

Washington Water Supply Outlook

June 2011

General Outlook

The month of May was another one for the record books. Below normal temperatures prevented much of the normal snowmelt so numbers went through the roof. A cloud burst that hit much of Central Washington on May 14-15 caused extensive flooding and road damage, effectively closing or blocking access to many forest roads and camp grounds. Mountain soil moisture is at an all time high since we began collecting data eight years ago as well. With current conditions the way they are pretty much all summer streamflow forecasts increased by at least 20% over last month. Short term weather forecasts call for continued cool temperatures. Month to date precipitation has been hit and miss with as little as no rain recorded to well over 200% in other locations. Long lead forecasts call for more seasonal temperatures with good chances of below normal precipitation for the rest of summer. The North Cascades National Park has conducted preliminary glacier studies for this season. Attached is their report of the on-going inventory and analysis of four glaciers within the park.

Snowpack

The June 1 statewide SNOTEL readings were 266% of average, up 110% from last month. Though all basins are above the 30-year average it is important to keep in mind that this mostly is not due to excessive late season snow accumulation but the extreme lag of normal snowmelt. Another way to look at it is that normally Washington would have about 40% of the peak snow accumulation still on the ground, meaning that 60% would have all ready melted. As of June 1 that number sits at 97% which means that we still have almost all of an "average" snowpack to melt out.

BASIN	PERCENT OF LAST YEAR	PERCENT OF AVERAGE
Spokane	556	277
Pend Oreille	238	236
Okanogan	349	225
Methow	276	193
Wenatchee	179	173
Chelan	169	171
Upper Yakima	207	201
Lower Yakima	152	209
Ahtanum Creek	154	346
Walla Walla	N/A	824
Lower Snake	310	320
Cowlitz	164	221
Lewis	239	382
White	148	190
Green	248	214
Puyallup	157	223
Cedar	N/A	768
Snoqualmie	227	218
Skykomish	220	218
Skagit	237	207
Nooksack	265	251
Olympic Peninsula	137	439

Precipitation

For the 3rd consecutive month the National Weather Service and Natural Resources Conservation Service climate stations reported much above average precipitation in all river basins in the state, bringing all basins to well above normal for the water-year. The lowest percent of average in the state was at Beaver Pass SNOTEL in the upper Skagit River which reported 67% of average. Alpine Meadows SNOTEL was the wettest spot in the state last month with 14 inches or 169% of average. Valley versus mountain precipitation was very consistent throughout the state.

RIVER BASIN	MAY PERCENT OF AVERAGE	WATER YEAR PERCENT OF AVERAGE
Spokane	147	135
Pend Oreille	127	140
Upper Columbia	168	126
Central Columbia	196	120
Upper Yakima	179	119
Lower Yakima	201	122
Walla Walla	160	106
Lower Snake	154	124
Lower Columbia	134	118
South Puget Sound	159	121
Central Puget Sound	157	124
North Puget Sound	123	117
Olympic Peninsula	156	134

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. Reservoir storage in the Yakima Basin was 791,000-acre feet, 114% of average for the Upper Reaches and 208,000-acre feet or 109% of average for Rimrock and Bumping Lakes. Storage at the Okanogan reservoirs was 114% of average for June 1. The power generation reservoirs included the following: Coeur d'Alene Lake, 419,000-acre feet, 155% of average and 176% of capacity; Chelan Lake, 323,000-acre feet, 68% of average and 48% of capacity; and the Skagit River reservoirs at 76% of average and 57% of capacity. All reservoirs are expected to have sufficient inflow to fill to capacity however pool size will be dependent on the above describe management objectives.

BASIN	PERCENT OF CAPACITY	CURRENT STORAGE AS PERCENT OF AVERAGE
Spokane	176	155
Pend Oreille	44	50
Upper Columbia	102	114
Central Columbia	48	68
Upper Yakima	95	109
Lower Yakima	90	102
Lower Snake	71	80
North Puget Sound	57	76

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

Streamflow

Forecasts vary from 116% of average for the Mill Creek near Walla Walla to 226% of average for the Spokane River near Post Falls. June-September forecasts for some Western Washington streams include the Cedar River near Cedar Falls, 156%; White River, 128%; and Skagit River, 134%. Some Eastern Washington streams include the Yakima River near Parker, 144%; Wenatchee River at Plain, 144%; and Spokane River at Long Lake, 201%. Volumetric forecasts are developed using current, historic and average snowpack, precipitation and streamflow data collected and coordinated by organizations cooperating with NRCS.

