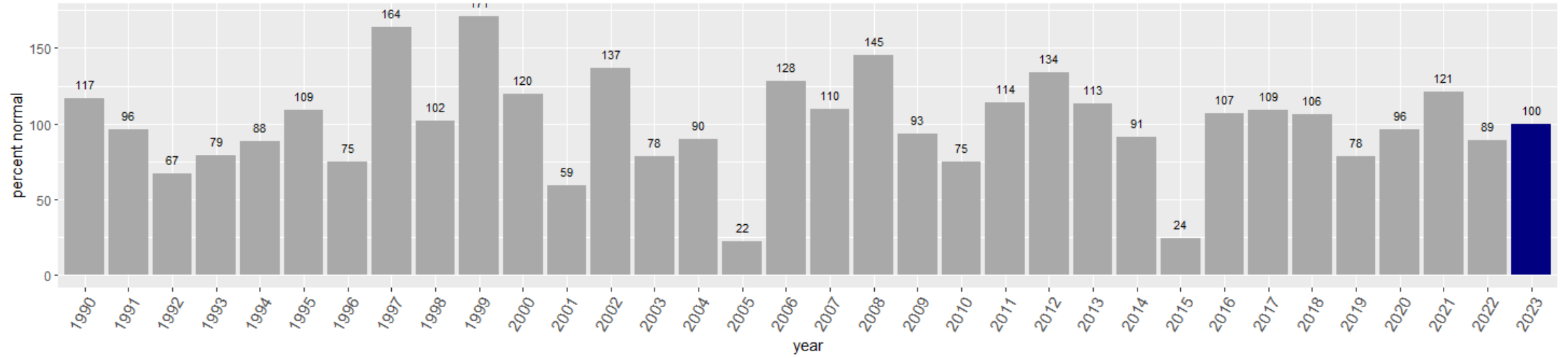


## Water Supply Availability Committee

Friday, March 24th

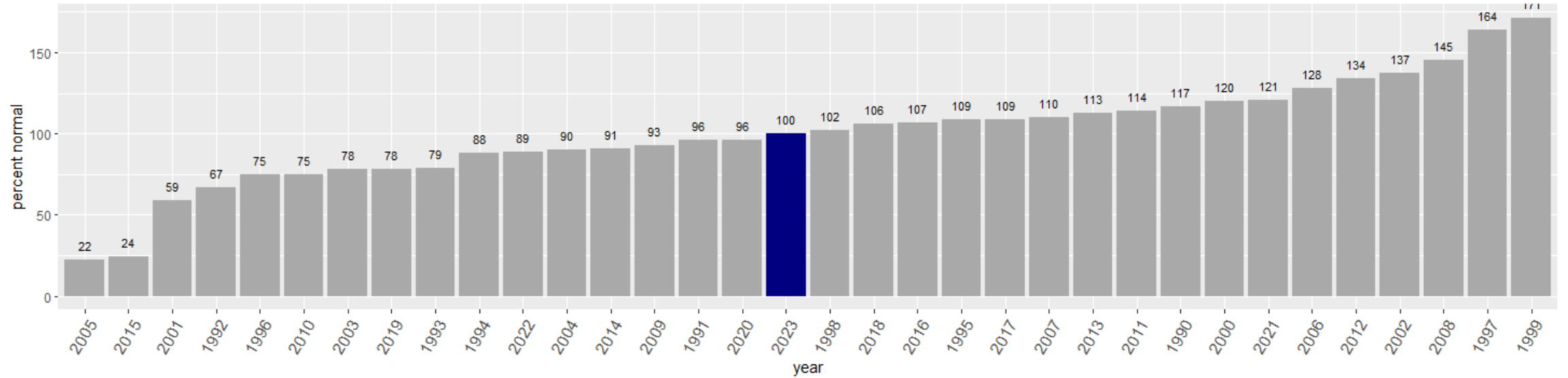
Start Time	End Time	Duration, min	Description	
10:00	10:10	10	Welcome & Introductions	Jeff Marti, Ecology
10:10	10:25	15	Regional Climate Setting/ ENSO	Nick Bond, OWSC
10:25	10:40	15	Mountain Conditions	Scott Pattee, NRCS
10:40	10:50	10	Streamflow and Groundwater	Nick Sutfin, USGS
10:50	11:05	15	Water Supply Forecasts	Amy Burke, NWRFC Brent Bower, NWS
11:05	11:25	20	Yakima Project	Chris Lynch, BOR
11:25	12:00	35	General Discussion	All
			Next Meeting Friday, April 21	

Washington statewide average Snow Water Equivalent on March 24 compared to previous years  
sorted by year



NRCS data

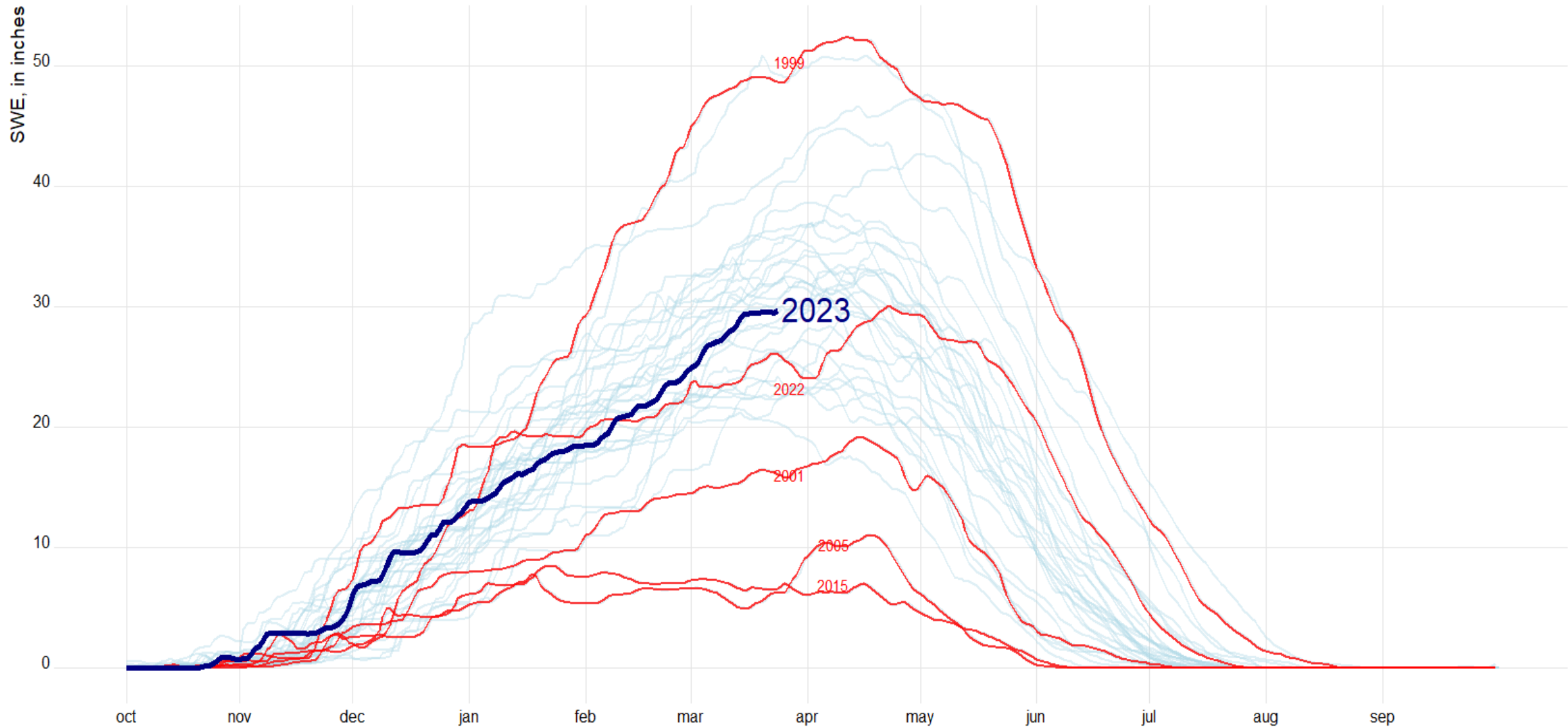
ranked by SWE



NRCS data

# Average Washington State SWE (SNOTEL)

Water Years: 1990 - 2023 Created on: 2023-03-24



## Snow Storage 2022-2023

Oct. 1, 2022 } • 483,442 af

Nov. 17, 2022 { • 6,171,010 af

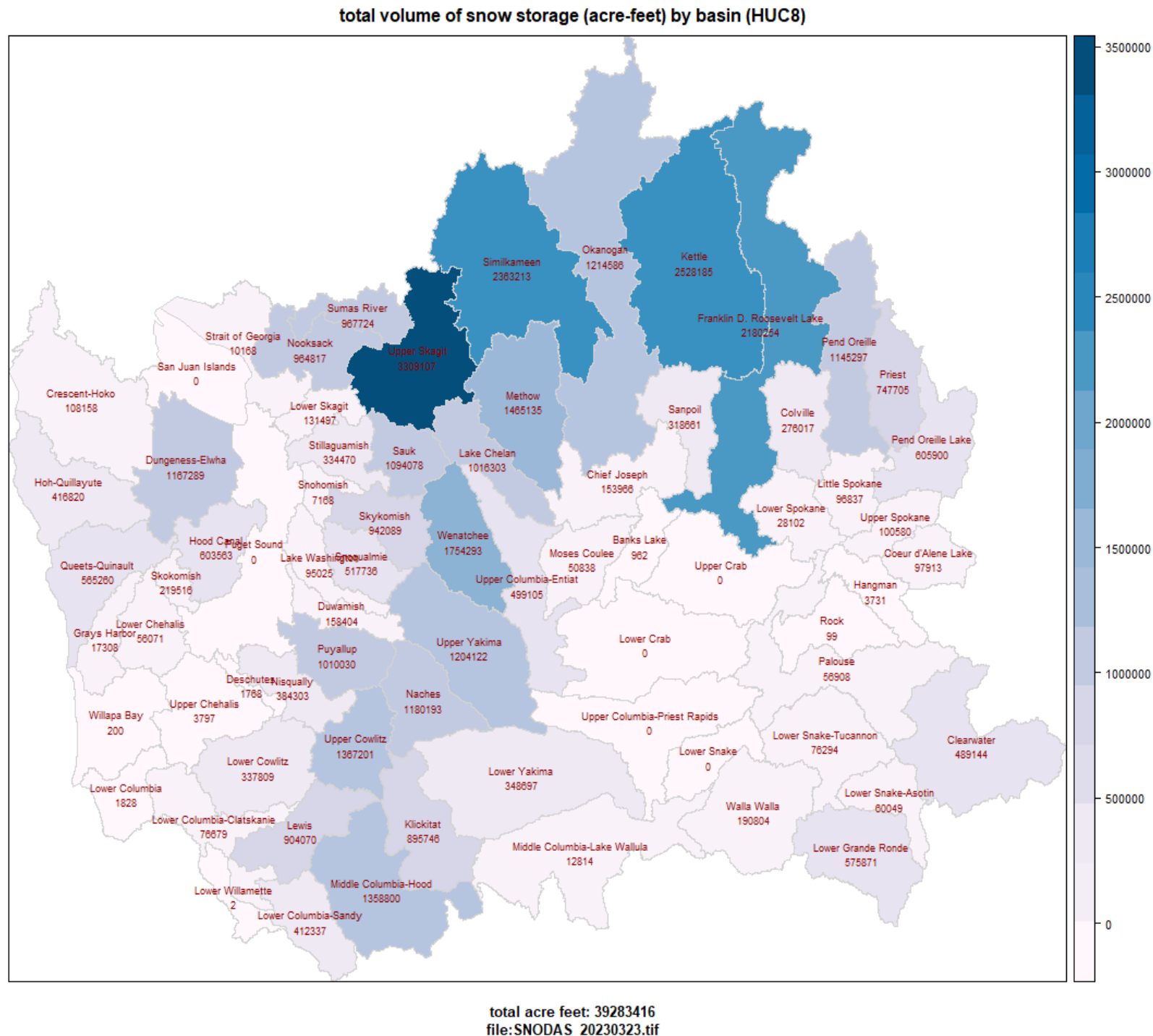
January 1, 2023 { • 24,175,516 af

January 18, 2023 { • 26,397,974 af

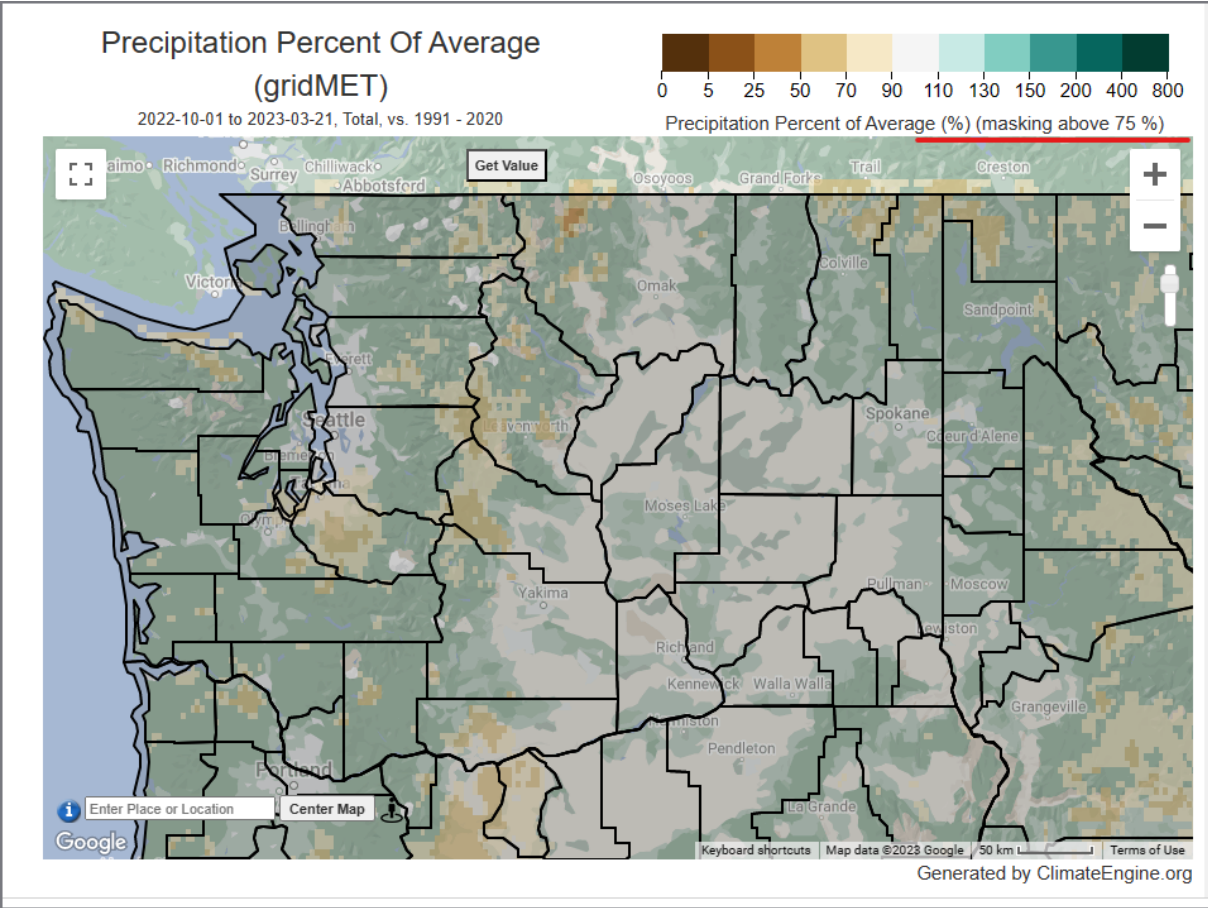
February 16, 2023 } • 30,991,617 af

March 23, 2023 { • 39,283,416 af

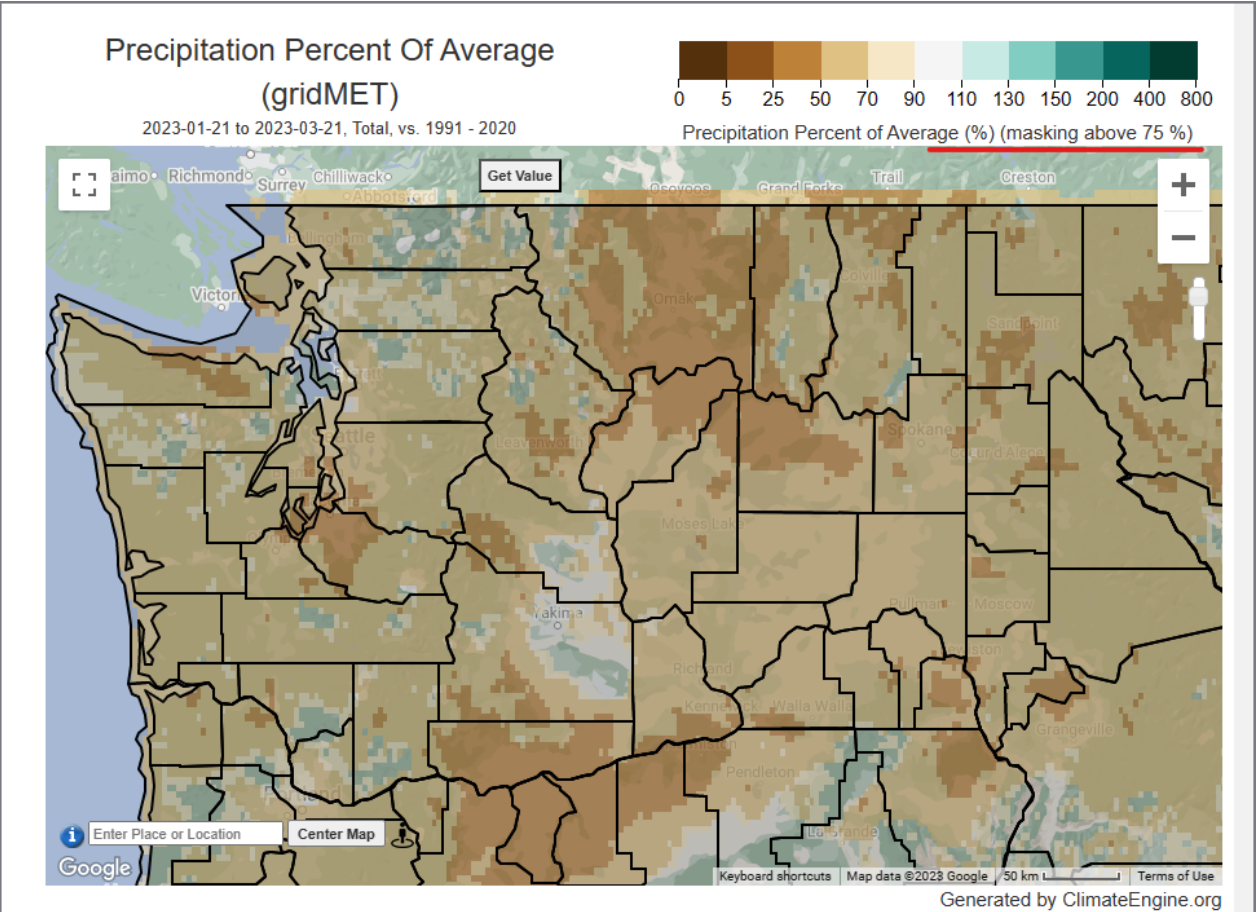
March 23, 2015 { • 12,533,161 af



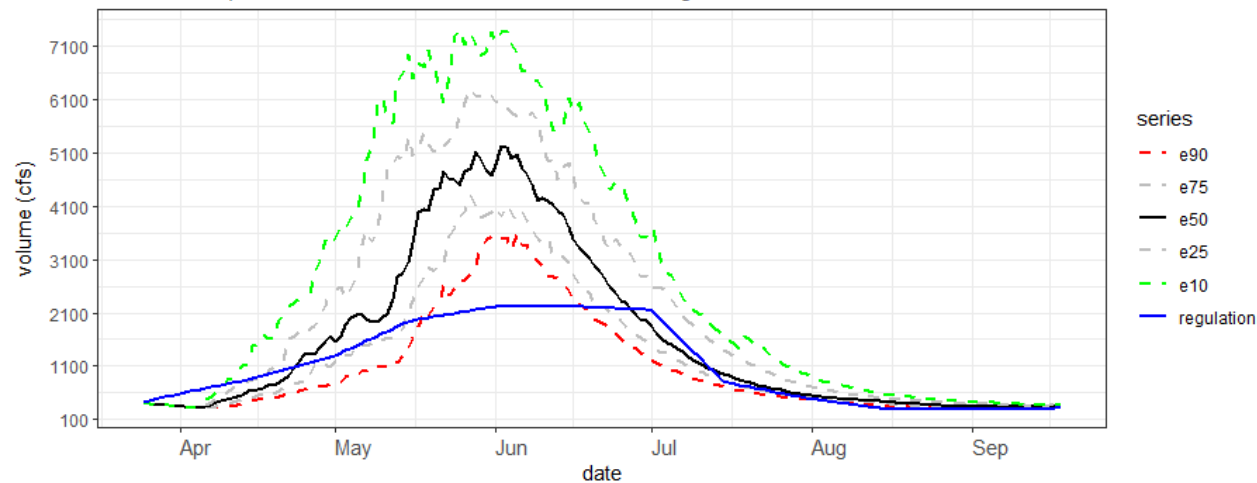
Water Year Precip to Date  
Percent of Average, Masked above 75 Percent



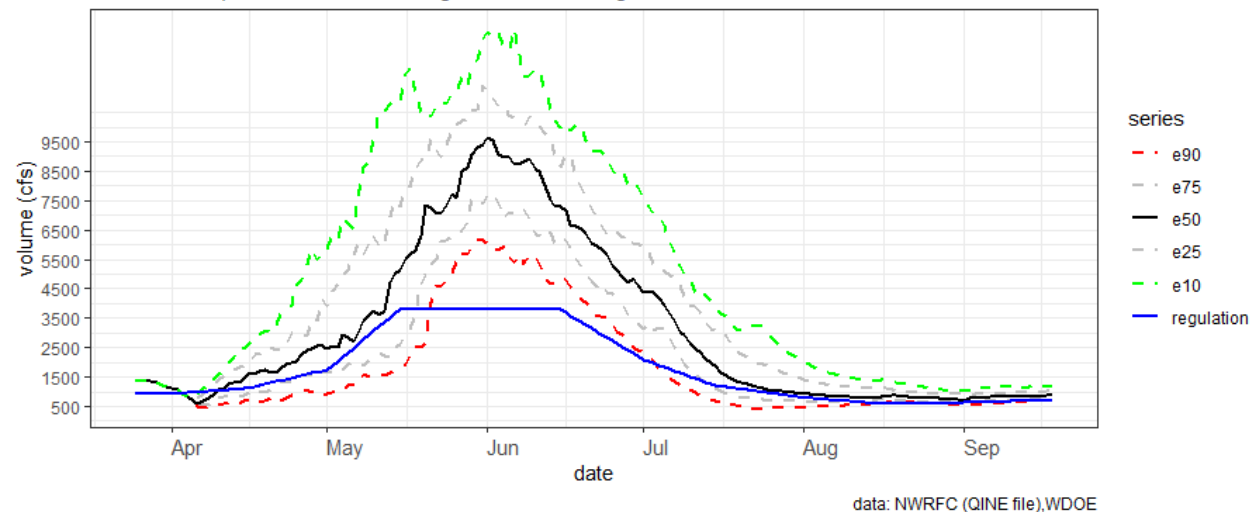
Most Recent 60 Days Precipitation  
Percent of Average, Masked above 75 Percent



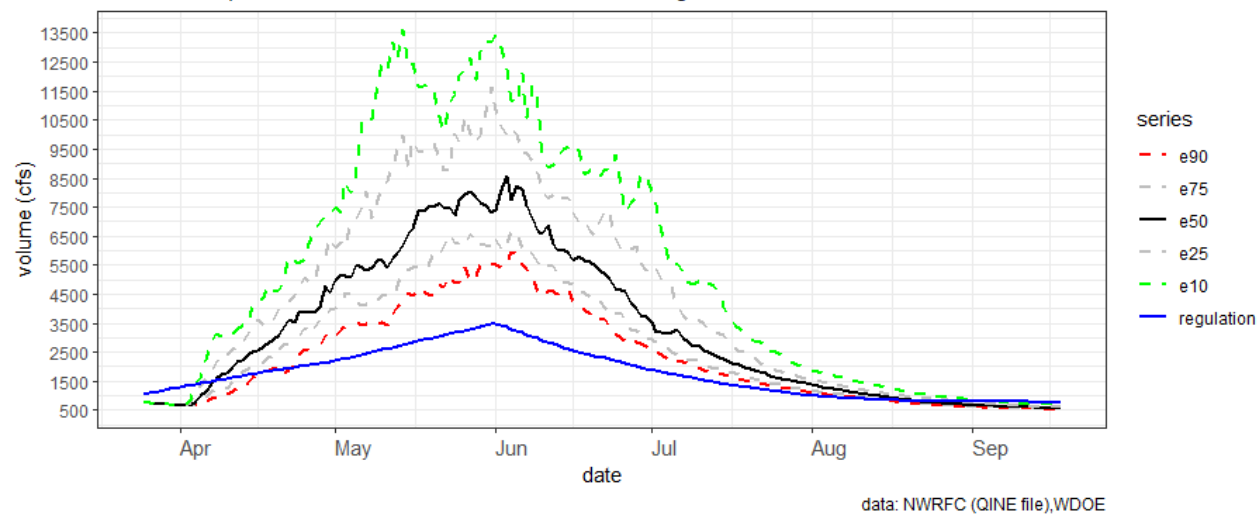
2023-03-23| forecast vs Methow River nr Pateros reg flow



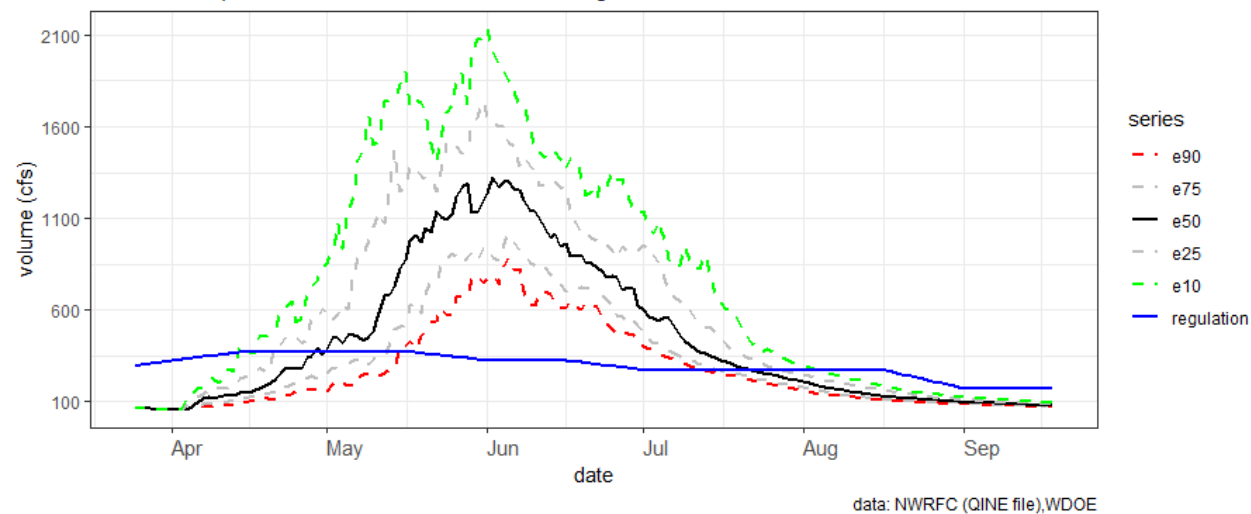
2023-03-23| forecast vs Okanogan at Malott reg flow



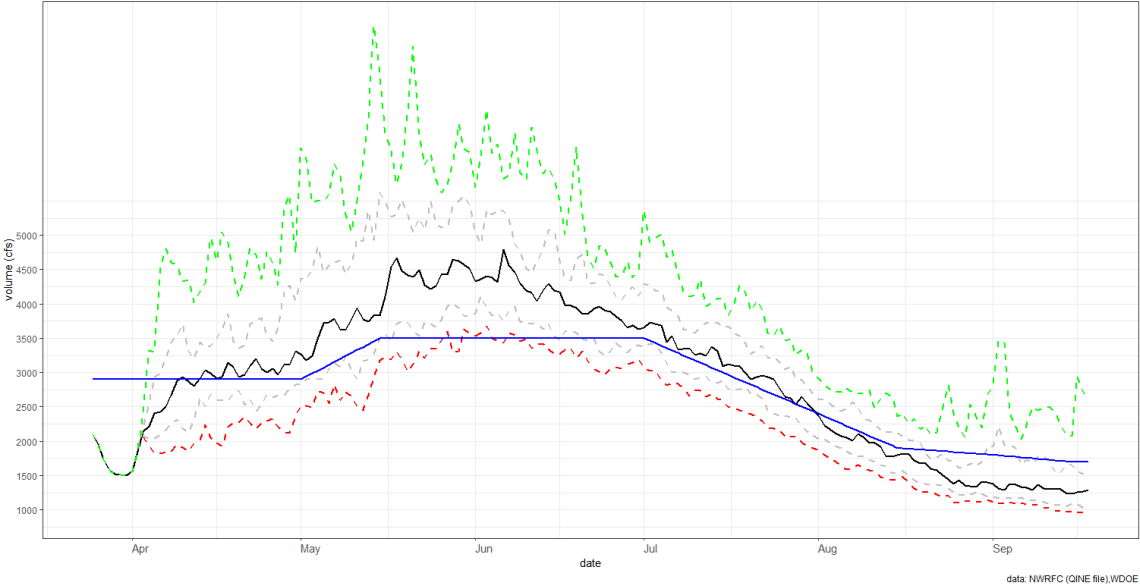
2023-03-23| forecast vs Wenatchee at Peshastin reg flow



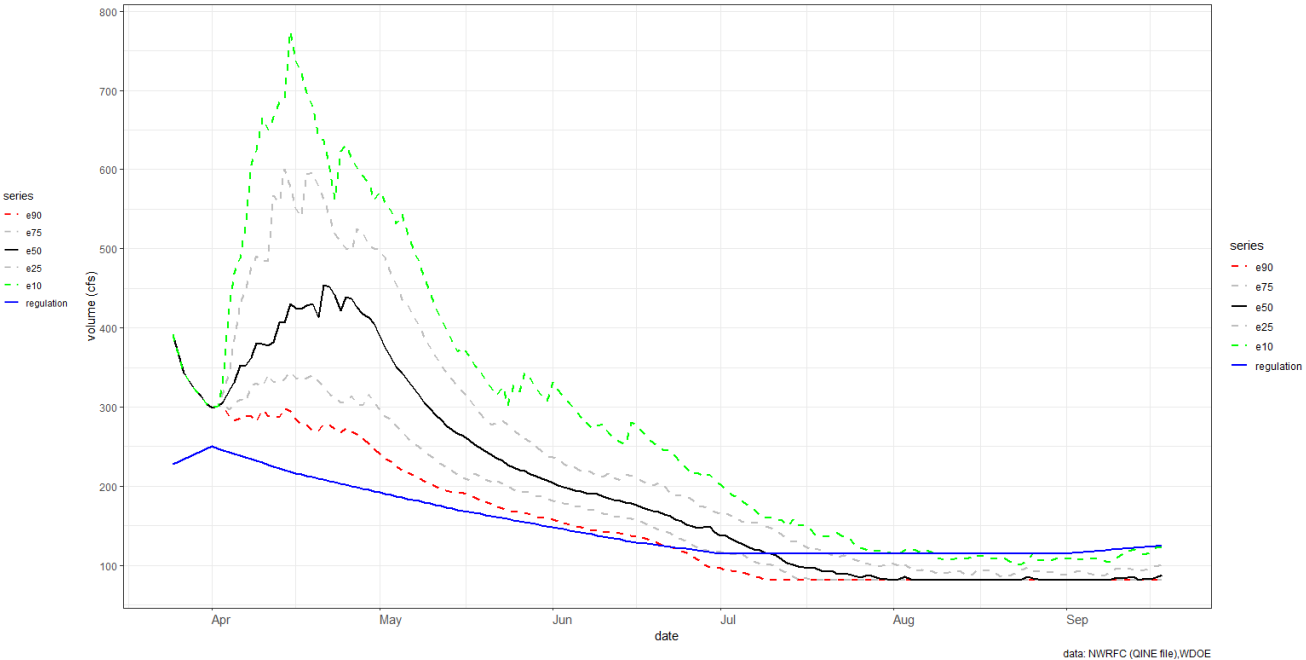
2023-03-23|forecast vs Entiat nr Ardenvoir reg flow



