast Exceedance Probabilities For Risk Assessment
 Chance that actual volume will exceed forecast

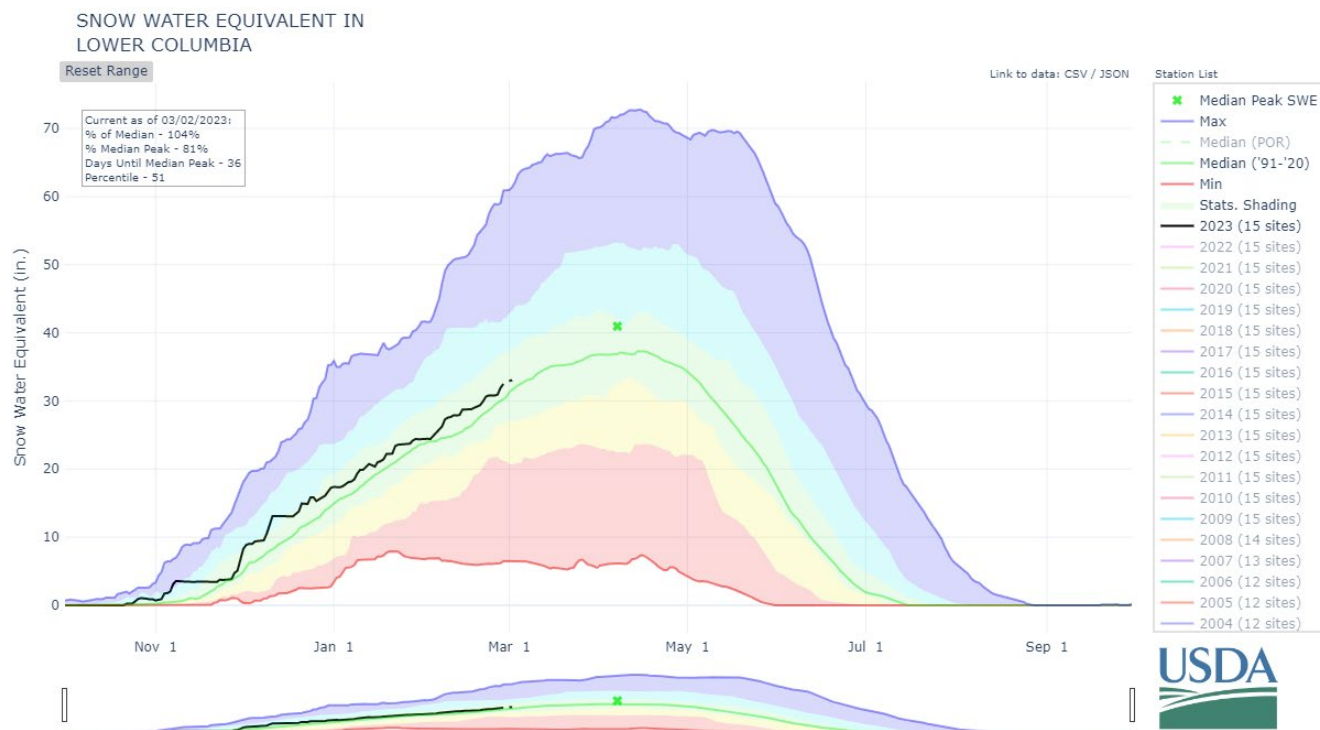
Lower Columbia	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Median	30% (KAF)	10% (KAF)	30yr Median (KAF)
Lewis R at Ariel	APR-JUL	785	965	1090	106%	1210	1390	1030
	APR-SEP	920	1100	1230	107%	1350	1540	1150
Cowlitz R bl Mayfield ²	APR-JUL	1200	1470	1660	104%	1840	2110	1600
	APR-SEP	1390	1670	1870	104%	2060	2350	1790
Cowlitz R at Castle Rock ²	APR-JUL	1570	2020	2320	109%	2620	3060	2120
	APR-SEP	1830	2290	2610	112%	2920	3380	2330

