

Washington Water Supply Outlook Report February 1, 2016



Aaron Erman, Seattle Public Utilities and Toby Rodgers, NRCS, Mt. Vernon, WA learning the ropes at West Wide Snow Survey School, January 14, 2016, Bend, OR. *Photo Tracy Robillard, NRCS*

Reminder: We are soliciting field work photos from our snow surveyors again this year. Each month we pick one to grace the cover of this report. The photographer will be given proper credit of course. Please include all specific information when submitting photos. Scott.pattee@wa.usda.gov

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

February 2016

General Outlook

Even with slightly above normal temperatures Washington managed to build on an already great snowpack throughout the month of January. Water year precipitation also remains well above normal for the state. With 70% of our typical winter already past the rest will be a coast as long as the temperatures don't elevate to the point to cause snowmelt. We would rather save that for late March and into April. The most recent NWS 3-month outlook is for above normal temperatures and below normal precipitation however short term forecasts call for continued snow in the mountains and rain in the valleys. <http://www.cpc.ncep.noaa.gov/>

Snowpack

The February 1 statewide SNOTEL readings were 109% of normal but vary across the state. The Skykomish River Basin reported the lowest readings at 68% of the 30-year median for February 1 and the Okanogan had the most snow with 146%. Most basins are recording near to above normal snowpack. Westside medians from SNOTEL, and February 1 snow surveys, included the North Puget Sound river basins with 107% of normal, the Central and South Puget river basins with 97% and 105% respectively, and the Lower Columbia basins with 107% of normal. Snowpack along the east slopes of the Cascade Mountains included the Yakima area with 111% and the Wenatchee area with 108%. Snowpack in the Spokane River Basin was at 90% and the Walla Walla River Basin had 122% of the long term median.

BASIN	PERCENT OF MEDIAN	LAST YEAR PERCENT MEDIAN
Spokane	90	54
Newman Lake	113	52
Pend Oreille	92	98
Okanogan	146	90
Methow	128	98
Conconully Lake	159	88
Central Columbia	108	60
Upper Yakima	109	37
Lower Yakima	113	42
Ahtanum Creek	123	37
Walla Walla	122	54
Lower Snake	104	68
Cowlitz	104	36
Lewis	111	16
White	105	47
Green	100	16
Puyallup	108	41
Cedar	118	14
Snoqualmie	85	15
Skykomish	68	21
Skagit	114	74
Nooksack	75	15
Olympic Peninsula	101	9

Precipitation

The state received normal too slightly above normal precipitation for the month of January keeping year to date averages above normal at 129%. Only the north east corner of the state fell below 100%. Quillayute State Airport measured 152% of normal rainfall. The wettest SNOTEL in the state was June Lake, located on the South flank of Mt. St. Helens, collected 26 inches of precipitation or 95% of normal during the month of January.

RIVER BASIN	FEBRUARY PERCENT OF AVERAGE	WATER YEAR PERCENT OF AVERAGE
Spokane	90	99
Pend Oreille	78	97
Upper Columbia	127	125
Central Columbia	90	133
Upper Yakima	89	132
Lower Yakima	100	137
Walla Walla	96	110
Lower Snake	97	106
Lower Columbia	97	131
South Puget Sound	89	134
Central Puget Sound	78	128
North Puget Sound	108	122
Olympic Peninsula	122	132

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. A very wet fall helped buffer many reservoirs to above normal levels for this time of year. February 1 Reservoir storage in the Yakima Basin was 454,000-acre feet, 112% of average for the Upper Reaches and 156,000-acre feet or 127% of average for Rimrock and Bumping Lakes. The power generation reservoirs included the following: Coeur d'Alene Lake, 114,000 acre feet, 118% of average and 48% of capacity; and the Skagit River reservoirs at 63% of average and 45% 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 AVERAGE
Spokane	48	118
Pend Oreille	41	84
Upper Columbia	43	71
Central Columbia	N/A	N/A
Upper Yakima	54	112
Lower Yakima	67	127
Lower Snake	68	101
North Puget Sound	45	63

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. April-September forecasts for some Western Washington streams include the Cedar River near Cedar Falls, 121%; White River, 117%; and Skagit River, 114%. Some Eastern Washington streams include the Yakima River near Parker 123%, Wenatchee River at Plain 109%; and Spokane River near Post Falls 92%. 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 (50 PERCENT CHANCE OF EXCEEDENCE)
Spokane	92-145
Pend Oreille	93-105
Upper Columbia	95-128
Central Columbia	96-120
Upper Yakima	104-120
Lower Yakima	118-141
Walla Walla	106-107
Lower Snake	97-102
Lower Columbia	94-141
South Puget Sound	112-117
Central Puget Sound	94-121
North Puget Sound	106-114
Olympic Peninsula	110-112

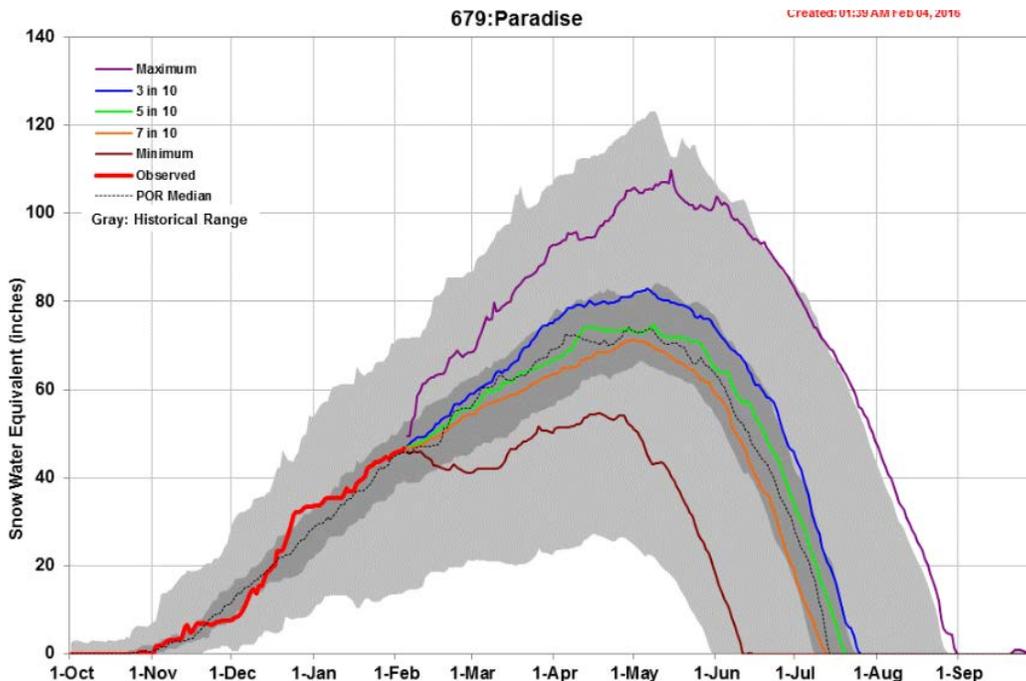
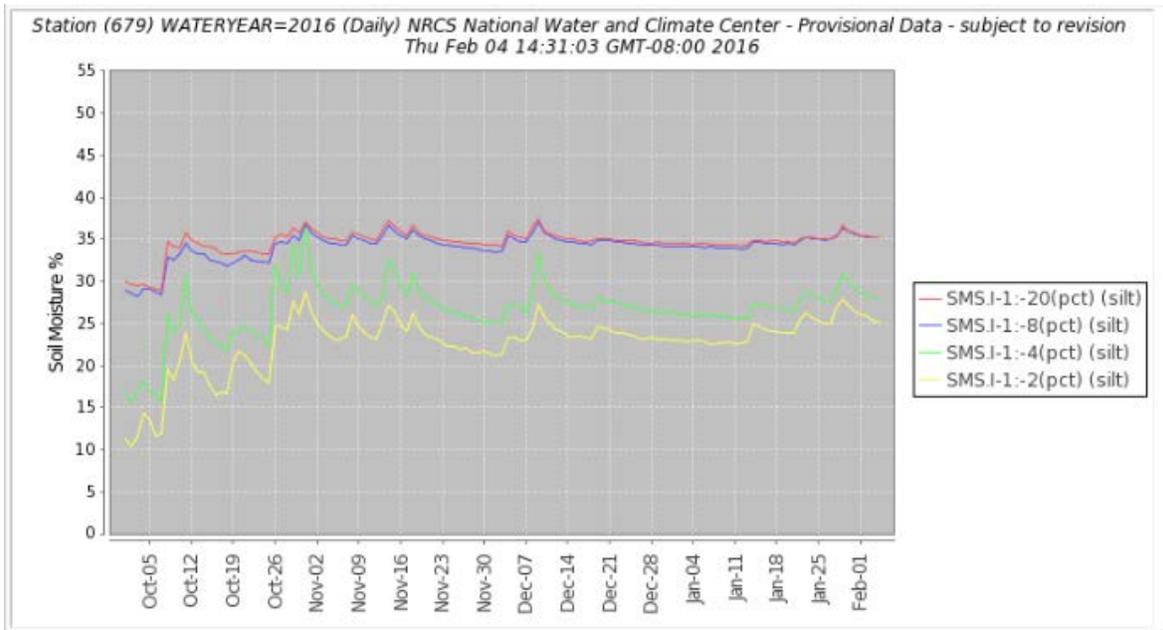
STREAM	PERCENT OF AVERAGE FEBRUARY STREAMFLOWS
Pend Oreille at Albeni Fall Dam	87
Kettle at Laurier	98
Columbia at Birchbank	104
Spokane at Spokane	90
Similkameen at Nighthawk	109
Okanogan at Tonasket	95
Methow at Pateros	114
Chelan at Chelan	110
Wenatchee at Pashastin	88
Cle Elum near Roslyn	67
Yakima at Parker	75
Naches at Naches	85
Grande Ronde at Troy	80
Snake below Lower Granite Dam	76
Columbia River at The Dalles	85
Lewis at Merwin Dam	99
Cowlitz below Mayfield Dam	109
Skagit at Concrete	146
Dungeness near Sequim	134

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

Soil Moisture

Near to above normal fall precipitation provided for wet and nearly saturated soils (60-70% saturation) as the snow finally began to accumulate in mid-December. Great fall soil moisture conditions can help buffer low snowpack runoff come spring however it is too early in the season to count those chickens. Current soil moisture data is available from a limited number of SNOTEL sites scattered throughout each basin. As the effort continues to install additional sensors and more years of data are acquired this information will become invaluable to the streamflow forecasting community.

The following graph shows a very typical winter soil moisture profile at Paradise SNOTEL site. Notice the profile recharge when fall rains began. The additional peaks in the last month or so indicate rain on snow events where the rain percolated through the snow. The second graph is a snowpack projection for the same site.