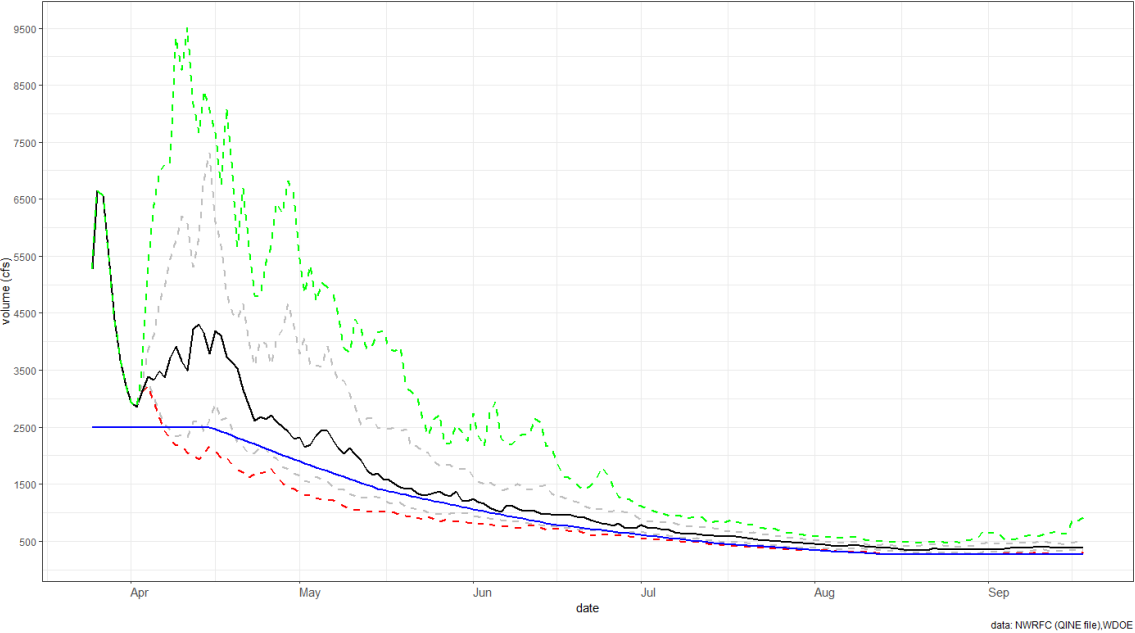
2023-03-24|forecast vs Nooksack at Ferndale reg flow



2023-03-24| forecast vs Little Spokane at Dartford reg flow



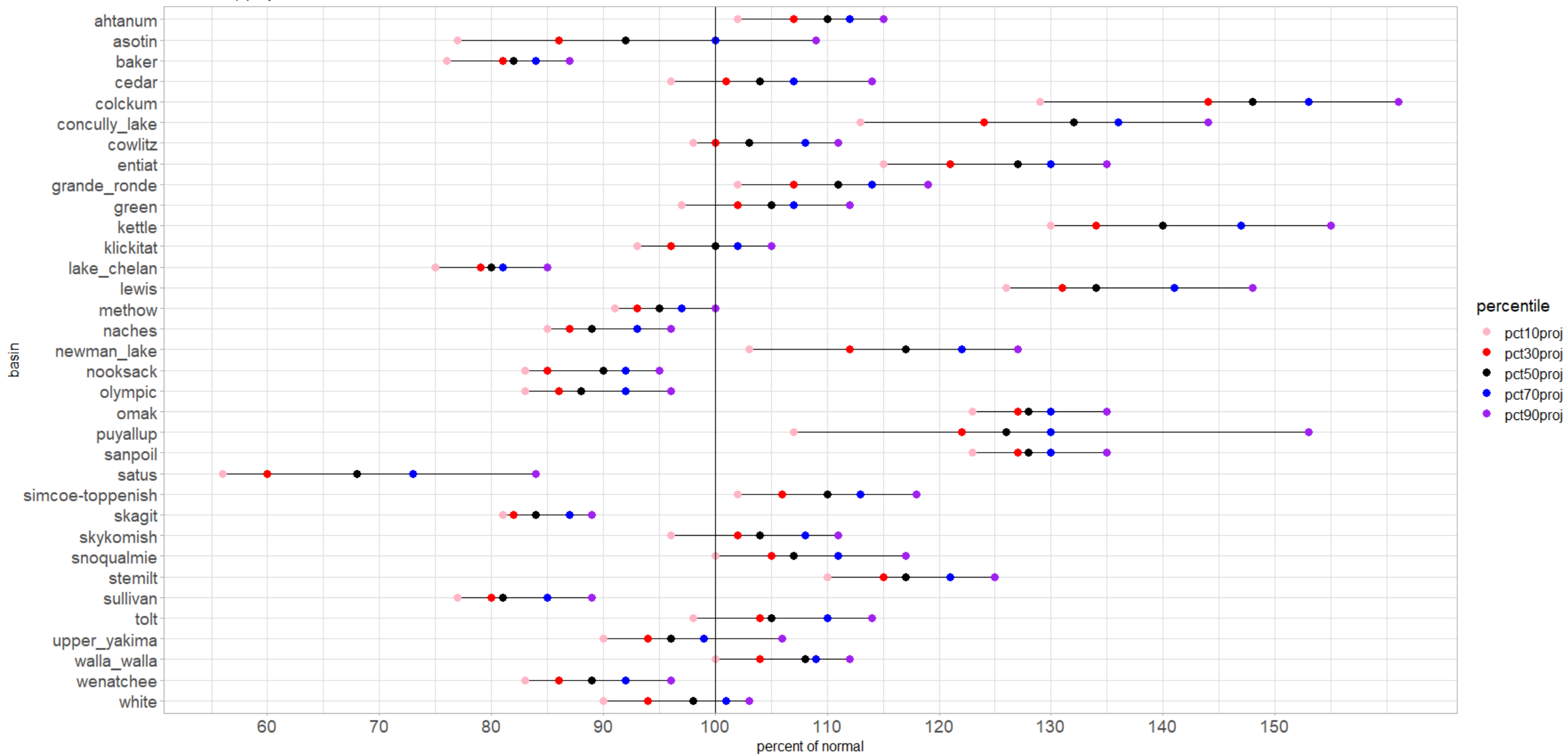
2023-03-24| forecast vs Chehalis at Porter reg flow





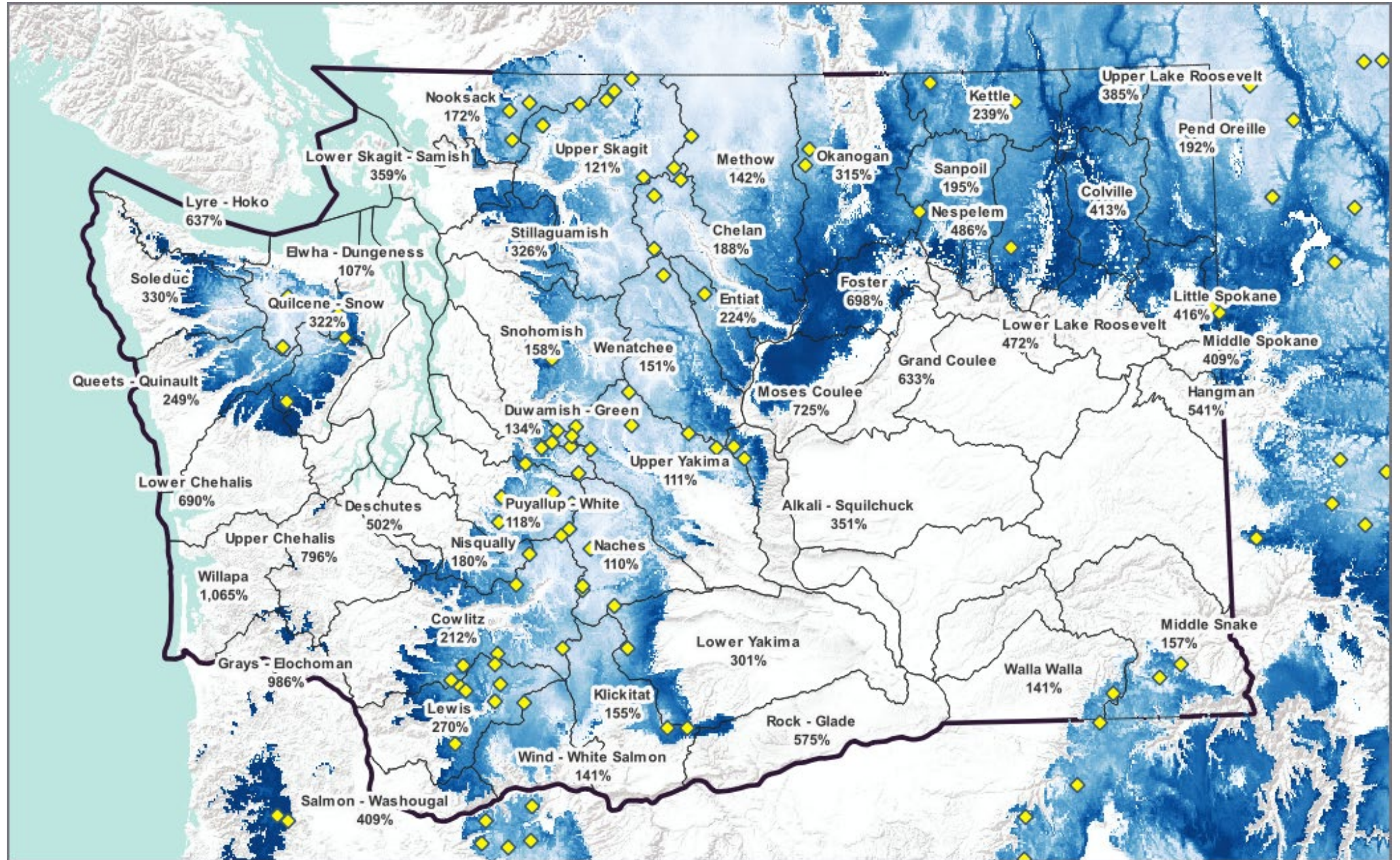
basin SWE projections to April 1 at a range of percentile levels of accumulation

NRCS Data | query date: 03-23



# SNODAS, PCT OF AVERAGE (2004-2023), AVERAGED BY WRIA, MARCH 22, 2023

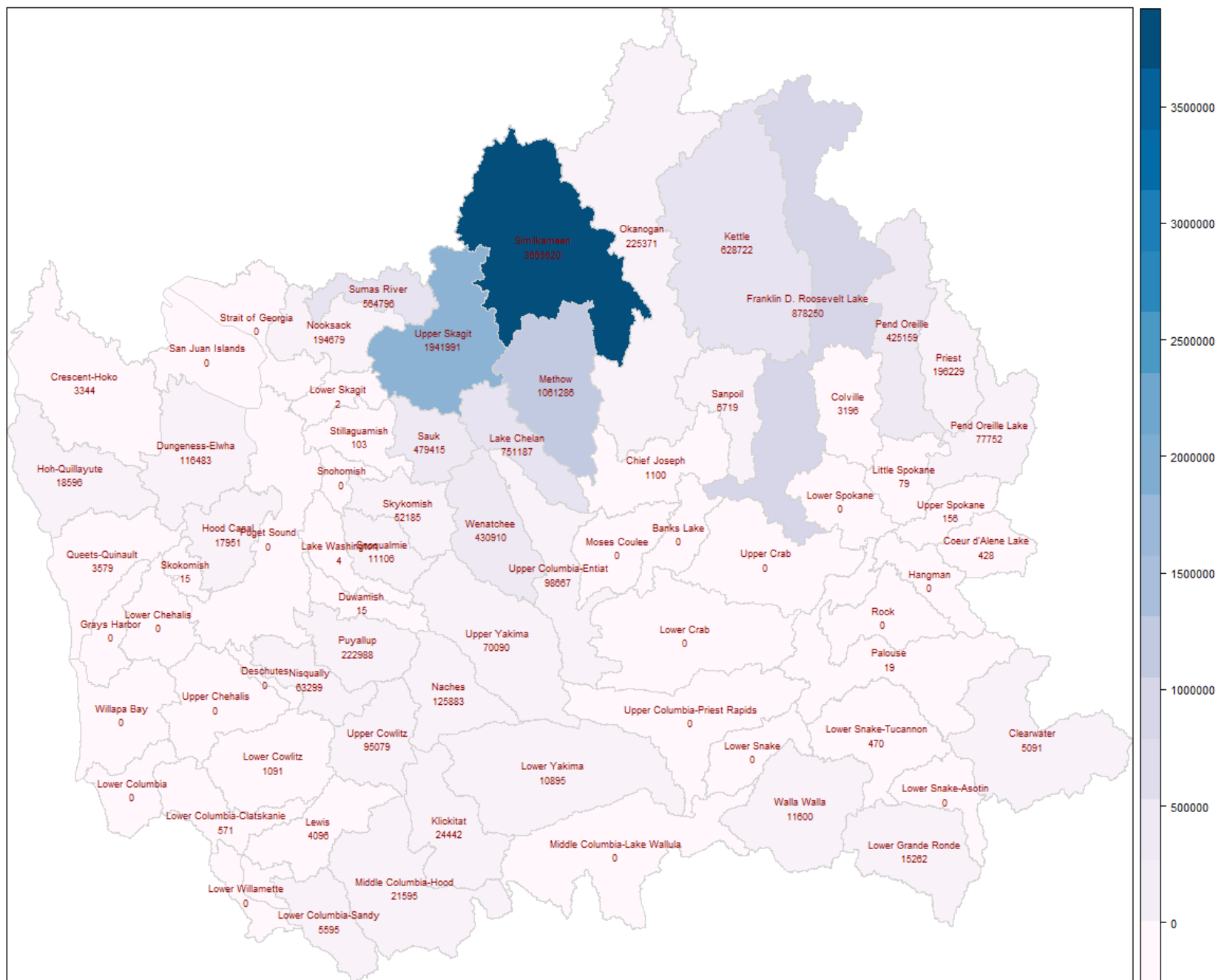
◆ SNOTEL





	States	03232023AcreFeet	03232015AcreFeet	Difference
Upper Chehalis	WA	3,797.00	-	(3,797.00)
Lower Chehalis	WA	56,071.00	-	(56,071.00)
Grays Harbor	WA	17,308.00	-	(17,308.00)
Willapa Bay	OR,WA	200.00	-	(200.00)
Duwamish	WA	158,404.00	15.00	(158,389.00)
Deschutes	WA	1,768.00	-	(1,768.00)
Strait of Georgia	CN,WA	10,168.00	-	(10,168.00)
San Juan Islands	CN,WA	-	-	-
Coeur d'Alene Lake	ID,WA	97,913.00	428.00	(97,485.00)
Wenatchee	WA	1,754,293.00	430,910.00	(1,323,383.00)
Upper Yakima	WA	1,204,122.00	70,090.00	(1,134,032.00)
Naches	WA	1,180,193.00	125,883.00	(1,054,310.00)
Upper Spokane	ID,WA	100,580.00	156.00	(100,424.00)
Rock	ID,WA	99.00	-	(99.00)
Pend Oreille Lake	ID,WA	605,900.00	77,752.00	(528,148.00)
Priest	CN,ID,WA	747,705.00	196,229.00	(551,476.00)
Hangman	ID,WA	3,731.00	-	(3,731.00)
Lower Columbia	OR,WA	1,828.00	-	(1,828.00)
Lower Spokane	WA	28,102.00	-	(28,102.00)
Little Spokane	ID,WA	96,837.00	79.00	(96,758.00)
Crescent-Hoko	CN,WA	108,158.00	3,344.00	(104,814.00)
Lower Snake-Tucannon	ID,WA	76,294.00	470.00	(75,824.00)
Palouse	ID,WA	56,908.00	19.00	(56,889.00)
Lower Snake	WA	-	-	-
Lake Washington	WA	95,025.00	4.00	(95,021.00)
Puyallup	WA	1,010,030.00	222,988.00	(787,042.00)
Skokomish	WA	219,516.00	15.00	(219,501.00)
Hood Canal	WA	603,563.00	17,951.00	(585,612.00)
Puget Sound	WA	-	-	-
Upper Skagit	CN,WA	3,309,107.00	1,941,991.00	(1,367,116.00)
Dungeness-Elwha	CN,WA	1,167,289.00	116,483.00	(1,050,806.00)
Nisqually	WA	384,303.00	63,299.00	(321,004.00)
Lewis	WA	904,070.00	4,096.00	(899,974.00)
Upper Cowlitz	WA	1,367,201.00	95,079.00	(1,272,122.00)
Lower Cowlitz	WA	337,809.00	1,091.00	(336,718.00)
Lower Columbia-Sandy	OR,WA	412,337.00	5,595.00	(406,742.00)
Lower Willamette	OR	2.00	-	(2.00)
Clearwater	ID,WA	489,144.00	5,091.00	(484,053.00)
Lower Snake-Asotin	ID,OR,WA	60,049.00	-	(60,049.00)
Colville	WA	276,017.00	3,196.00	(272,821.00)
Sanpoil	WA	318,661.00	6,719.00	(311,942.00)
Chief Joseph	WA	153,966.00	1,100.00	(152,866.00)
Methow	WA	1,465,135.00	1,061,286.00	(403,849.00)
Lake Chelan	WA	1,016,303.00	751,187.00	(265,116.00)
Upper Columbia-Entiat	WA	499,105.00	98,667.00	(400,438.00)
Moses Coulee	WA	50,838.00	-	(50,838.00)
Upper Crab	WA	-	-	-
Banks Lake	WA	962.00	-	(962.00)
Lower Crab	WA	-	-	-
Upper Columbia-Priest Rapids	WA	-	-	-
Lower Yakima	WA	348,697.00	10,895.00	(337,802.00)
Franklin D. Roosevelt Lake	CN,WA	2,180,254.00	878,250.00	(1,302,004.00)
Kettle	CN,WA	2,528,185.00	628,722.00	(1,899,463.00)
Okanogan	CN,WA	1,214,586.00	225,371.00	(989,215.00)
Similkameen	CN,WA	2,363,213.00	3,665,620.00	1,302,407.00
Pend Oreille	CN,ID,WA	1,145,297.00	425,159.00	(720,138.00)
Middle Columbia-Lake Wallula	OR,WA	12,814.00	-	(12,814.00)
Walla Walla	OR,WA	190,804.00	11,600.00	(179,204.00)
Klickitat	WA	895,746.00	24,442.00	(871,304.00)
Hoh-Quillayute	WA	416,820.00	18,596.00	(398,224.00)
Lower Columbia-Clatskanie	OR,WA	76,679.00	571.00	(76,108.00)
Skykomish	WA	942,089.00	52,185.00	(889,904.00)
Sumas River	CN,WA	967,724.00	564,796.00	(402,928.00)
Queets-Quinault	WA	565,260.00	3,579.00	(561,681.00)
Nooksack	CN,WA	964,817.00	194,679.00	(770,138.00)
Sauk	WA	1,094,078.00	479,415.00	(614,663.00)
Lower Skagit	WA	131,497.00	2.00	(131,495.00)
Stillaguamish	WA	334,470.00	103.00	(334,367.00)
Snoqualmie	WA	517,736.00	11,106.00	(506,630.00)
Snohomish	WA	7,168.00	-	(7,168.00)
Lower Grande Ronde	OR,WA	575,871.00	15,262.00	(560,609.00)
Middle Columbia-Hood	OR,WA	1,358,800.00	21,595.00	(1,337,205.00)
		39,283,416.00	12,533,161.00	(26,750,255.00)

**total volume of snow storage (acre-feet) by basin (HUC8)**



total acre feet: 12533161

file:SNODAS\_20150323.tif



# Current Conditions and Seasonal Outlook

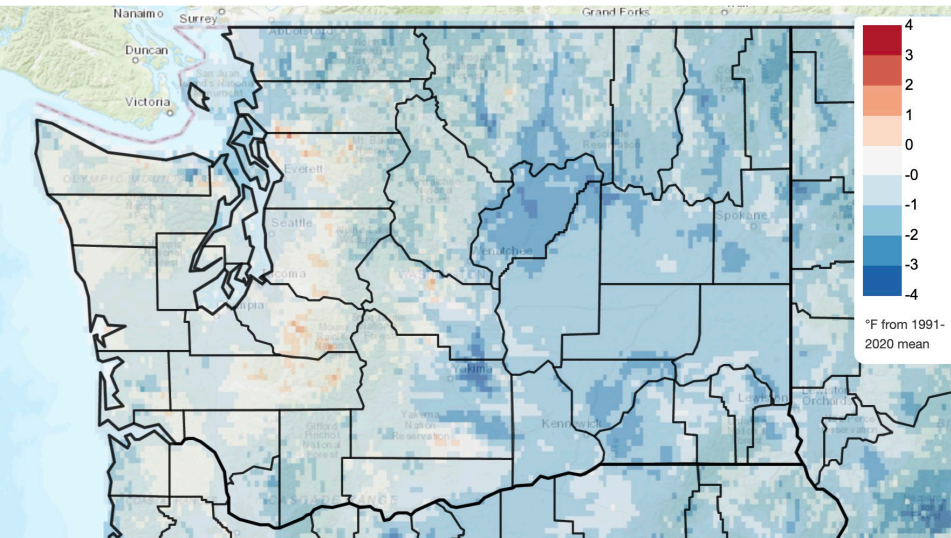
Nick Bond & Karin Bumbaco  
Office of the Washington State Climatologist  
Cooperative Institute for Climate, Ocean, and Ecosystem Studies  
University of Washington  
24 March 2023

# Water Year 2023

## Temperature

Mean Daily Temperature Anomaly, Since Oct 1st

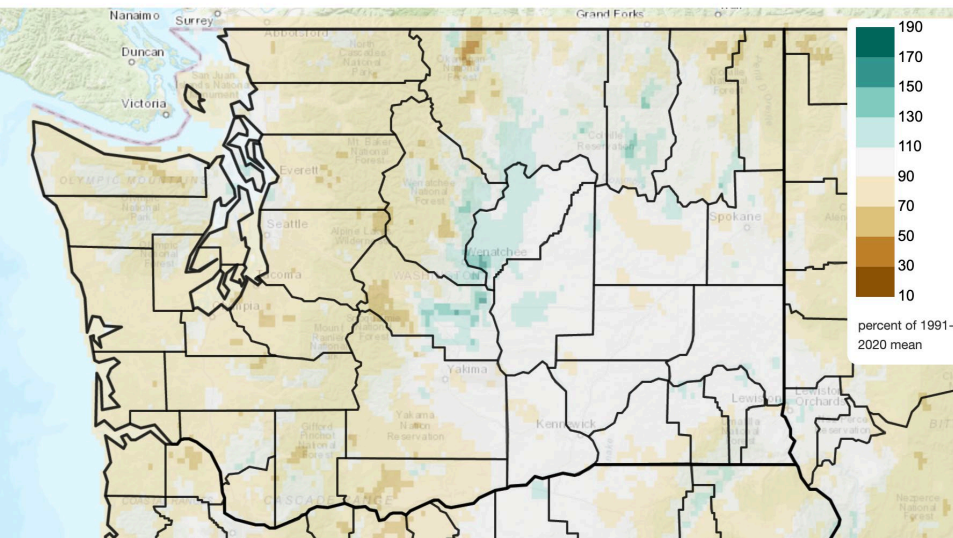
2022/10/01 - 2023/03/20



## Precipitation

Total Precipitation Anomaly, Since Oct 1st

2022/10/01 - 2023/03/20



Climate Toolbox

- Averaged statewide, Oct-Feb temperatures below normal\* (-0.7°F)
- Averaged statewide, Oct-Feb precipitation ranks as the 30<sup>th</sup> driest (-4.22")\*

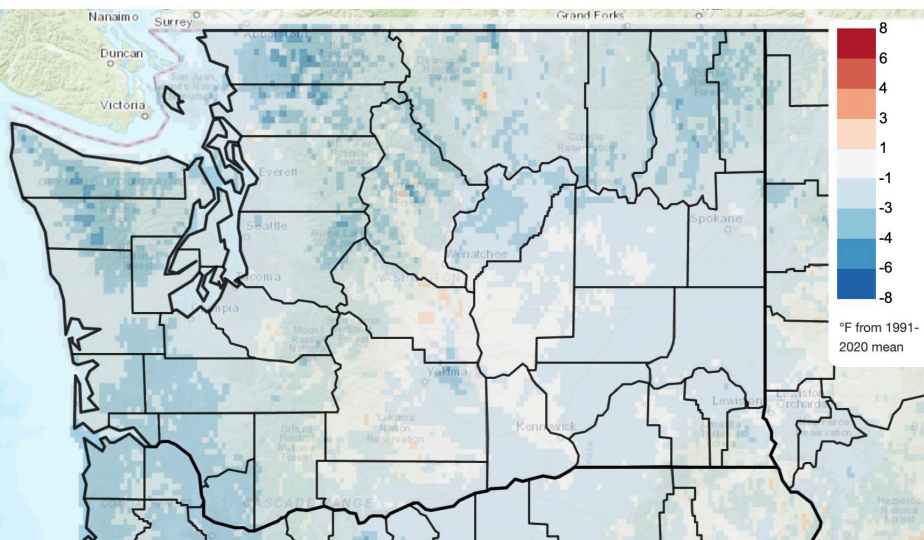
\*Records since 1895; 1991-2020 normal

# February 2023

## Temperature

### Mean Daily Temperature Anomaly, Last Full Month

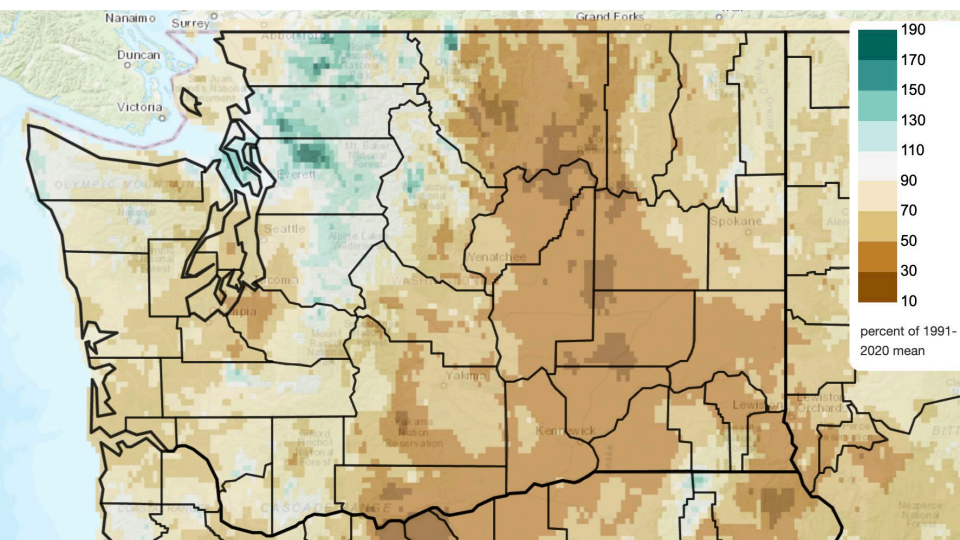
2023/02/01 - 2023/02/28



## Precipitation

### Total Precipitation Anomaly, Last Full Month

2023/02/01 - 2023/02/28



Climate Toolbox

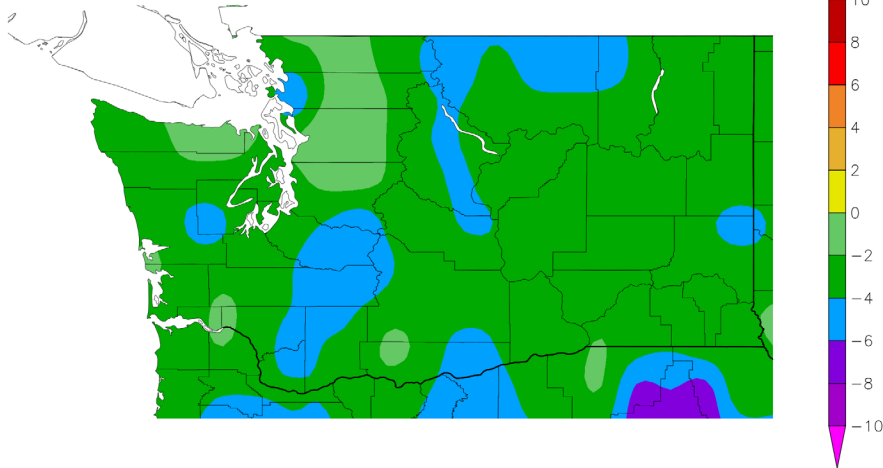
- Averaged statewide, February was the 51<sup>st</sup> coldest on record ( $-1.9^{\circ}\text{F}$ )\*
- Averaged statewide, February was the 31<sup>st</sup> driest ( $-1.03''$ ) on record\*

\*Records since 1895

# March 2023 so far

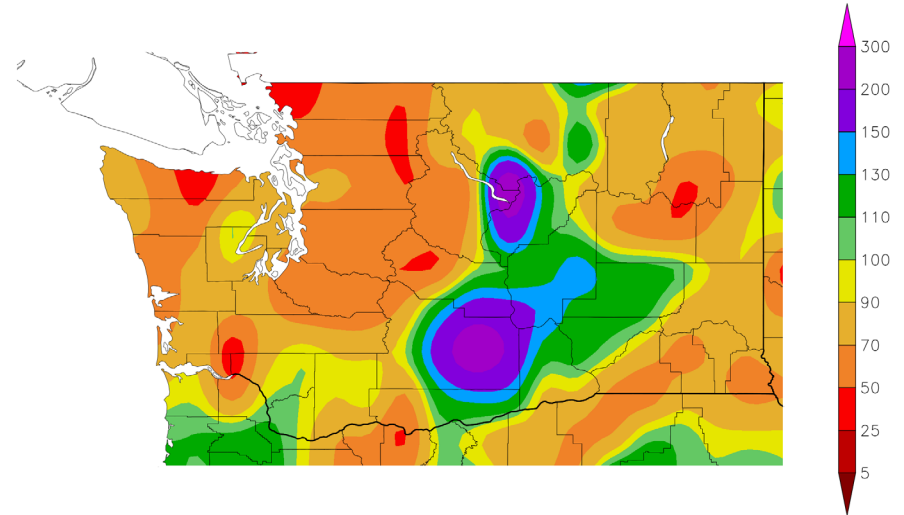
## Temperature

Departure from Normal Temperature (F)  
3/1/2023 – 3/21/2023



## Precipitation

Percent of Normal Precipitation (%)  
3/1/2023 – 3/21/2023



Generated 3/22/2023 at HPRCC using provisional data.