1) 90% And 10% exceedance probabilities are actually 95% And 5%

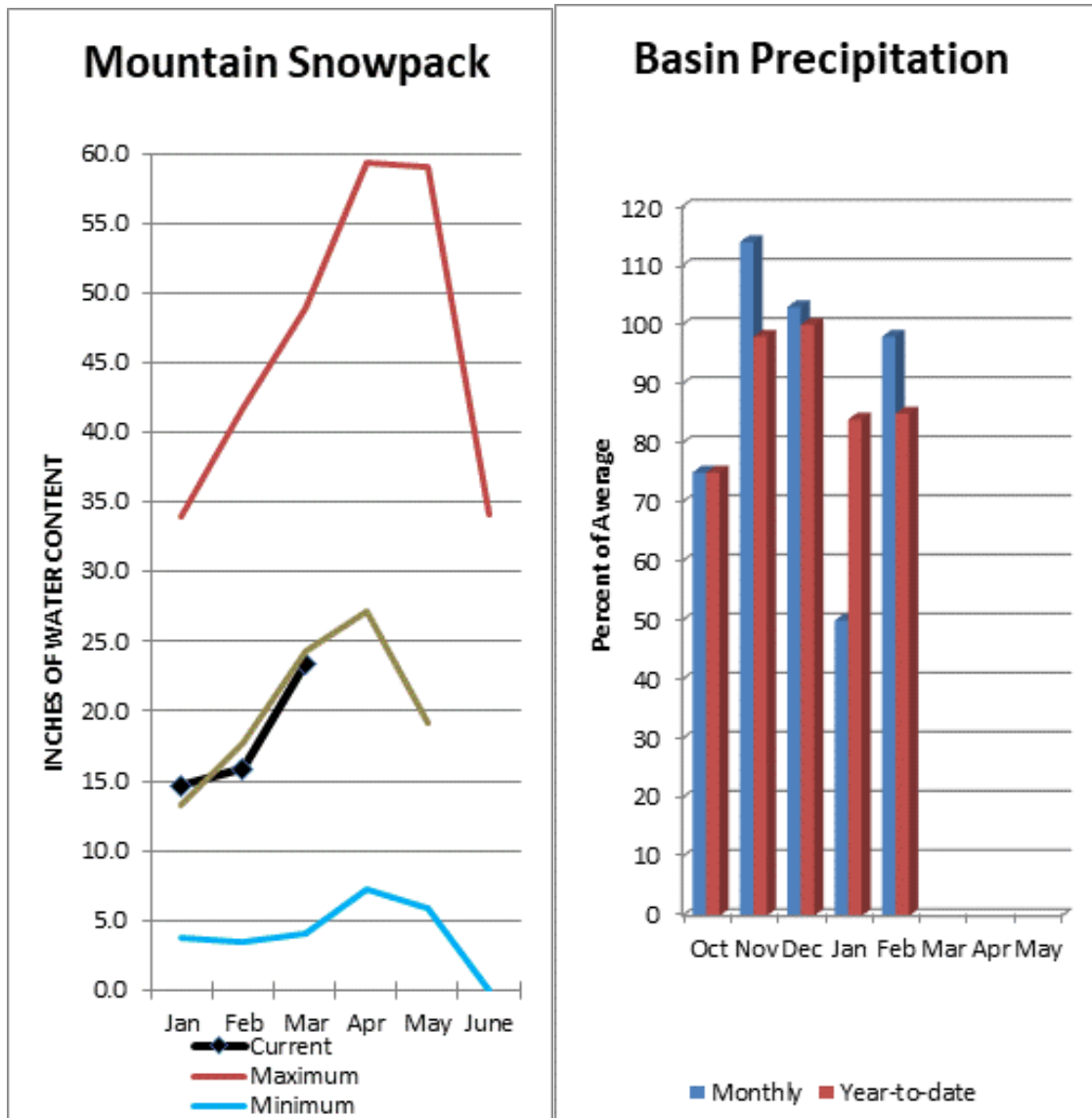
2) Forecasts are For unimpaired flows. Actual flow will be dependent On management of upstream reservoirs And diversions

Reservoir Storage End of February, 2023	Current (KAF)	Last Year (KAF)	Median (KAF)	Capacity (KAF)
Mayfield	129.8	126.9	127.4	
Mossyrock Dam (Riffe Lk)	430.6	712.2	850.6	

Watershed Snowpack Analysis March 1, 2023	# of Sites	% Median	Last Year % Median
Lower Columbia	15	105%	96%
Lewis	8	125%	96%
Cowlitz	9	97%	95%



South Puget Sound River Basins



March 1 snowpack was 96% of normal for the South Puget Sound. February precipitation was 98% of normal, bringing the water year-to-date to 85% of normal for the basins.

For more information contact your local Natural Resources Conservation Service office.

South Puget Sound River Basins

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South Puget Sound Streamflow Forecasts - March 1, 2023

Forecast Exceedance Probabilities For Risk Assessment
Chance that actual volume will exceed forecast