Statewide May streamflows varied by region but were surprisingly low in some locations considering the amount of precipitation that we had. The Walla Walla River had the highest reported natural flows with 231% of average. The Similkameen at Nighthawk with 79% of average was the lowest in the state. Other streamflows were the following percentage of average as reported by the River Forecast Center: the Cowlitz at Castle Rock, 126%; the Spokane at Spokane, 176%; the Columbia below Rock Island Dam, 107%; and the Cle Elum near Roslyn, 89%. Some operations were obviously voiding storage to make room for the impending snowmelt which is running surprisingly late this season.

BASIN	PERCENT OF AVERAGE (50 PERCENT CHANCE OF EXCEEDENCE)
-------	---

Spokane	183-226
Pend Oreille	171-178
Upper Columbia	124-206
Central Columbia	128-145
Upper Yakima	129-168
Lower Yakima	128-164
Walla Walla	113-130
Lower Snake	141-163
Lower Columbia	146-167
South Puget Sound	116-128
Central Puget Sound	132-220
North Puget Sound	121-134
Olympic Peninsula	154-163

STREAM	PERCENT OF AVERAGE MAY STREAMFLOWS
--------	---------------------------------------

Pend Oreille Below Box Canyon	124
Kettle at Laurier	124
Columbia at Birchbank	93
Spokane at Long Lake	170
Similkameen at Nighthawk	95
Okanogan at Tonasket	107
Methow at Pateros	135
Chelan at Chelan	101
Wenatchee at Pashastin	96
Yakima at Cle Elum	95
Yakima at Parker	133
Naches at Naches	141
Grande Ronde at Troy	138
Snake below Lower Granite Dam	136
SF Walla Walla near Milton Freewater	231
Columbia River at The Dalles	119
Cowlitz below Mayfield Dam	119
Skagit at Concrete	79
Dungeness near Sequim	106

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

Soil Moisture

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. Heavy fall precipitation has allowed for above the curve soil moisture carryover through the winter. This will be of great benefit to water supplies come runoff season since the melting snow won't have to first fill a depleted soil moisture profile.

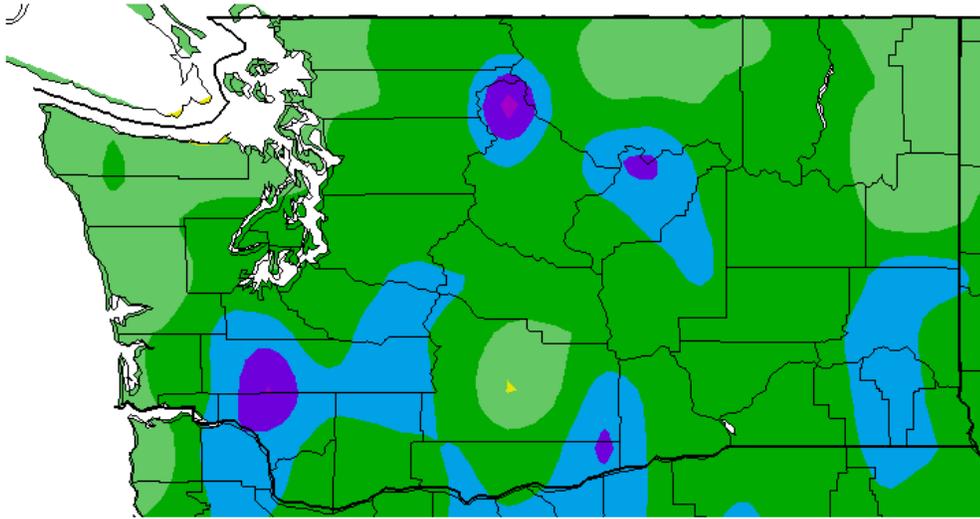
BASIN	ESTIMATED PERCENT SATURATION
Spokane	65
Pend Oreille	79
Upper Columbia	65
Central Columbia	66
Upper Yakima	88
Lower Yakima	74
Walla Walla	87
Lower Snake	86
Lower Columbia	75
South Puget Sound	63
Central Puget Sound	N/A
North Puget Sound	98
Olympic Peninsula	49