NOAA Regional Climate Centers

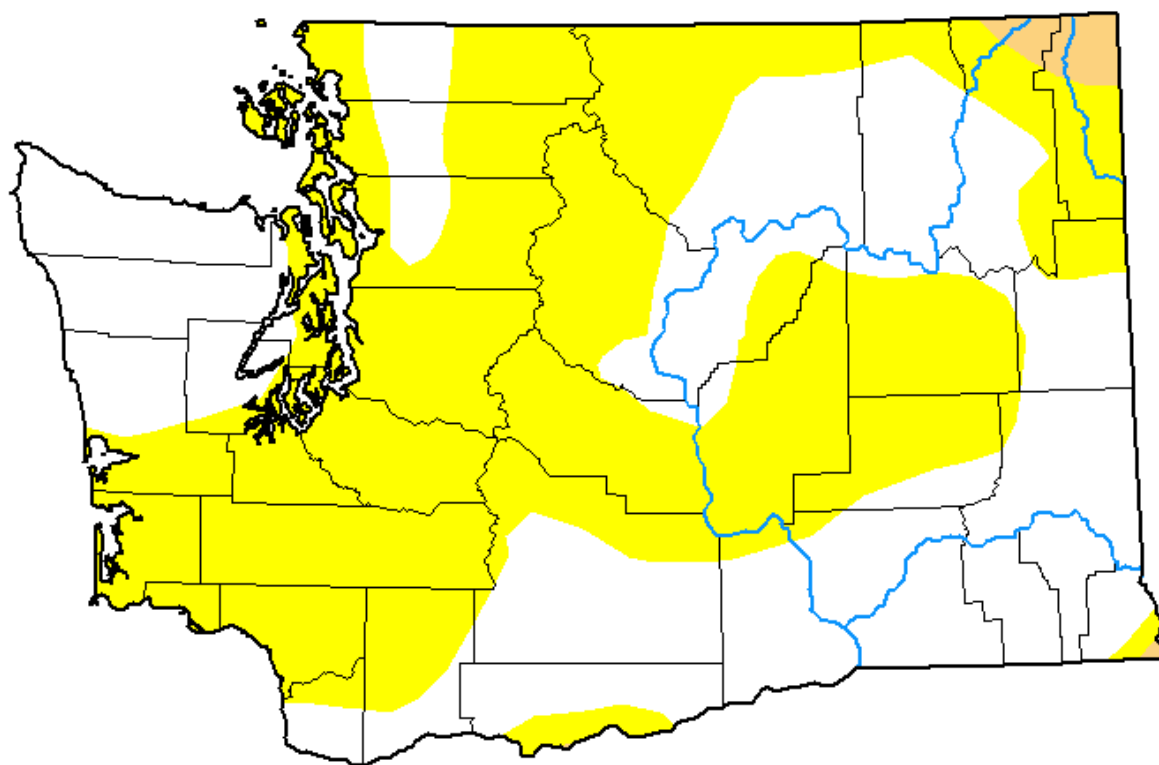
Generated 3/22/2023 at HPRCC using provisional data.

NOAA Regional Climate Centers







HPRCC

# U.S. Drought Monitor Washington

**March 21, 2023**  
(Released Thursday, Mar. 23, 2023)  
Valid 8 a.m. EDT



## 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>*

## Author:

Curtis Riganti  
National Drought Mitigation Center



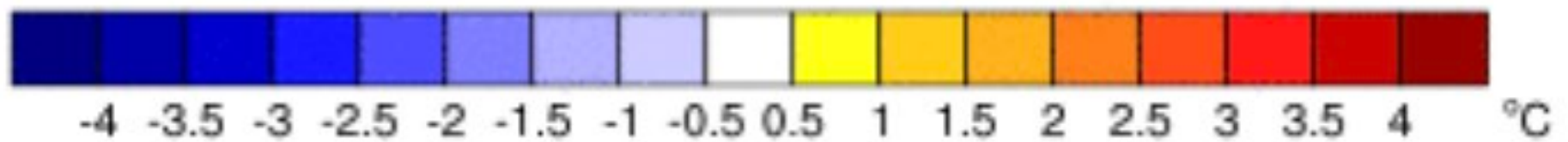
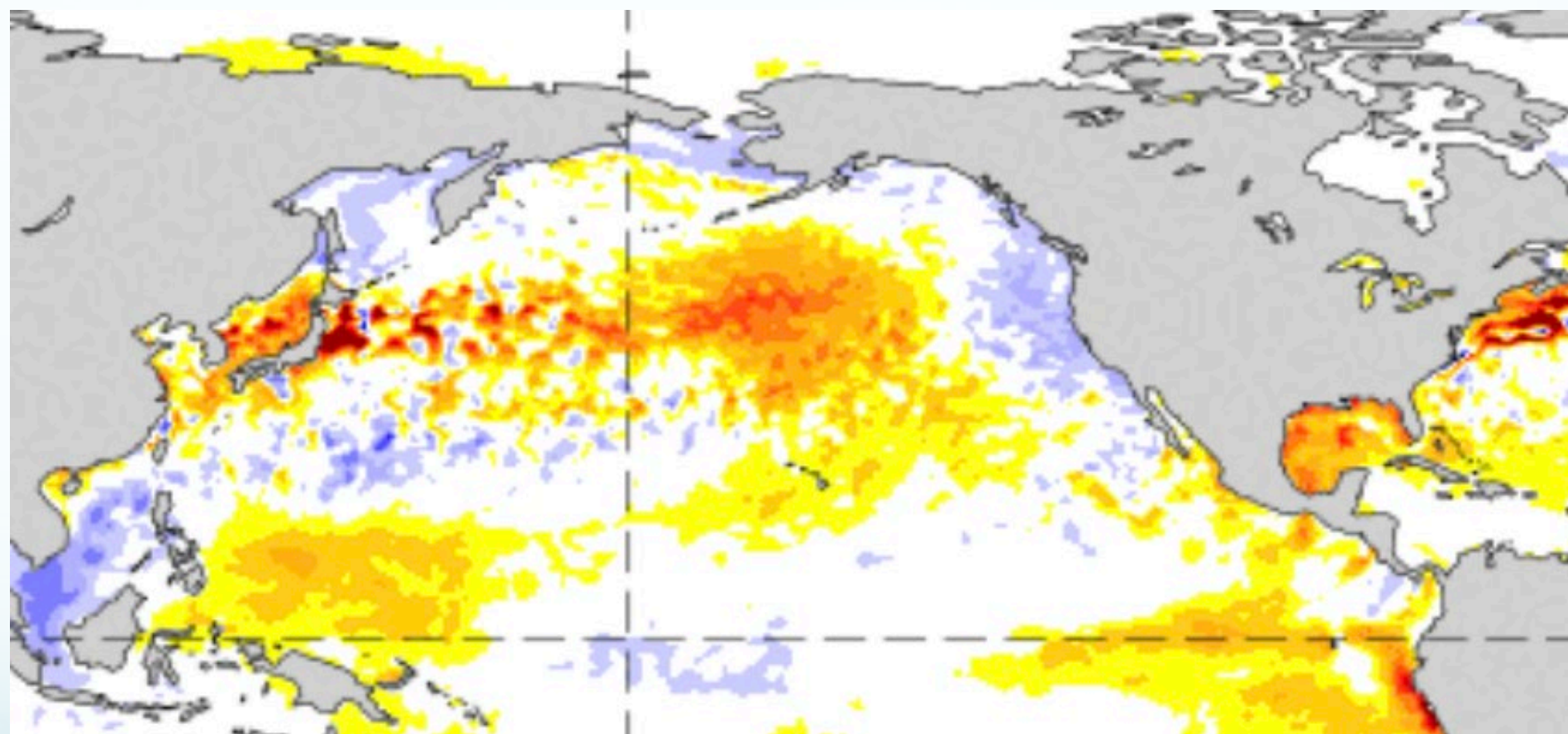
**droughtmonitor.unl.edu**

# PNW Water Year Impacts Assessment

<https://www.drought.gov/documents/2022-pacific-northwest-water-year-impacts-assessment>

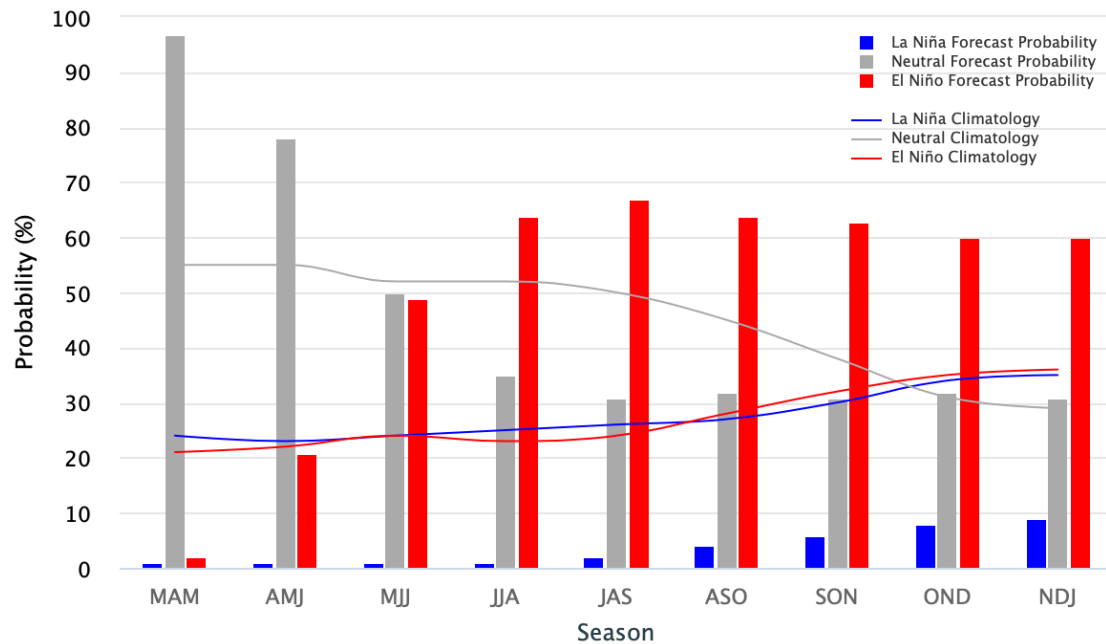
 <h1>2022</h1> <h2>PACIFIC NORTHWEST WATER YEAR</h2> <h3>IMPACTS ASSESSMENT</h3>	 <h1>2022</h1> <h2>PACIFIC NORTHWEST WATER YEAR</h2> <h3>IMPACTS ASSESSMENT</h3> <p><b>Lesson 1.1: For the second year in a row, spring was critical in determining the magnitude and extent of drought.</b> The record wet April–June in 2022 was the mirror image of the record dry April–June 2021. Above normal precipitation and below normal temperatures in April–June drastically changed the outlook for drought for the remainder of the water year. This demonstrates the limitations of April 1 conditions for predicting water shortages and impacts later in the water year. Additionally, two sequential, anomalous springs potentially undermined the confidence of the public and natural resource managers in seasonal forecasts.</p>	<h2>TABLE OF CONTENTS</h2> <h1>2022</h1> <h2>PACIFIC NORTHWEST WATER YEAR</h2> <h3>IMPACTS ASSESSMENT</h3> <p>Supported by the NOAA National Drought Information System</p> <p></p> <p>ON THE COVER: The Skagit River delta near Mt. Vernon, Washington. Credit: Edmund Lowe</p>	<h2>Executive Summary</h2> <h3>1 Purpose</h3> <h3>2 Lessons Learned</h3> <h3>3 Water Year Evolution</h3> <p>Water Year Summary Seasonal Progression</p> <ul style="list-style-type: none"><li>• October–November 2021</li><li>• December 2021</li><li>• January–March 2022</li><li>• April–June 2022</li><li>• July–September 2022</li></ul> <p>Multi-Year Drought</p> <h3>4 Water Year Impacts</h3> <p>Annual Pacific Northwest Water Year Impacts Survey Sector-Specific Water Year Impacts</p> <ul style="list-style-type: none"><li>• Drinking Water</li><li>• Agriculture</li><li>• Forestry</li><li>• Fisheries</li><li>• Hydropower</li><li>• Recreation</li><li>• Stormwater</li></ul> <h3>5 State-Level &amp; Sector-Specific Responses</h3> <p>State Responses Sector-Specific Changes in Operations Changes in Operations Based on Forecast Conditions</p> <h3>6 Forecast Verification</h3> <p>January–March 2022 Forecast and Verification April–June 2022 Forecast and Verification</p> <h2>References</h2>
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## Sea Surface Temperature Anomalies: 12-18 March 2023



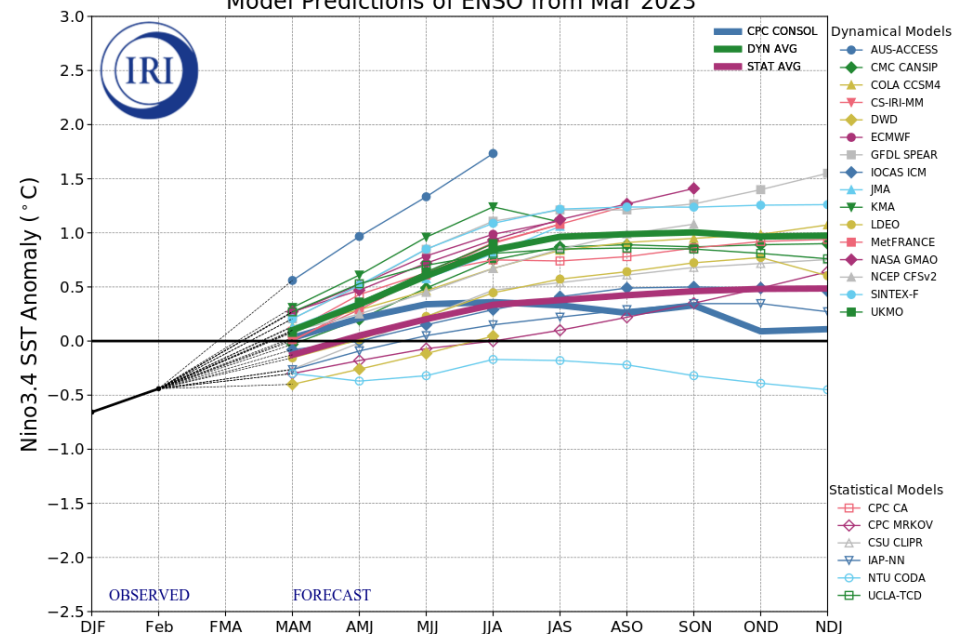
## Mid-March 2023 IRI Model-Based Probabilistic ENSO Forecasts

ENSO state based on NINO3.4 SST Anomaly Neutral ENSO:  $-0.5^{\circ}\text{C}$  to  $0.5^{\circ}\text{C}$

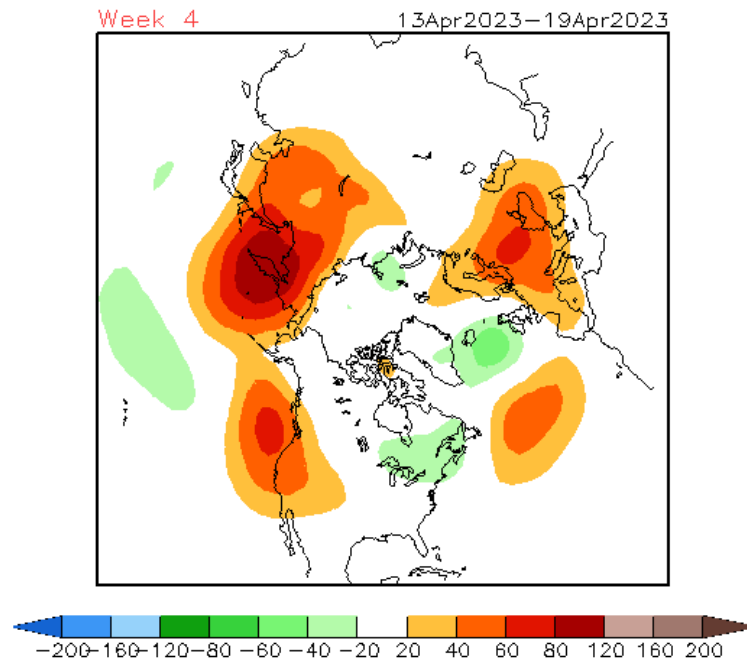
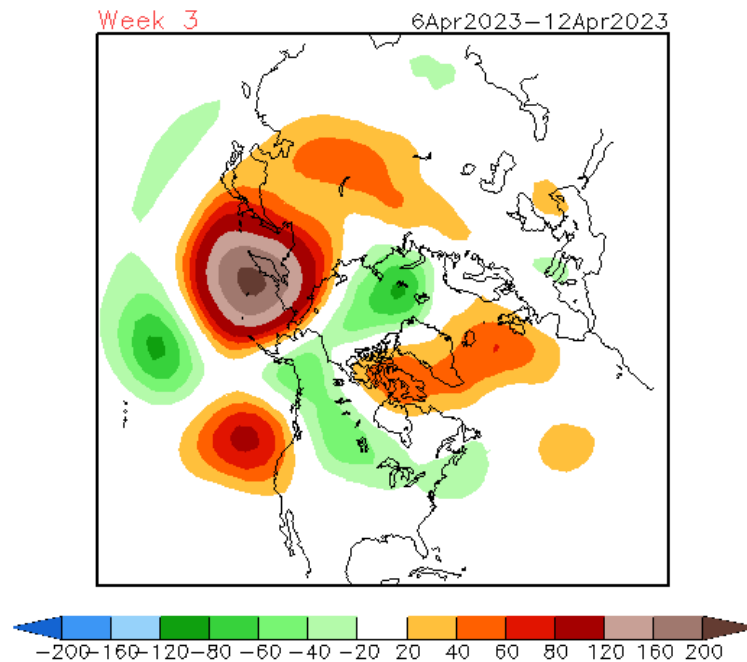


**Latest ENSO predictions suggest that El Niño may soon be rearing its ugly head**

## Model Predictions of ENSO from Mar 2023

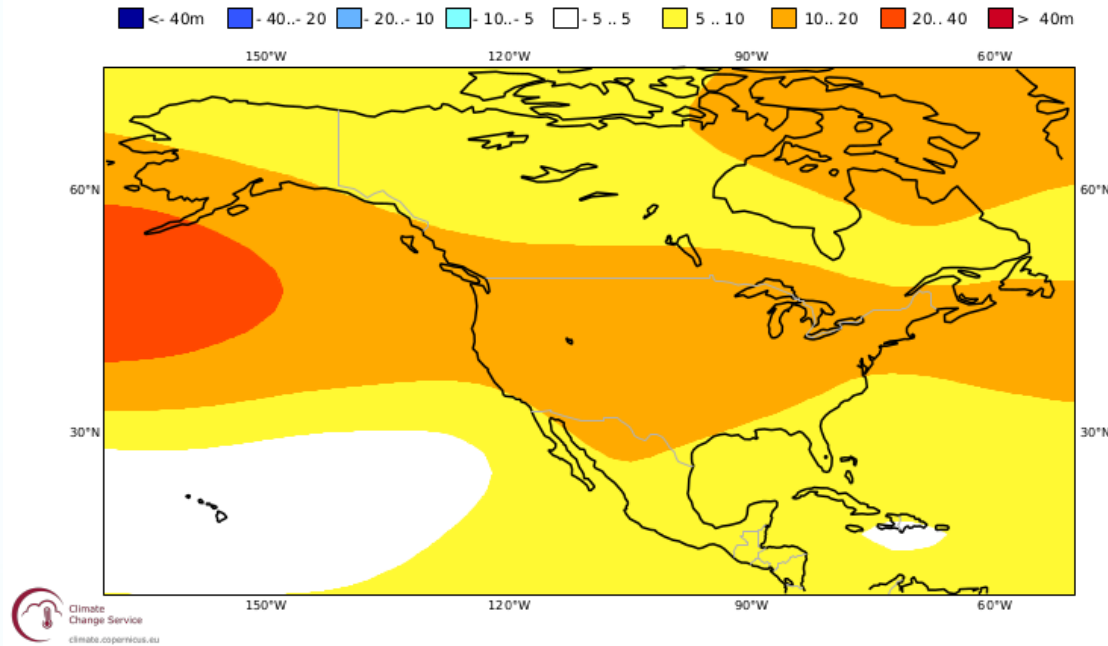


CFSv2 Weeks 3 & 4 500 hPa Z Anomalies (m)  
16 Member Ensemble Mean Forecast from 22Mar2023



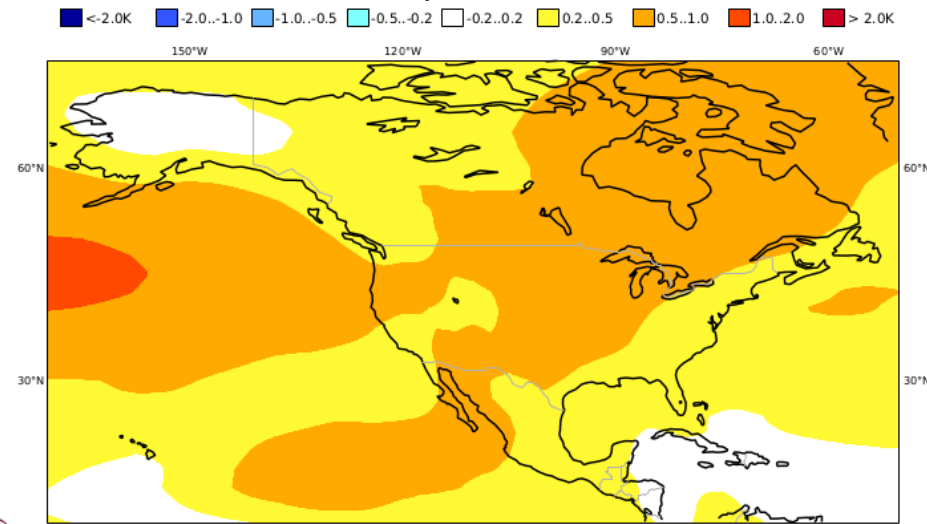
**CFS 3 & 4 Week 500 hPa  
Model Projections:  
Cool Early and Dry Late**

## 500 hPa Z

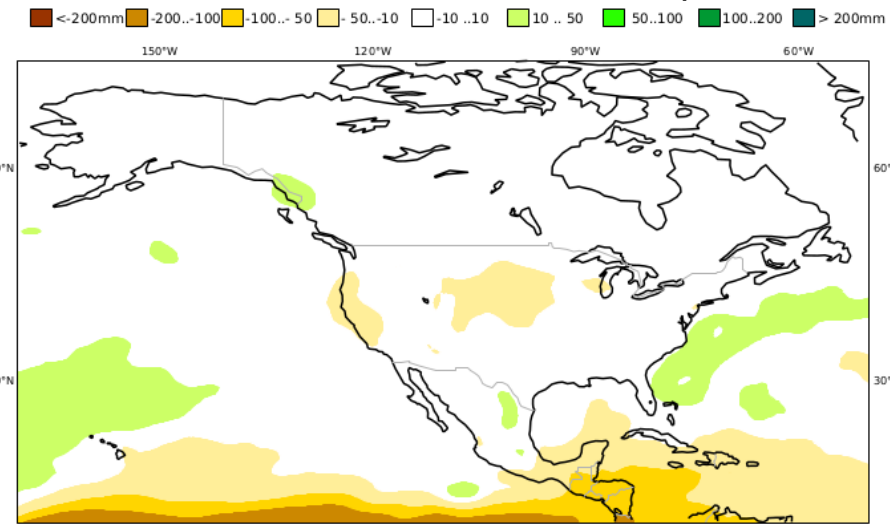


**IMME Projections  
for Apr-Jun:  
Higher 500 hPa Z  
and warmer  
temperatures aloft  
may result in an  
early melt**

## Temperature at 850 hPa

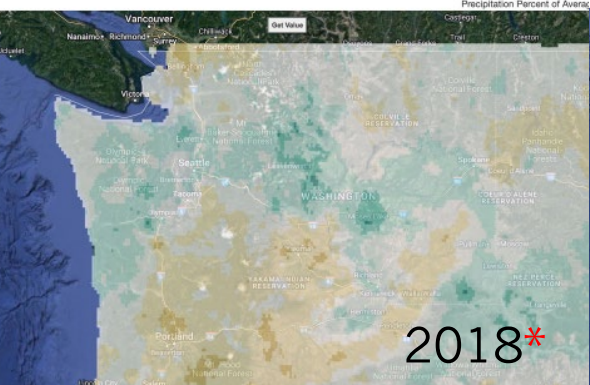


## Precipitation



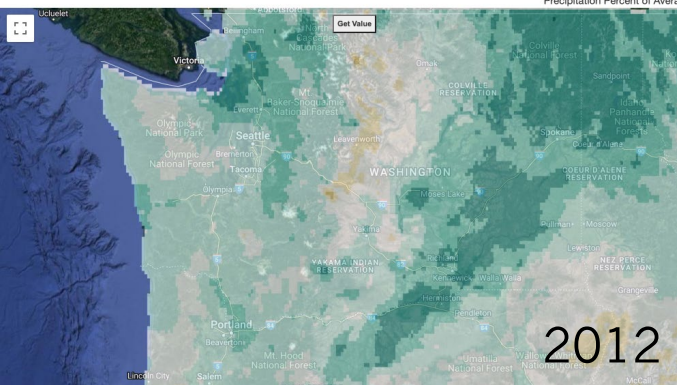
Precipitation Percent Of Average (gridMET)

2018-04-01 to 2018-06-30, Total, vs. 1991 - 2020



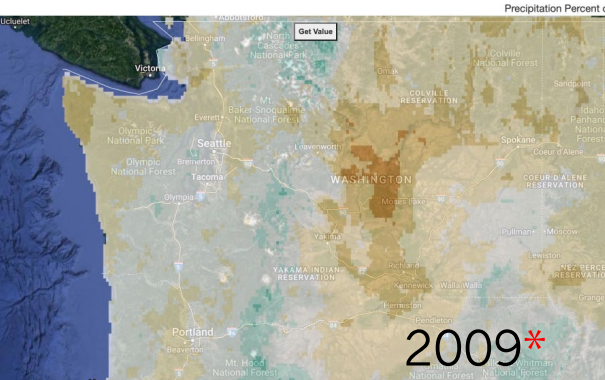
Precipitation Percent Of Average (gridMET)

2012-04-01 to 2012-06-30, Total, vs. 1991 - 2020



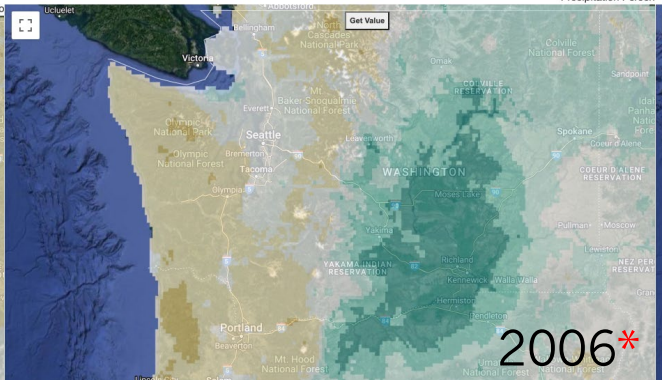
Precipitation Percent Of Average (gridMET)

2009-04-01 to 2009-06-30, Total, vs. 1991 - 2020



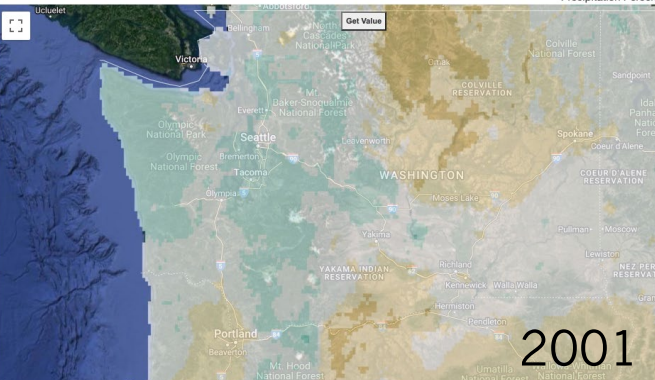
Precipitation Percent Of Average (gridMET)

2006-04-01 to 2006-06-30, Total, vs. 1991 - 2020



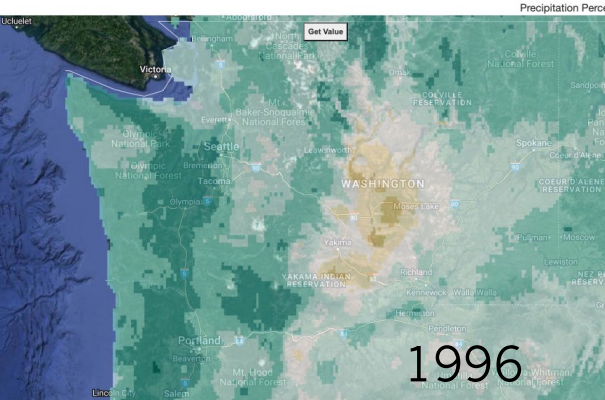
Precipitation Percent Of Average (gridMET)

2001-04-01 to 2001-06-30, Total, vs. 1991 - 2020



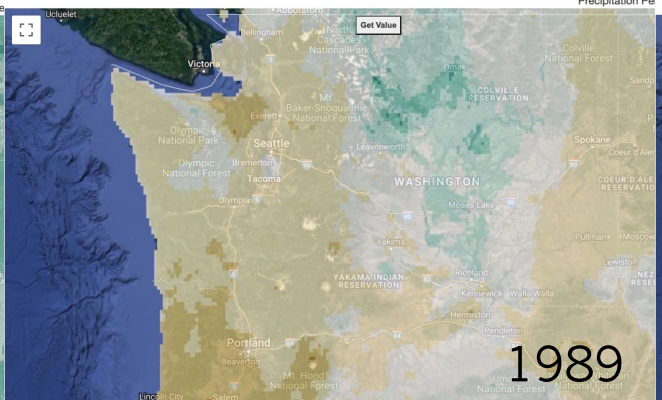
Precipitation Percent Of Average (gridMET)

1996-04-01 to 1996-06-30, Total, vs. 1991 - 2020



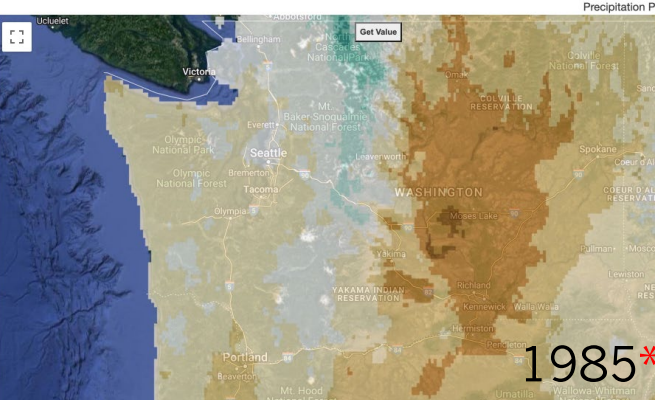
Precipitation Percent Of Average (gridMET)