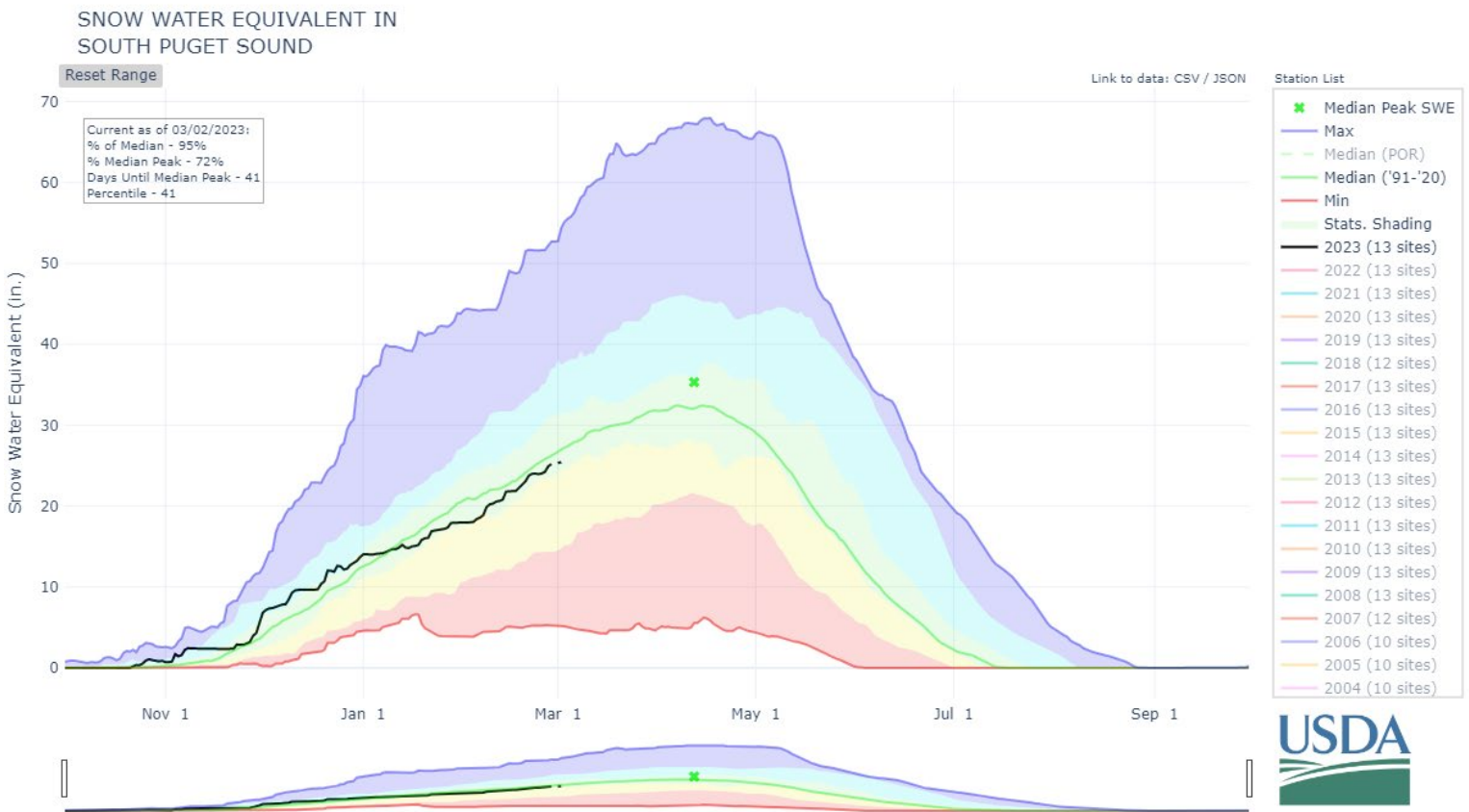
South Puget Sound	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Median	30% (KAF)	10% (KAF)	30yr Median (KAF)
White R nr Buckley ¹	APR-JUL	310	385	420	98%	455	535	430
	APR-SEP	375	465	505	97%	545	635	520
Green R bl Howard A Hanson Dam	APR-JUL	139	220	255	109%	290	370	235
	APR-SEP	156	240	275	108%	310	395	255

1) 90% And 10% exceedance probabilities are actually 95% And 5%

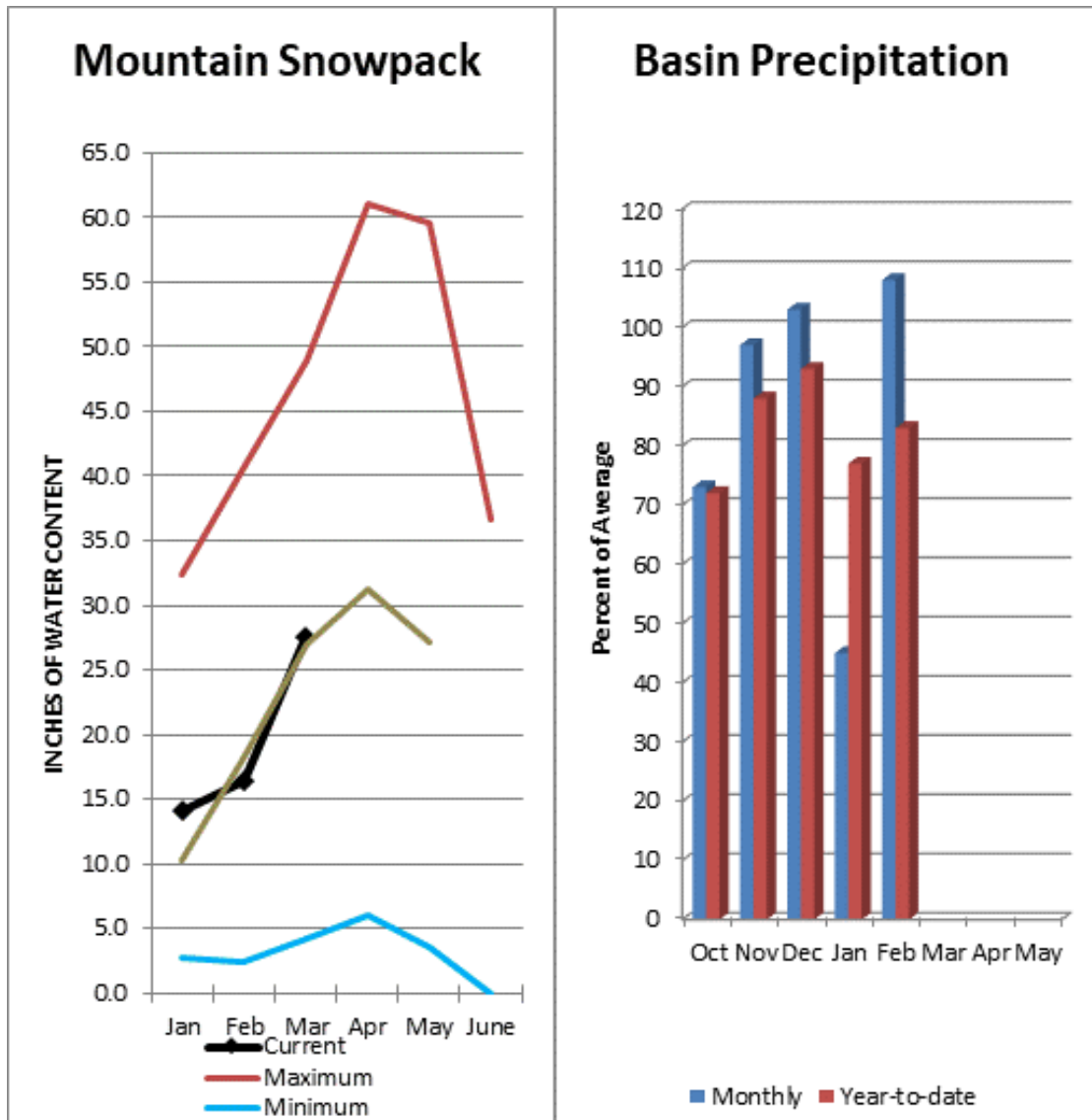
2) Forecasts are For unimpaired flows. Actual flow will be dependent On management of upstream reservoirs And diversions