BASIN SUMMARY OF
SNOW COURSE DATA

JUNE 2011

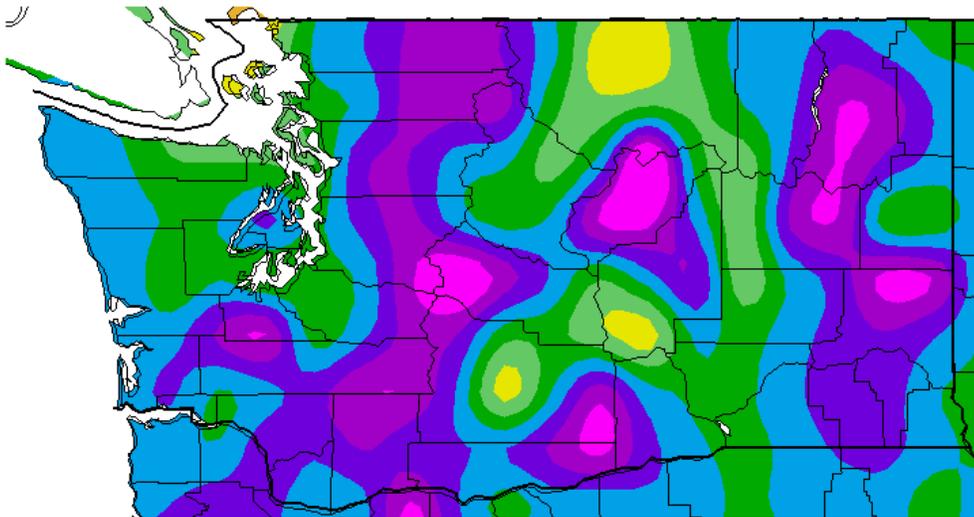
SNOW COURSE	ELEVATION	DATE	SNOW DEPTH	WATER CONTENT	LAST YEAR	AVERAGE 1971-00	SNOW COURSE	ELEVATION	DATE	SNOW DEPTH	WATER CONTENT	LAST YEAR	AVERAGE 1971-00
ALPINE MEADOWS SNTL	3500	6/01/11	110	63.0	29.8	31.4	MOUNT CRAG SNOTEL	3960	6/01/11	101	35.4	26.1	7.8
BADGER PASS SNOTEL	6900	6/01/11	101	49.3	26.2	22.9	MOWICH SNOTEL	3160	6/01/11	0	.0	.0	.0
BARKER LAKES SNOTEL	8250	6/01/11	77	25.6	20.0	9.5	MOUNT GARDNER SNOTEL	2920	6/01/11	7	5.0	.0	.0
BASIN CREEK SNOTEL	7180	6/01/11	26	8.1	3.4	4.1	N.F. ELK CR SNOTEL	6250	6/01/11	8	3.1	.0	.6
BEAVER PASS SNOTEL	3630	6/01/11	79	39.0	22.1	16.8	NEVADA RIDGE SNOTEL	7020	6/01/11	43	19.2	3.8	3.4
BLACK PINE SNOTEL	7100	6/01/11	22	8.1	.0	1.9	NEZ PERCE CMP SNOTEL	5650	6/01/11	8	4.3	.0	.3
BLEWETT PASS#2SNOTEL	4240	6/01/11	0	.0	.0	.0	NOISY BASIN SNOTEL	6040	6/01/11	140	69.7	38.2	30.1
BUCKINGHORSE SNOTEL	4870	6/01/11	147	85.2	64.5	--	NORTH FORK JOCKO	6330	5/31/11	106	51.4	22.7	23.3
BUMPING LAKE (NEW)	3400	5/31/11	0	.0	--	--	OLALLIE MDWS SNOTEL	4030	6/01/11	107	56.7	38.6	31.8
BUMPING RIDGE SNOTEL	4610	6/01/11	52	23.0	13.5	11.6	OPHIR PARK	7150	5/29/11	33	13.9	4.9	--
BUNCHGRASS MDWSNOTEL	5000	6/01/11	62	26.5	10.9	9.7	PARADISE SNOTEL	5130	6/01/11	174	99.5	65.8	61.6
BURNT MOUNTAIN PIL	4170	6/01/11	44	19.4	.0	.4	PARK CK RIDGE SNOTEL	4600	6/01/11	57	30.5	14.4	11.5
CALAMITY SNOTEL	2500	6/01/11	0	.0	.0	--	PEPPER CREEK SNOTEL	2140	6/01/11	0	.0	.0	--
CAYUSE PASS SNOTEL	5240	6/01/11	179	81.7	47.4	--	PETERSON MDW SNOTEL	7200	6/01/11	36	11.4	10.6	2.7
CHICKEN CREEK	4060	5/26/11	0	.0	.0	.0	PIGTAIL PEAK SNOTEL	5800	6/01/11	145	67.2	53.7	39.9
COMBINATION SNOTEL	5600	6/01/11	0	.0	.0	.0	PIKE CREEK SNOTEL	5930	6/01/11	29	13.5	.0	7.3
COPPER BOTTOM SNOTEL	5200	6/01/11	0	.0	.0	.0	POPE RIDGE SNOTEL	3590	6/01/11	0	.0	.0	.0
CORRAL PASS SNOTEL	5800	6/01/11	113	47.0	30.7	23.1	POTATO HILL SNOTEL	4510	6/01/11	77	32.4	17.8	2.7