This is an automated product based on SNOTEL data, provisional data are subject to change. This product combines the historical period of record data (gray background) with the recent daily data (heavy red, left) to project into the future (colored lines, right). This product does not consider climate information such as El Niño or short range weather forecasts and therefore should only be used as a seasonal planning tool. Contact Jim.Marron@por.usda.gov 503.414.3047



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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):

<http://www.wcc.nrcs.usda.gov>

USDA-NRCS Agency Homepages

Washington:

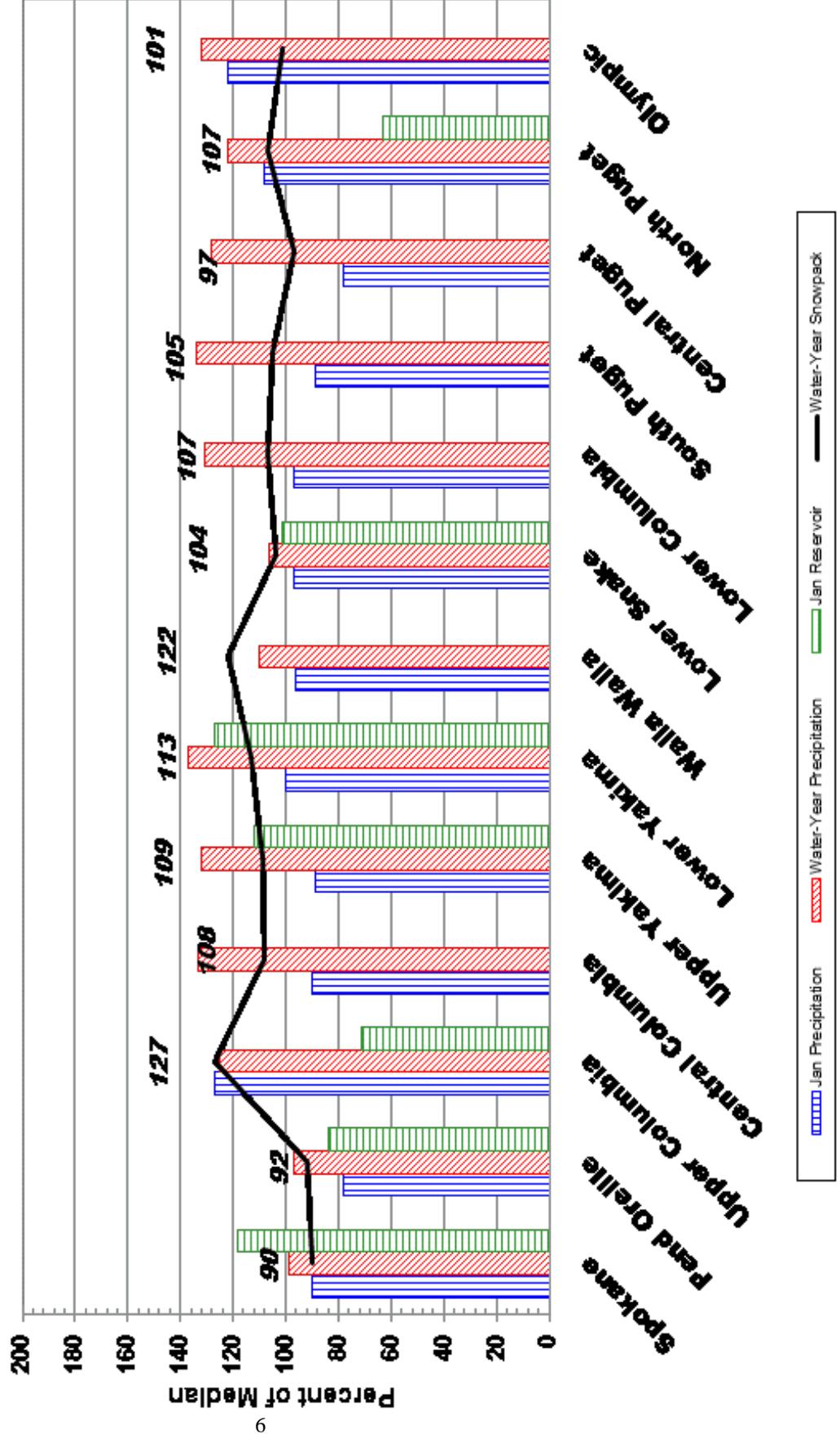
<http://www.nrcs.usda.gov/wps/portal/nrcs/site/wa/home/>

NRCS National:

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

February 1, 2016 - Snowpack, Precipitation and Reservoir Conditions at a Glance

(Water Year = October 1, 2015 - Current Date)



Western Snow Conference

The Western Snow Conference is an annual tradition which started in 1932 as an international forum for individuals and organizations to share scientific, management and socio-political information on snow and runoff. The principal aim of the Western Snow Conference is to advance snow and hydrological sciences. The North Pacific Area Committee is making plans for the 84th Annual Western Snow Conference in 2016.

Mark your calendar and start thinking about submitting a paper to attend the 2016 Western Snow Conference:

Dates: April 18-21, 2016

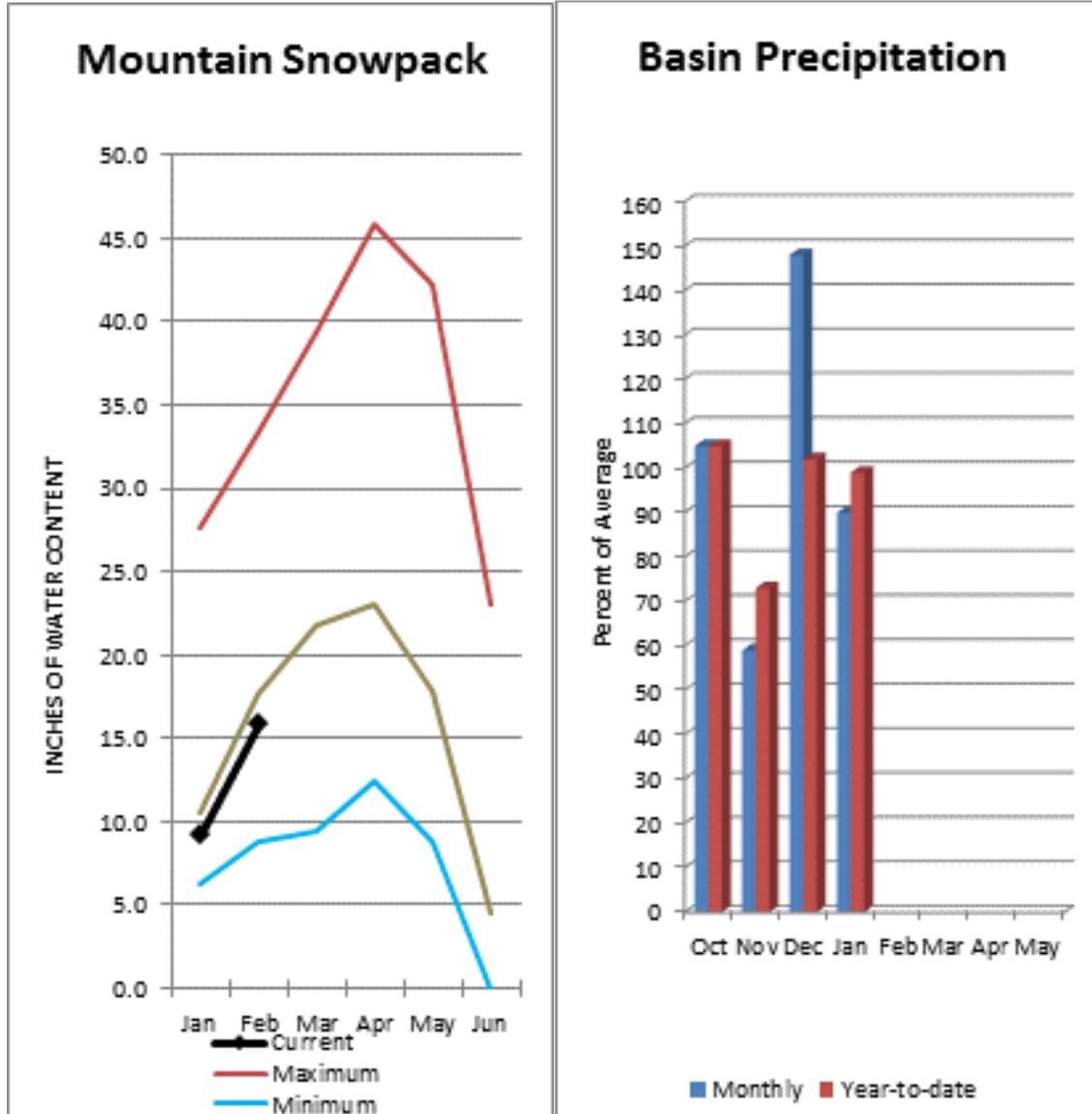
Location: Seattle, Washington

The Conference will begin Monday, April 18th with a short course and panel discussion on "Validation of the rain/snow Global Precipitation Measurements (GPM) satellite data in the Olympic Mountains: University of Washington and NASA" with several invited experts in the field. Tuesday and Wednesday will include formal paper and poster presentations on a variety of topics, including snow drought, climatology of drought, forecasting in drought conditions, dichotomy of precipitation and snow conditions, impacts and mitigation of low snow packs and record events in the snow environment. Thursday will include a technical of northwest geology and hydropower complexes in the North Cascade Mountains.

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

Also find Western Snow Conference on Facebook and Twitter.

Spokane River Basin



The February 1 forecasts for summer runoff within the Spokane River Basin are 92% of average near Post Falls and 94% at Long Lake. The Chamokane River near Long Lake forecasted to have 145% of average flows for the May-August period. The forecast is based on a basin snowpack that is 90% of normal and precipitation that is 99% of average for the water year. Precipitation for February was slightly below normal at 90% of average. Streamflow on the Spokane River at Spokane was 90% of average for February. February 1 storage in Coeur d'Alene Lake was 114,000 acre feet, 118% of average and 48% of capacity. Snowpack at Quartz Peak SNOTEL site was 134% of average with 19.9 inches of water content. Average temperatures in the Spokane basin were 2-4 degrees above normal for February and for the water year.

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

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Spokane Streamflow Forecasts - February 1, 2016

Spokane	Forecast Period	Forecast Exceedance Probabilities for Risk Assessment Chance that actual volume will exceed forecast						30yr Avg (KAF)
		90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	
Spokane R nr Post Falls	APR-JUL	1590	1960	2210	92%	2460	2820	2390
	APR-SEP	1670	2030	2280	92%	2530	2900	2480
Spokane R at Long Lake	APR-JUL	1800	2210	2490	95%	2760	3170	2620
	APR-SEP	1990	2400	2680	94%	2960	3370	2850
Chamokane Ck nr Long Lake	MAY-AUG	7.8	11.2	13.5	145%	15.8	19.2	9.3