Reservoir Storage End of February, 2023	Current (KAF)	Last Year (KAF)	Median (KAF)	Capacity (KAF)
Howard Hansen	2.9	6.6	2.3	

Watershed Snowpack Analysis March 1, 2023	# of Sites	% Median	Last Year % Median
South Puget Sound	14	96%	104%
White	6	95%	114%
Puyallup	2	110%	91%
Green	7	105%	112%



Central Puget Sound River Basins



March 1 median snow cover in Central Puget Sound was 102%. Basin-wide precipitation for February was 108% of normal, bringing water-year-to-date to 83% of normal.

For more information contact your local Natural Resources Conservation Service office.

Central Puget Sound River Basins

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Central Puget Sound Streamflow Forecasts - March 1, 2023

Forecast Exceedance Probabilities For Risk Assessment
Chance that actual volume will exceed forecast

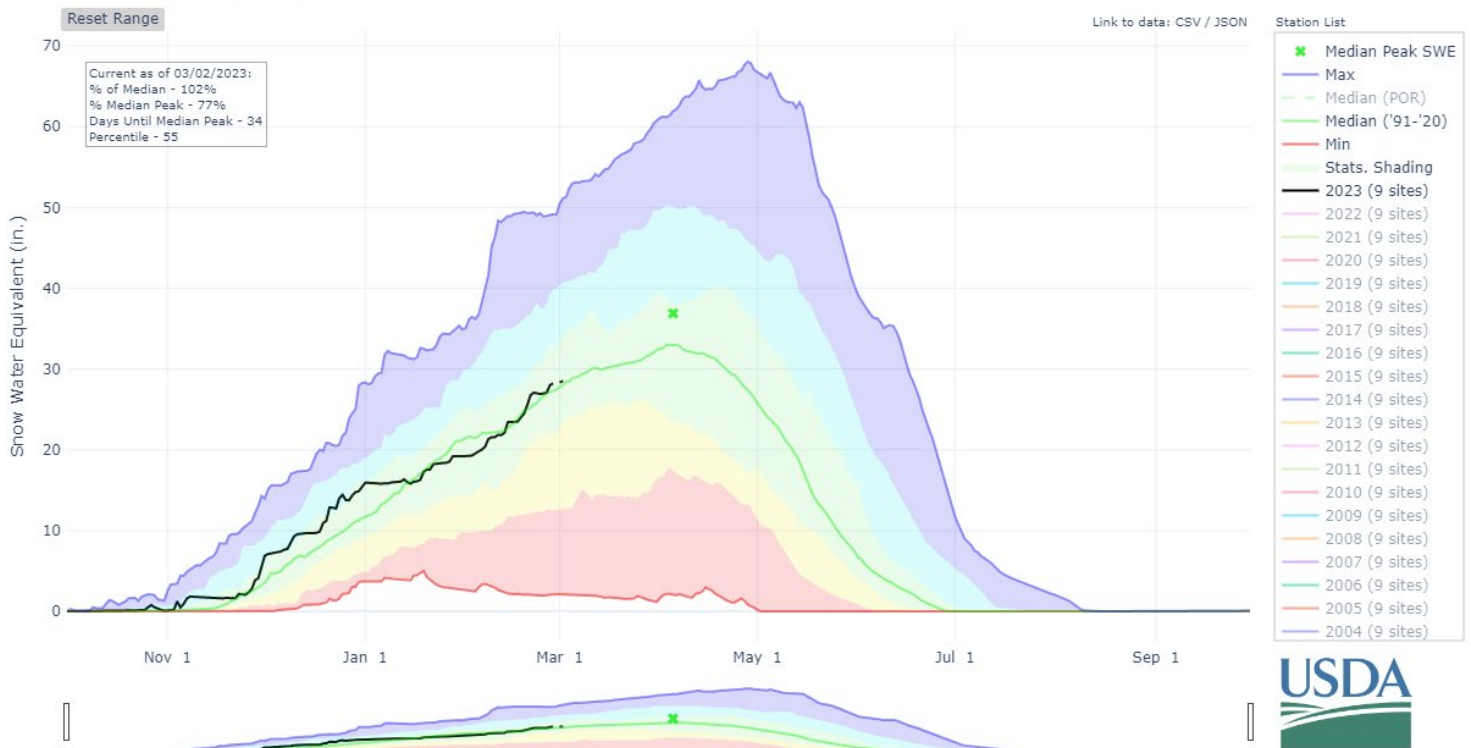
Central Puget Sound	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Median	30% (KAF)	10% (KAF)	30yr Median (KAF)
SF Tolt R nr Index	APR-JUL	8.8	11.5	13.4	100%	15.2	17.9	13.4
	APR-SEP	10.2	13.2	15.2	99%	17.3	20	15.4
Cedar R nr Cedar Falls	APR-JUL	45	60	70	97%	81	96	72
	APR-SEP	50	66	76	99%	87	102	77
Taylor Ck nr Selleck	APR-JUL	15.7	18.9	21	100%	23	26	21
	APR-SEP	19.2	22	25	104%	27	30	24
Rex R nr Cedar Falls	APR-JUL	16.5	22	26	113%	29	35	23
	APR-SEP	18	24	28	108%	32	37	26