COUGAR MTN. SNOTEL	3200	6/01/11	25	11.7	.0	1.5	QUARTZ PEAK SNOTEL	4700	6/01/11	41	18.0	.0	.0
COYOTE HILL	4200	5/27/11	0	.0	.0	--	RAGGED MTN SNOTEL	4210	6/01/11	7	2.5	.0	--
DALY CREEK SNOTEL	5780	6/01/11	0	.0	.0	.0	RAINY PASS SNOTEL	4890	6/01/11	69	37.4	18.5	24.3
DISCOVERY BASIN	7050	5/27/11	30	10.7	5.7	2.4	REX RIVER SNOTEL	3810	6/01/11	62	33.0	3.2	6.1
DIX HILL	6400	5/29/11	0	.0	.0	--	ROCKER PEAK SNOTEL	8000	6/01/11	59	23.1	15.0	11.7
DUNGENESS SNOTEL	4010	6/01/11	12	6.2	.0	.0	SADDLE MTN SNOTEL	7900	6/01/11	73	33.2	12.6	16.3
ELBOW LAKE SNOTEL	3200	6/01/11	67	33.5	.0	8.5	SALMON MDWS SNOTEL	4460	6/01/11	0	.0	.0	.0
EMERY CREEK SNOTEL	4350	6/01/11	0	.0	.0	.0	SASSE RIDGE SNOTEL	4340	6/01/11	53	21.3	11.8	5.9
FISH LAKE	3370	5/31/11	10	5.0	--	--	SAVAGE PASS SNOTEL	6170	6/01/11	54	26.4	4.3	10.4
FISH LAKE SNOTEL	3430	6/01/11	26	10.9	.0	7.5	SAWMILL RIDGE SNOTEL	4640	6/01/11	75	46.8	24.6	--
FLATTOP MTN SNOTEL	6300	6/01/11	142	62.0	38.5	36.5	SENTINEL BT SNOTEL	4680	6/01/11	0	.0	.0	.0
FROHNER MDWS SNOTEL	6480	6/01/11	2	.7	.0	.7	SHEEP CANYON SNOTEL	3990	6/01/11	120	60.1	24.5	13.7
GRAVE CRK SNOTEL	4300	6/01/11	21	8.7	.0	.0	SHERWIN SNOTEL	3200	6/01/11	---	.0	.0	.0
GREEN LAKE SNOTEL	5920	6/01/11	56	23.5	15.3	6.6	SKALKAHO SNOTEL	7260	6/01/11	54	25.1	6.9	14.6
GROUSE CAMP SNOTEL	5390	6/01/11	19	8.3	.0	.2	SKOOKUM CREEK SNOTEL	3310	6/01/11	52	30.5	.0	1.5
HAND CREEK SNOTEL	5030	6/01/11	0	.0	.0	.0	SOURDOUGH GUL SNOTEL	4000	6/01/11	0	.0	.0	--
HARTS PASS SNOTEL	6490	6/01/11	105	65.7	18.8	29.2	SPENCER MDW SNOTEL	3400	6/01/11	50	28.9	.7	3.0
HELL ROARING DIVIDE	5770	5/27/11	98	41.4	16.3	10.8	SPIRIT LAKE SNOTEL	3520	6/01/11	0	.0	.0	.0
HERRIG JUNCTION	4850	5/26/11	58	26.8	8.7	5.4	SPOTTED BEAR MTN.	7000	5/31/11	15	6.1	--	--
HIGH RIDGE SNOTEL	4920	6/01/11	32	18.6	.0	1.2	SPRUCE SPGS SNOTEL	5700	6/01/11	12	5.0	.0	--
HOODOO BASIN SNOTEL	6050	6/01/11	117	53.8	19.6	28.4	STAHL PEAK SNOTEL	6030	6/01/11	134	57.4	34.8	28.0