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

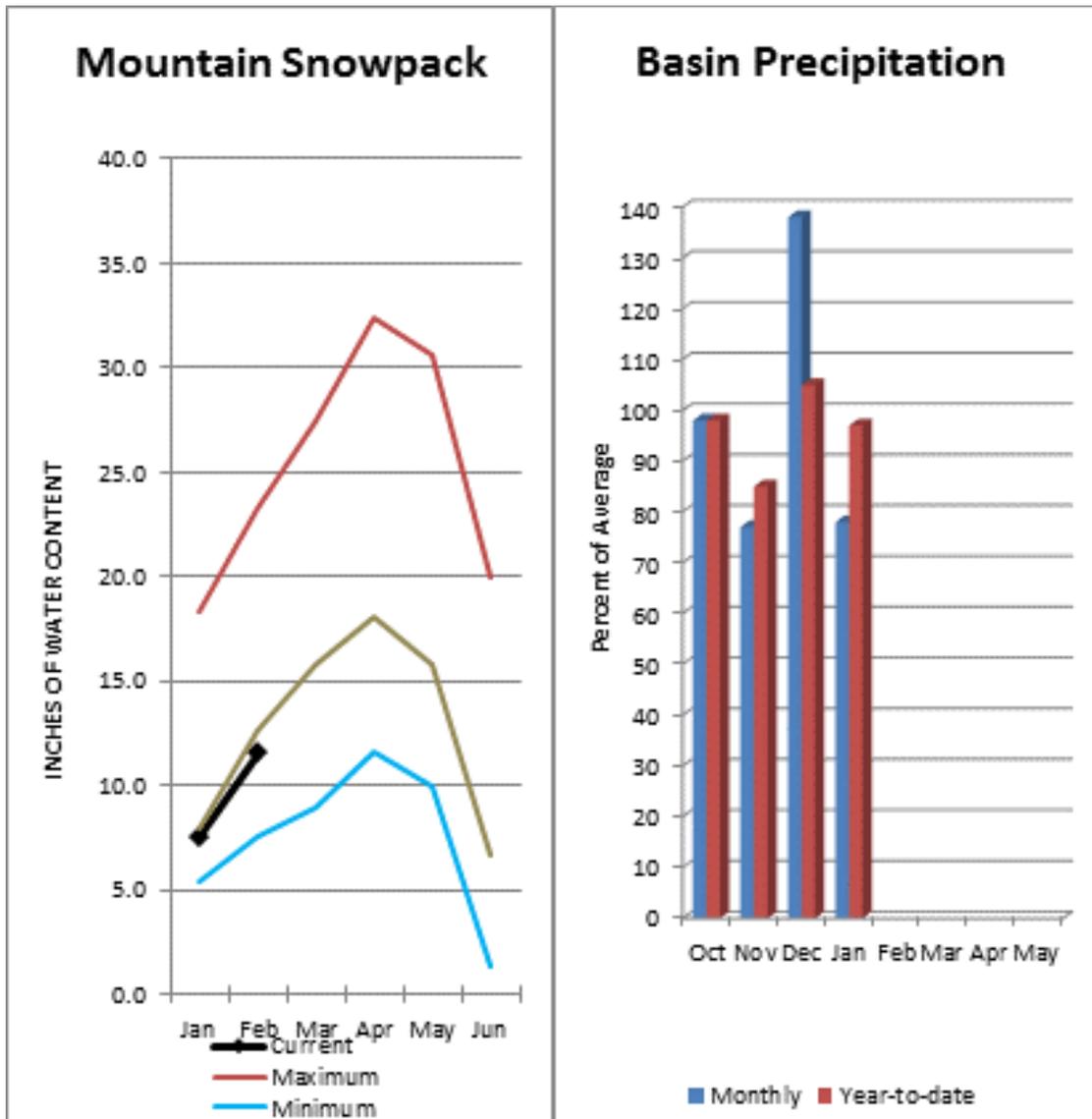
2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions

3) Median value used in place of average

Reservoir Storage End of January, 2016	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Lake Coeur d' Alene	114.1	154.1	96.3	238.5
Basin-wide Total	114.1	154.1	96.3	238.5
# of reservoirs	1	1	1	1

Watershed Snowpack Analysis February 1, 2016	# of Sites	% Median	Last Year % Median
Spokane	13	90%	54%
Newman Lake	3	113%	52%

Pend Oreille River Basins



The April – September average forecast for the Priest River near the town of Priest River is 105% and the Pend Oreille below Box Canyon is 94%. February streamflow was 96% of average on the Pend Oreille River and 104% on the Columbia at Birchbank. February 1 snow cover was 92% of normal in the Pend Oreille Basin River Basin. Bunchgrass Meadows SNOTEL site had 17.9 inches of snow water on the snow pillow. Normally Bunchgrass would have 18 inches on February 1. Precipitation during February was 78% of average, dropping the year-to-date precipitation at 97% of average. Reservoir storage in the basin, including Lake Pend Oreille and Priest Lake was 84% of normal. Average temperatures were 2-4 degrees above normal for February and for the water year.

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

Pend Oreille River Basins

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Pend Oreille Basins Streamflow Forecasts - February 1, 2016

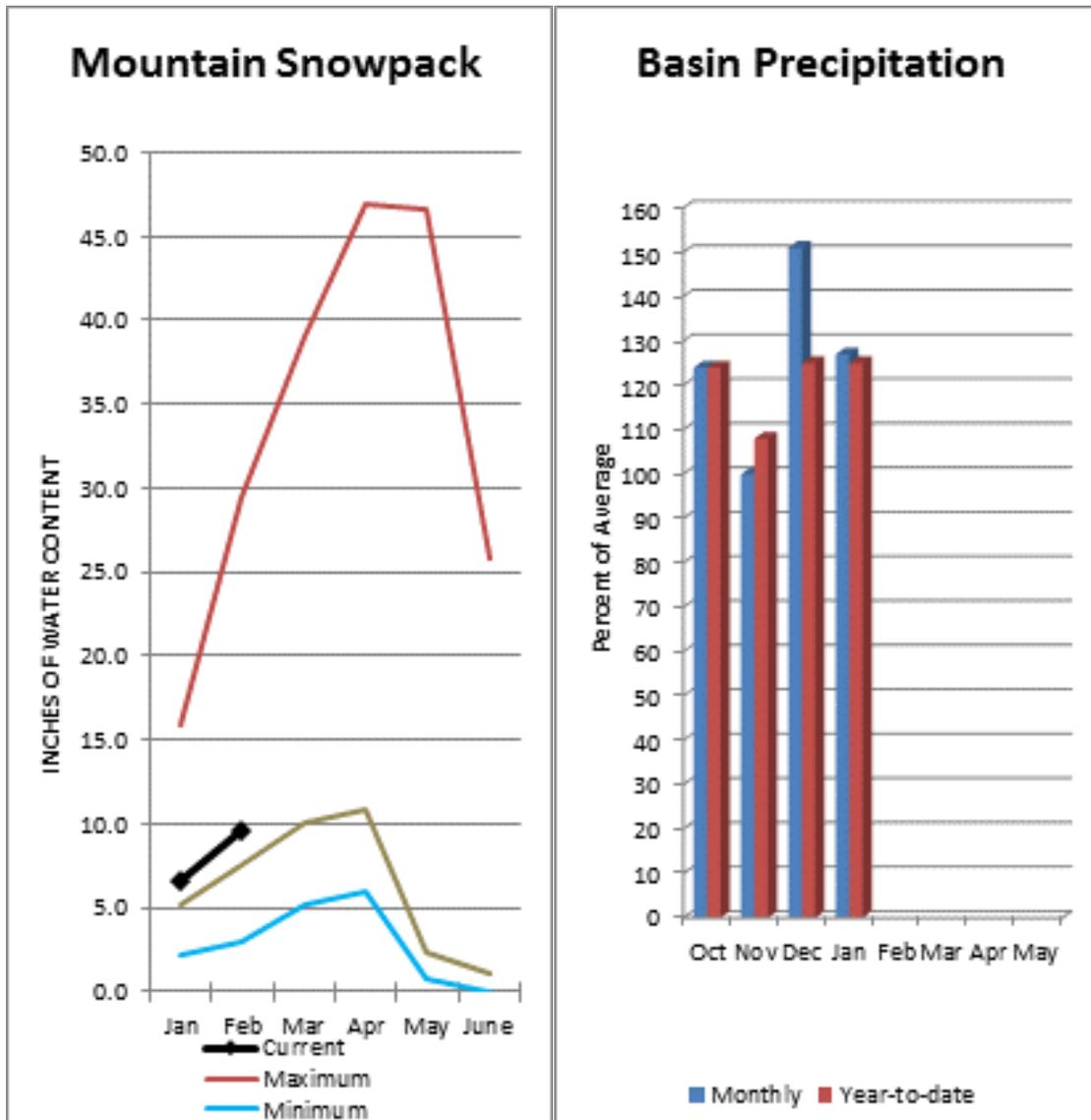
Forecast Exceedance Probabilities for Risk Assessment
Chance that actual volume will exceed forecast

Pend Oreille Basins	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	30yr Avg (KAF)
Pend Oreille Lake Inflow	APR-JUL	8930	10200	11000	93%	11800	13100	11800
	APR-SEP	9850	11200	12000	94%	12900	14200	12800
Priest R nr Priest River	APR-JUL	655	755	820	105%	885	985	780
	APR-SEP	690	795	870	105%	940	1050	830
Pend Oreille R bl Box Canyon	APR-JUL	9030	10300	11100	93%	12000	13300	11900
	APR-SEP	9920	11300	12200	94%	13100	14400	13000

- 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
- 3) Median value used in place of average

Reservoir Storage End of January, 2016	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Lake Pend Oreille	629.3	534.8	753.9	1561.3
Priest Lake	54.2	50.4	56.7	119.3
Basin-wide Total	683.5	585.1	810.6	1680.6
# of reservoirs	2	2	2	2

Watershed Snowpack Analysis February 1, 2016	# of Sites	% Median	Last Year % Median
Pend Oreille Basins	56	92%	97%
Colville River	1	82%	54%
Pend Oreille River	55	92%	98%
Kettle River	4	144%	81%



Summer runoff average forecast for the Okanogan River is 119%, Similkameen River is 105%, and Methow River is 128%. February 1 snow cover on the Okanogan was 146% of normal, Omak Creek was 147% and the Methow was 128%. February precipitation in the Upper Columbia was 127% of average, with precipitation for the water year at 125% of average. February streamflow for the Methow River was 114% of average, 95% for the Okanogan River and 109% for the Similkameen. Snow-water content at Salmon Meadows SNOTEL was 9.8 inches or 148% of normal for February 1. Combined storage in the Conconully Reservoirs was 10,000 acre-feet or 71% of normal. Temperatures were 2-4 degrees above normal for February and for the water year.

Upper Columbia River Basins

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Upper Columbia Basins Streamflow Forecasts - February 1, 2016

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

Upper Columbia Basins	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	30yr Avg (KAF)
Kettle R nr Laurier	APR-JUL	1370	1580	1720	96%	1870	2080	1800
	APR-SEP	1420	1640	1800	96%	1960	2180	1880
Colville R at Kettle Falls	APR-JUL	75	116	143	120%	171	210	119
	APR-SEP	81	126	157	120%	187	230	131
Columbia R at Grand Coulee ¹	APR-JUL	37800	45000	48200	94%	51500	58700	51015
	APR-SEP	44500	53000	56900	95%	60800	69400	60110
Similkameen R nr Nighthawk ¹	APR-JUL	885	1140	1260	105%	1370	1630	1200
	APR-SEP	975	1230	1350	105%	1460	1720	1280
Okanogan R nr Tonasket ¹	APR-JUL	1110	1490	1660	112%	1830	2210	1480
	APR-SEP	1260	1670	1860	113%	2050	2460	1650
Okanogan R at Malott ¹	APR-JUL	1130	1530	1710	118%	1900	2300	1450
	APR-SEP	1280	1720	1920	119%	2120	2560	1620
Methow R nr Pateros	APR-JUL	905	1000	1070	128%	1140	1230	835
	APR-SEP	975	1080	1150	128%	1220	1320	895
Columbia R at Birchbank ¹								