1989-04-01 to 1989-06-30, Total, vs. 1991 - 2020



Precipitation Percent Of Average (gridMET)

1985-04-01 to 1985-06-30, Total, vs. 1991 - 2020



Precipitation anomalies during the past 8 springs (AMJ) featuring the demise of La Nina

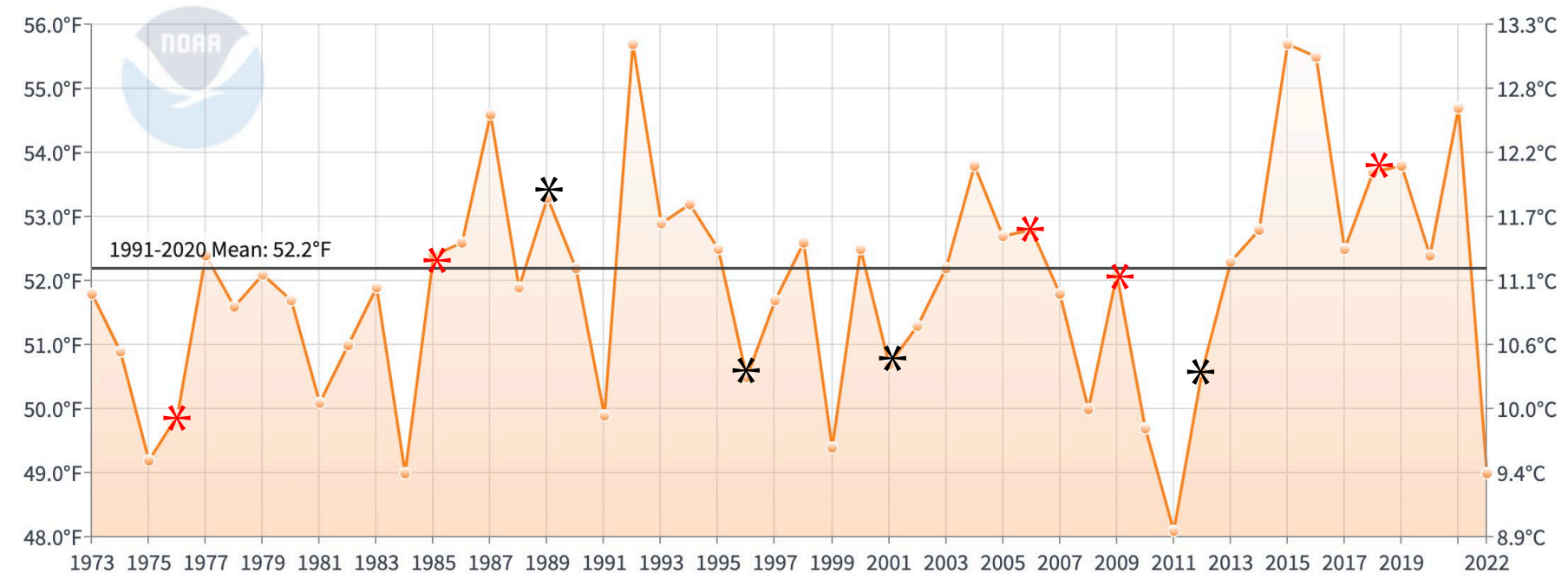
(\*'s refer to years with El Nino by autumn)

# WA Statewide Temperatures (Apr-Jun)

\*'s followed by Neutral; \*'s followed by El Nino

## Washington Average Temperature

April-June



Powered by ZingChart



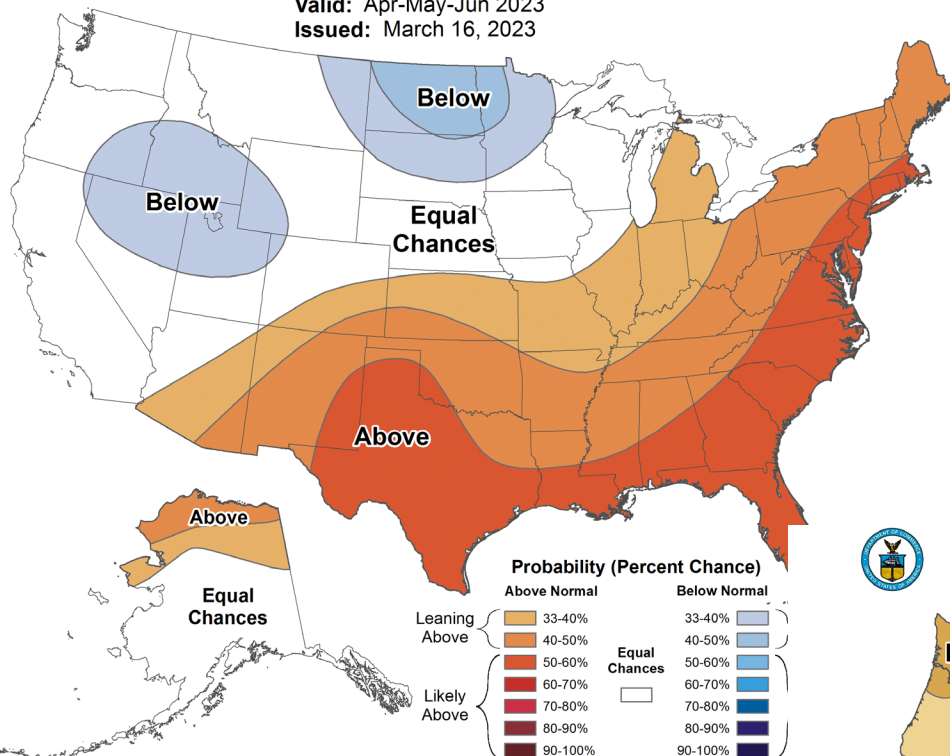
# Seasonal Temperature Outlook

Valid: Apr-May-Jun 2023

Issued: March 16, 2023



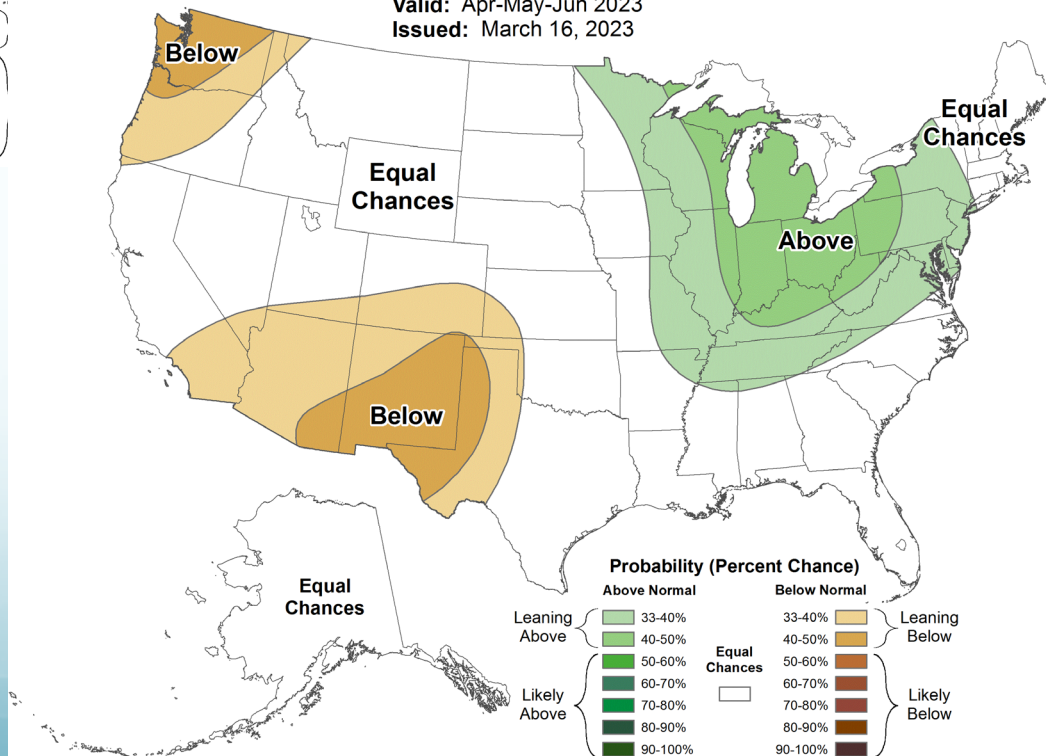
## NOAA/CPC Forecasts for April-June 2023



# Seasonal Precipitation Outlook

Valid: Apr-May-Jun 2023

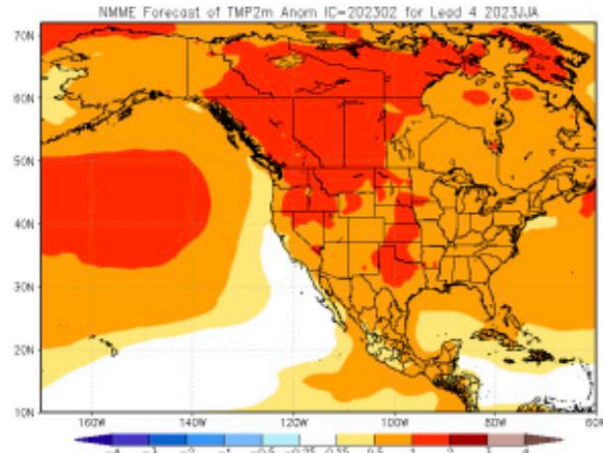
Issued: March 16, 2023



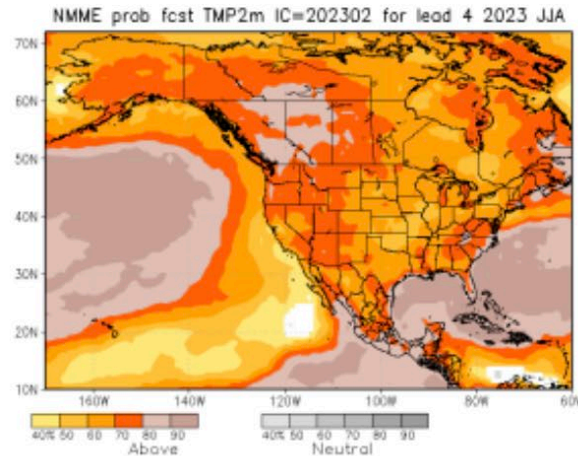
# NMME Temperature Projections for Summer (JJA) 2023

From Feb 2023

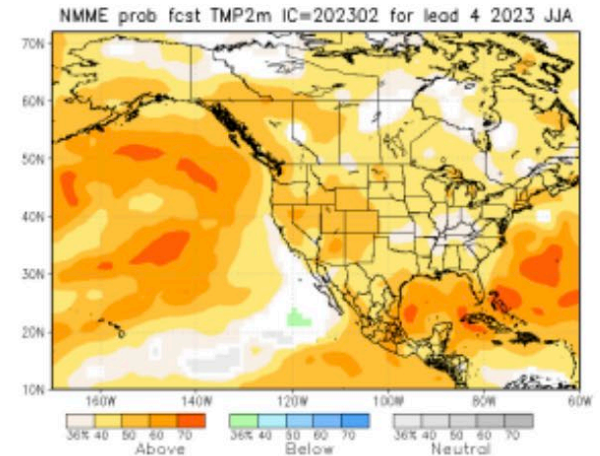
NMME



Prob fcast

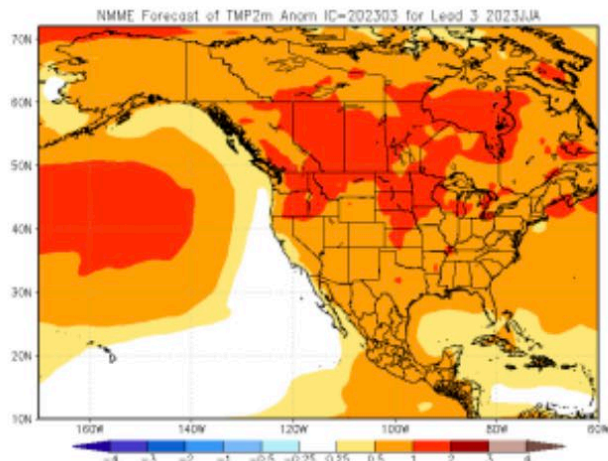


PAC calib. prob fcast

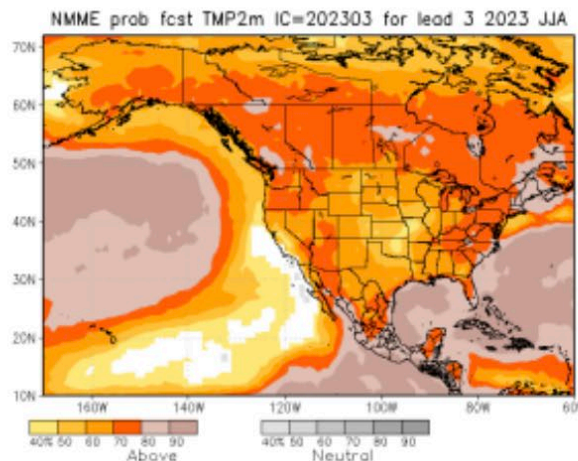


From Mar 2023

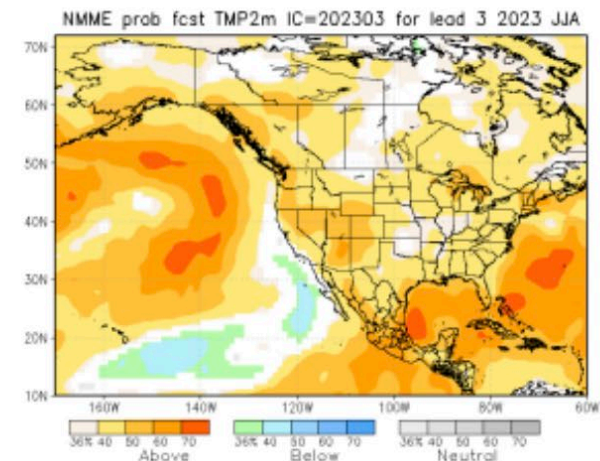
NMME



Prob fcast



PAC calib. prob fcast



# Summary

- Water year to date now colder than normal throughout all of WA; mostly drier than normal except for parts of eastern WA
- Cooler and drier than normal conditions have persisted for most of the state since February and "abnormally dry" conditions have expanded on the USDM
- Effects of La Nina may persist – to an extent – into April resulting in some snow at higher elevations, but for the most part, what you see is what you get
- Potential for hard frosts remains, especially in the southern Puget Sound region
- Spring 2023: *Here Comes the Sun* (with apologies to the Beatles)



Natural Resources Conservation Service  
U.S. DEPARTMENT OF AGRICULTURE

 Search



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# Washington Snow Survey & Water Supply Program

## WSAC March 2023

[Home](#) > [Conservation Basics](#) > [Conservation By State](#) > [Washington](#) > [Washington Snow Survey & Water Supply Program](#)

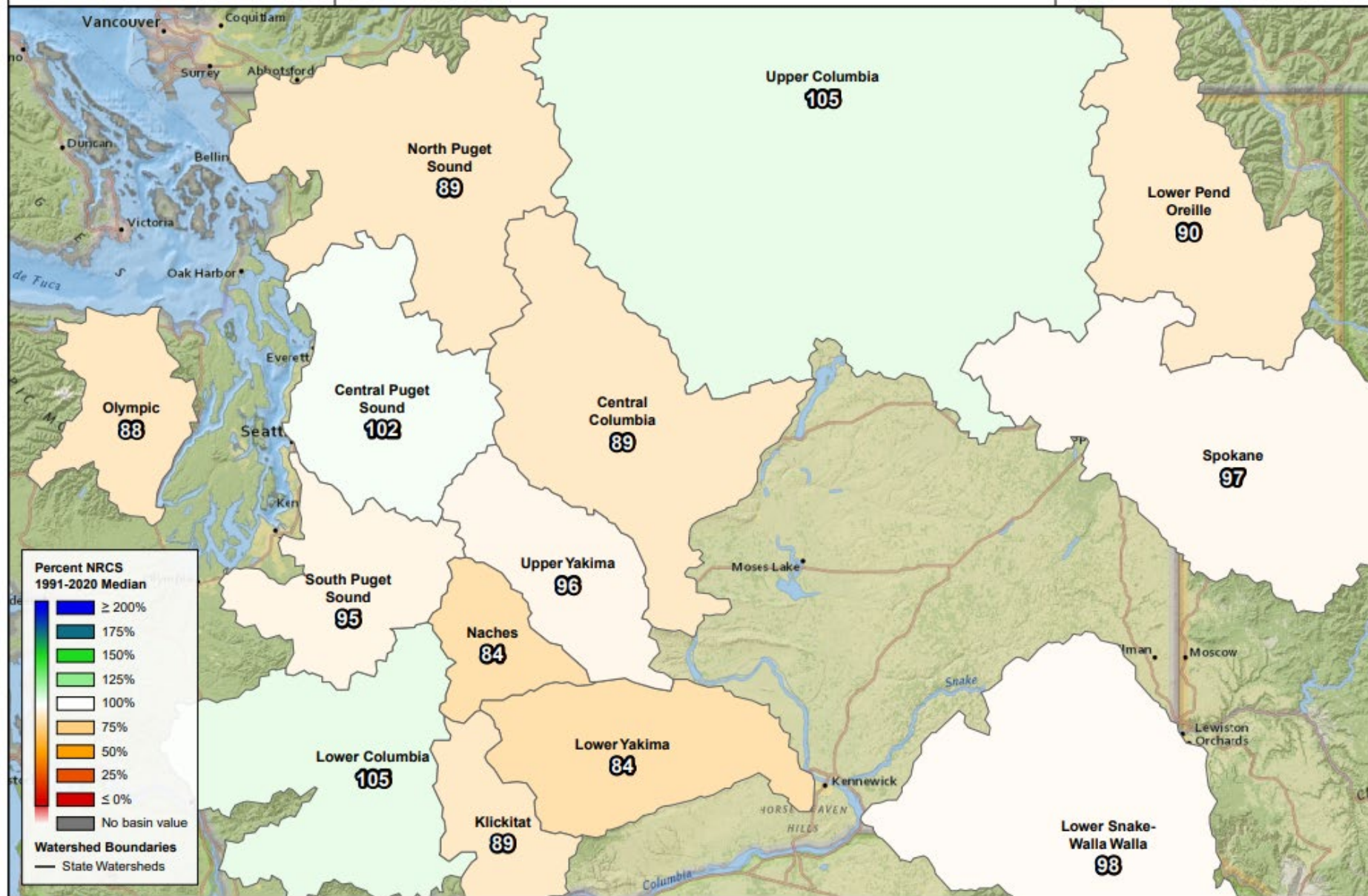
The NRCS Snow Survey Program provides mountain snowpack data and streamflow forecasts for the western United States. Applications of snow survey products include water supply management, flood control, climate modeling, recreation, and



Snow Water Equivalent

Percent NRCS 1991-2020 Median

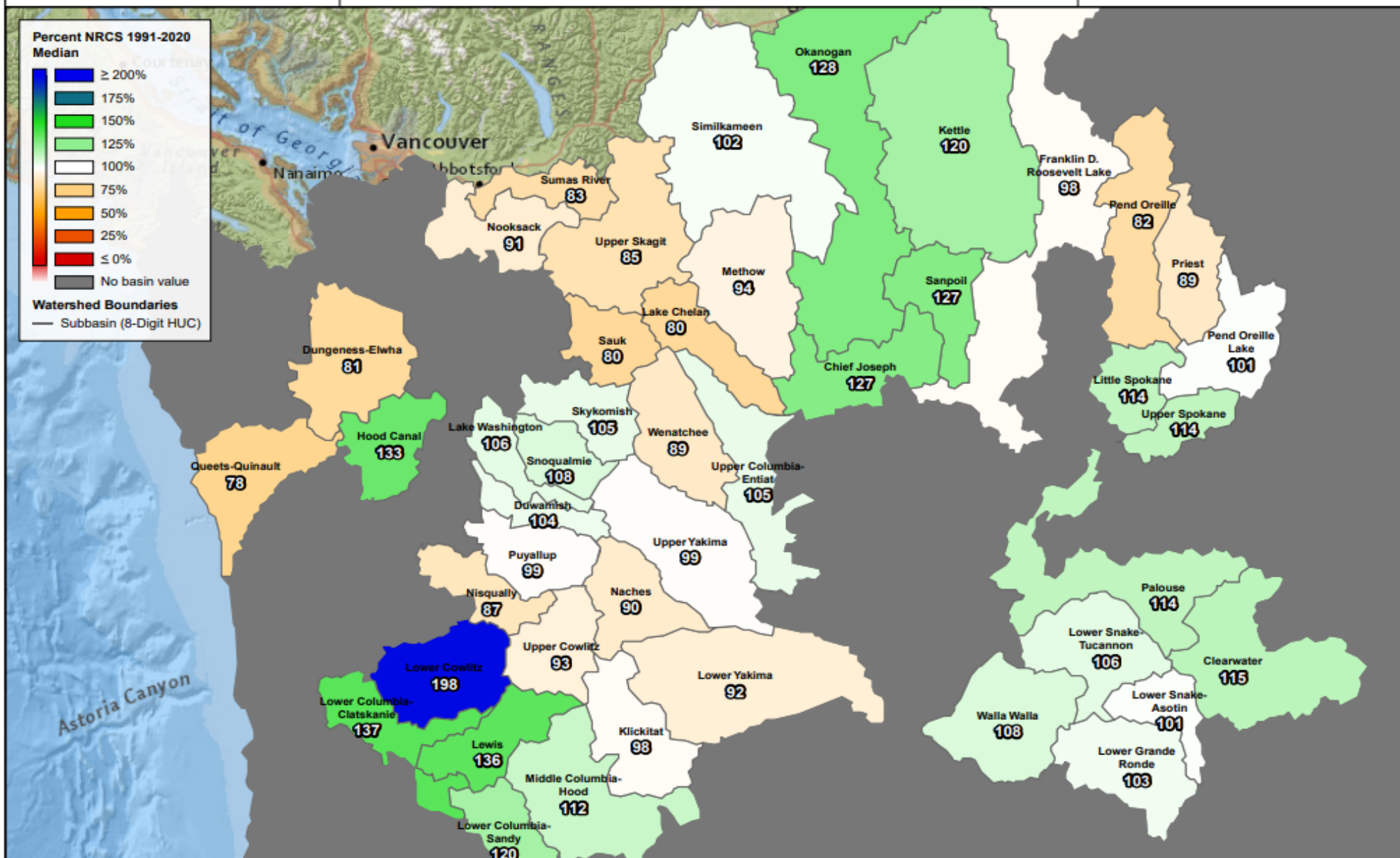
March 1, 2023, first of day



Snow Water Equivalent

Percent NRCS 1991-2020 Median

March 23, 2023, first of day



Natural Resources  
Conservation Service  
United States Department of Agriculture



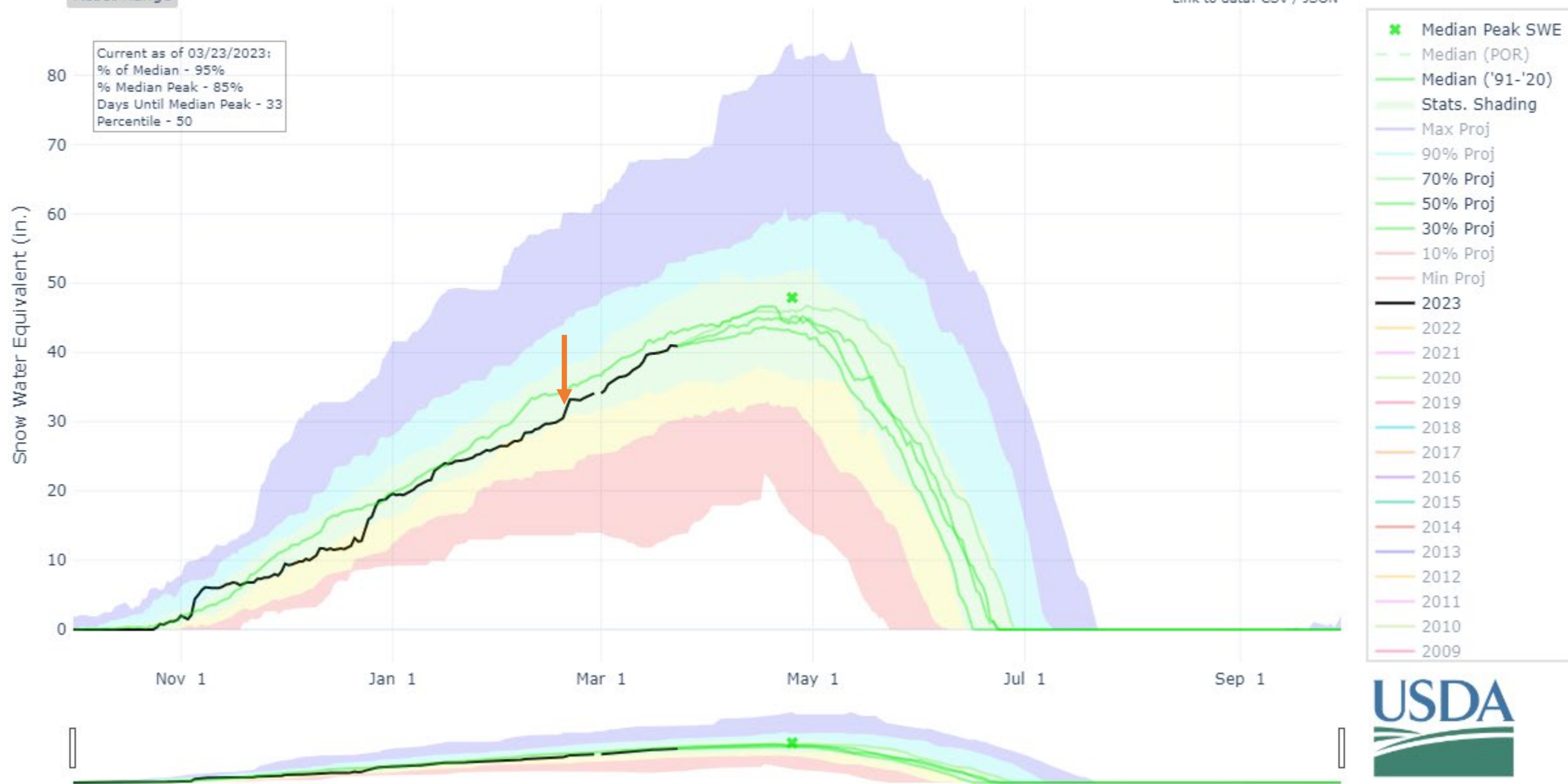
0 10 20 40 60 80 100 Miles

Created 3-23-2023

# SNOW WATER EQUIVALENT PROJECTIONS AT HARTS PASS

Reset Range

[Link to data: CSV / JSON](#)



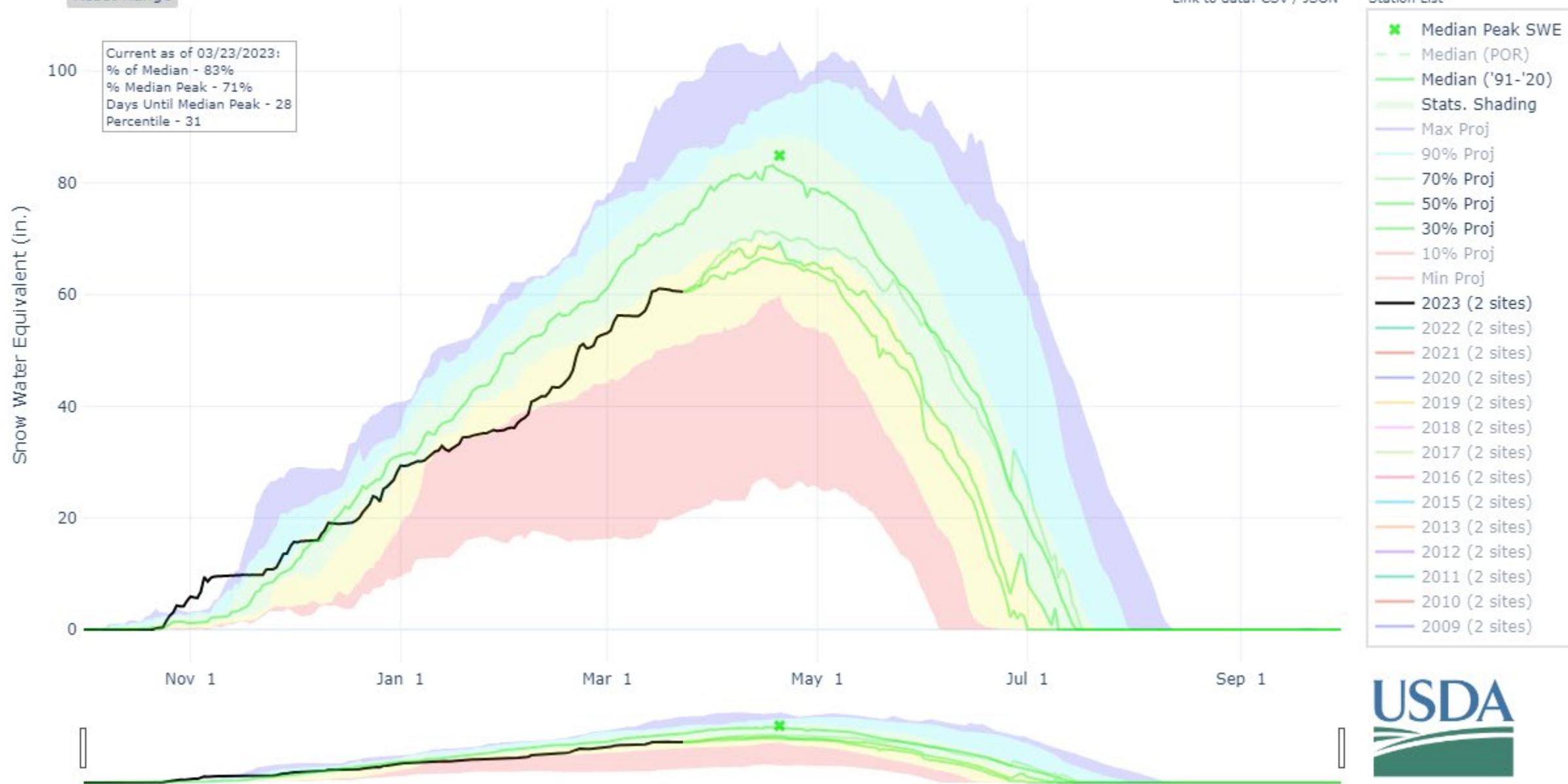
# SNOW WATER EQUIVALENT PROJECTIONS IN BAKER

Reset Range

[Link to data: CSV / JSON](#)