HUCKLEBERRY SNOTEL	2250	6/01/11	0	.0	.0	.0	STAMPEDE PASS SNOTEL	3850	6/01/11	65	31.4	11.6	18.6
HUMBOLDT GLCH SNOTEL	4250	6/01/11	---	2.2	.0	.0	STEVENS PASS SNOTEL	3950	6/01/11	71	24.9	10.1	9.0
INDIAN ROCK SNOTEL	5360	6/01/11	51	26.9	10.6	--	STRYKER BASIN	6180	5/26/11	99	46.8	26.9	19.4
JUNE LAKE SNOTEL	3440	6/01/11	104	59.9	16.1	10.1	STUART MOUNTAIN	7400	5/31/11	91	44.5	--	--
KRAFT CREEK SNOTEL	4750	6/01/11	0	.0	.0	.0	SUNSET SNOTEL	5540	6/01/11	---	29.5	4.8	13.5
LOLO PASS SNOTEL	5240	6/01/11	44	20.1	.0	4.9	SURPRISE LKS SNOTEL	4290	6/01/11	120	58.3	32.0	19.0
LONE PINE SNOTEL	3930	6/01/11	109	60.4	30.6	18.4	SWAMP CREEK SNOTEL	3930	6/01/11	2	.7	.0	.0
LOOKOUT SNOTEL	5140	6/01/11	51	25.1	.0	8.0	SWIFT CREEK SNOTEL	4440	6/01/11	172	100.6	74.1	40.0
LOST HORSE SNOTEL	5120	6/01/11	0	.0	.0	.2	THUNDER BASIN SNOTEL	4320	6/01/11	40	22.3	10.2	9.3
LOST LAKE SNOTEL	6110	6/01/11	155	67.2	23.0	41.5	TINKHAM CREEK SNOTEL	2990	6/01/11	52	23.3	.0	2.9
LUBRECHT SNOTEL	4680	6/01/11	0	.0	.0	.0	TOUCHET SNOTEL	5530	6/01/11	39	20.6	.0	2.5
LYMAN LAKE SNOTEL	5980	6/01/11	146	80.5	55.0	50.8	TROUGH #2 SNOTEL	5480	6/01/11	0	.0	.0	.0
LYNN LAKE SNOTEL	3900	6/01/11	59	26.2	.9	--	TUNNEL AVENUE	2450	6/01/11	8	3.5	--	--
MARIAS PASS	5250	5/30/11	34	15.2	--	--	TV MOUNTAIN	6800	5/31/11	40	18.8	6.9	6.8
MARTEN RIDGE SNOTEL	3520	6/01/11	128	74.9	33.4	--	TWELVEMILE SNOTEL	5600	6/01/11	0	.0	.0	.4
MEADOWS PASS SNOTEL	3230	6/01/11	34	14.7	.0	.9	TWIN LAKES SNOTEL	6400	6/01/11	75	38.8	12.4	22.3
M F NOOKSACK SNOTEL	4970	6/01/11	149	86.2	49.2	49.6	UPPER WHEELER SNOTEL	4330	6/01/11	0	.0	.0	.0
MICA CREEK SNOTEL	4510	6/01/11	40	21.4	.0	.0	WARM SPRINGS SNOTEL	7800	6/01/11	77	32.5	24.1	17.0
MORSE LAKE SNOTEL	5410	6/01/11	129	61.0	50.5	33.6	WATERHOLE SNOTEL	5010	6/01/11	109	58.5	46.9	15.0
MOSES MTN SNOTEL	5010	6/01/11	17	7.6	.0	.1	WELLS CREEK SNOTEL	4030	6/01/11	84	48.6	14.3	8.9
MOSQUITO RDG SNOTEL	5200	6/01/11	---	41.9	9.6	11.0	WHITE PASS ES SNOTEL	4440	6/01/11	46	13.8	7.6	5.6