1) 90% And 10% exceedance probabilities are actually 95% And 5%

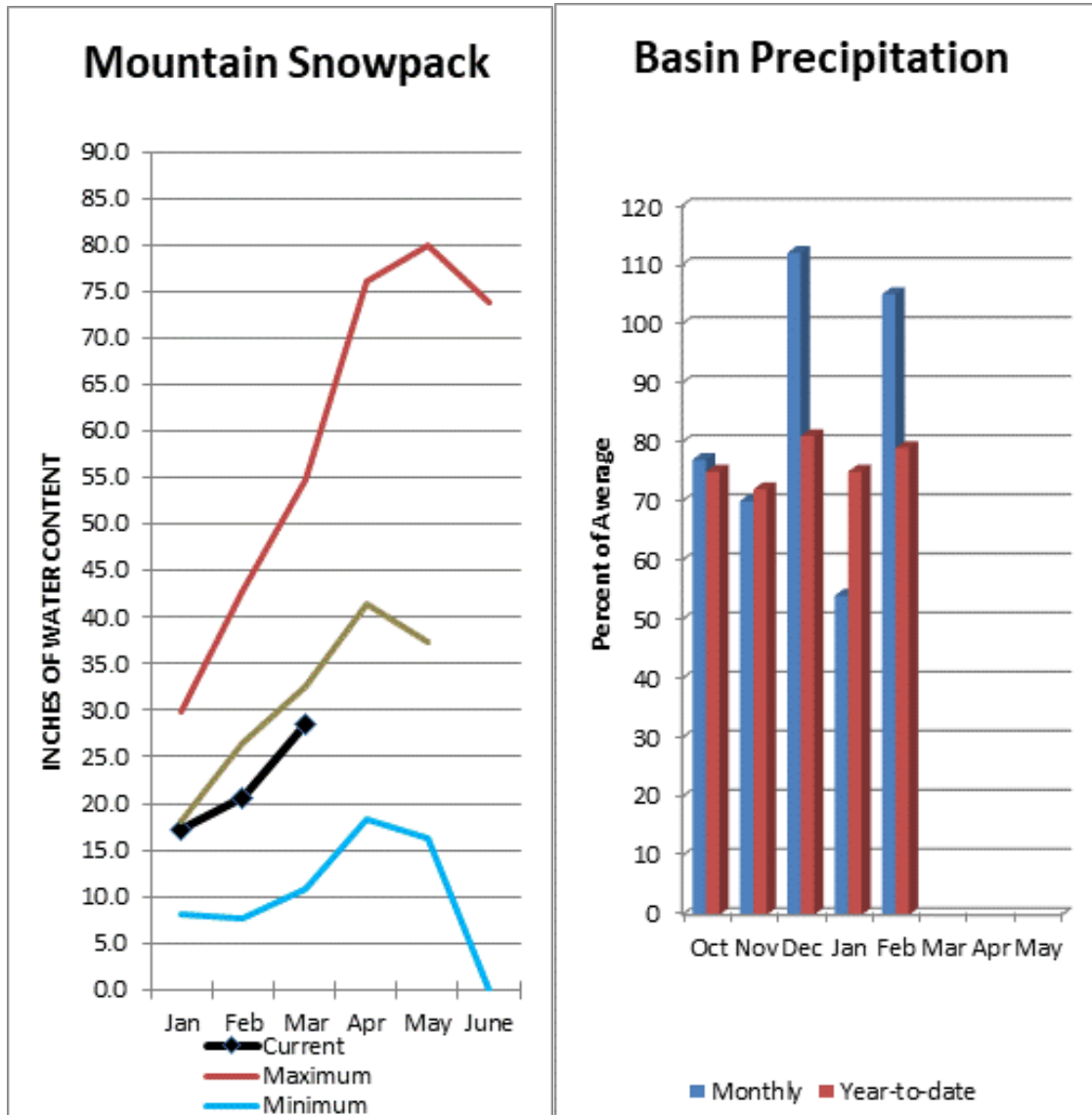
2) Forecasts are For unimpaired flows. Actual flow will be dependent On management of upstream reservoirs And diversions