Station List

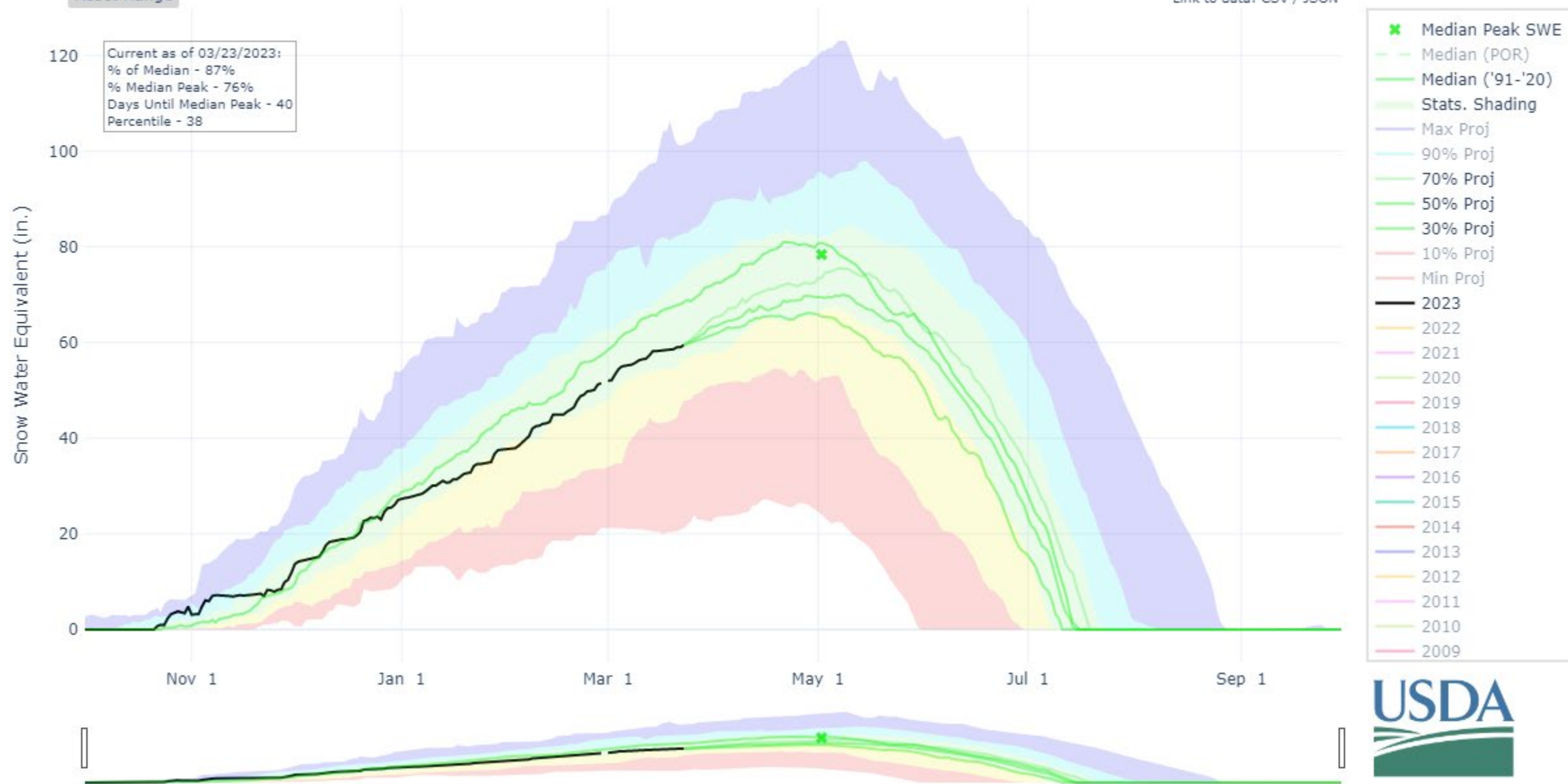
Current as of 03/23/2023:  
% of Median - 83%  
% Median Peak - 71%  
Days Until Median Peak - 28  
Percentile - 31



# SNOW WATER EQUIVALENT PROJECTIONS AT PARADISE

Reset Range

[Link to data: CSV / JSON](#)

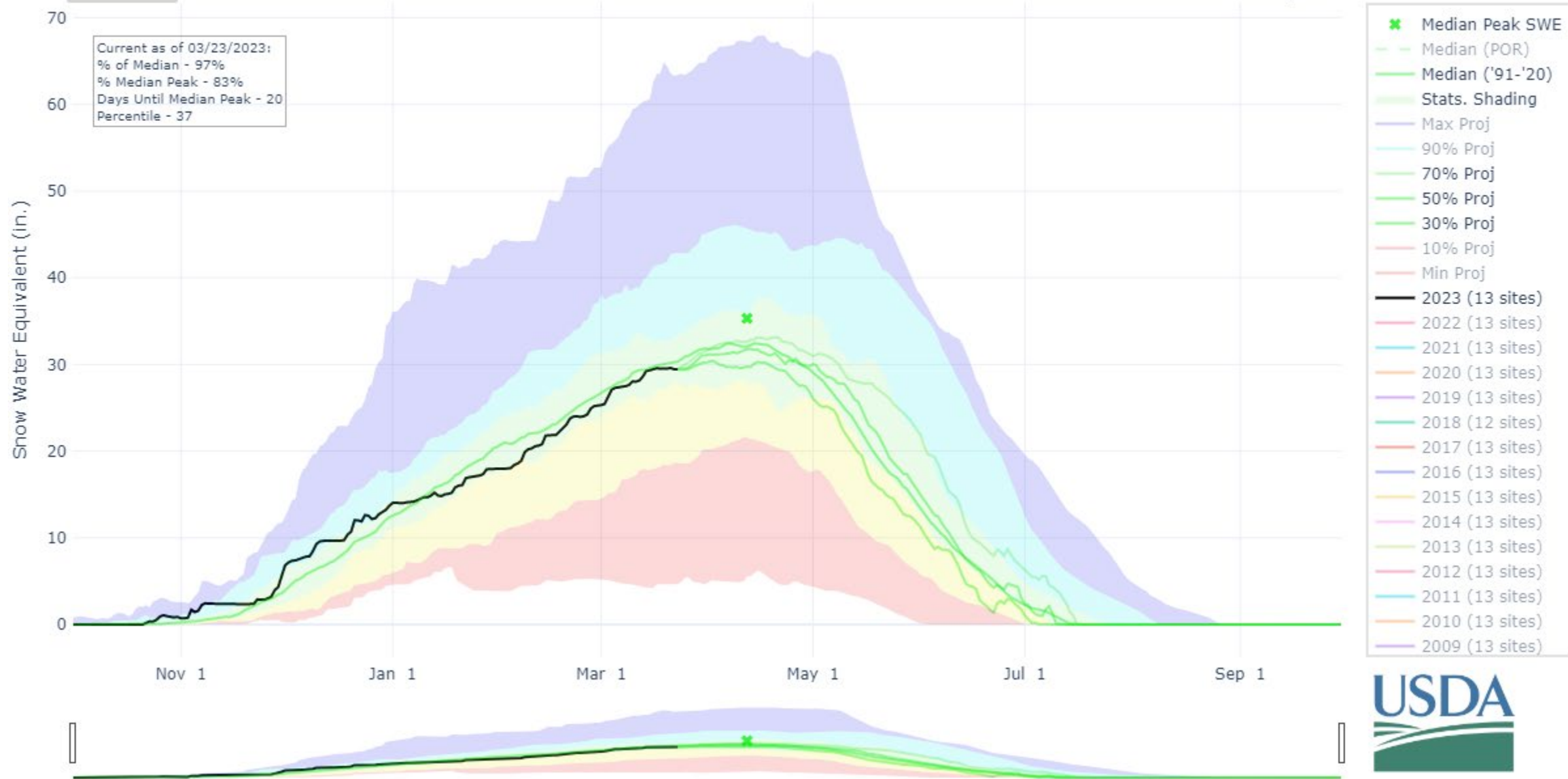


# SNOW WATER EQUIVALENT PROJECTIONS IN SOUTH PUGET SOUND

Reset Range

[Link to data: CSV / JSON](#)

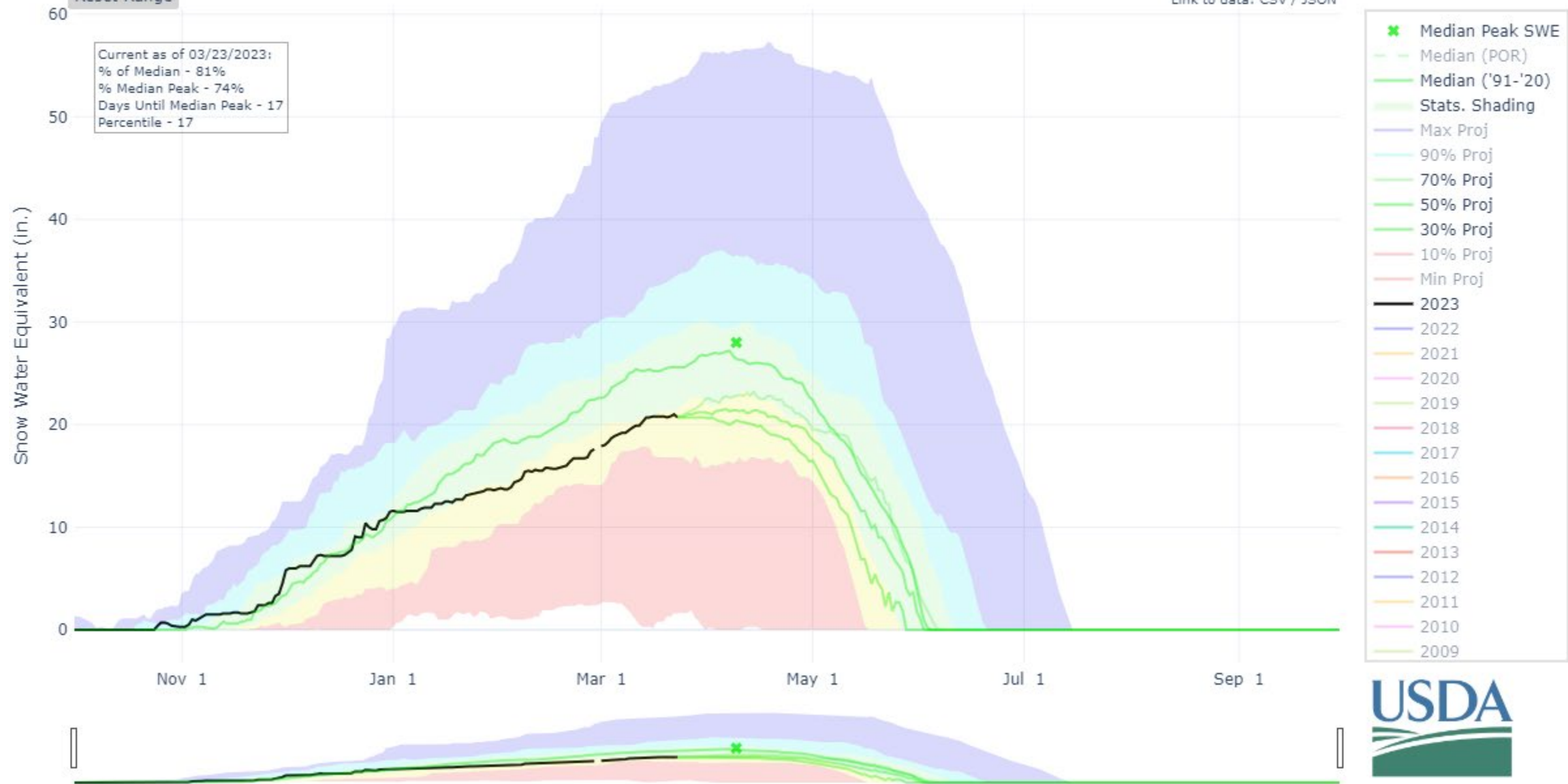
Station List



# SNOW WATER EQUIVALENT PROJECTIONS AT BUMPING RIDGE

Reset Range

[Link to data: CSV / JSON](#)

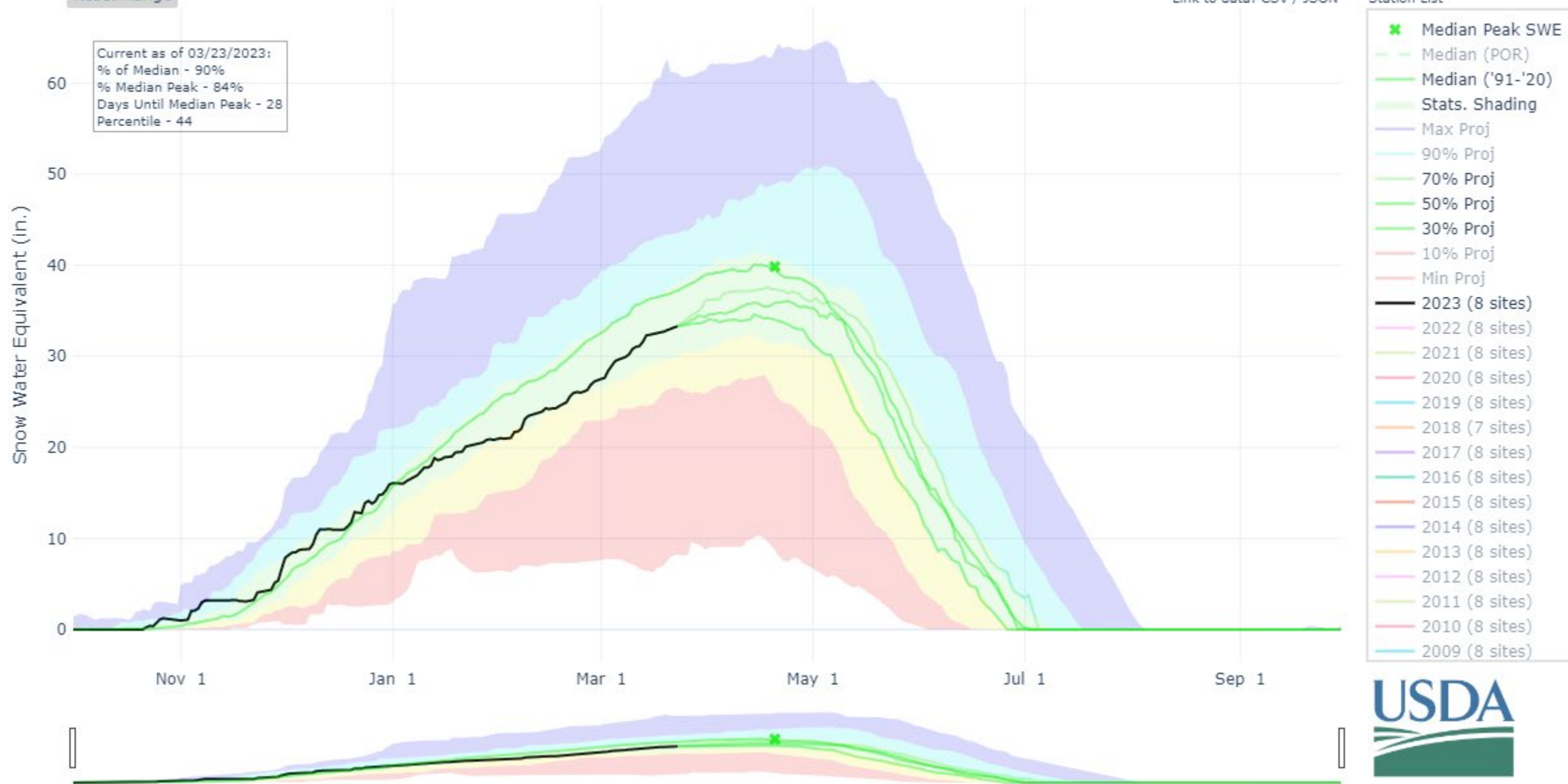


# SNOW WATER EQUIVALENT PROJECTIONS IN NACHES

Reset Range

[Link to data: CSV / JSON](#)

Station List

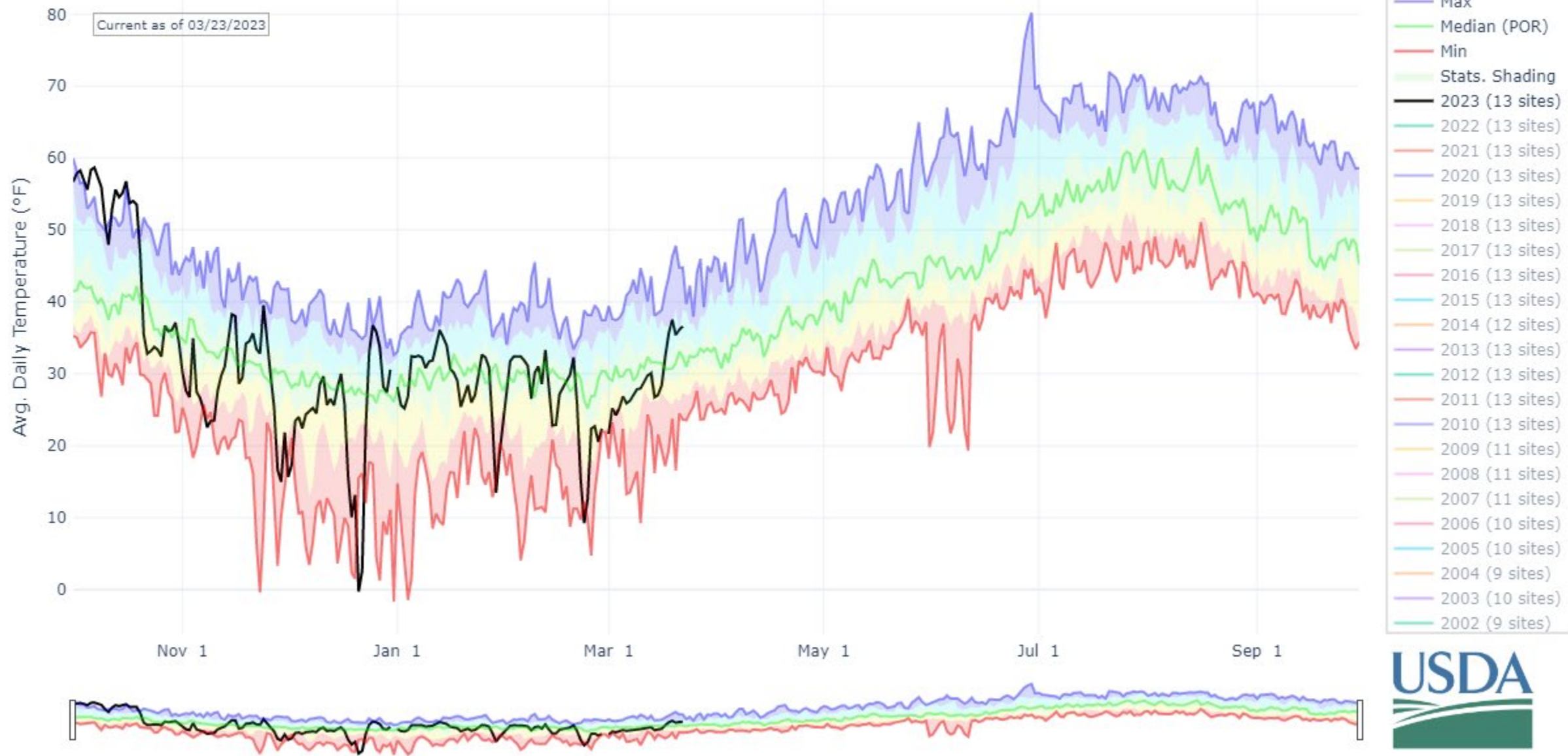


# DAILY AVERAGE TEMPERATURE IN NORTH PUGET SOUND

Reset Range

[Link to data: CSV / JSON](#)

Station List

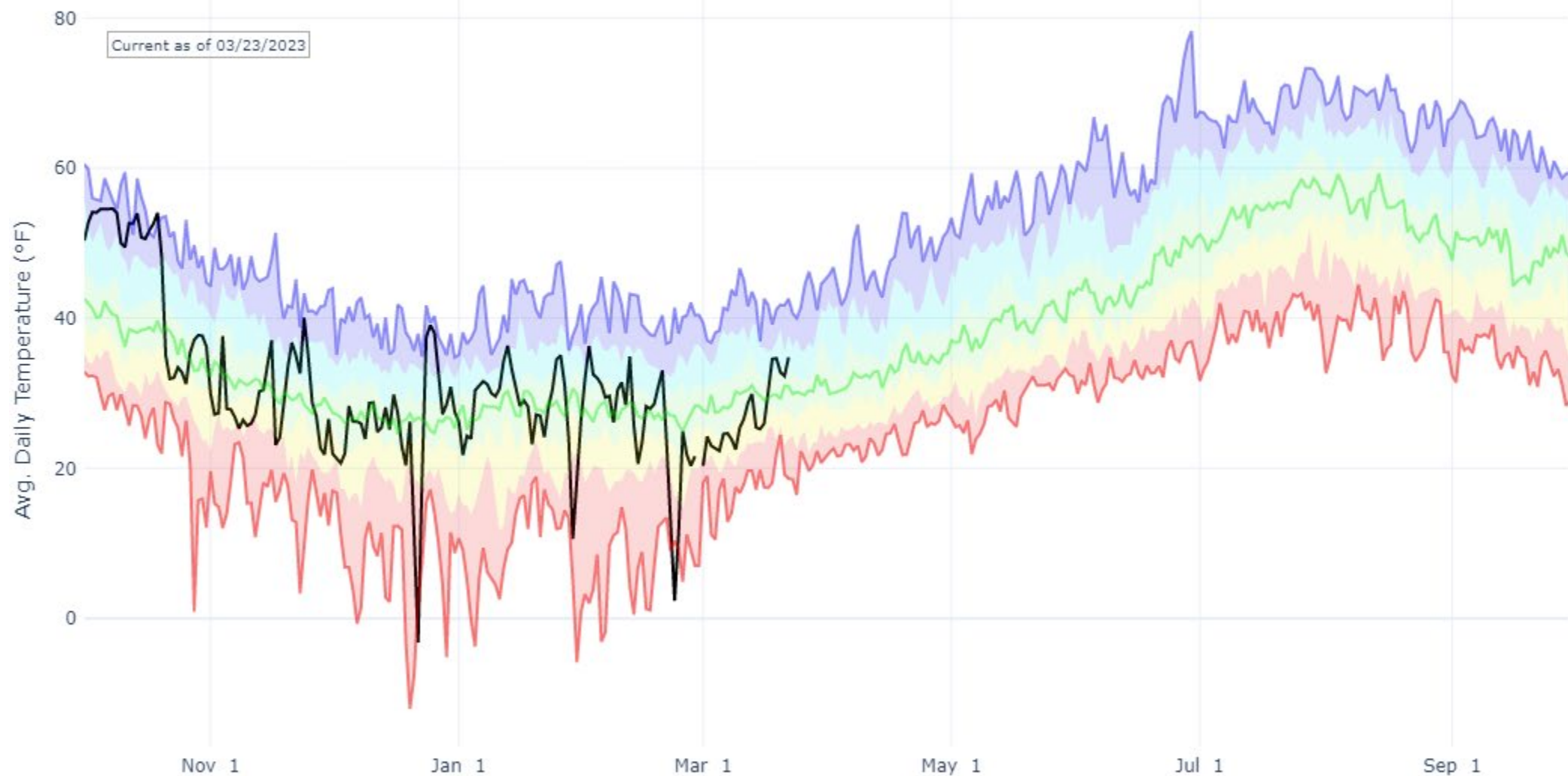


# DAILY AVERAGE TEMPERATURE IN NACHES

Reset Range

[Link to data: CSV / JSON](#)

Station List



- Max
- Median (POR)
- Min
- Stats. Shading
- 2023 (8 sites)
- 2022 (8 sites)
- 2021 (8 sites)
- 2020 (8 sites)
- 2019 (8 sites)
- 2018 (7 sites)
- 2017 (8 sites)
- 2016 (8 sites)
- 2015 (8 sites)
- 2014 (8 sites)
- 2013 (8 sites)
- 2012 (8 sites)
- 2011 (8 sites)
- 2010 (8 sites)
- 2009 (8 sites)
- 2008 (8 sites)
- 2007 (8 sites)
- 2006 (6 sites)
- 2005 (6 sites)
- 2004 (6 sites)
- 2003 (6 sites)
- 2002 (6 sites)



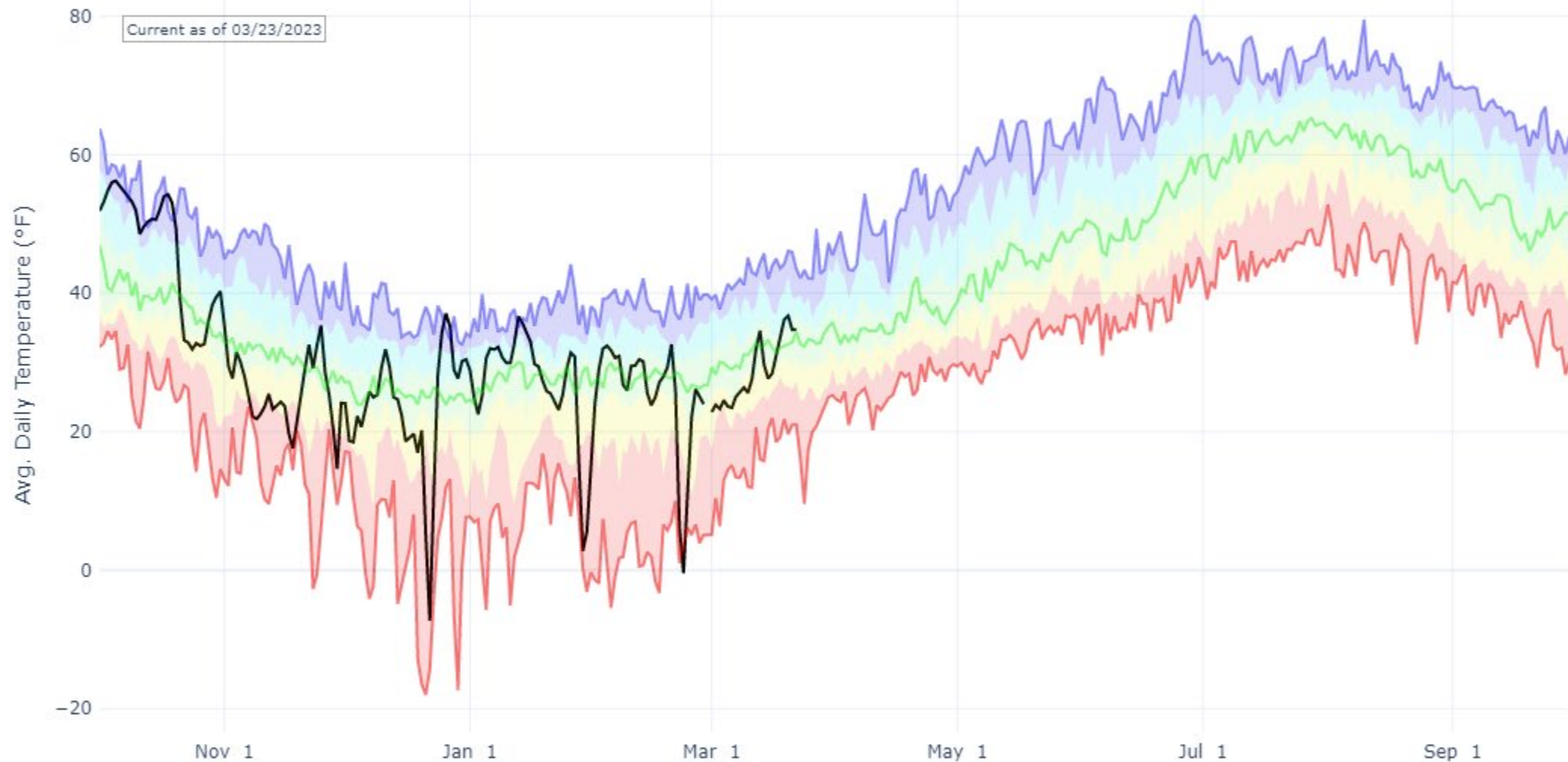
# DAILY AVERAGE TEMPERATURE IN SPOKANE

Reset Range

[Link to data: CSV / JSON](#)

Station List

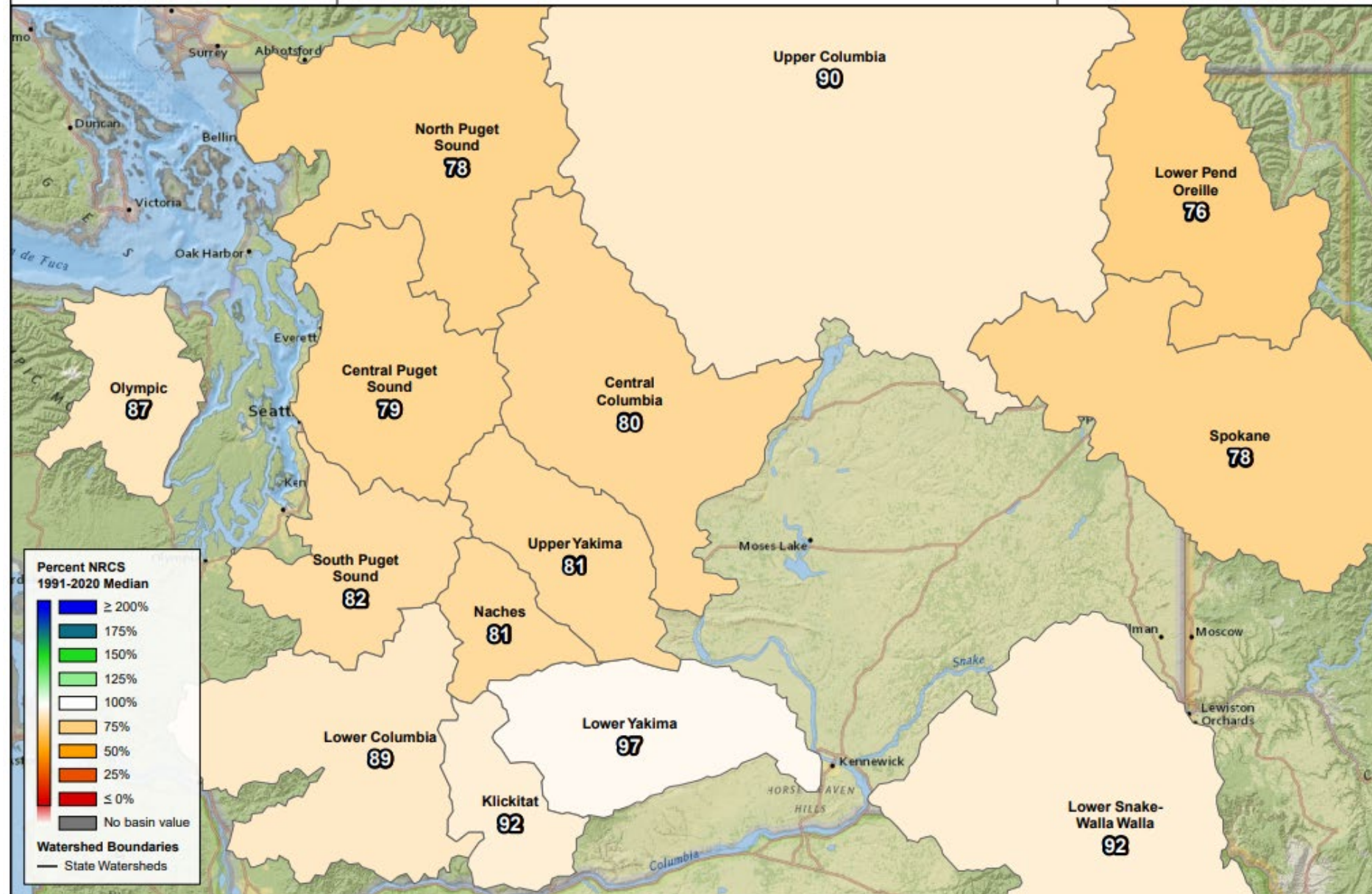
- Max
- Median (POR)
- Min
- Stats. Shading
- 2023 (10 sites)
- 2022 (10 sites)
- 2021 (10 sites)
- 2020 (10 sites)
- 2019 (10 sites)
- 2018 (10 sites)
- 2017 (10 sites)
- 2016 (10 sites)
- 2015 (10 sites)
- 2014 (10 sites)
- 2013 (10 sites)
- 2012 (10 sites)
- 2011 (10 sites)
- 2010 (10 sites)
- 2009 (10 sites)
- 2008 (10 sites)
- 2007 (10 sites)
- 2006 (9 sites)
- 2005 (9 sites)
- 2004 (9 sites)
- 2003 (9 sites)
- 2002 (9 sites)