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

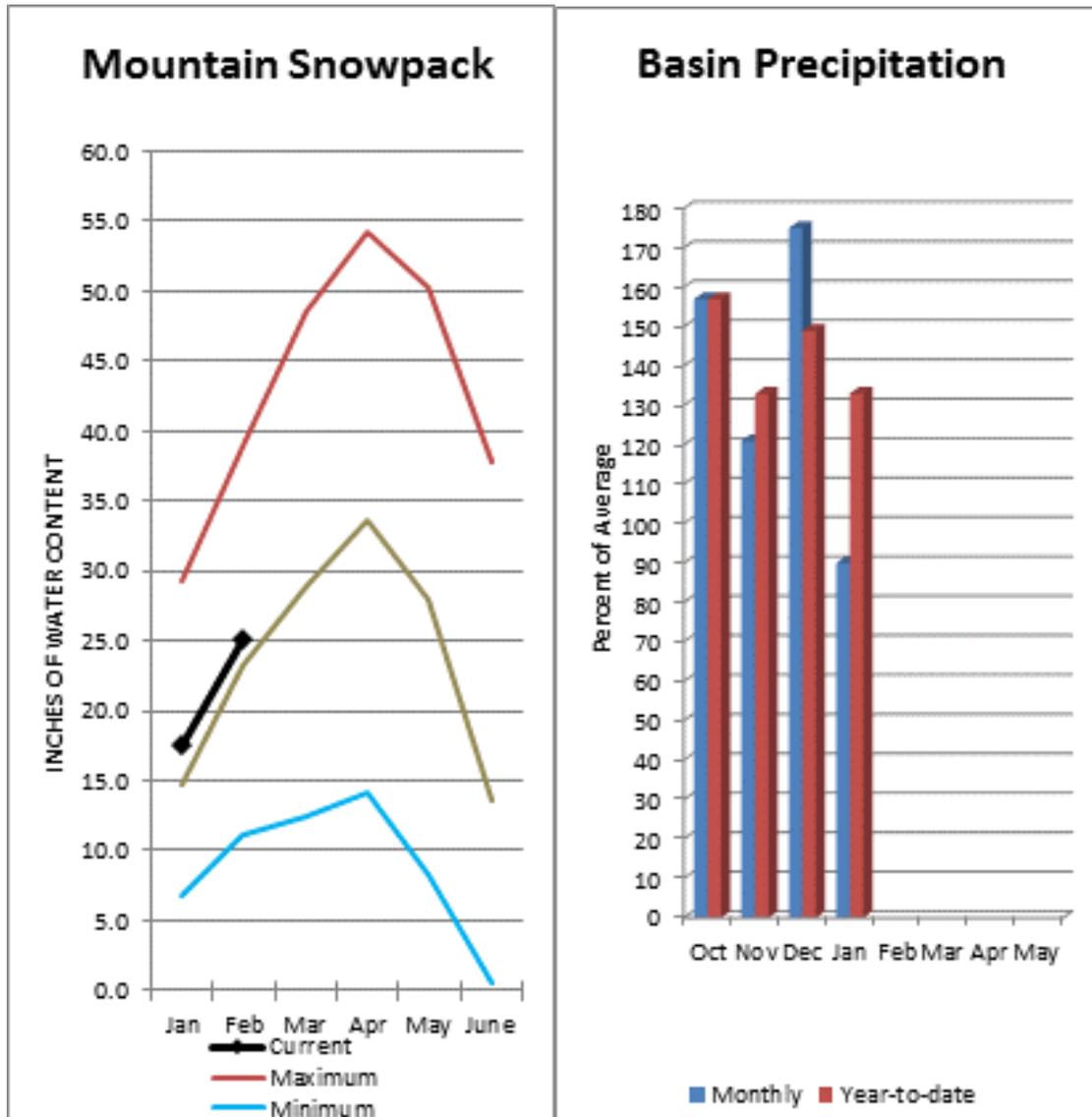
2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions

3) Median value used in place of average

Reservoir Storage End of January, 2016	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Conconully Lake (Salmon Lake Dam)	3.9	6.9	7.3	10.5
Conconully Reservoir	6.2	9.3	7.0	13.0
Basin-wide Total	10.1	16.2	14.3	23.5
# of reservoirs	2	2	2	2

Watershed Snowpack Analysis February 1, 2016	# of Sites	% Median	Last Year % Median
Upper Columbia Basins	20	126%	87%
Okanogan River	11	146%	90%
Omak Creek	2	145%	48%
Sanpoil River	1	48%	39%
Similkameen River	4	105%	91%
Toats Coulee Creek	3	150%	95%
Conconully Lake	3	159%	88%
Methow River	6	133%	96%

Central Columbia River Basins



Precipitation during February was 90% of average in the basin and 133% for the year-to-date. Runoff for Entiat River is forecast to be 120% of average for the summer. The April-September average forecast for Chelan River is 113%, Wenatchee River at Plain is 109%, Stehekin River is 113% and Icicle Creek is 110%. February average streamflow on the Chelan River was 110% and on the Wenatchee River 88%. February 1 snowpack in the Wenatchee River Basin was 108% of normal; the Chelan, 110%; the Entiat, 107%; Stemilt Creek, 122% and Colockum Creek, 175%. Reservoir storage in Lake Chelan was not available. Lyman Lake SNOTEL had the most snow water with 43.6 inches of water. This site would normally have 40.1 inches on February 1. Temperatures were slightly above normal for February and for the water year.

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

Central Columbia River Basins

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Central Columbia Basins Streamflow Forecasts - February 1, 2016

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

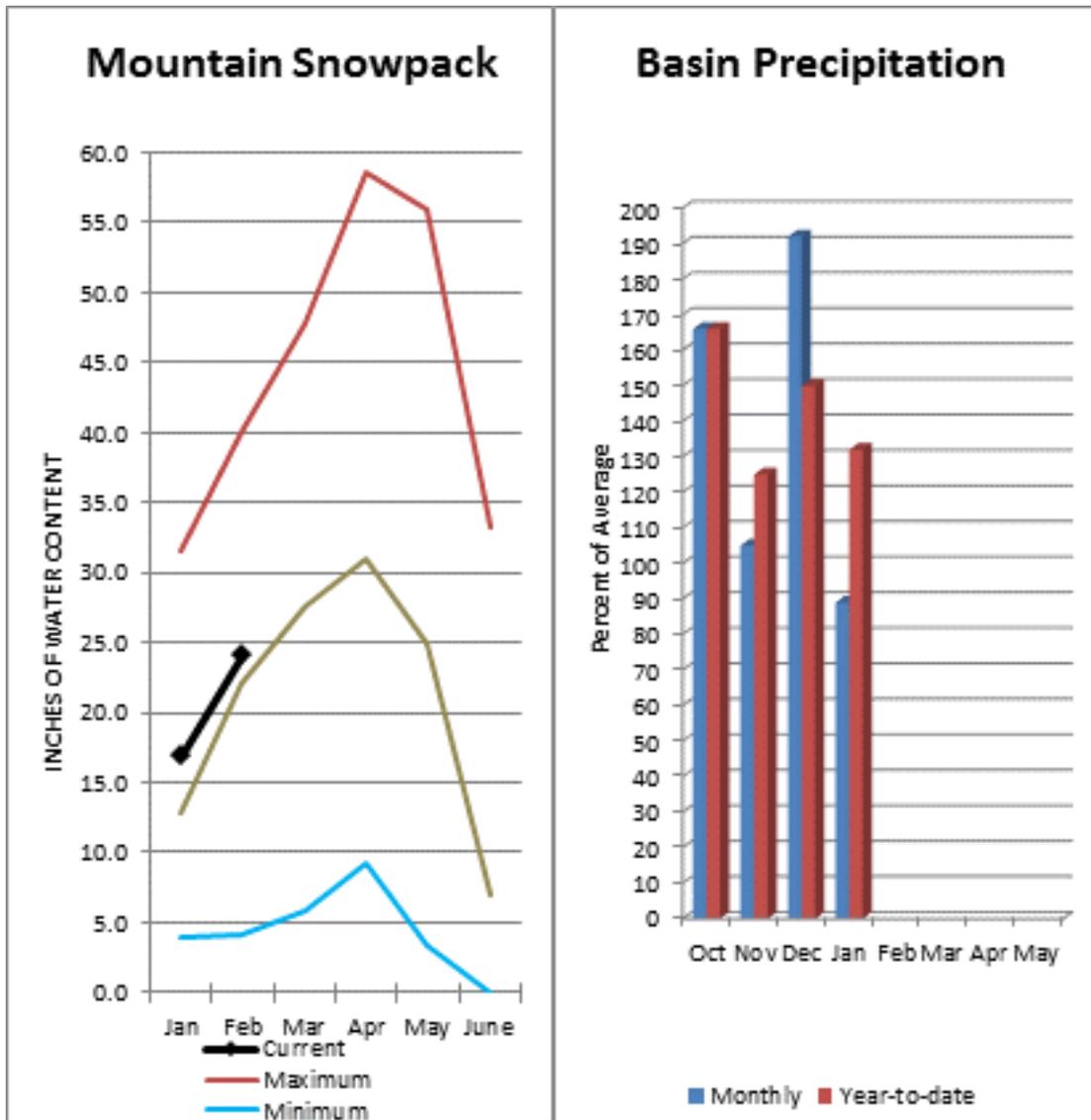
Central Columbia Basins	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	30yr Avg (KAF)
Stehekin R at Stehekin	APR-JUL	660	725	770	113%	810	875	680
	APR-SEP	785	850	895	113%	940	1010	790
Chelan R at Chelan	APR-JUL	1010	1070	1120	112%	1160	1230	1000
	APR-SEP	1120	1200	1260	113%	1320	1400	1120
Entiat R nr Ardenvoir	APR-JUL	210	230	240	120%	255	270	200
	APR-SEP	230	250	265	120%	275	295	220
Wenatchee R at Plain	APR-JUL	950	1030	1080	109%	1130	1210	990
	APR-SEP	1030	1120	1180	109%	1240	1330	1080
Icicle Ck nr Leavenworth	APR-JUL	270	290	300	109%	315	335	275
	APR-SEP	290	310	330	110%	345	365	300
Wenatchee R at Peshastin	APR-JUL	1310	1420	1490	109%	1560	1660	1370
	APR-SEP	1410	1540	1620	109%	1710	1830	1490
Columbia R bl Rock Island Dam	APR-JUL	43700	49300	53100	95%	56900	62500	55770
	APR-SEP	51700	58300	62800	96%	67200	73800	65200

- 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
- 3) Median value used in place of average

Reservoir Storage End of January, 2016	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Lake Chelan	357.8	419.1	343.1	676.1
Basin-wide Total	357.8	419.1	343.1	676.1
# of reservoirs	1	1	1	1

Watershed Snowpack Analysis February 1, 2016	# of Sites	% Median	Last Year % Median
Central Columbia Basins	5	110%	89%
Chelan Lake Basin	5	110%	89%
Entiat River	1	107%	70%
Wenatchee River	7	108%	60%
Stemilt Creek	1	122%	68%
Colockum Creek	1	175%	55%

Upper Yakima River Basin



February 1 reservoir storage for the Upper Yakima reservoirs was 454,000-acre feet, 112% of average. Forecasts for the Yakima River at Cle Elum are 102% of average and the Teanaway River near Cle Elum is at 120%. Lake inflows are all forecasted to be slightly above average this summer as well. February streamflows within the basin were Cle Elum River near Roslyn at 67%. February 1 snowpack was 109% based upon 8 snow course and SNOTEL readings within the Upper Yakima Basin. Precipitation was 89% of average for February and 132% for the water-year. Volume forecasts for the Yakima Basin are for natural flow. As such, they may differ from the U.S. Bureau of Reclamation's forecast for the total water supply available, which includes irrigation return flow.