Ave. Temperature dep from Ave (deg F)
5/9/2011 – 6/7/2011



Generated 6/08/2011 at WRCC using provisional data.
NOAA Regional Climate Centers

Ave. Temperature dep from Ave (deg F)
10/1/2010 – 6/6/2011



Generated 6/07/2011 at WRCC using provisional data.
NOAA Regional Climate Centers



Natural Resources Conservation Service

Washington State
Snow, Water and Climate Services

Program Contacts

Roylene Rides At The Door
State Conservationist
Spokane State Office
W. 316 Boone Ave., Suite 450
Spokane, WA 99201-2348
phone: 509-323-2961
fax: 509-323-2979
roylene.rides-at-the-door@wa.usda.gov

Jon Lea
DCO Supervisor
Oregon Data Collection Office
101 SW Main St, Suite 1300
Portland, OR 97204
Phone: 503-414-3267
Fax: 503-414-3277
jon.lea@or.usda.gov

Scott Pattee
Water Supply Specialist
Washington Snow Survey Office
2021 E. College Way, Suite 214
Mount Vernon, WA 98273-2873
phone: 360-428-7684
fax: 360-424-6172
scott.pattee@wa.usda.gov

Rashawn Tama
Forecast Hydrologist
National Water and Climate Center
101 SW Main St., Suite 1600
Portland, OR 97204-3224
phone: 503-414-3010
fax: 503-414-3101
rashawn.tama@por.usda.gov

Helpful Internet Addresses

NRCS Snow Survey and Climate Services Homepages

Washington:
<http://www.wa.nrcs.usda.gov/snow>

Oregon:
<http://www.or.nrcs.usda.gov/snow>

Idaho:
<http://www.id.nrcs.usda.gov/snow>

National Water and Climate Center (NWCC):
<http://www.wcc.nrcs.usda.gov>

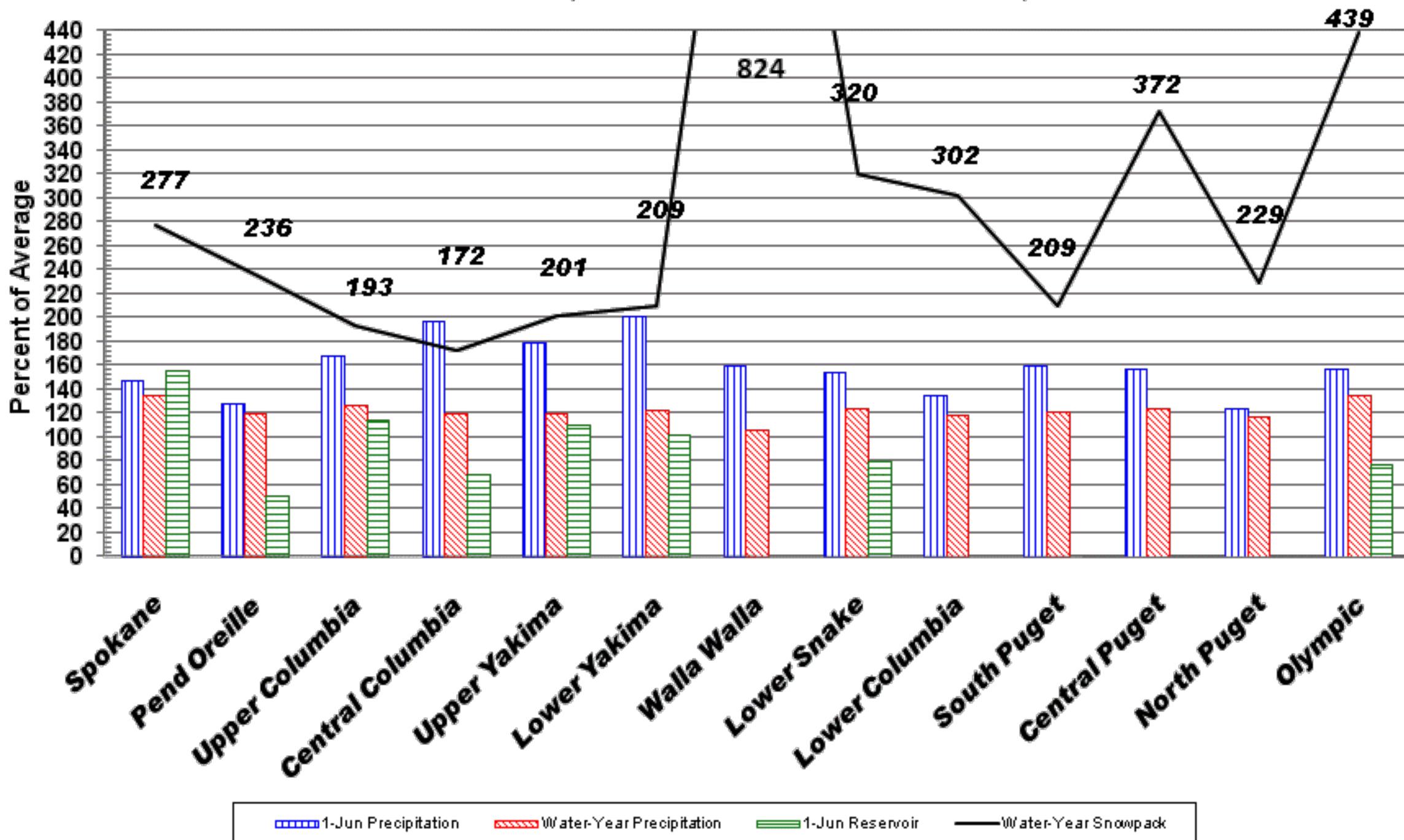
USDA-NRCS Agency Homepages

Washington:
<http://www.wa.nrcs.usda.gov>

NRCS National:
<http://www.nrcs.usda.gov>

June 1, 2011 - Snowpack, Precipitation and Reservoir Conditions at a Glance

(Water Year = October 1, 2010 - Current Date)