Water Year to Date Precipitation

Percent NRCS 1991-2020 Median

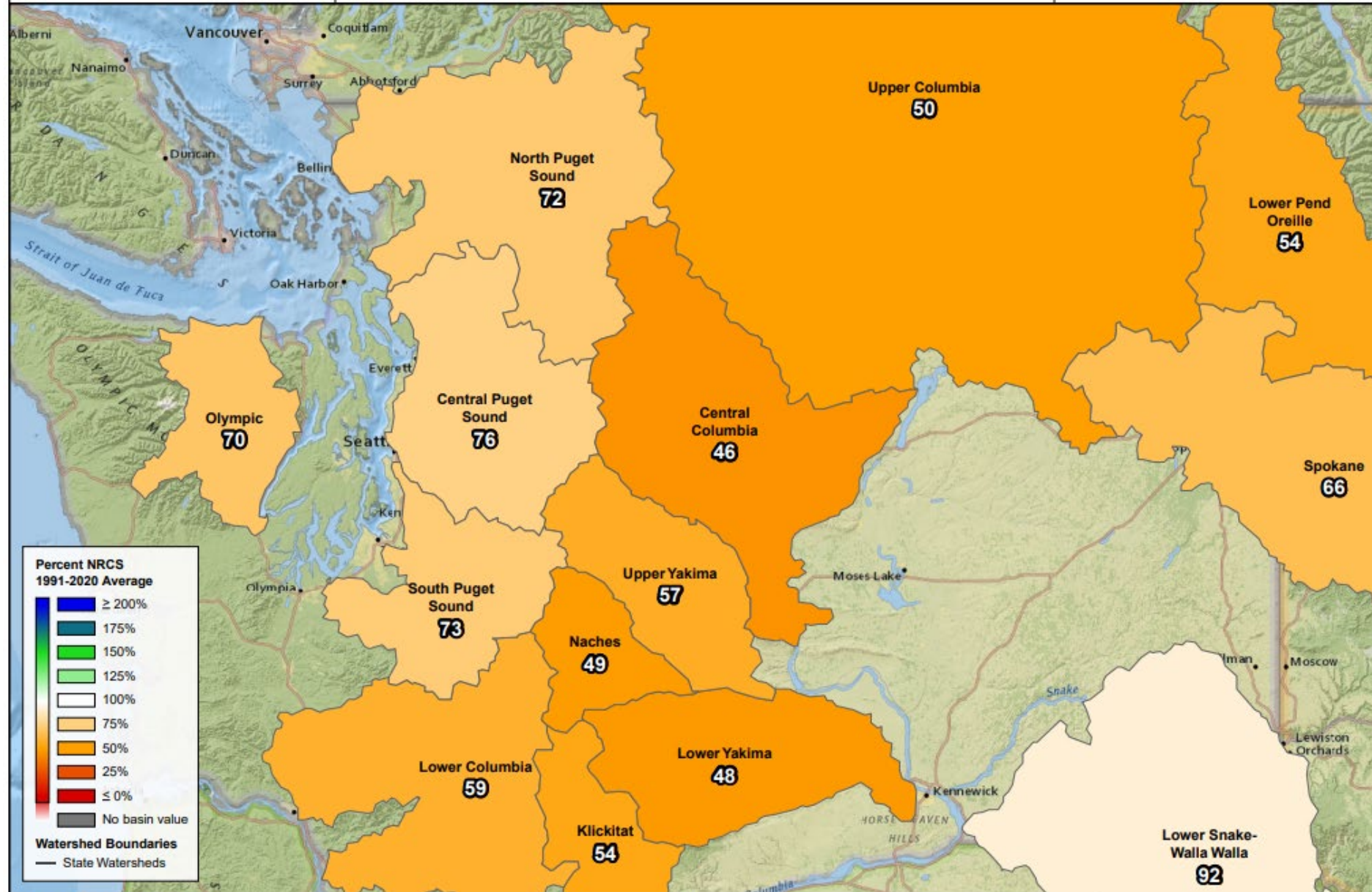
October 1, 2022 - March 23, 2023



1 month Precipitation

Percent NRCS 1991-2020 Average

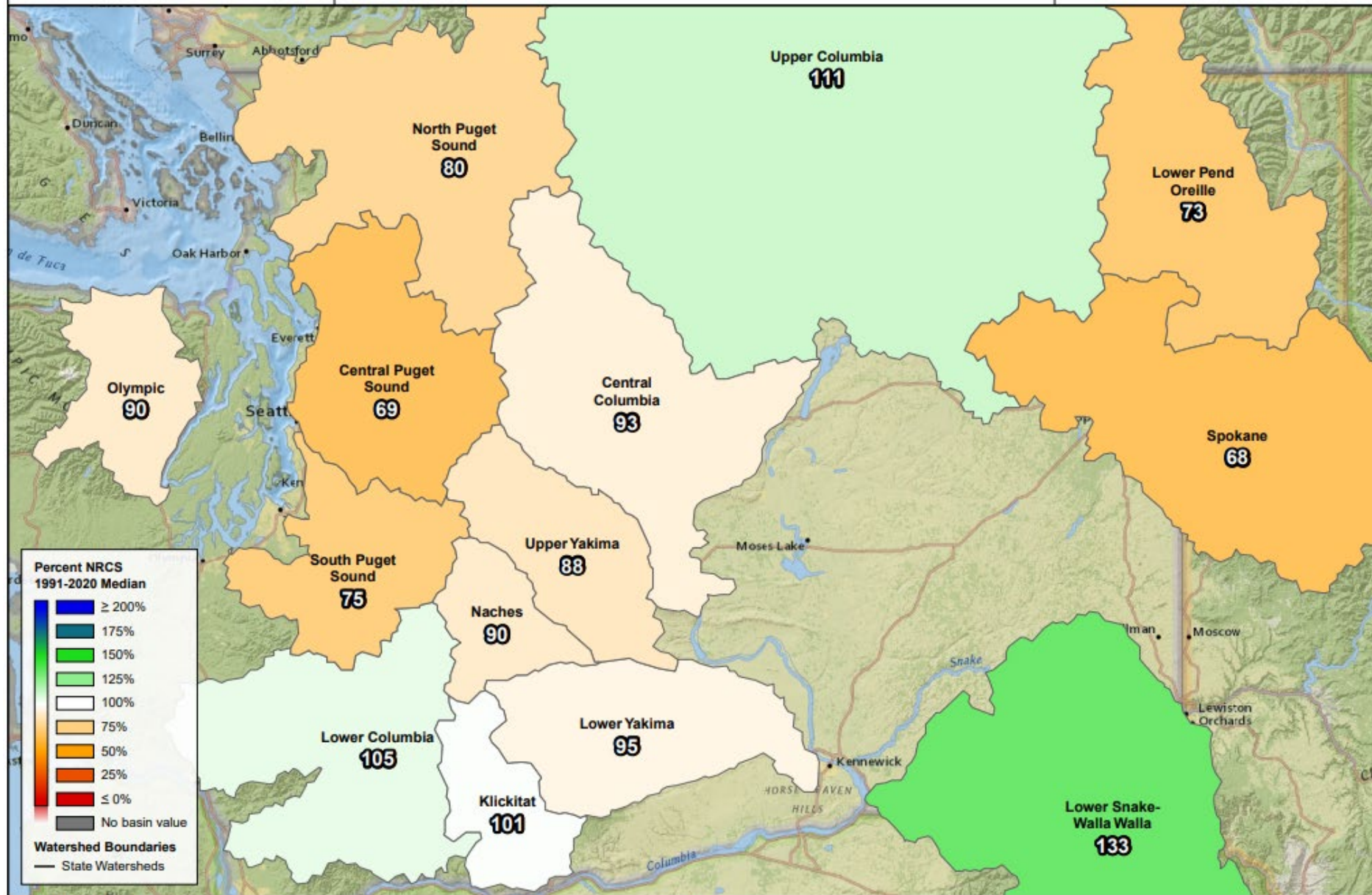
October 1, 2022 - October 31, 2022



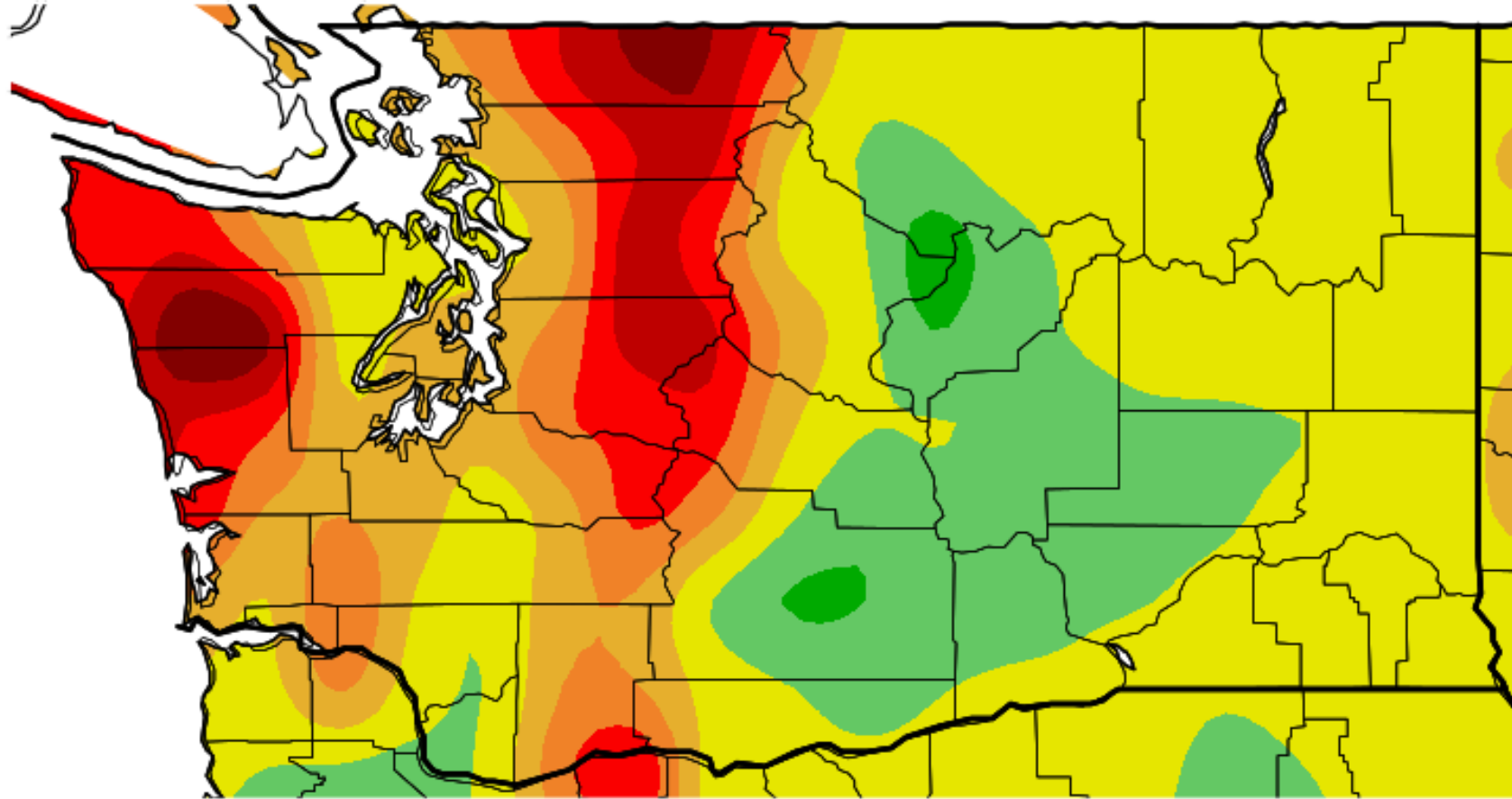
Month to Date Precipitation

Percent NRCS 1991-2020 Median

March 1, 2023 - March 23, 2023



Precipitation Departure from Average (in.)  
3/1/2023 – 3/22/2023



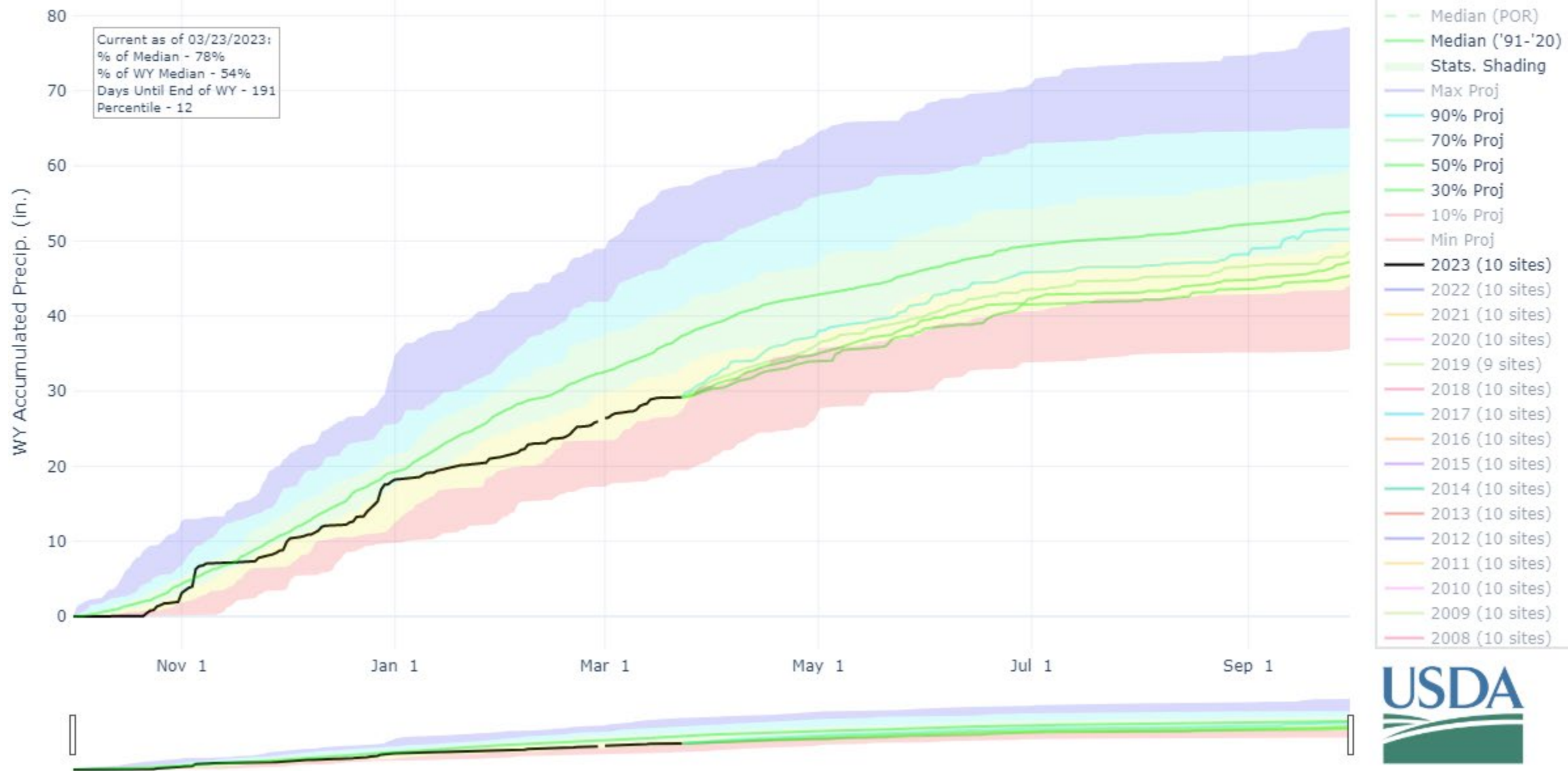
Generated 3/23/2023 at WRCC using provisional data.  
NOAA Regional Climate Centers

# PRECIPITATION PROJECTIONS IN SPOKANE

Reset Range

[Link to data: CSV / JSON](#)

Station List



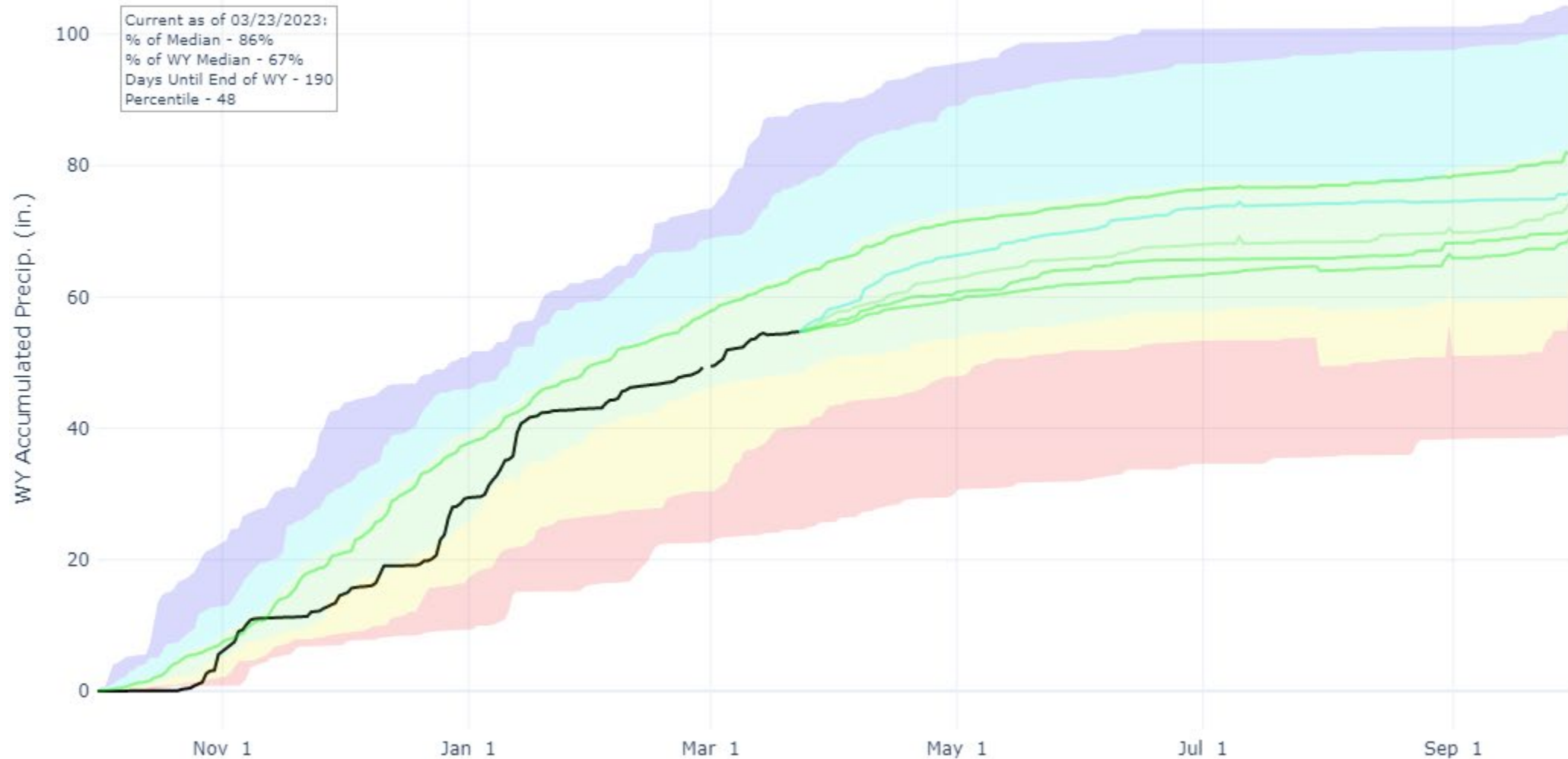
# PRECIPITATION PROJECTIONS IN OLYMPIC

Reset Range

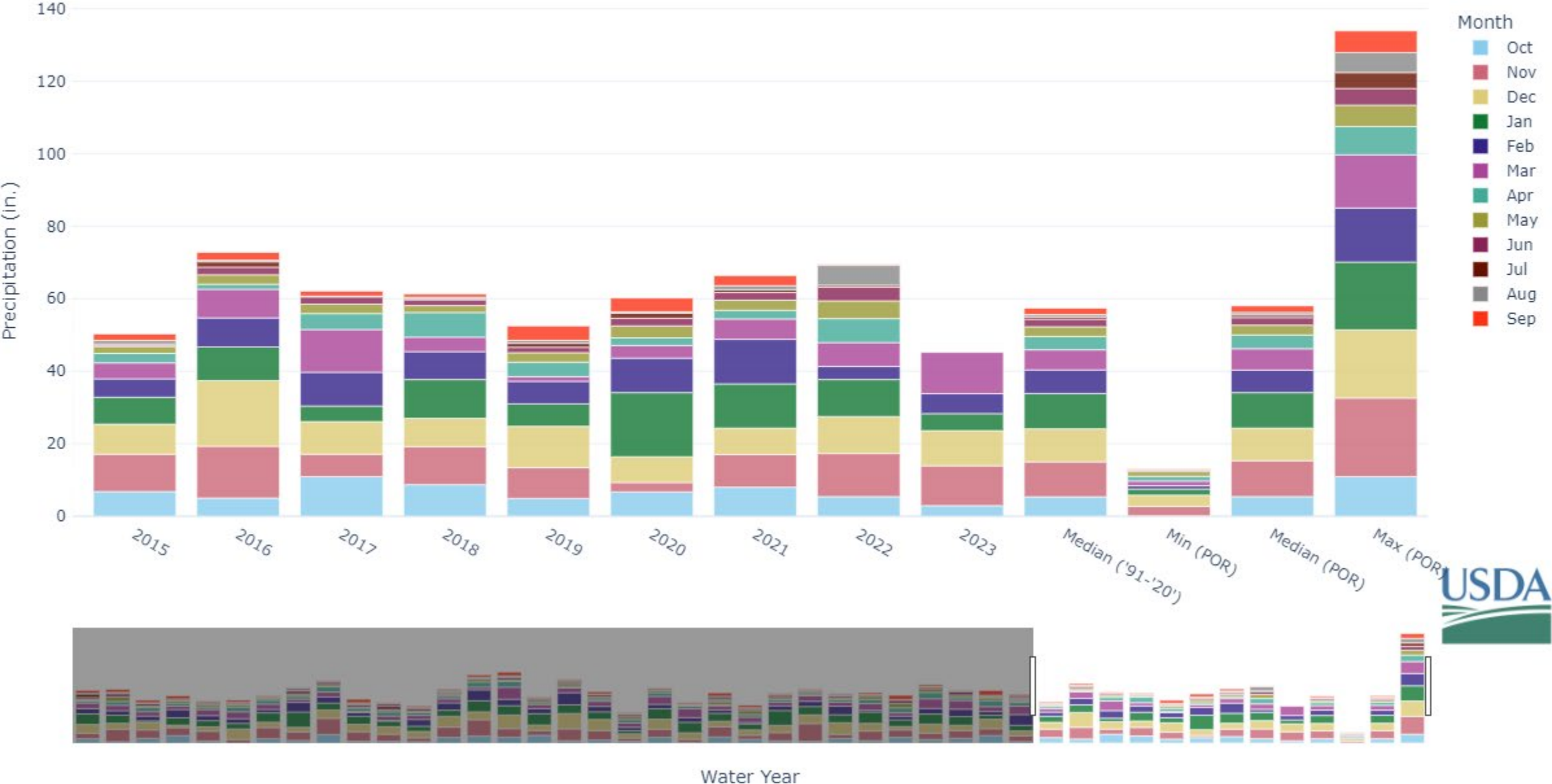
[Link to data: CSV / JSON](#)

Station List

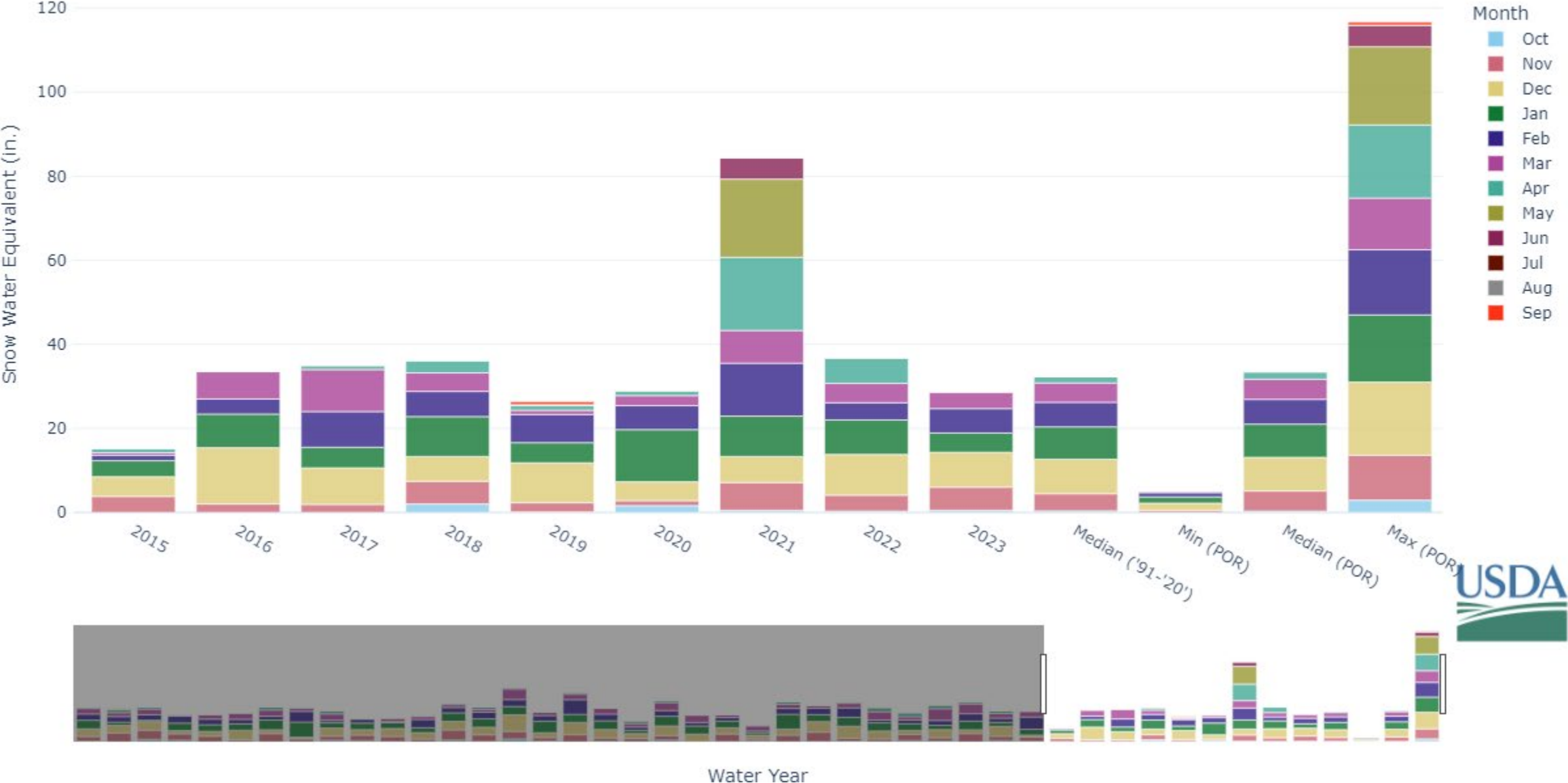
- Median (POR)
- Median ('91-'20)
- Stats. Shading
- Max Proj
- 90% Proj
- 70% Proj
- 50% Proj
- 30% Proj
- 10% Proj
- Min Proj
- 2023 (4 sites)
- 2022 (4 sites)
- 2021 (4 sites)
- 2020 (4 sites)
- 2019 (4 sites)
- 2018 (4 sites)
- 2017 (4 sites)
- 2016 (4 sites)
- 2015 (4 sites)
- 2014 (4 sites)
- 2013 (3 sites)
- 2012 (4 sites)
- 2011 (4 sites)
- 2010 (4 sites)
- 2009 (4 sites)
- 2008 (3 sites)



UPPER YAKIMA MONTHLY PRECIPITATION SUMMARY



UPPER YAKIMA MONTHLY SNOW WATER EQUIVALENT SUMMARY

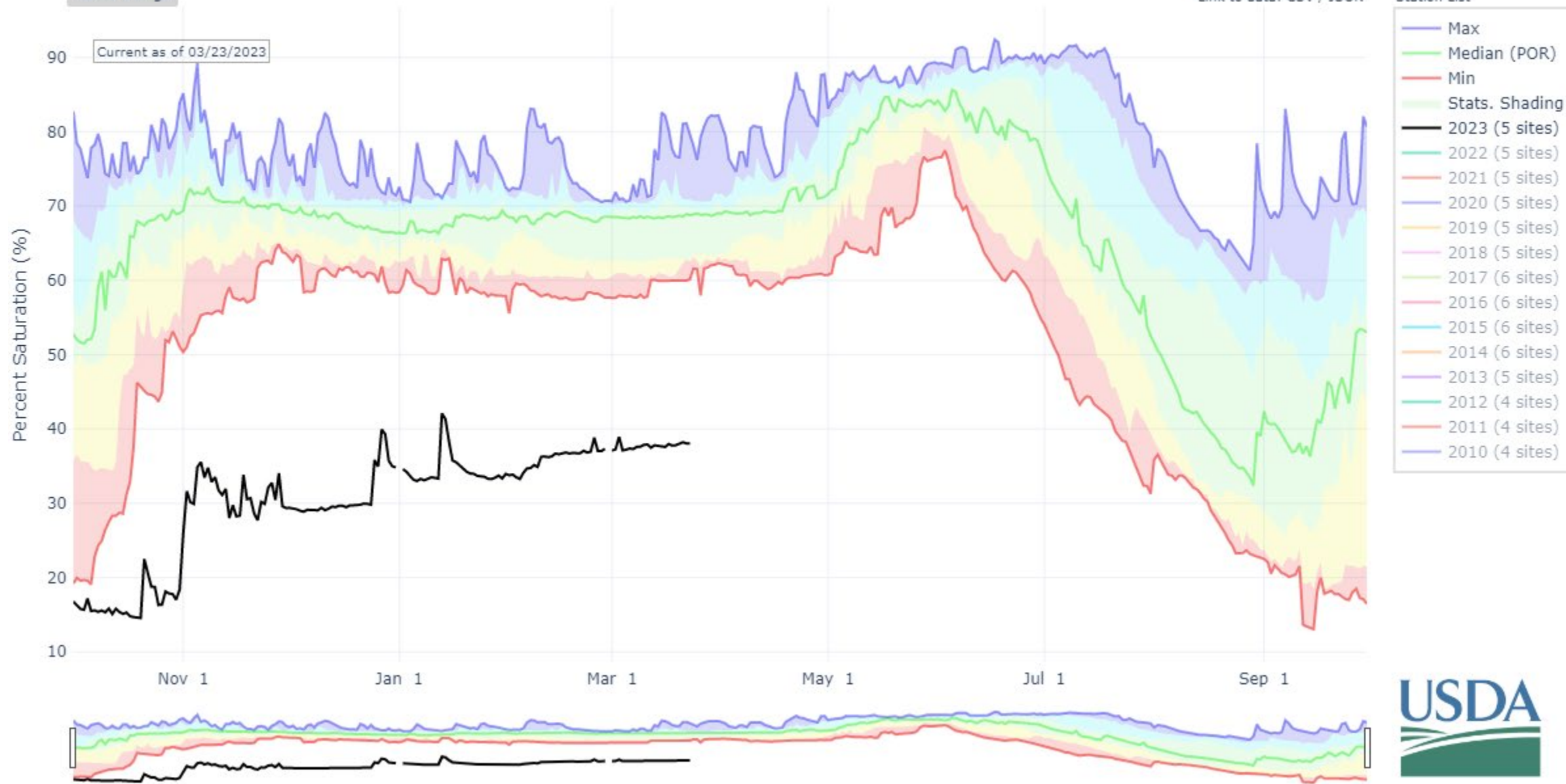


# DEPTH AVERAGED SOIL SATURATION IN NORTH PUGET SOUND

Reset Range

[Link to data: CSV / JSON](#)