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

Upper Yakima River Basin

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Upper Yakima River Streamflow Forecasts - February 1, 2016

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

Upper Yakima River	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	30yr Avg (KAF)
Keechelus Reservoir Inflow	APR-JUL	88	108	121	104%	134	154	116
	APR-SEP	97	117	131	104%	145	166	126
Kachess Reservoir Inflow	APR-JUL	83	99	110	106%	120	137	104
	APR-SEP	90	106	117	104%	128	145	113
Cle Elum Lake Inflow	APR-JUL	330	370	400	104%	430	475	385
	APR-SEP	350	400	435	105%	465	515	415
Yakima R at Cle Elum	APR-JUL	575	695	775	103%	855	975	755
	APR-SEP	620	755	845	102%	935	1070	830
Teanaway R. bl Forks nr Cle Elum	APR-JUL	117	140	156	120%	172	195	130
	APR-SEP	120	143	159	120%	175	198	133

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

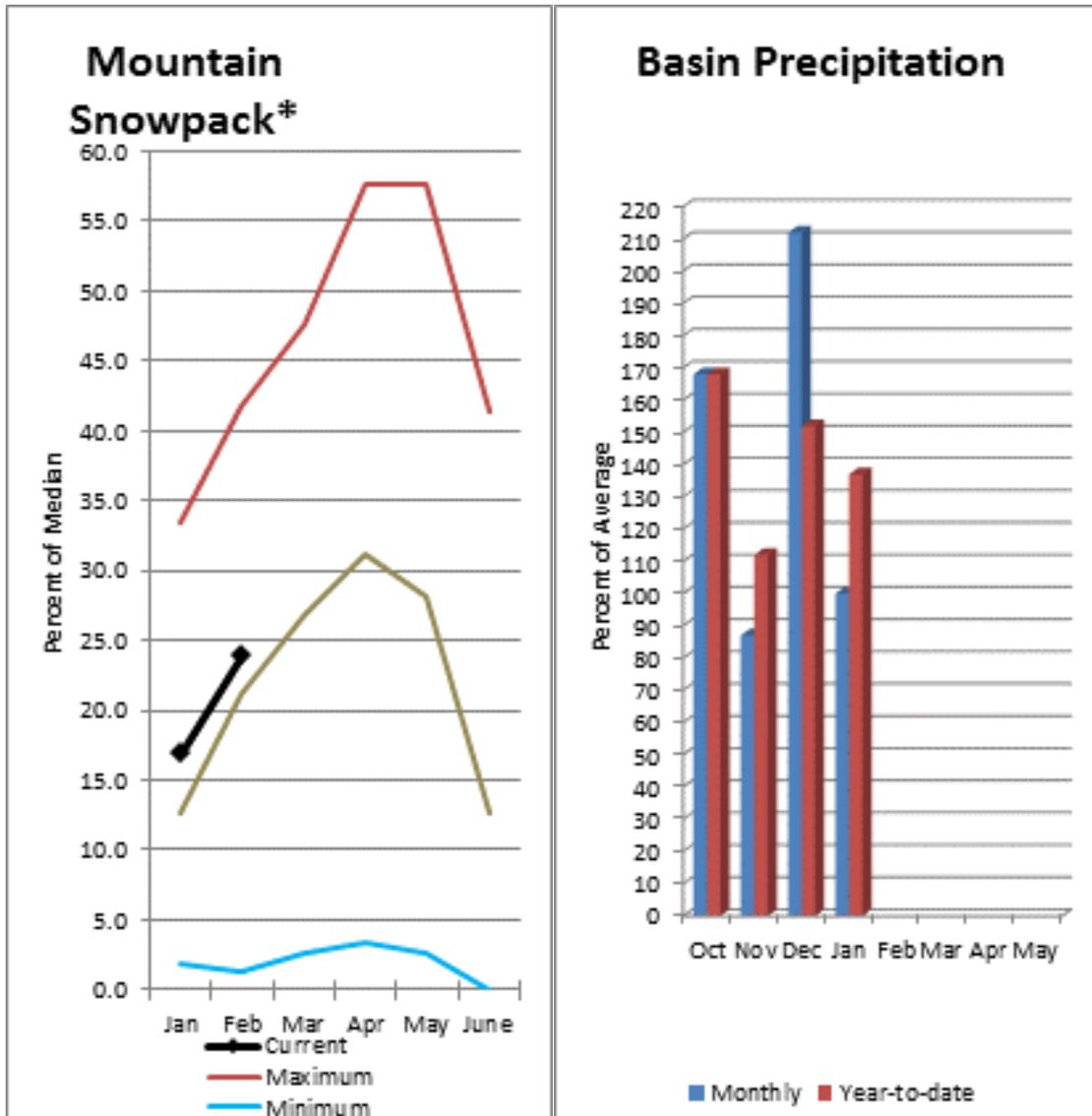
2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions

3) Median value used in place of average

Reservoir Storage End of January, 2016	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Keechelus	101.4	139.6	82.1	157.8
Kachess	119.8	201.2	130.8	239.0
Cle Elum	233.1	337.6	191.5	436.9
Basin-wide Total	454.2	678.4	404.4	833.7
# of reservoirs	3	3	3	3

Watershed Snowpack Analysis February 1, 2016	# of Sites	% Median	Last Year % Median
Upper Yakima River	8	110%	37%

Lower Yakima River Basin



February average streamflows within the basin were: Yakima River near Parker, 75% and the Naches River near Naches, 85%. February 1 reservoir storage for Bumping and Rimrock reservoirs was 156,000-acre feet, 127% of average. Forecast averages for Yakima River near Parker are 123%; American River near Nile, 125%; Ahtanum Creek, 138%; and Klickitat River near Glenwood, 141%. February 1 snowpack was 113% based upon 6 snow course and SNOTEL readings within the Lower Yakima Basin and Ahtanum Creek reported in at 123% of normal. Precipitation was 100% of average for February and 137% for the water-year. Temperatures were near normal for February and for 1-3 degrees above normal for the water year. Volume forecasts for Yakima Basin are for natural flow. As such, they February differ from the U.S. Bureau of Reclamation's forecast for the total water supply available, which includes irrigation return flow.

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

Lower Yakima River Basin

Data Current as of: 2/5/2016 11:23:41 AM

Lower Yakima River Streamflow Forecasts - February 1, 2016

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

Lower Yakima River	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	30yr Avg (KAF)
Bumping Lake Inflow	APR-JUL	111	125	134	118%	143	157	114
	APR-SEP	120	135	145	118%	156	170	123
American R nr Nile	APR-JUL	107	119	127	125%	135	147	102
	APR-SEP	115	129	138	125%	148	162	110
Rimrock Lake Inflow	APR-JUL	199	215	225	120%	235	250	187
	APR-SEP	235	250	265	120%	275	295	220
Naches R nr Naches	APR-JUL	720	795	850	121%	900	980	700
	APR-SEP	765	855	915	120%	975	1060	760
Ahtanum Ck at Union Gap	APR-JUL	28	34	38	141%	42	48	27
	APR-SEP	30	36	40	138%	44	50	29
Yakima R nr Parker	APR-JUL	1720	1910	2040	123%	2170	2370	1660
	APR-SEP	1880	2090	2230	123%	2370	2580	1820
Klickitat R nr Glenwood	APR-JUL	156	169	178	141%	187	200	126
	APR-SEP	171	186	196	141%	205	220	139
Klickitat R nr Pitt	APR-JUL	535	580	615	141%	645	690	435
	APR-SEP	635	690	730	140%	770	825	520

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

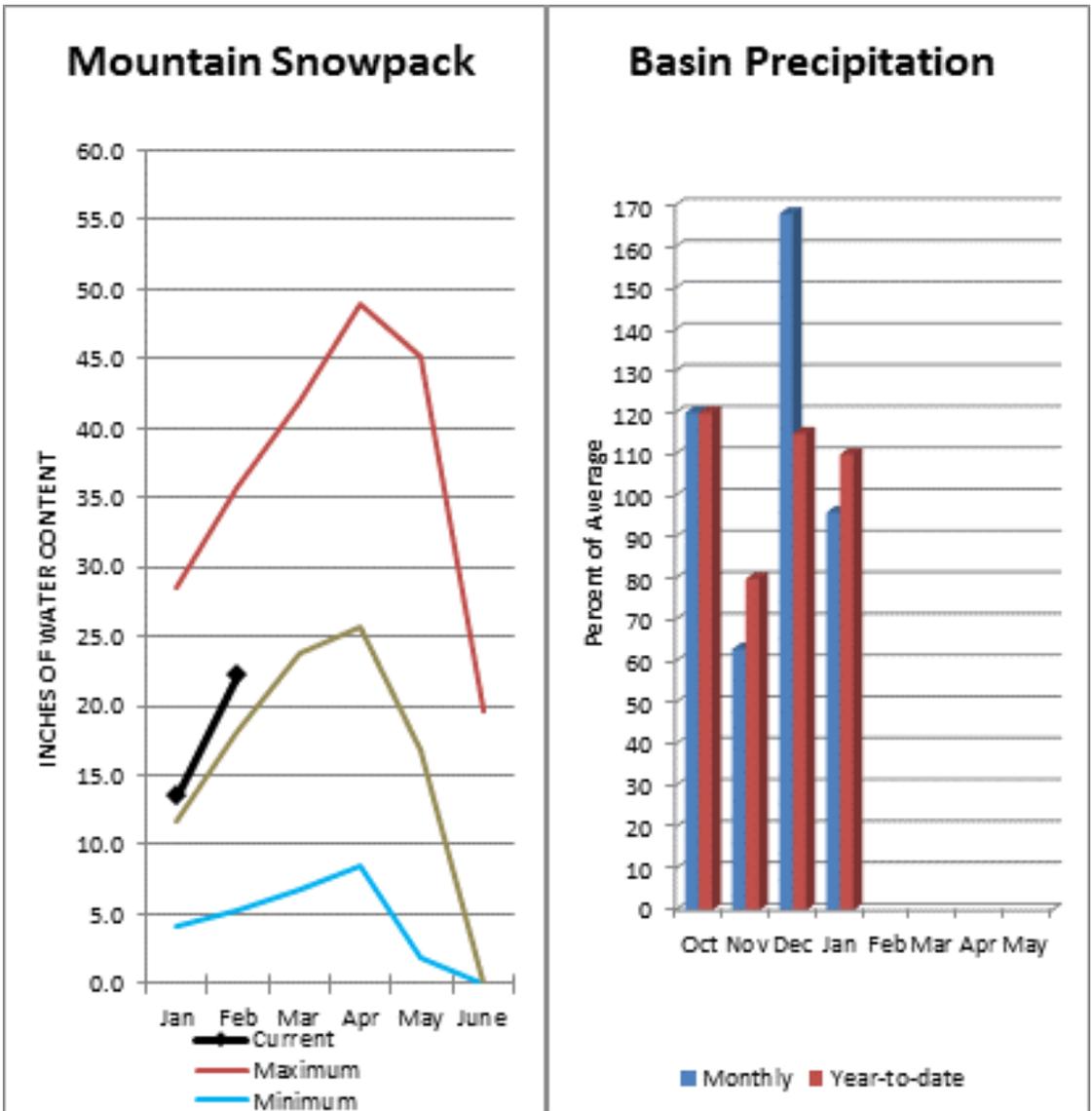
2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions

3) Median value used in place of average

Reservoir Storage End of January, 2016	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Bumping Lake	21.0	26.3	12.7	33.7
Rimrock	134.9	168.2	109.6	198.0
Basin-wide Total	155.9	194.5	122.3	231.7
# of reservoirs	2	2	2	2

Watershed Snowpack Analysis February 1, 2016	# of Sites	% Median	Last Year % Median
Lower Yakima River	7	117%	42%
Ahtanum Creek	2	123%	37%

Walla Walla River Basin



February precipitation was 96% of average, maintaining the year-to-date precipitation at 110% of average. Snowpack in the basin was 122% of normal. Streamflow forecasts are 107% of average for Mill Creek and 106% for the SF Walla Walla near Milton-Freewater. Average temperatures were 1-3 degrees above normal for February and for the water year.