Watershed Snowpack Analysis March 1, 2023	# of Sites	% Median	Last Year % Median
Central Puget Sound	12	102%	104%
Tolt	3	101%	92%
Snoqualmie	5	102%	102%
Skykomish	4	100%	102%
Cedar	8	103%	105%

SNOW WATER EQUIVALENT IN CENTRAL PUGET SOUND



North Puget Sound River Basins



March 1 median snow cover in North Puget Sound was 87%. Basin-wide precipitation for February was 105% of normal, bringing water-year-to-date to 79% of normal. March 1 Basin-wide reservoir storage was 96% of normal.

For more information contact your local Natural Resources Conservation Service office.

North Puget Sound River Basins

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North Puget Sound Streamflow Forecasts - March 1, 2023

Forecast Exceedance Probabilities For Risk Assessment
Chance that actual volume will exceed forecast

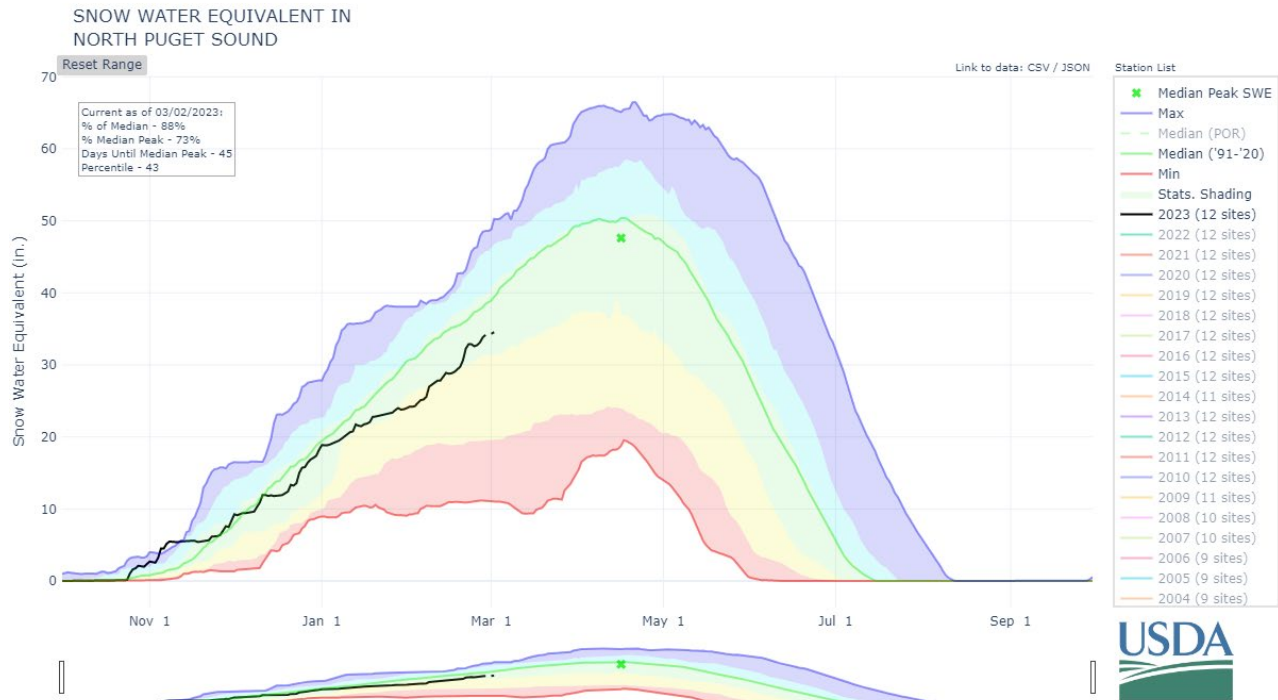
North Puget Sound	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Median	30% (KAF)	10% (KAF)	30yr Median (KAF)
Baker R at Concrete	APR-JUL	540	635	700	91%	765	860	770
	APR-SEP	725	830	900	91%	970	1080	990
Thunder Ck nr Newhalem	APR-JUL	193	215	230	96%	245	265	240
	APR-SEP	280	305	320	97%	335	360	330
Skagit R at Newhalem	APR-JUL	1240	1420	1550	89%	1680	1860	1740
	APR-SEP	1450	1660	1800	89%	1940	2150	2020