Station List

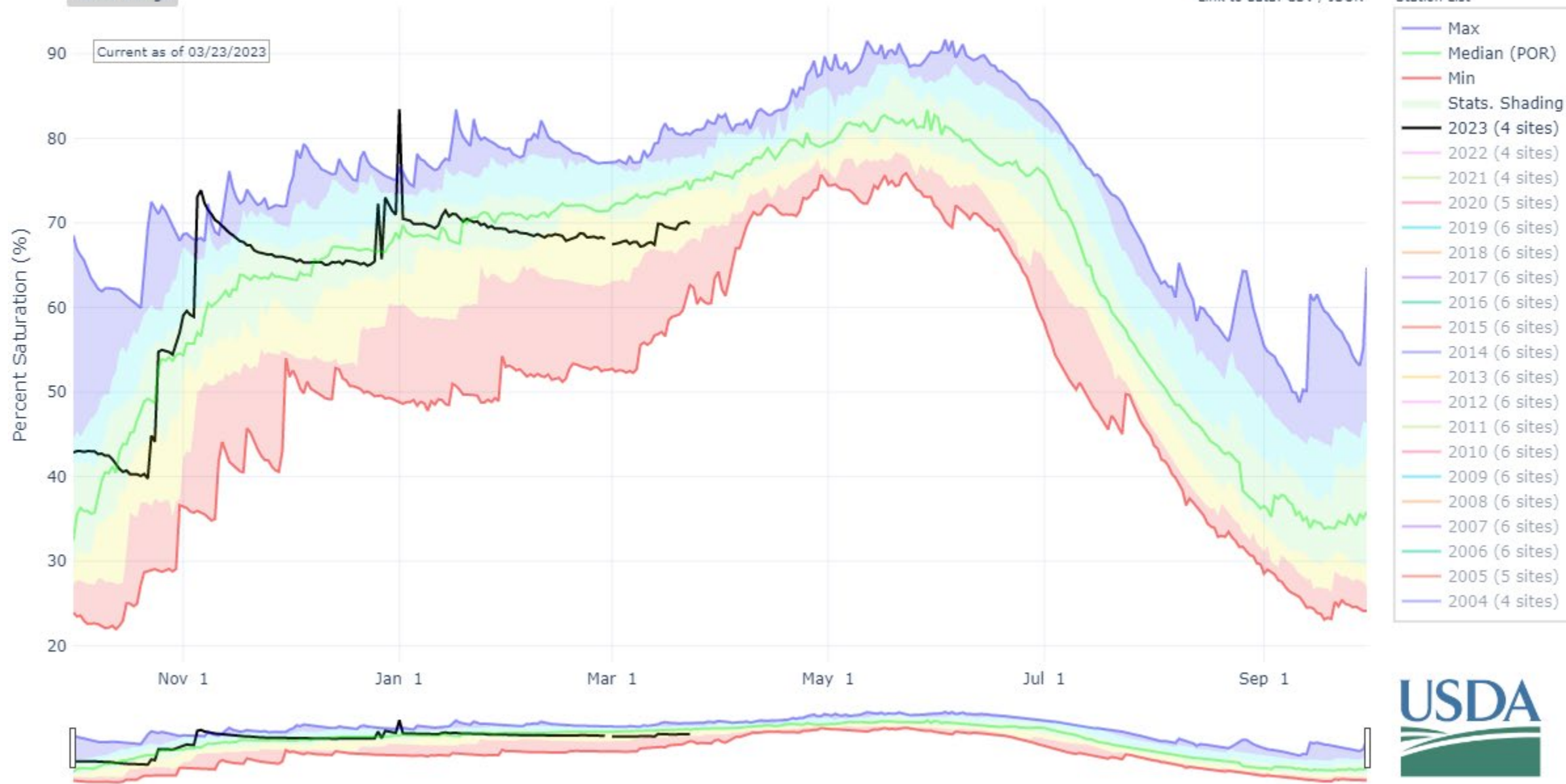


# DEPTH AVERAGED SOIL SATURATION IN LOWER SNAKE-WALLA WALLA

Reset Range

[Link to data: CSV / JSON](#)

Station List

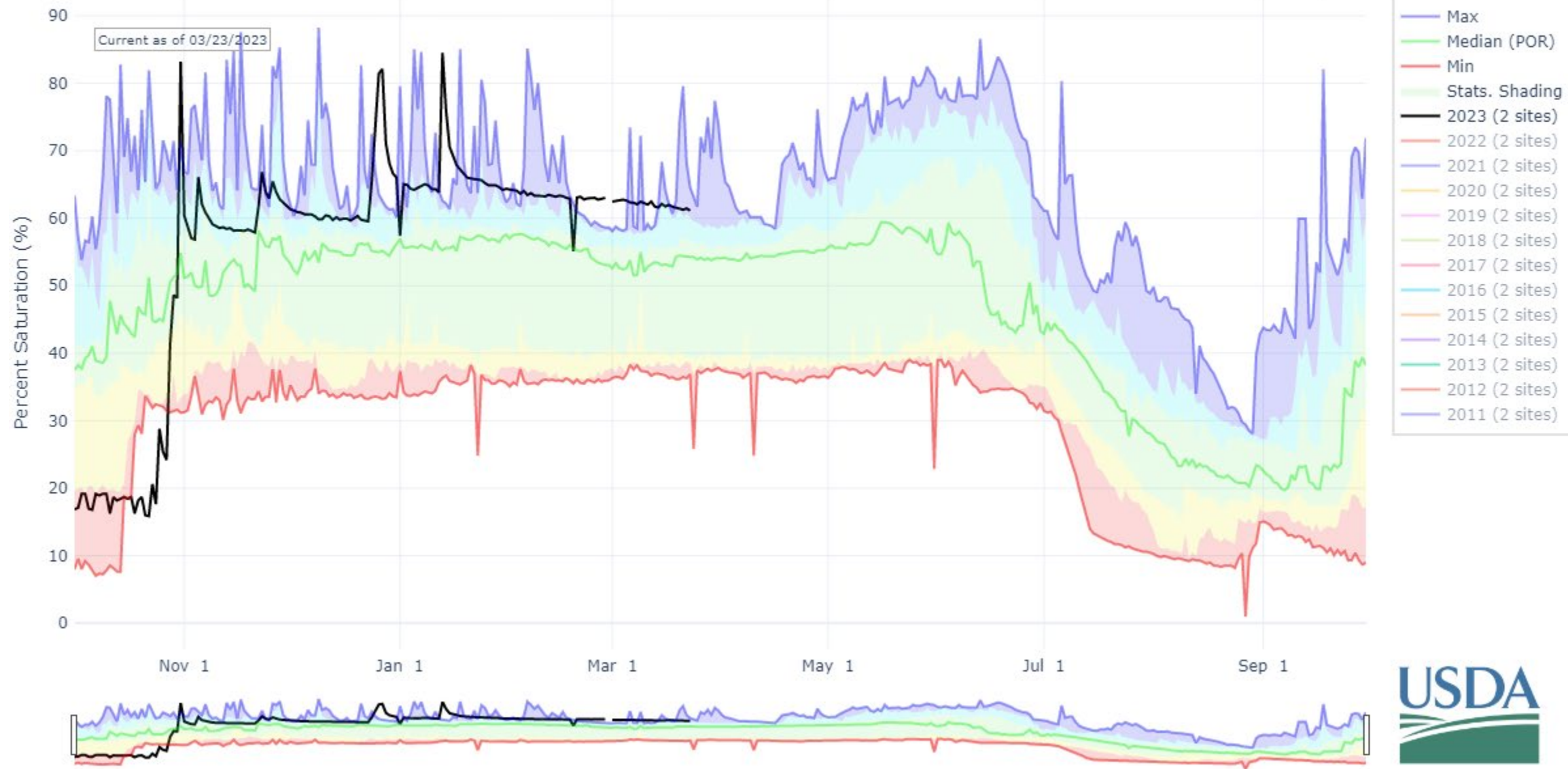


# DEPTH AVERAGED SOIL SATURATION IN OLYMPIC

Reset Range

[Link to data: CSV / JSON](#)

Station List

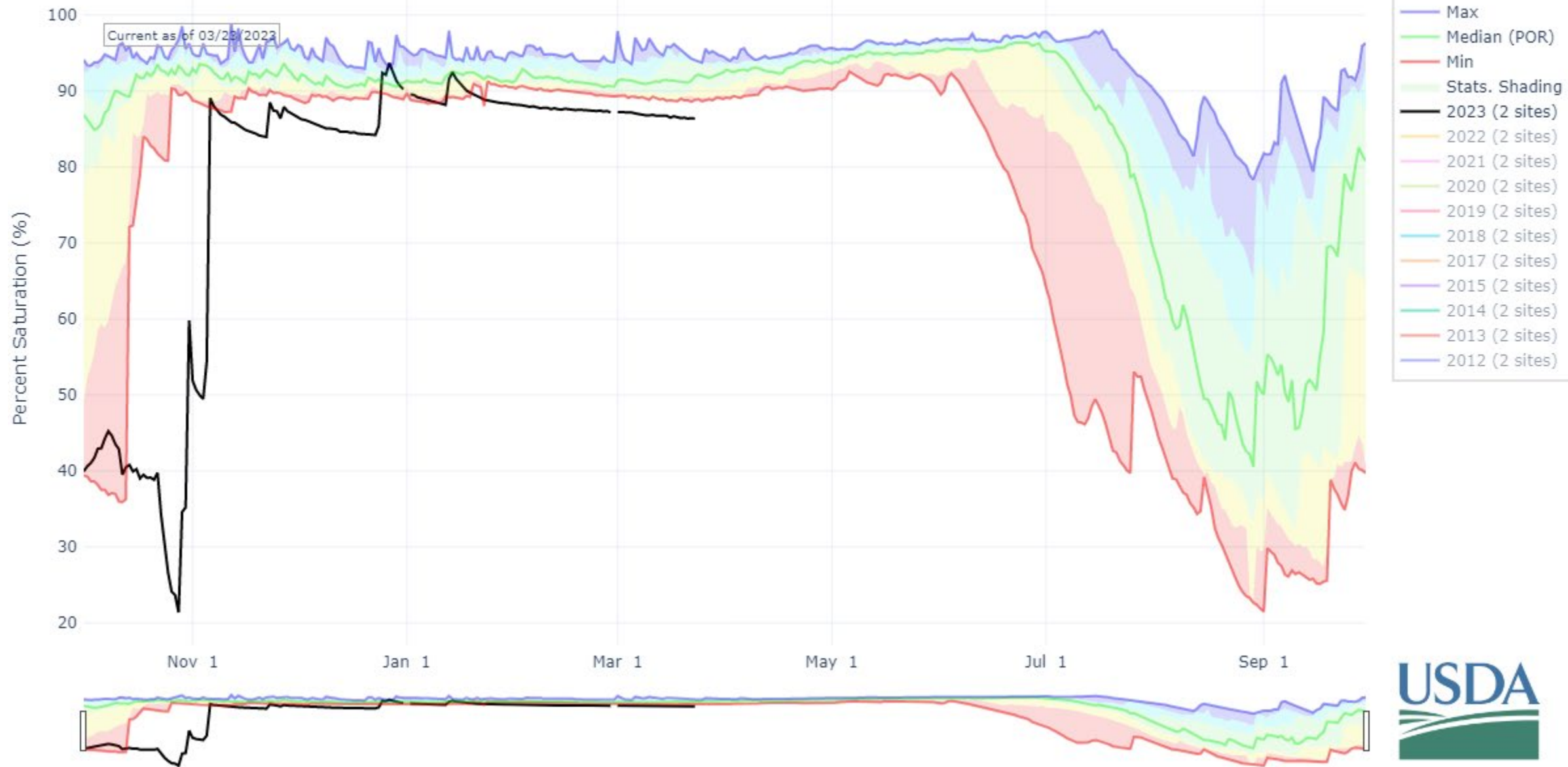


# DEPTH AVERAGED SOIL SATURATION IN COWLITZ

Reset Range

[Link to data: CSV / JSON](#)

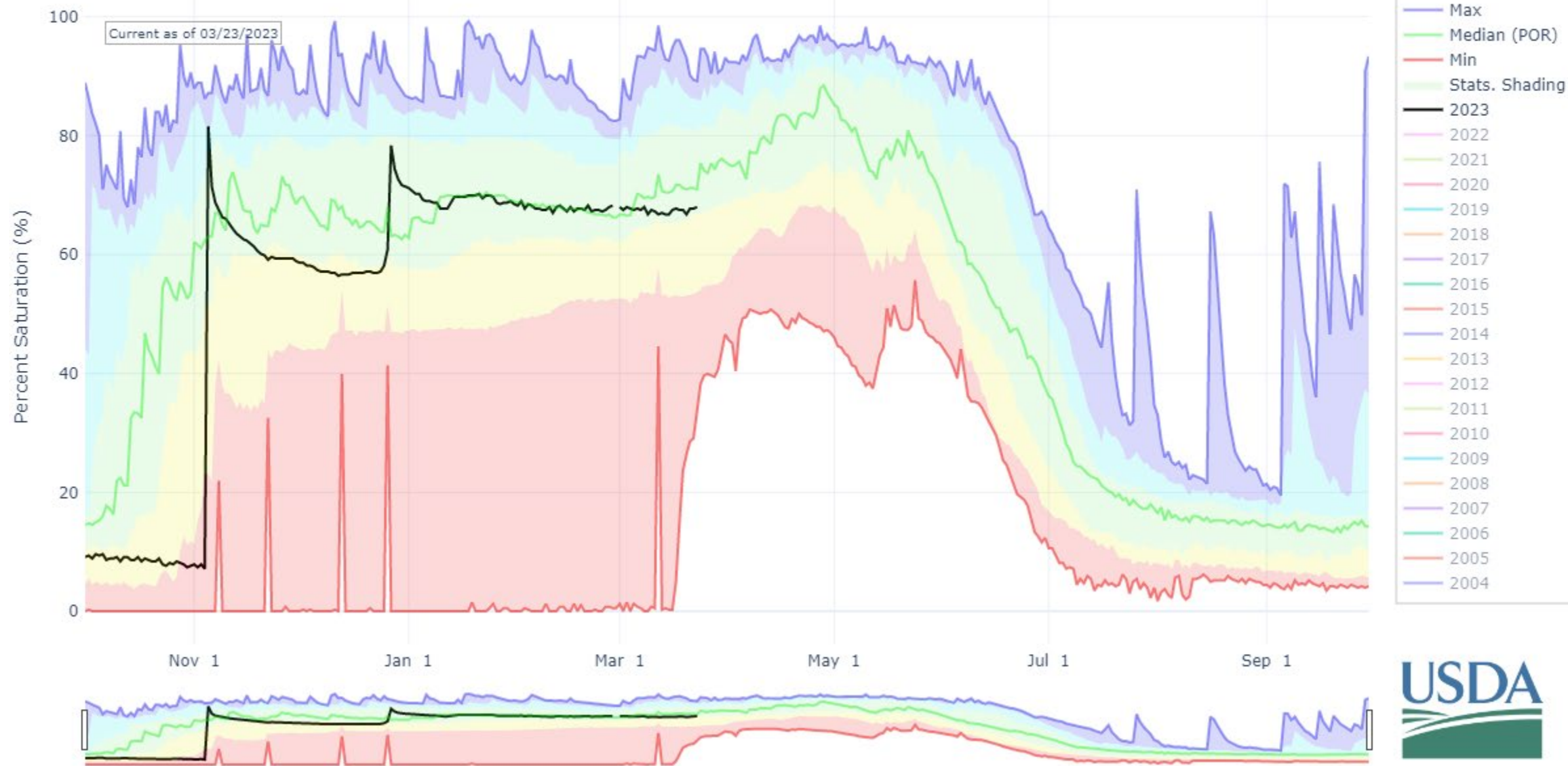
Station List



# DEPTH AVERAGED SOIL SATURATION AT TROUGH

Reset Range

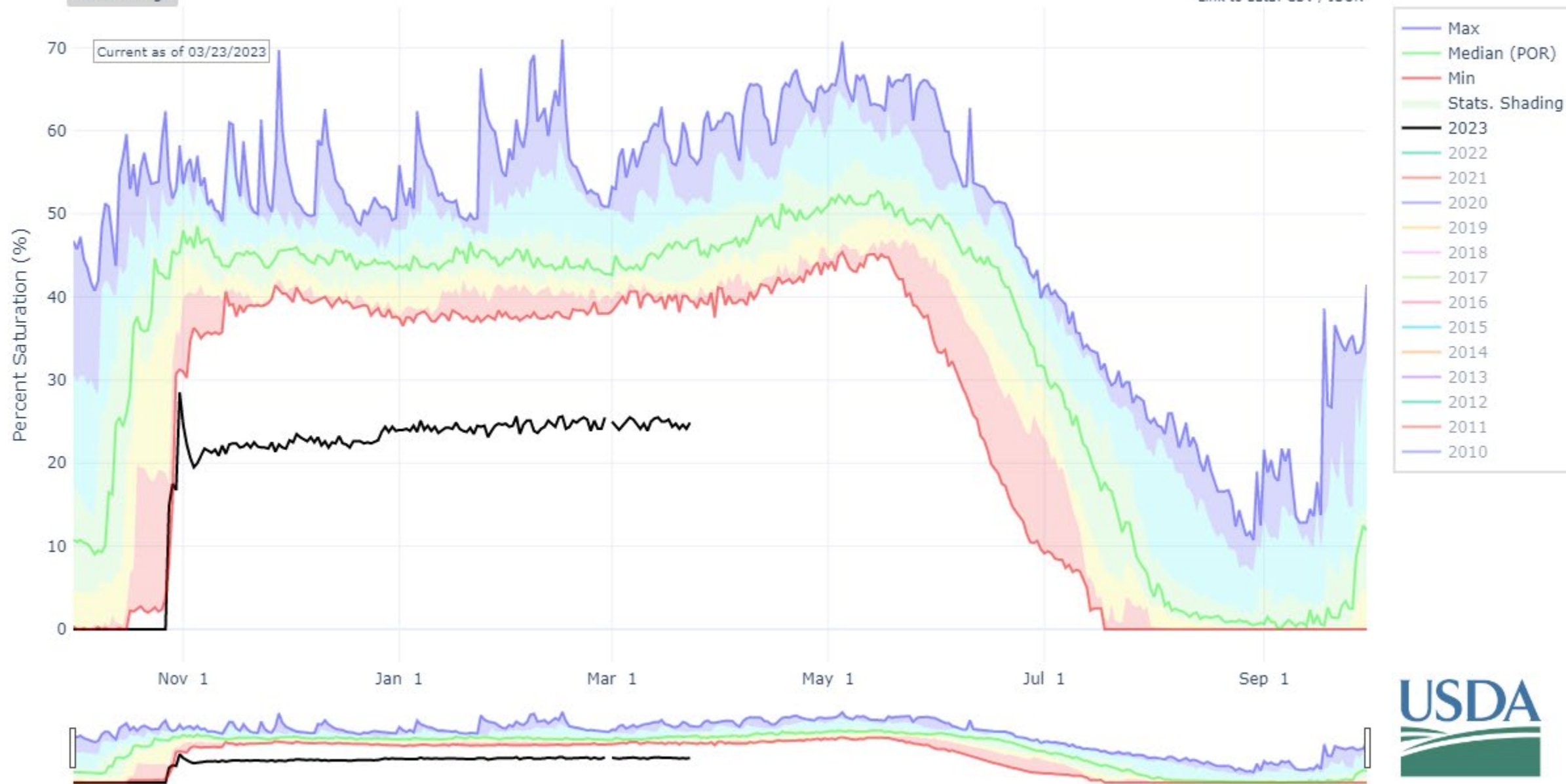
[Link to data: CSV / JSON](#)



# DEPTH AVERAGED SOIL SATURATION AT PARK CREEK RIDGE

Reset Range

[Link to data: CSV / JSON](#)

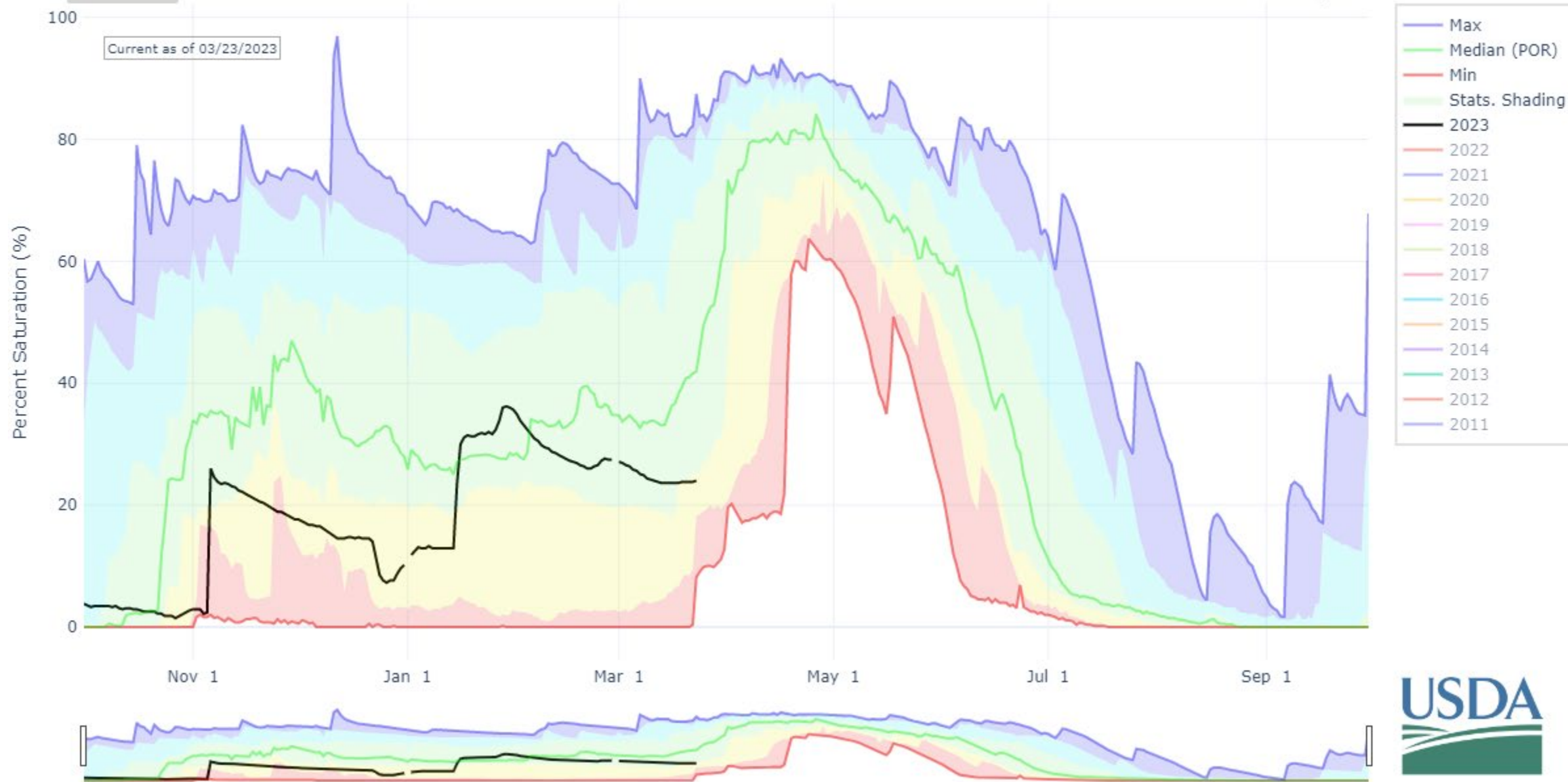


# DEPTH AVERAGED SOIL SATURATION AT SALMON MEADOWS

Reset Range

[Link to data: CSV / JSON](#)

Current as of 03/23/2023

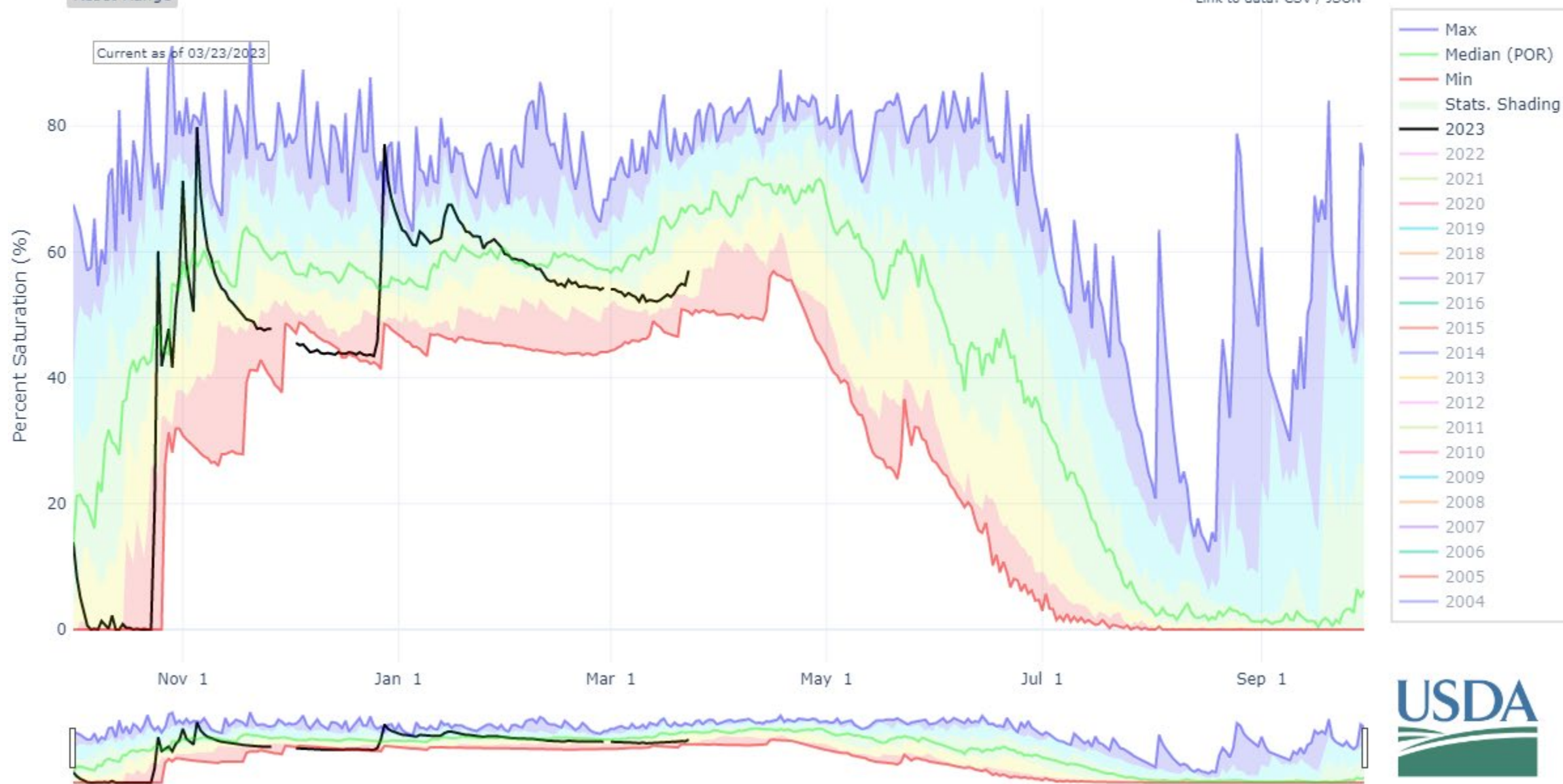


# DEPTH AVERAGED SOIL SATURATION AT QUARTZ PEAK

Reset Range

[Link to data: CSV / JSON](#)

Current as of 03/23/2023





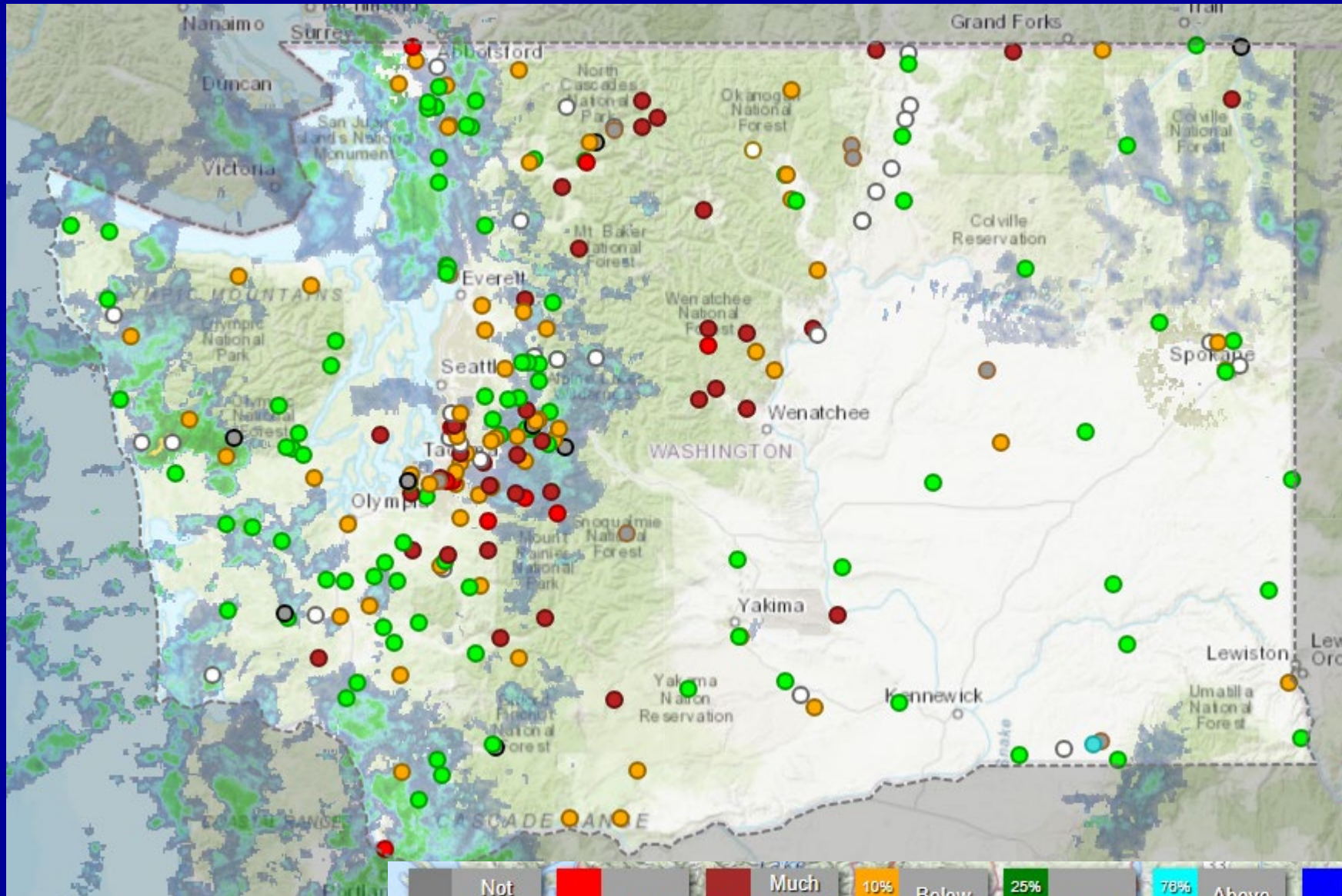
---

Questions?