NORTH CASCADES GLACIER PAGE 2011

North Cascades National Park Glacier Monitoring Program

The National Park Service began monitoring glaciers in North Cascades National Park in 1993 and Mount Rainier glaciers in 2003 (see the Mount Rainier Glacier Page). Goals for this program and additional data can be found at North Cascades National Park home page at <http://www.nps.gov/noca/naturescience/glacial-mass-balance1.htm> or contact Jon_Riedel@nps.gov or Mike_Larrabee@nps.gov.

The four glaciers monitored are located at the headwaters of four watersheds, each with large hydroelectric dams (Figure 1). The glaciers represent a range in elevation from 8800 to 5600 feet, and a range in climatic conditions from maritime to continental. Methods include three visits annually to each glacier to measure winter accumulation and summer melt. Measurements are taken at a series of points down the centerline of the glacier (Table 1), and then integrated across the entire glacier surface to determine mass balance for the entire glacier. In 2010, Silver Glacier was the only glacier to record a positive net balance. The remaining three glaciers all had negative net balances, for the eighth consecutive year.

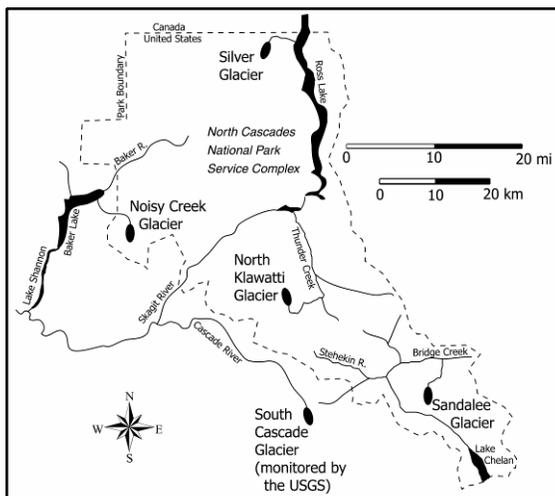


Figure 1. Glaciers monitored in North Cascades N.P.S. Complex.

Table 1		Average	2011	2011
Glacier:	Elev. (feet)	Accumulation (inches W.E.)	Accumulation (inches W.E.)	Percent of Average
Noisy Creek Density = 0.5	Entire Glacier	122	152	125
	6061	131	179	137
	6035	136	188	138
	5904	119	142	119
	5756	111	133	120
	5655	113	133	118
Silver Density = 0.46	Entire Glacier	92	96	104
	8420	107	97	91
	7938	90	105	118
	7606	110	90	82
	7209	63	82	130
North Klawatti Density = 0.50	Entire Glacier	113	139	123
	7669	114	145	128
	7301	119	148	124
	6901	119	159	133
	6396	102	117	114
	6094	91	99	109
Sandalee Density = 0.44	Entire Glacier	114	115	101
	7360	108	109	101
	7203	116	123	106
	6868	109	101	93
	6521	126	133	105

Table 1. Table 1 presents this spring's provisional winter accumulation data, along with average values and percent of the 18-year average. The 2011 snow depths were measured on April 19th and May 19th on the four glaciers. The provisional data show 2011 winter accumulation as near or above average, depending on the glacier. However, due to the cool and wet spring, most measurements were collected a month later than normal. Glaciers located on the west-slopes of the Cascades observed a larger increase from averages than glaciers located further east. These data are tentative and will be revised after a July visit. Based on historical field data, a snow density of 0.46 was assumed for Silver Glacier, 0.44 for Sandalee Glacier and 0.50 for Noisy and North Klawatti glaciers. Densities are in fraction of water

The 2010 estimates of glacial contribution to runoff for four watersheds are based on the mass balance measurements and GIS analyses to determine glacier area within 165 ft (50-meter) elevation bands (Table 2). Glaciers reduce the variation of flow in these watersheds by providing melt water from firn and ice during summer drought, in dry/warm years, and by storing water in excess snowpack during wet/cool years. Glacial contribution to stream flow in these watersheds varies by as much as 100% annually. Magnitude of glacial contribution to streamflow is large, but varies by the amount of glacial cover in each watershed. Thunder Creek is 13% glacierized; Baker River, 3%; Stehekin River, 6%; and Ross Lake, 0.9% (Post and others, 1971; Granshaw, 2002).