1) 90% And 10% exceedance probabilities are actually 95% And 5%

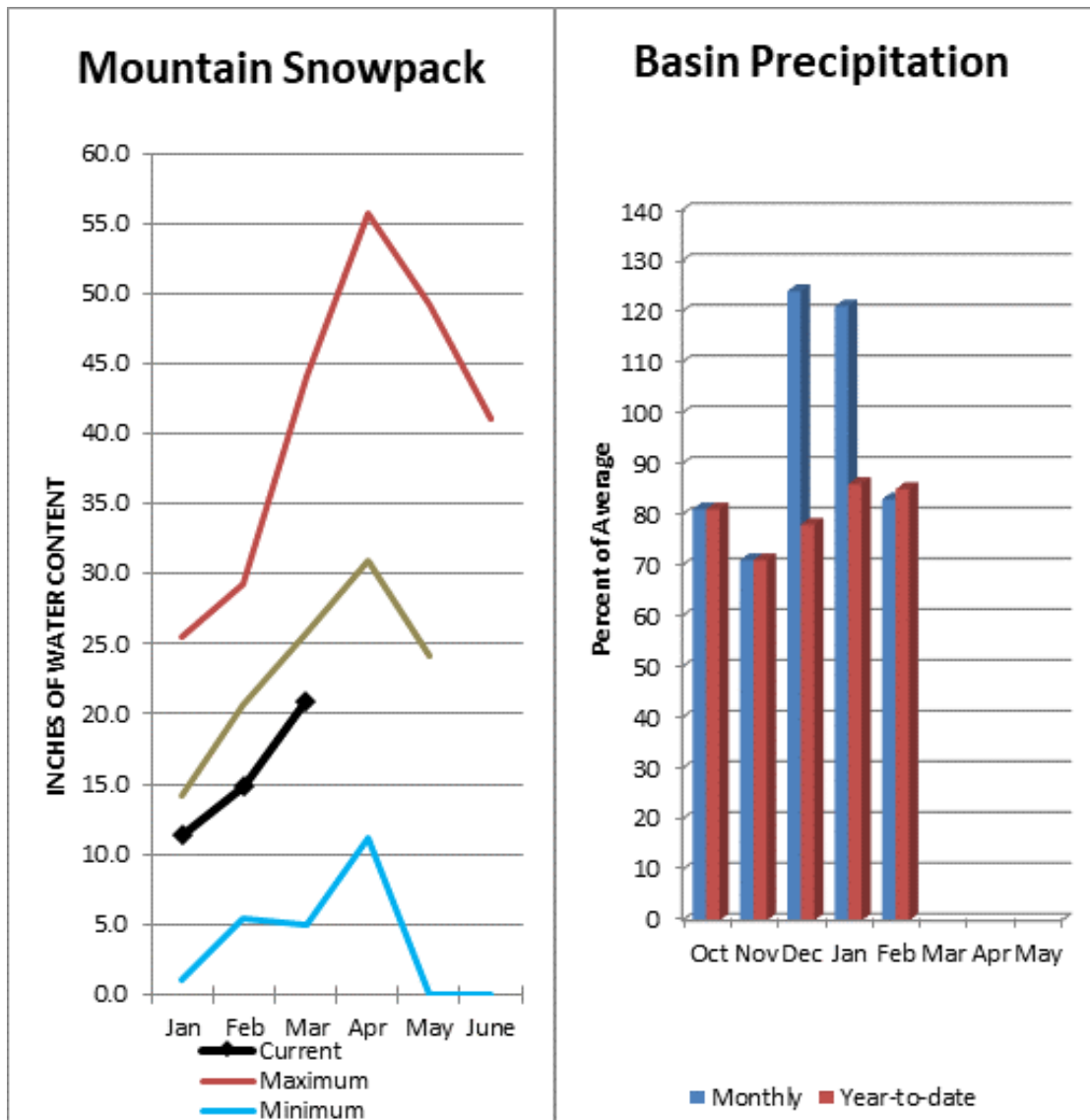
2) Forecasts are For unimpaired flows. Actual flow will be dependent On management of upstream reservoirs And diversions

Reservoir Storage End of February, 2023	Current (KAF)	Last Year (KAF)	Median (KAF)	Capacity (KAF)
Ross	773.5	863.8	816.3	1434.7
Lake Shannon	68.1	91.5	76.0	
Upper Baker	94.1	74.8	86.7	

Watershed Snowpack Analysis March 1, 2023	# of Sites	% Median	Last Year % Median
North Puget Sound	16	87%	99%
Skagit	9	83%	105%
Nooksack	3	94%	85%
Baker	2	87%	103%



Olympic Peninsula River Basins



Olympic Peninsula snowpack averaged 81% of normal on March 1. February precipitation was 83% of normal. Precipitation has accumulated at 85% of normal for the water year.

For more information contact your local Natural Resources Conservation Service office.

Olympic Peninsula River Basins

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Olympic Streamflow Forecasts - March 1, 2023