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

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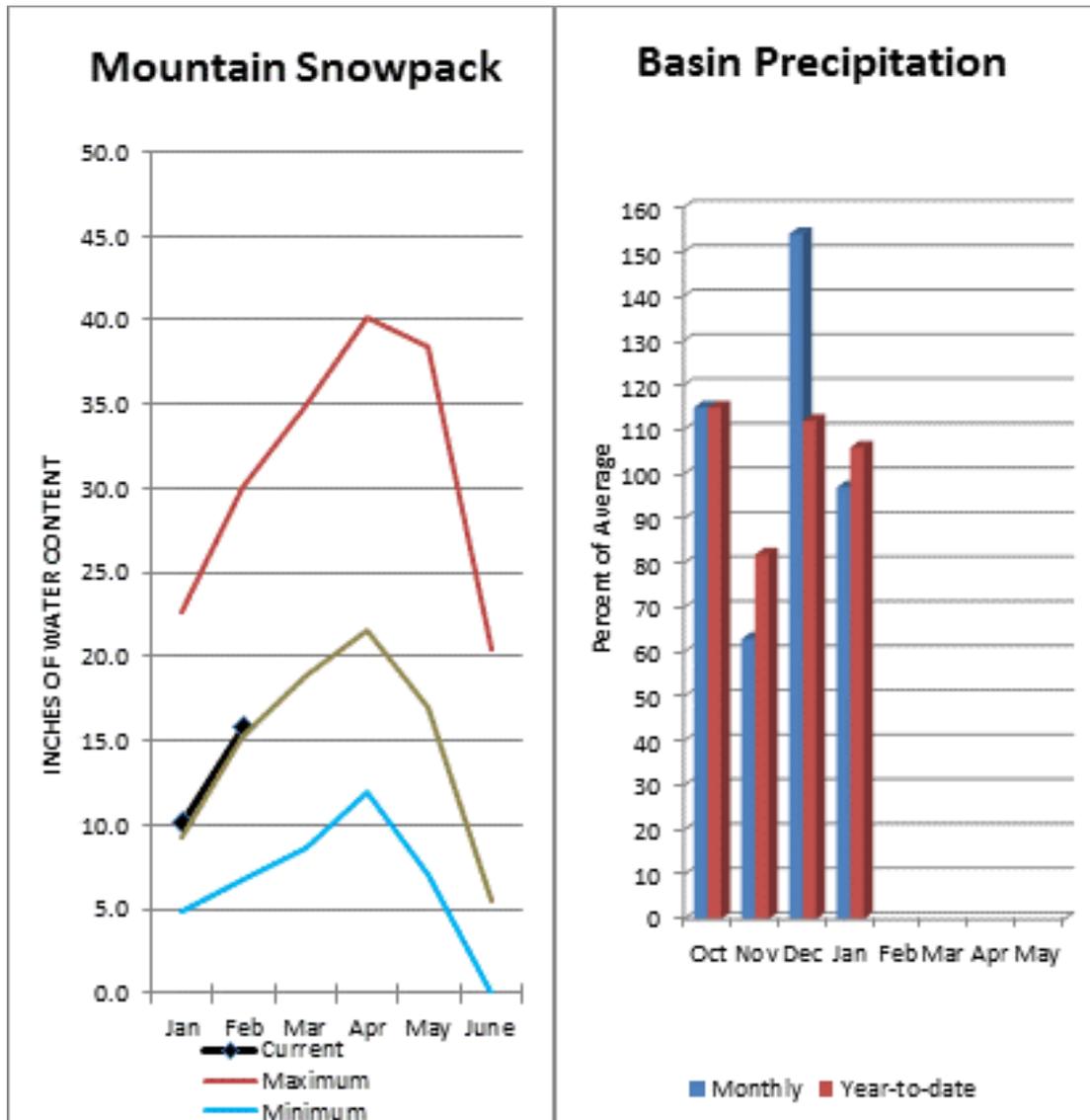
Walla Walla River Streamflow Forecasts - February 1, 2016

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

Walla Walla River	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	30yr Avg (KAF)
<hr/>								
SF Walla Wall R nr Milton-Freewater	MAR-SEP	70	79	84	105%	90	99	80
	APR-JUL	46	53	57	106%	62	68	54
	APR-SEP	58	65	70	106%	75	83	66
Mill Ck nr Walla Walla	APR-JUL	18.8	23	25	104%	28	31	24
	APR-SEP	22	26	29	107%	31	35	27

- 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
- 3) Median value used in place of average

Watershed Snowpack Analysis February 1, 2016	# of Sites	% Median	Last Year % Median
Walla Walla River	2	122%	54%



The Grande Ronde River can expect summer flows to be about 105% of normal. The forecast for Asotin Creek at Asotin predicts 100% of average flows for the April – July runoff period. February precipitation was 97% of average, bringing the year-to-date precipitation to 106% of average. February 1 snowpack readings averaged 104% of normal. February streamflow was 76% of average for Snake River below Lower Granite Dam and 80% for Grande Ronde River near Troy. Dworshak Reservoir storage was 101% of average. Average temperatures were 1-3 degrees above normal for February and for the water year.

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

Lower Snake River Basin

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Lower Snake, Grande Ronde, Clearwater Basins Streamflow Forecasts - February 1, 2016

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

Lower Snake, Grande Ronde, Clearwater Basins	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	30yr Avg (KAF)
Grande Ronde R at Troy	MAR-JUL	1280	1470	1600	106%	1730	1920	1510
	APR-SEP	1060	1250	1380	105%	1510	1700	1310
Asotin Ck at Asotin	APR-JUL	19.9	29	35	100%	41	50	35
Clearwater R at Spalding	APR-JUL	5490	6420	7050	102%	7680	8610	6890
	APR-SEP	5830	6780	7430	102%	8070	9020	7270
Snake R bl Lower Granite Dam ¹	APR-JUL	9700	16100	19000	96%	21900	28300	19848
	APR-SEP	11100	18300	21600	97%	24800	32000	22280

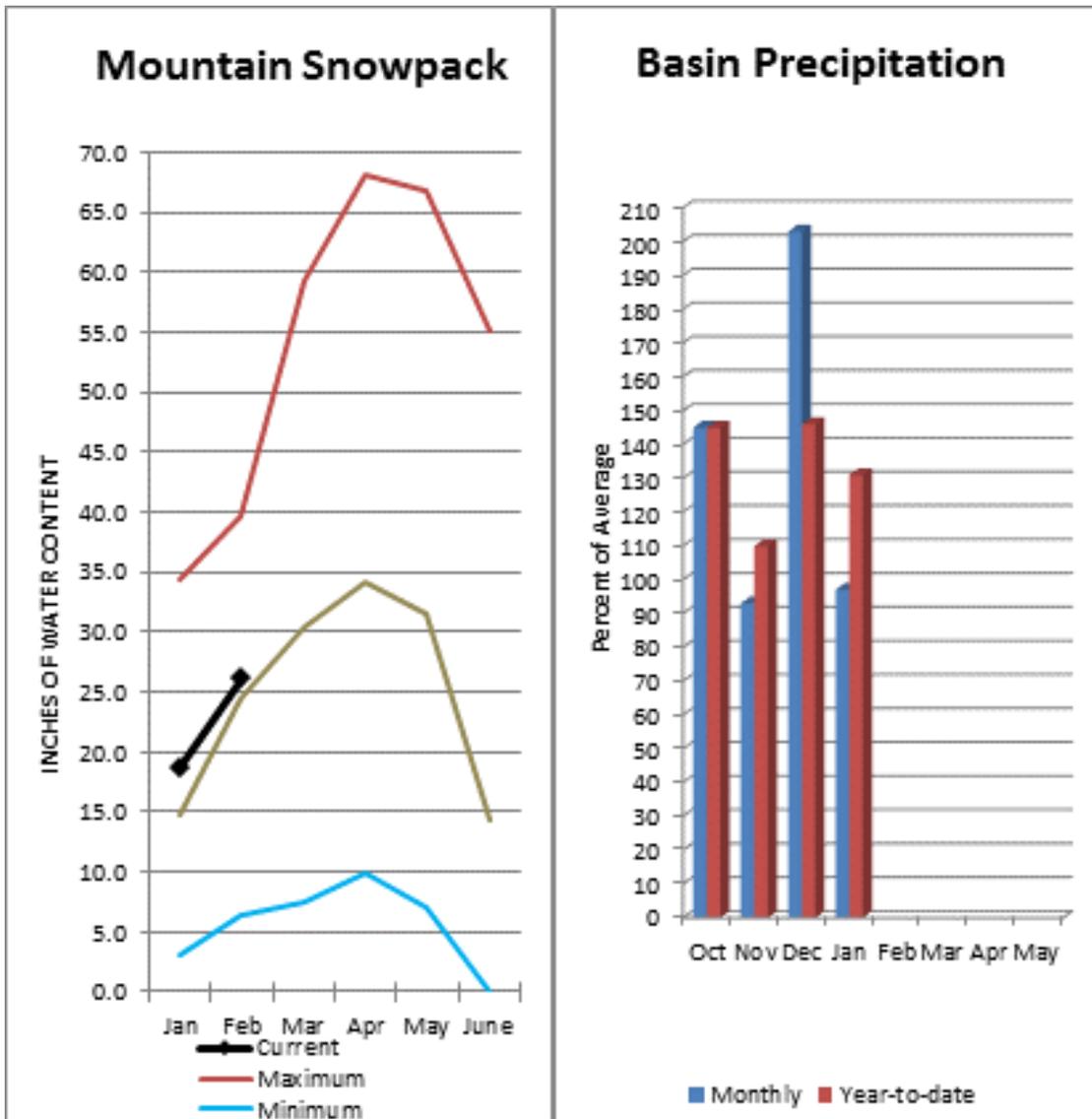
1) 90% and 10% exceedance probabilities are actually 95% and 5%

2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions

3) Median value used in place of average

Reservoir Storage End of January, 2016	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Dworshak Reservoir	2347.1	2599.9	2335.0	3468.0
Basin-wide Total	2347.1	2599.9	2335.0	3468.0
# of reservoirs	1	1	1	1

Watershed Snowpack Analysis February 1, 2016	# of Sites	% Median	Last Year % Median
Lower Snake, Grande Ronde, Clearwater Basins	14	104%	68%



Forecasts for April – September streamflows within the basin are Lewis River at Ariel, 94% and Cowlitz River at Castle Rock, 104% of average. The Columbia at The Dalles is forecasted to have 95% of average flows this summer according to the River Forecast Center. February average streamflow for Cowlitz River was 117%. The Columbia River at The Dalles was 89% of average. February precipitation was 97% of average and the water-year average was 131%. February 1 snow cover for Cowlitz River was 104%, and Lewis River was 111% of normal. Temperatures were near normal during February and for the water year.