The glacierized area of a watershed primarily dictates the glacier contribution to runoff. However, the relative importance of glacial contribution to streamflow also generally increases from west to east. For example, glaciers annually contribute a higher percentage of meltwater to streamflow in the Stehekin watershed than in the Baker, despite the fact that the Baker is more highly glacierized. This is due to lower snowfall east of the hydrologic crest of the North Cascades.

Table 2 Provisional Data	May-September Runoff (thousands acre-feet)				Percent Glacial Runoff to Total Summer Runoff		
	2010	mean	min	max	2010	min	max
Noisy Creek Glacier	1.4	1.5	1.2	1.9			
Baker River Watershed	45.1	69.2	45.1	87.2	6.4	5.6	14.6
North Klawatti Glacier	2.8	4.0	2.8	5.1			
Thunder Creek Watershed	66.5	98.2	66.5	118.8	24.0	20.7	47.7
Sandalee Glacier	0.6	0.5	0.4	0.7			
Stehekin River Watershed	48.3	71.0	51.6	88.1	6.9	5.4	22.9
Silver Glacier	0.5	1.0	0.5	1.3			
Ross Lake Watershed	43.8	64.5	43.8	80.5	3.5	2.5	13.5

Table 2. Glacial contribution to summer stream flow (May 1 to Sept. 30) for four watersheds. Runoff units are thousands of acre-feet. Data from 1993-2010 except the Sandalee Glacier and Stehekin River Watershed (1995-2010).

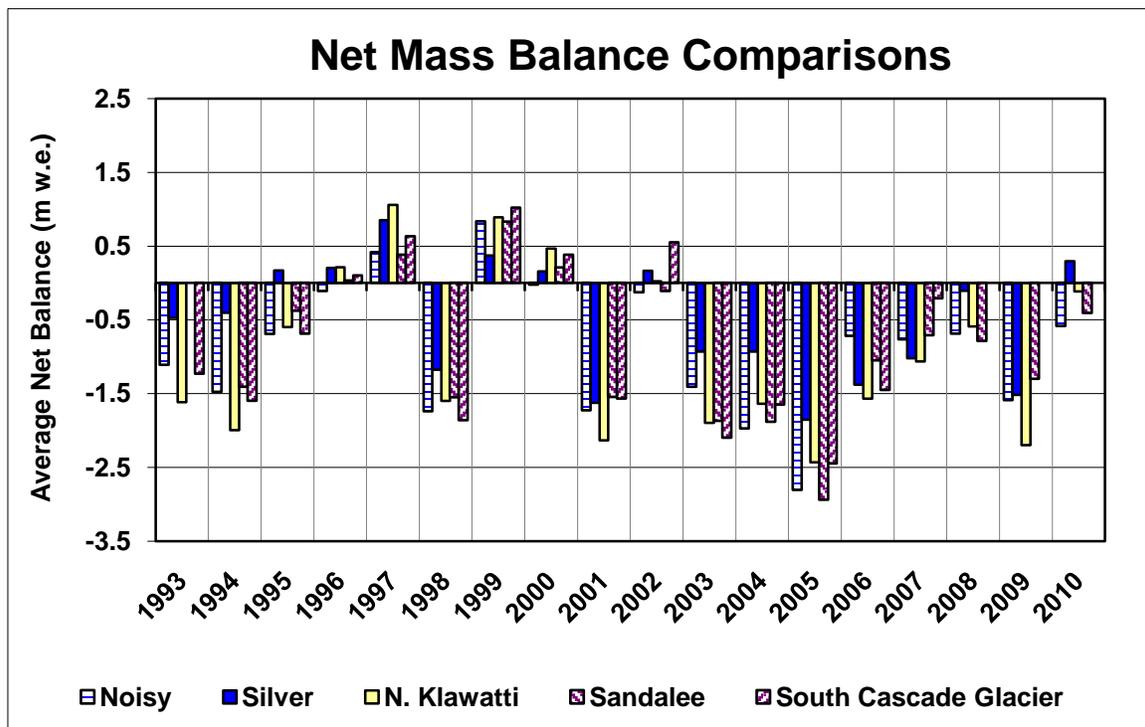


Figure 2. Net annual mass balance for the five glaciers monitored in the North Cascades.