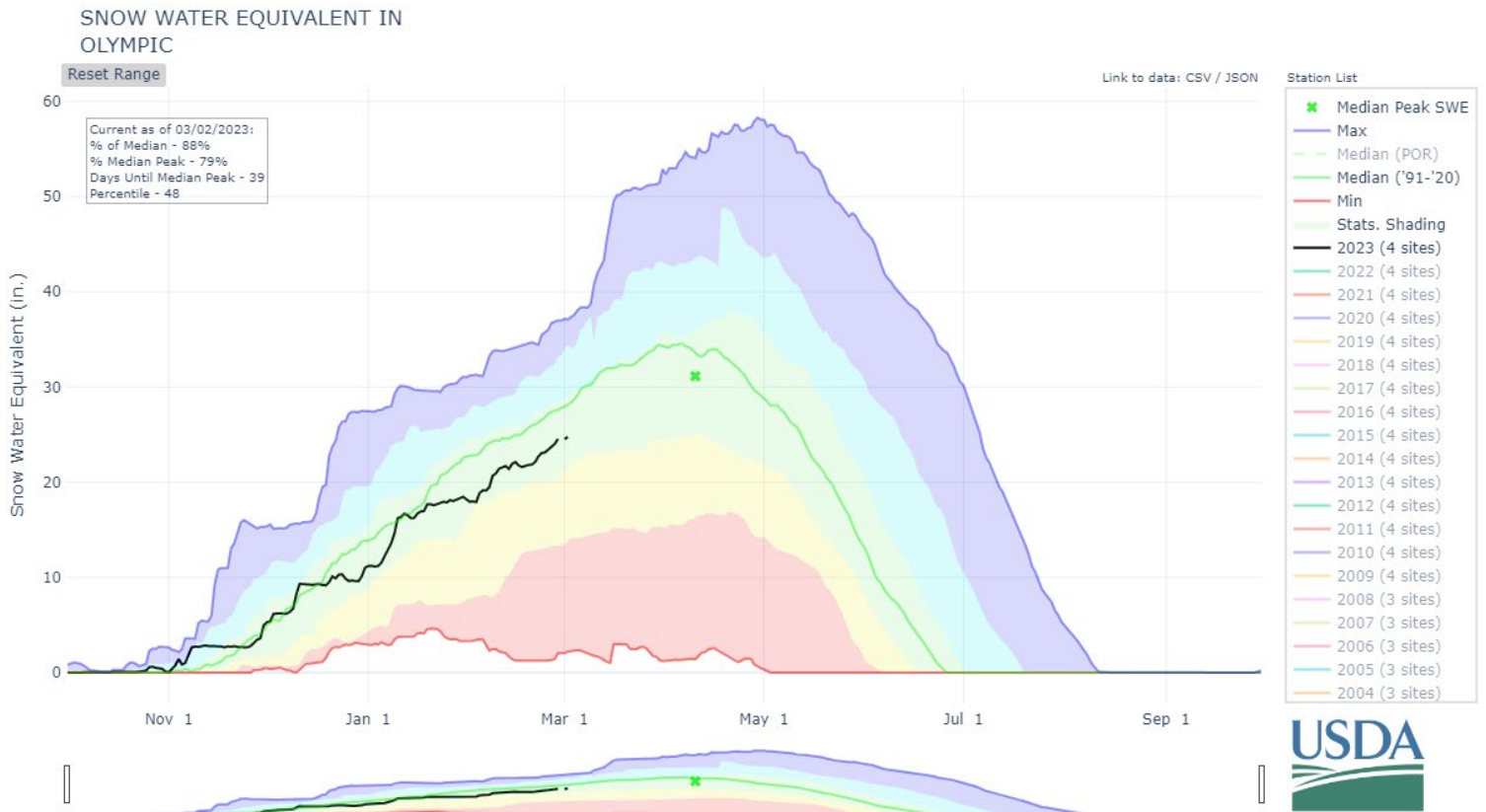
Forecast Exceedance Probabilities For Risk Assessment
Chance that actual volume will exceed forecast

Olympic	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Median	30% (KAF)	10% (KAF)	30yr Median (KAF)
Elwha R at McDonald Br nr Port Angeles	APR-JUL	265	325	365	99%	405	460	370
	APR-SEP	315	380	425	96%	470	535	445
Dungeness R nr Sequim	APR-JUL	93	111	123	103%	135	153	119
	APR-SEP	109	131	147	106%	162	184	139

1) 90% And 10% exceedance probabilities are actually 95% And 5%

2) Forecasts are For unimpaired flows. Actual flow will be dependent On management of upstream reservoirs And diversions

Watershed Snowpack Analysis March 1, 2023	# of Sites	% Median	Last Year % Median
Olympic	7	81%	80%
Olympic	7	81%	80%



Issued by

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The Following Organizations Cooperate with the Natural Resources Conservation Service in Snow Survey Work*:

Canada	Snow Survey Network Program – British Columbia Ministry of Environment River Forecast Center – British Columbia Ministry of Forests, Lands and Natural Resource Operations
State	Washington State Department of Ecology Washington State Department of Natural Resources Washington State Fish and Wildlife
Federal	Department of the Army, Corps of Engineers U.S. Department of Agriculture, Forest Service U.S. Department of Commerce, NOAA, National Weather Service U.S. Department of Interior Bonneville Power Administration Bureau of Reclamation Geological Survey National Park Service Bureau of Indian Affairs U.S. Fish and Wildlife Service
Local	City of Tacoma City of Seattle City of Bellingham Chelan County P.U.D. Pacific Power/PacificCorp Puget Sound Energy Washington Water Power Company Snohomish County P.U.D. Colville Confederated Tribes Spokane County Yakama Indian Nation Whatcom County Pierce County Kalispel Tribe of Indians Spokane Indian Tribe Jamestown S’Klallam Tribe Sauk-Suiattle Tribe of Indians Stillaguamish Tribe
Private	Okanogan Irrigation District Wenatchee Heights Irrigation District Newman Lake Homeowners Association Whitestone Reclamation District Kinross Mining

*Other organizations and individuals furnish valuable information for the snow survey reports. Their cooperation is gratefully acknowledged.



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Washington Water Supply Outlook Report

**Natural Resources Conservation Service
Spokane, WA**