Lower Columbia River Basins

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Lower Columbia Basins Streamflow Forecasts - February 1, 2016

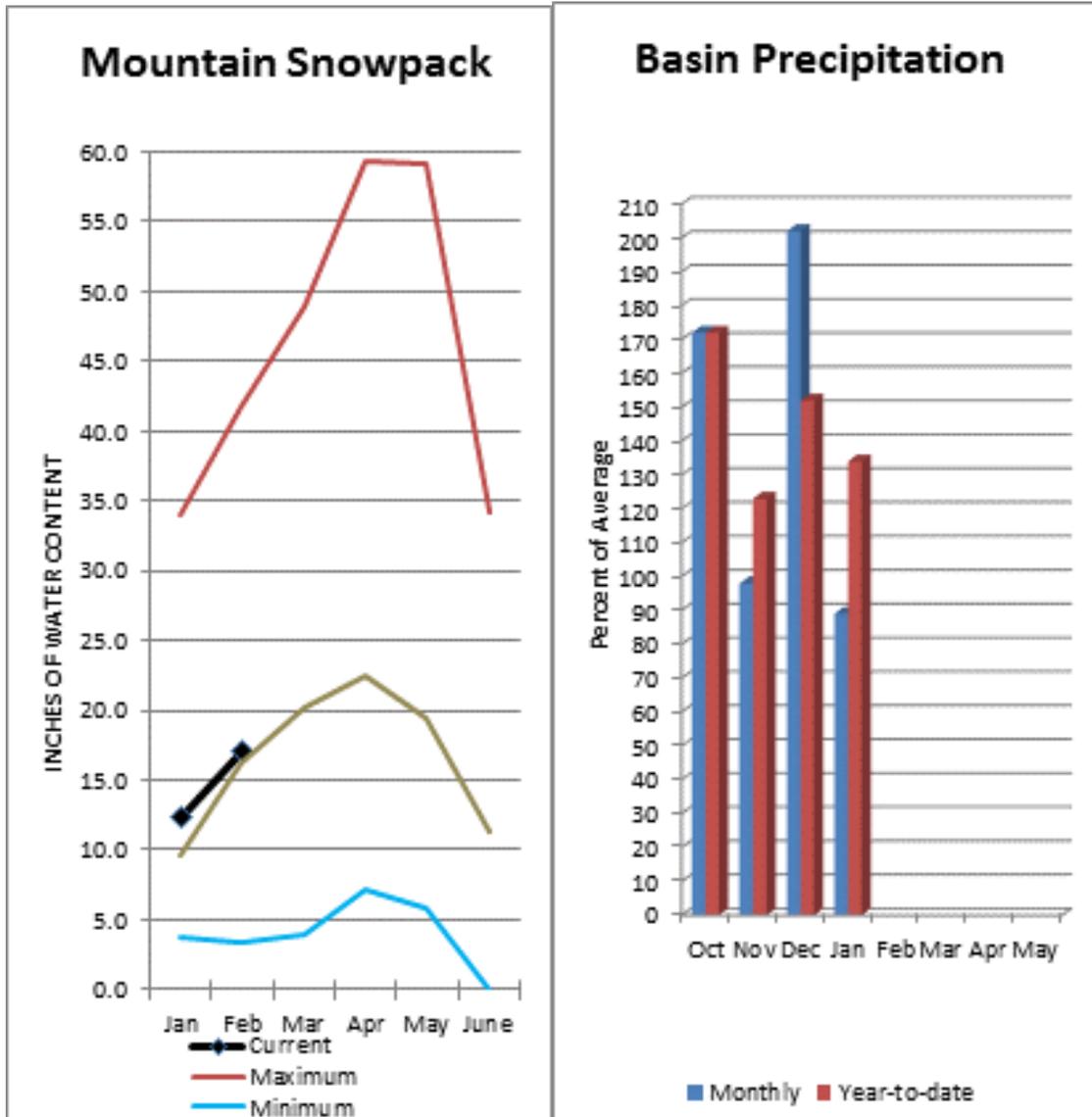
Forecast Exceedance Probabilities for Risk Assessment Chance that actual volume will exceed forecast

Lower Columbia Basins	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	30yr Avg (KAF)
Columbia R at The Dalles	APR-JUL	60300	69200	75300	94%	81400	90300	79855
	APR-SEP	70500	80900	87900	95%	95000	105000	92704
Klickitat R nr Glenwood	APR-JUL	156	169	178	141%	187	200	126
	APR-SEP	171	186	196	141%	205	220	139
Klickitat R nr Pitt	APR-JUL	535	580	615	141%	645	690	435
	APR-SEP	635	690	730	140%	770	825	520
Lewis R at Ariel	APR-JUL	680	850	965	99%	1080	1260	970
	APR-SEP	745	930	1050	94%	1180	1360	1120
Cowlitz R bl Mayfield	APR-JUL	1260	1460	1590	98%	1730	1930	1620
	APR-SEP	1550	1780	1940	105%	2100	2330	1840
Cowlitz R at Castle Rock	APR-JUL	1810	2040	2200	99%	2360	2590	2230
	APR-SEP	2420	2540	2620	104%	2700	2820	2520

- 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
- 3) Median value used in place of average

Watershed Snowpack Analysis February 1, 2016	# of Sites	% Median	Last Year % Median
Lower Columbia Basins	10	105%	27%
Lewis River	4	106%	15%
Cowlitz River	6	104%	36%

South Puget Sound River Basins



Summer runoff is forecast to be 112% of normal for the Green River below Howard Hanson Dam and 117% for the White River near Buckley. February 1 snowpack was 105% of average for the White River, 108% for Puyallup River and 100% in the Green River Basin. February precipitation was 89% of average, bringing the water year-to-date to 134% of average for the basins. Average temperatures in the area were near normal for February and for the water-year.

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

South Puget Sound River Basins

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South Puget Sound Basins Streamflow Forecasts - February 1, 2016

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

South Puget Sound Basins	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	30yr Avg (KAF)
White R nr Buckley ¹	APR-JUL	400	475	510	119%	545	620	430
	APR-SEP	475	565	605	117%	645	735	515
Green R bl Howard A Hanson Dam ¹	APR-JUL	173	240	270	115%	300	365	235
	APR-SEP	194	260	290	112%	320	390	260

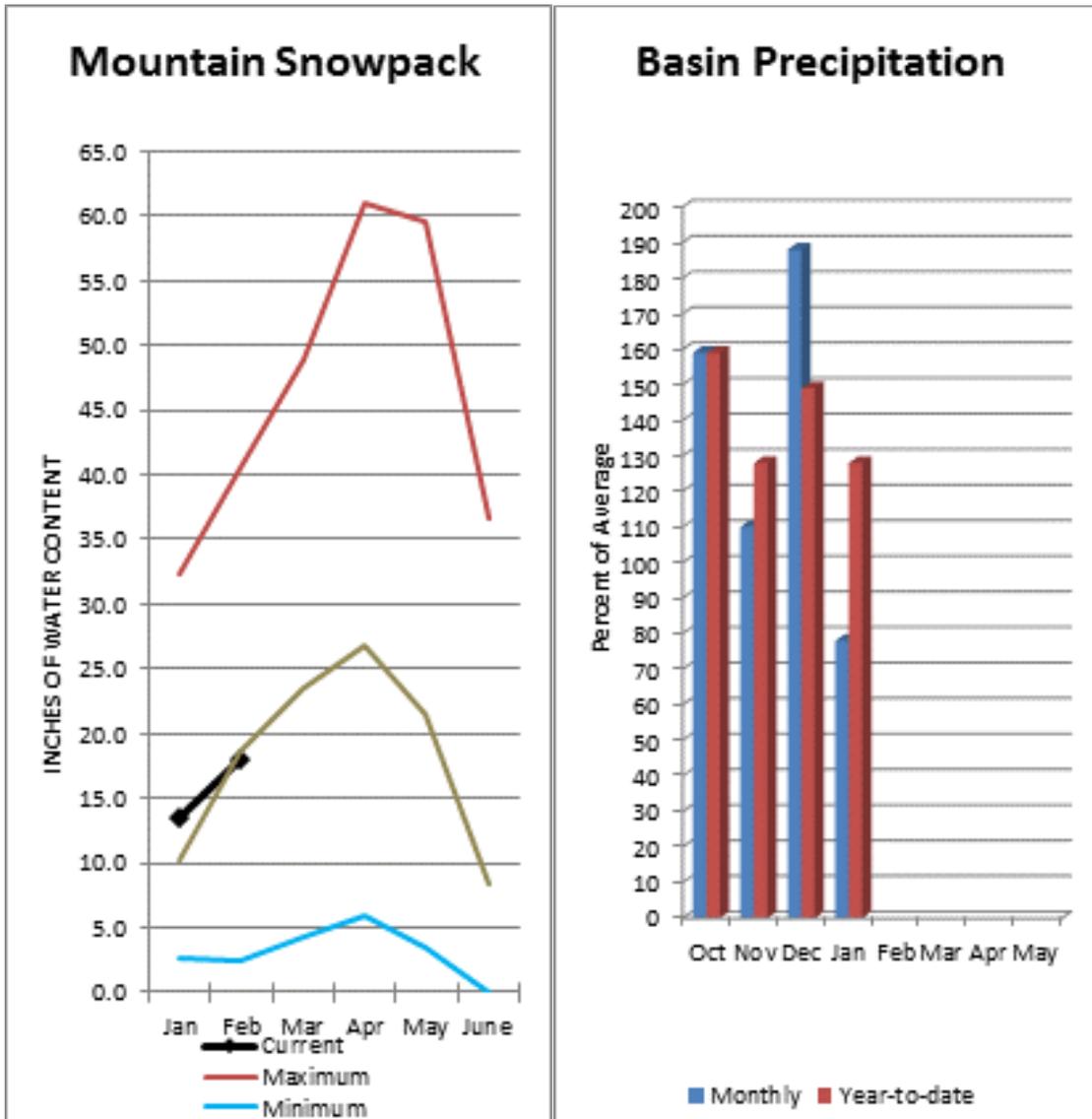
1) 90% and 10% exceedance probabilities are actually 95% and 5%

2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions

3) Median value used in place of average

Watershed Snowpack Analysis February 1, 2016	# of Sites	% Median	Last Year % Median
South Puget Sound Basins	11	107%	34%
White River	3	105%	47%
Green River	3	107%	12%

Central Puget Sound River Basins



Forecast for spring and summer flows are: 121% for Cedar River near Cedar Falls; 119% for Rex River; 94% for South Fork of the Tolt River; and 108% for Taylor Creek near Selleck. Basin-wide precipitation for February was 78% of average, bringing water-year-to-date to 128% of average. February 1 median snow cover in Cedar River Basin was 118%, Tolt River Basin was 66%, Snoqualmie River Basin was 85%, and Skykomish River Basin was 68%. Temperatures were near normal for February and for the water-year.

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

Central Puget Sound River Basins

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Central Puget Sound Basins Streamflow Forecasts - February 1, 2016

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

Central Puget Sound Basins	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	30yr Avg (KAF)
Cedar R nr Cedar Falls	APR-JUL	66	77	84	120%	92	103	70
	APR-SEP	73	84	92	121%	100	111	76
Rex R nr Cedar Falls	APR-JUL	21	26	30	125%	33	38	24
	APR-SEP	24	29	32	119%	36	41	27
Taylor Ck nr Selleck	APR-JUL	17	20	22	110%	24	27	20
	APR-SEP	20	24	26	108%	28	32	24
SF Tolt R nr Index	APR-JUL	9.4	11.7	13.3	94%	14.8	17.1	14.2
	APR-SEP	11	13.4	15.1	94%	16.8	19.3	16.1

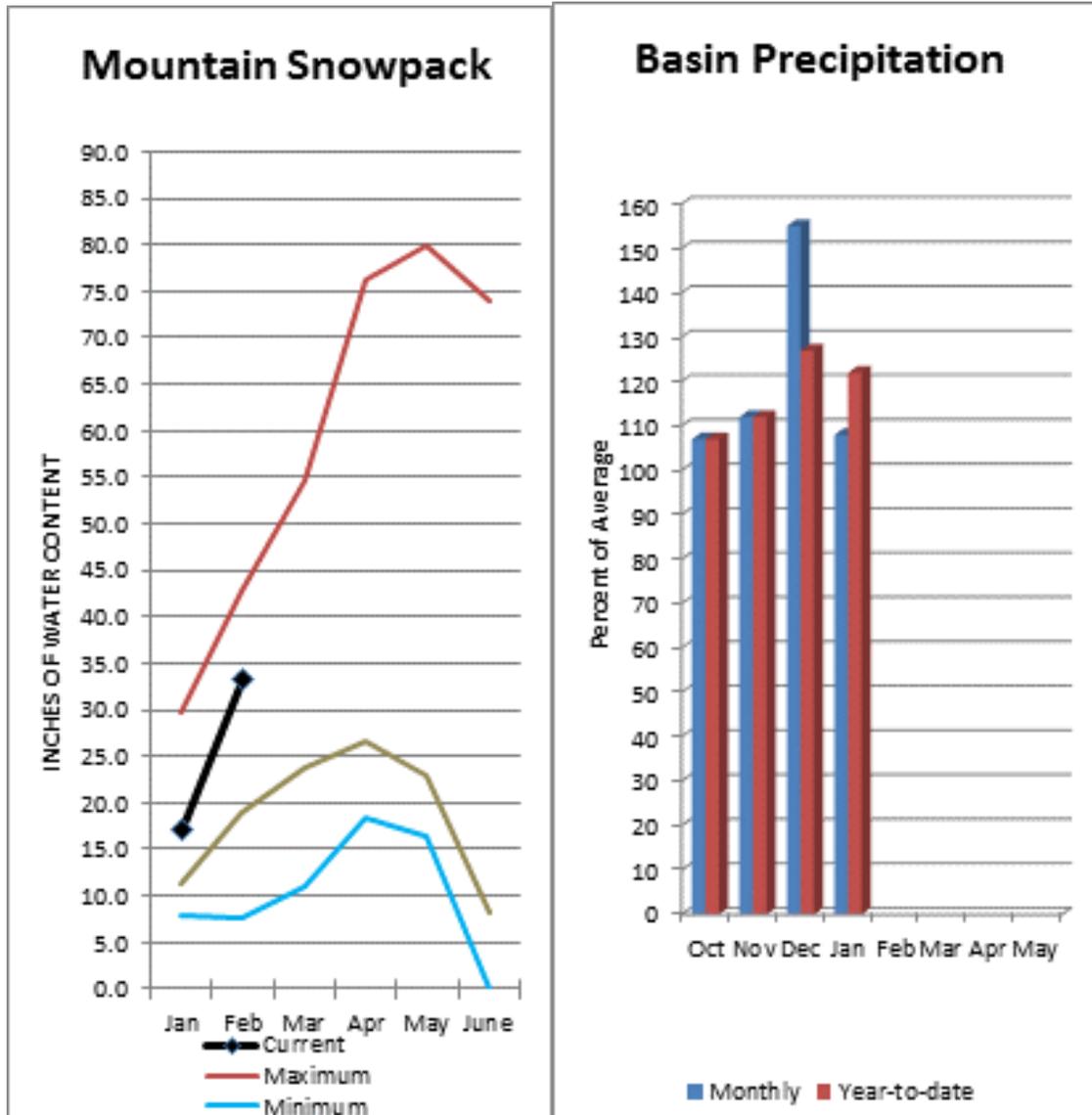
1) 90% and 10% exceedance probabilities are actually 95% and 5%

2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions

3) Median value used in place of average

Watershed Snowpack Analysis February 1, 2016	# of Sites	% Median	Last Year % Median
Central Puget Sound Basins	14	99%	23%
Puyallup River	5	108%	41%
Cedar River	4	118%	14%
Tolt River	2	66%	3%
Snoqualmie River	4	86%	15%
Skykomish River	2	68%	21%

North Puget Sound River Basins



Forecast for Skagit River streamflow at Newhalem is 114% of average for the spring and summer period. February streamflow in Skagit River was 119% of average. Other forecast points included Baker River at 109% and Thunder Creek at 106% of average. Basin-wide precipitation for February was 108% of average, bringing water-year-to-date to 122% of average. February 1 average snow cover in Skagit River Basin was 114%, Nooksack River Basin was 75% and Baker River Basin was not available. February 1 Skagit River reservoir storage was 63% of average and 45% of capacity. Average temperatures were slightly below normal for February and near normal for the water year.

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

North Puget Sound River Basins

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North Puget Sound Basins Streamflow Forecasts - February 1, 2016

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

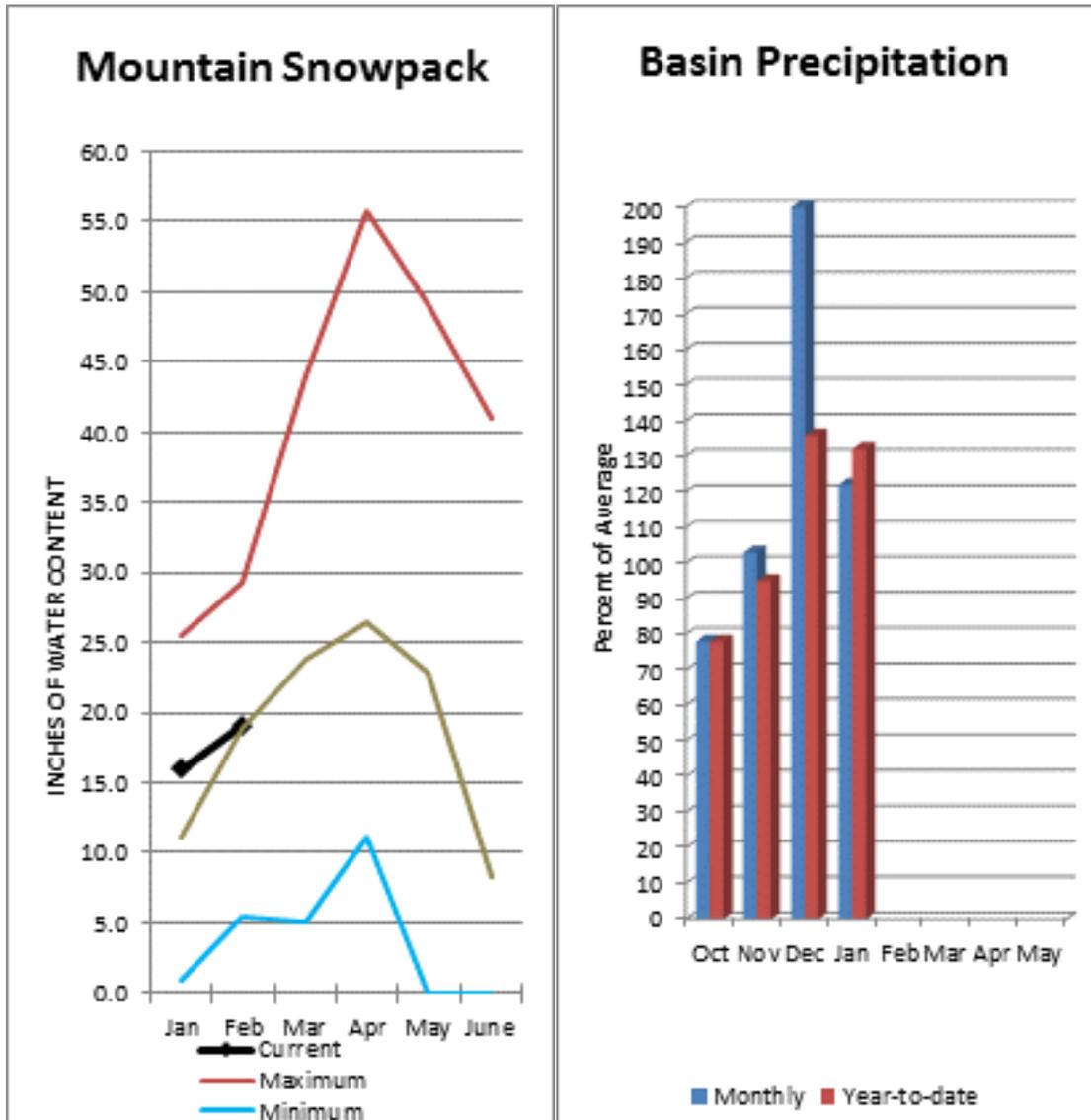
North Puget Sound Basins	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	30yr Avg (KAF)
Thunder Ck nr Newhalem	APR-JUL	220	235	245	104%	260	275	235
	APR-SEP	315	335	350	106%	360	380	330
Skagit R at Newhalem	APR-JUL	1740	1880	1970	117%	2060	2200	1680
	APR-SEP	2060	2210	2320	114%	2420	2570	2030
Baker R at Concrete	APR-JUL	700	780	840	108%	895	975	780
	APR-SEP	915	1010	1070	109%	1130	1220	980

- 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
- 3) Median value used in place of average

Reservoir Storage End of January, 2016	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Ross	628.6	787.6	996.3	1404.1
Diablo Reservoir			85.8	90.6
Basin-wide Total	628.6	787.6	996.3	1404.1
# of reservoirs	1	1	1	1

Watershed Snowpack Analysis February 1, 2016	# of Sites	% Median	Last Year % Median
North Puget Sound Basins	15	110%	62%
Skagit River	13	116%	71%
Baker River	0		
Nooksack River	2	75%	15%

Olympic Peninsula River Basins



Forecasted average runoff for streamflow for the Dungeness River is 112% and Elwha River is 110%. February runoff in the Dungeness River was 134% of normal. Big Quilcene and Wynoochee rivers may expect near average runoff this summer as well. February precipitation was 122% of average. Precipitation has accumulated at 132% of average for the water year. February precipitation at Quillayute was 152% of normal. Olympic Peninsula snowpack averaged 101% of normal on February 1. Temperatures were 1-2 degrees above average for in the mountains but 2-4 degrees above normal on the coast and 1-4 degrees above 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 Peninsula Streamflow Forecasts - February 1, 2016

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

Olympic Peninsula	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	30yr Avg (KAF)
Dungeness R nr Sequim	APR-JUL	115	127	135	113%	143	155	120
	APR-SEP	136	151	162	112%	172	187	145
Elwha R at McDonald Bridge nr Port Angeles	APR-JUL	375	415	445	111%	475	515	400
	APR-SEP	435	485	515	110%	550	600	470

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

3) Median value used in place of average

Watershed Snowpack Analysis February 1, 2016	# of Sites	% Median	Last Year % Median
Olympic Peninsula	6	101%	9%

Issued by

Jason Weller
Chief
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Roylene Rides At The Door
State Conservationist
Natural Resources Conservation Service
Spokane, Washington

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
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 Recourse Conservation & Development Councils
Local	City of Tacoma City of Seattle Chelan County P.U.D. Pacific Power and Light Company 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'klallum Tribe
Private	Okanogan Irrigation District Wenatchee Heights Irrigation District Newman Lake Homeowners Association Whitestone Reclamation District

*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