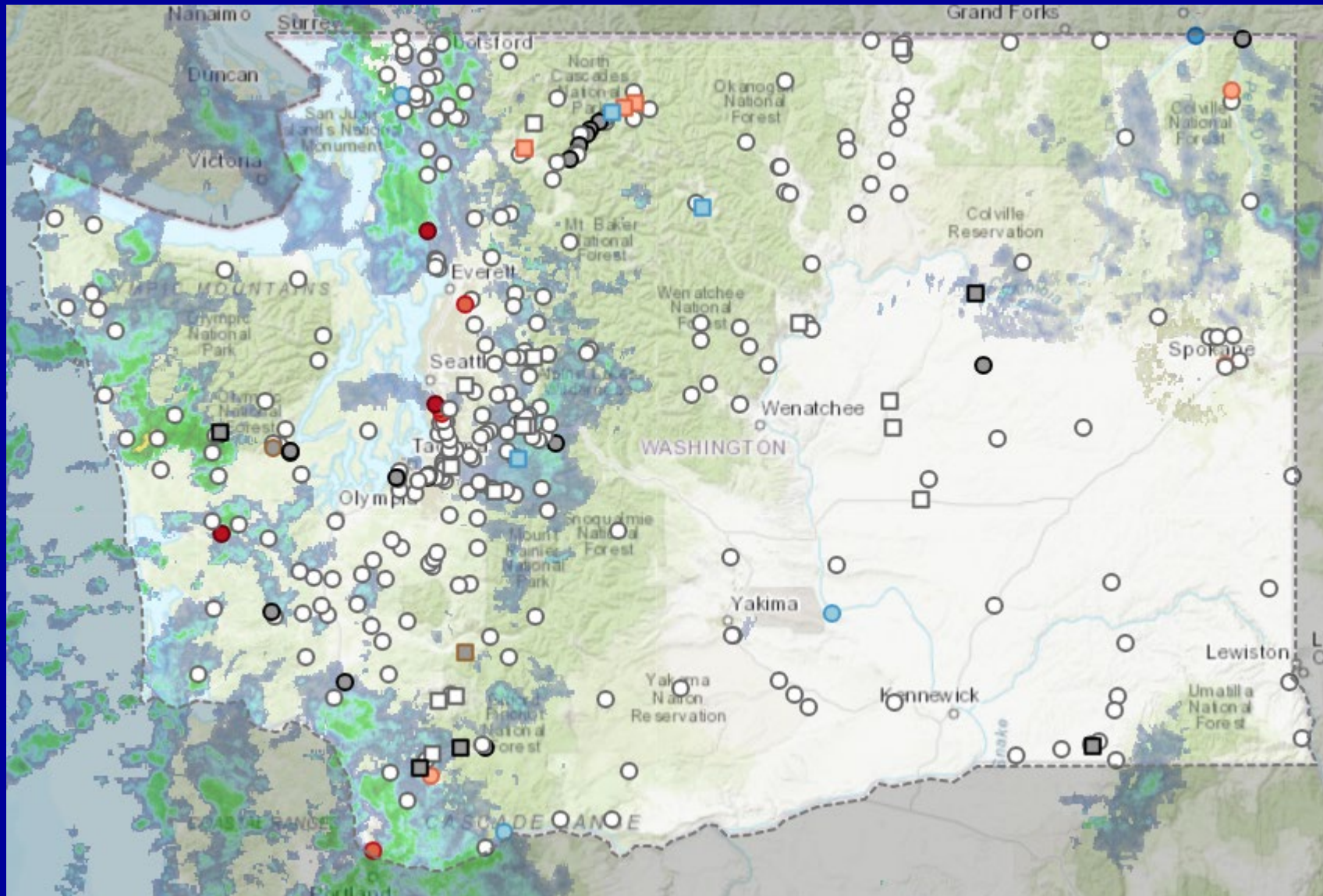
# Streamflow & Groundwater Conditions in Washington State as of 24 March 2023

Presented to  
The Washington State Water Supply Availability Committee  
on 24 March 2023  
by Nicholas Sutfin, USGS Washington Water Science Center

# WA Current Streamflow Conditions, 24 March 2023



# Rising and Falling conditions of WA streams on 24 March 2023



## Surface-Water Levels: Rising and falling

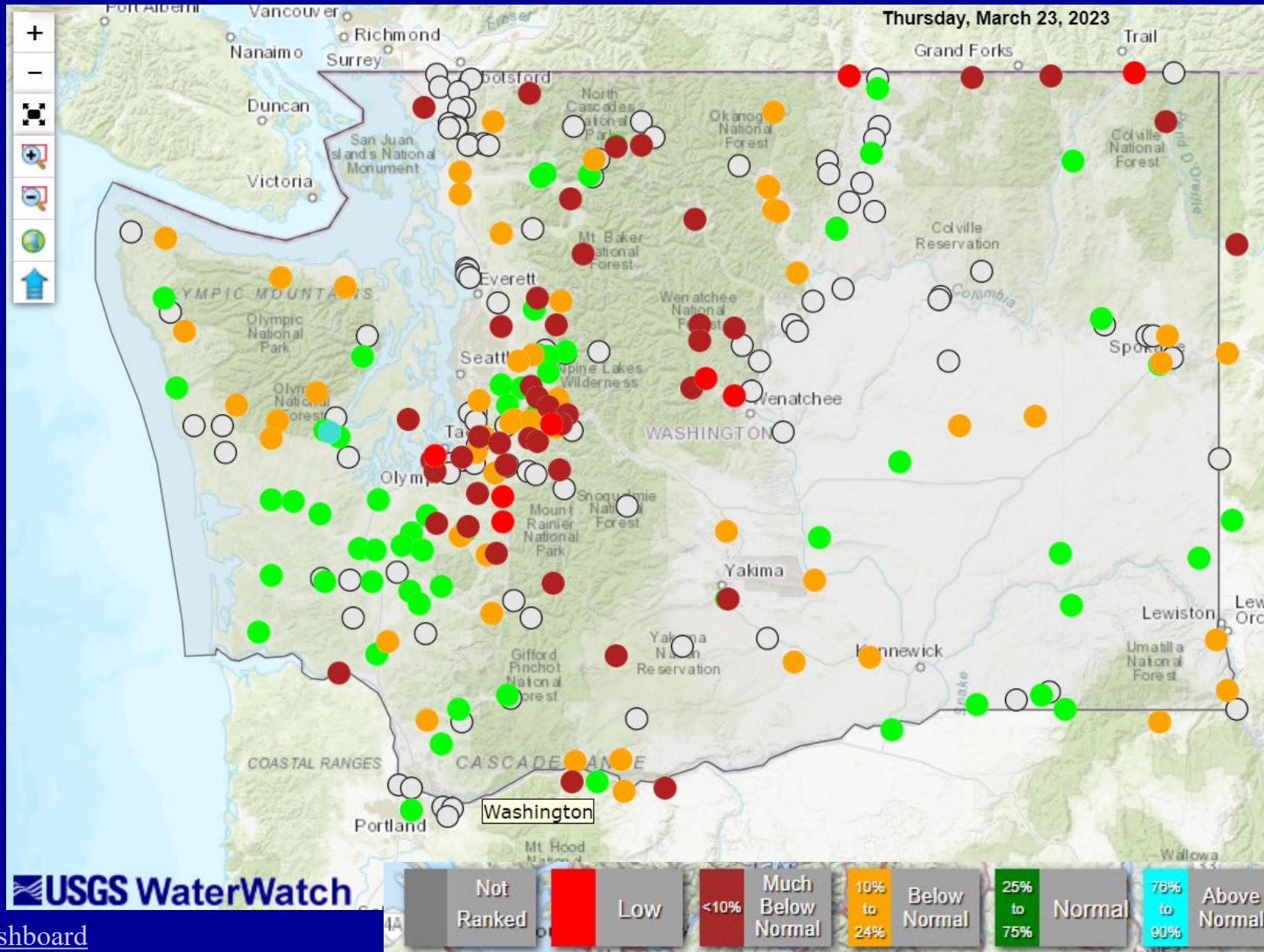
### COLOR – CHANGE

- Water level rising  $\geq 1$  foot/hour
- Water level rising  $\geq 0.5 - 1$  foot/hour
- Water level rising  $\geq 0.05 - 0.5$  foot/hour
- Water level changing  $< 0.05$  foot/hour
- Water level falling  $\geq 0.05 - 0.5$  foot/hour
- Water level falling  $\geq 0.5 - 1$  foot/hour
- Water level falling  $\geq 1$  foot/hour

### SHAPE – SITE TYPE

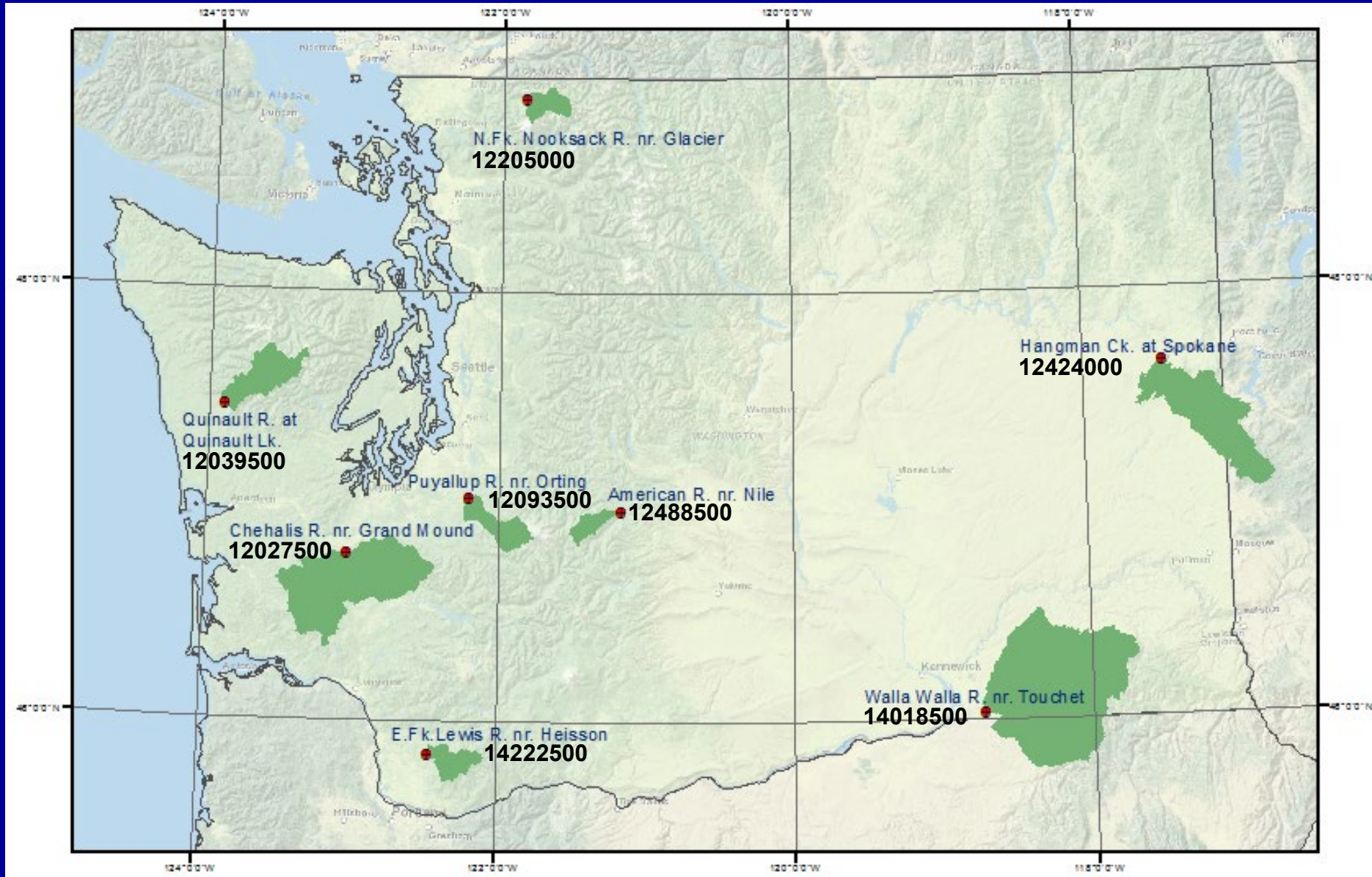
- Stream
- Lake
- Wetland
- Estuary
- Coastal

# WA 7-day Average Streamflow Conditions as of 24 March 2023

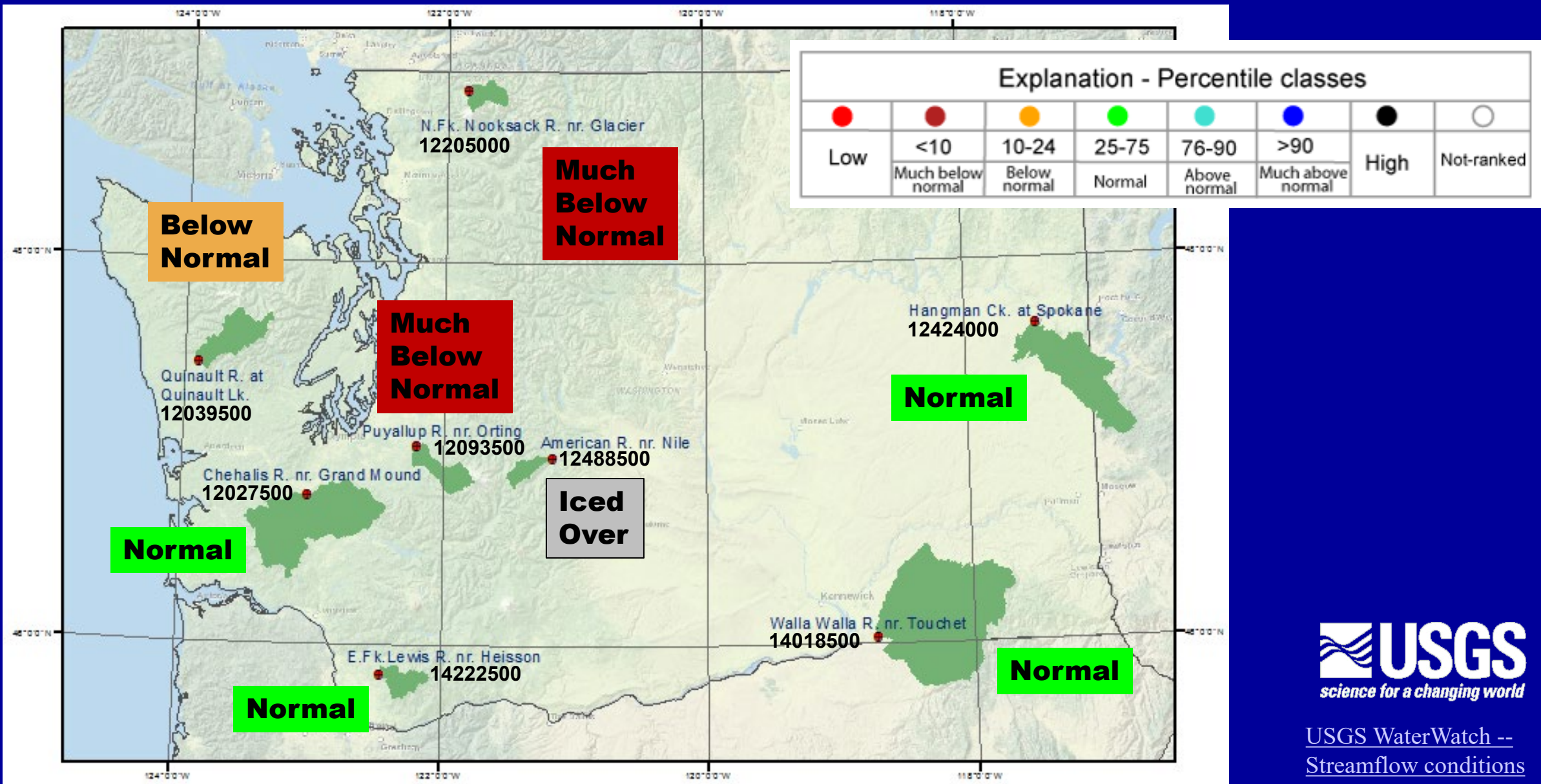


# Index Gaging Stations

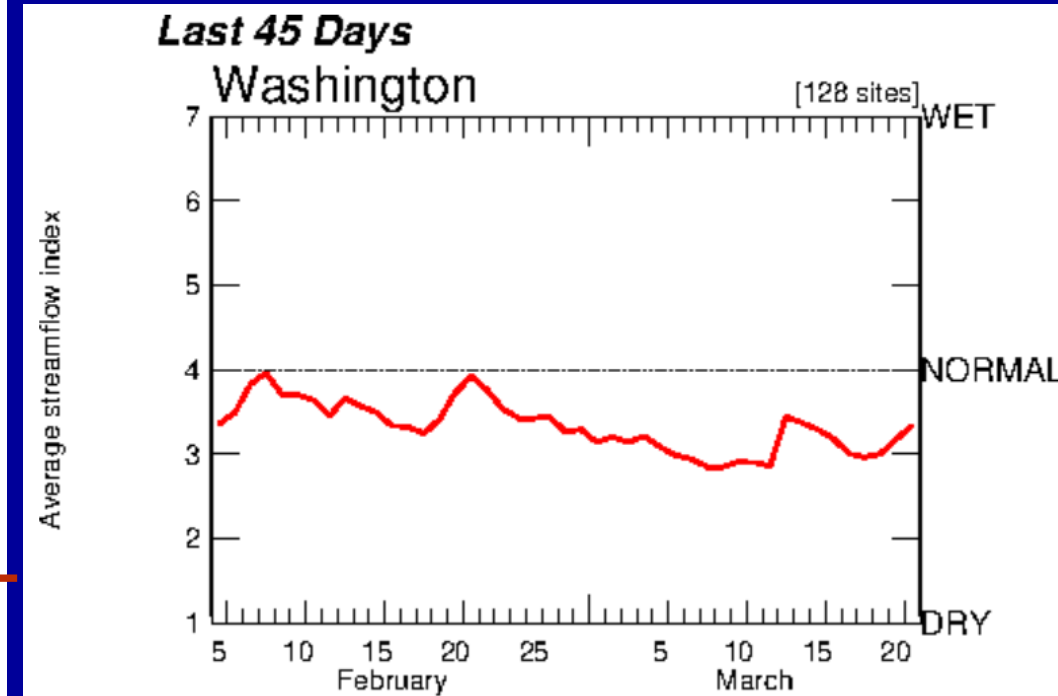
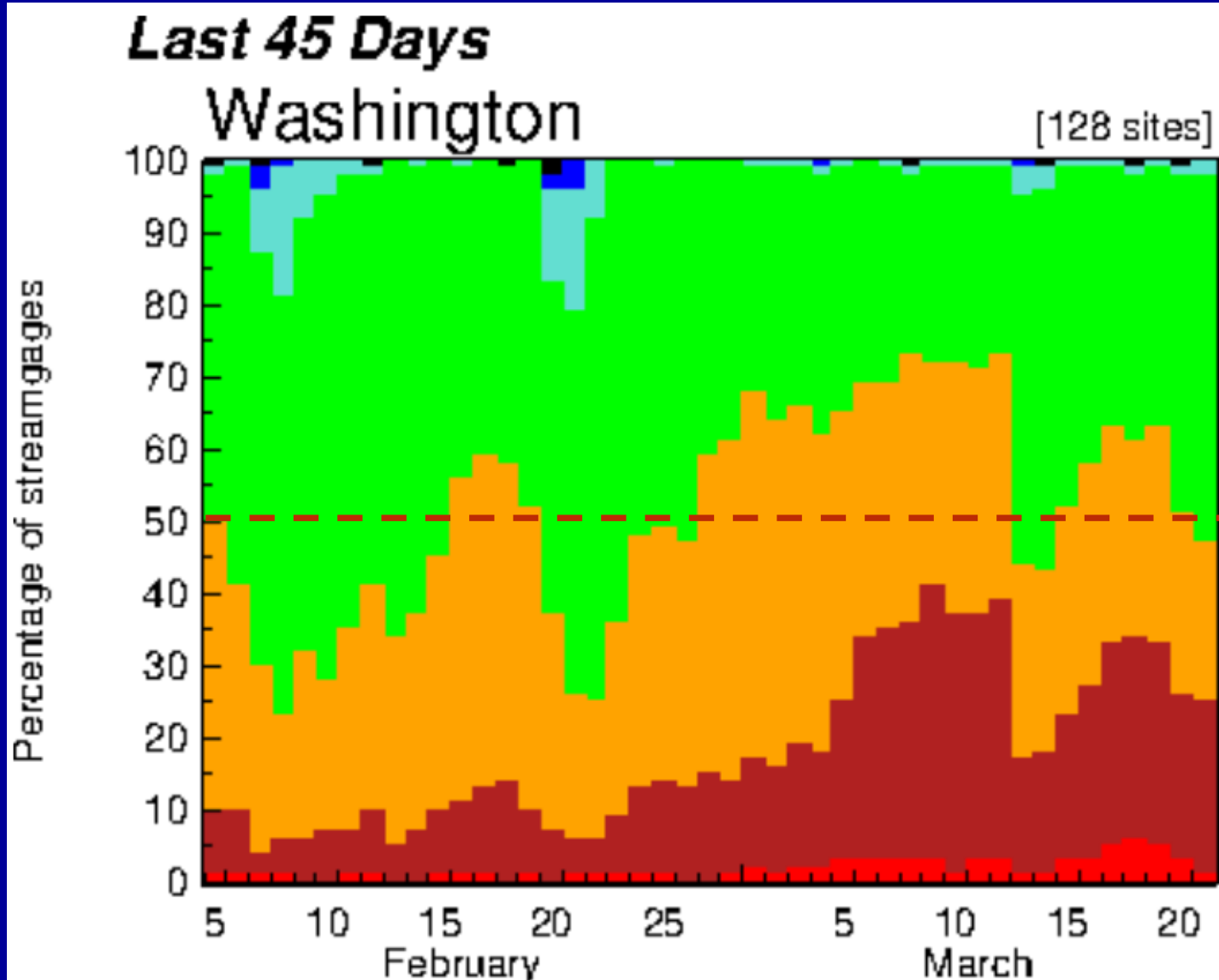
(Stations that measure natural or near-natural streamflow)



# Index Gaging Stations, 7-day average streamflow (as of 24 March 2023)



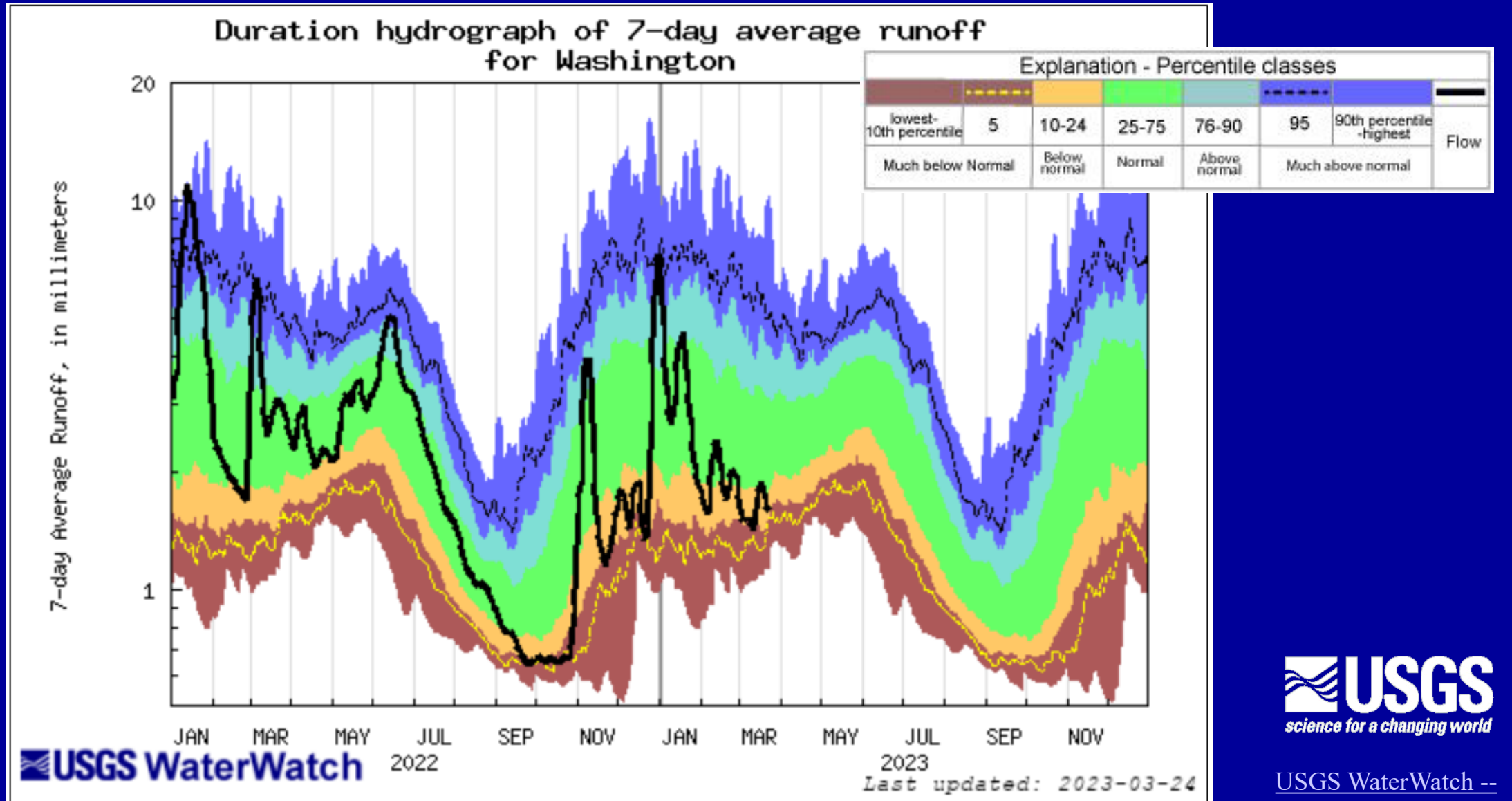
# 7-day average streamflow in Washington Rivers compared to historical streamflow, Feb. 2023 to March. 2023



Explanation - Percentile classes						
Low	<10	10-24	25-75	76-90	>90	High
	Much below normal	Below normal	Normal	Above normal	Much above normal	

# Duration Hydrograph, Washington State

7-day Average Streamflow (as of 24 March 2023) is below normal



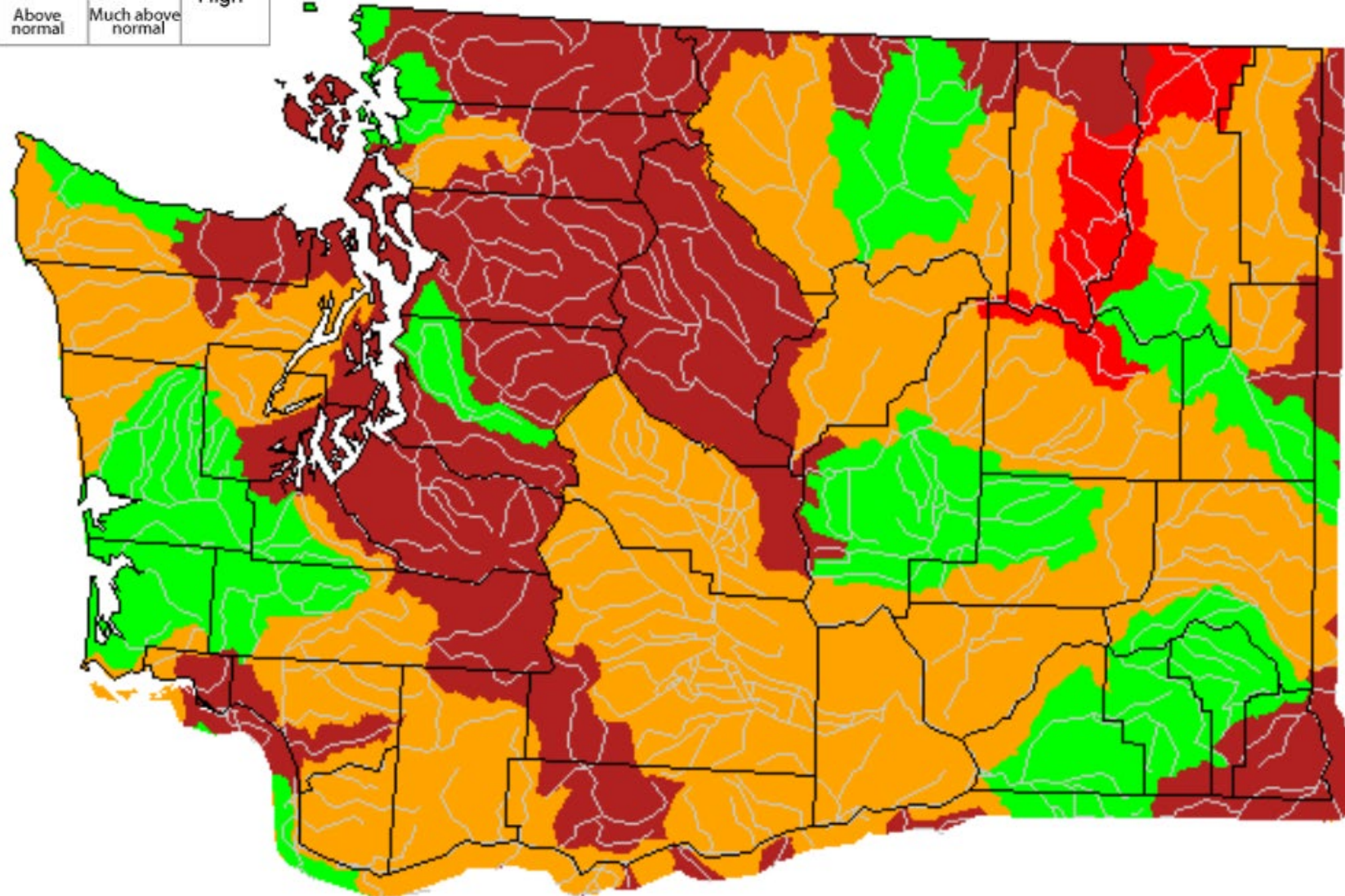
USGS WaterWatch --  
Streamflow conditions

# WA 28-day average streamflow

As of 24 March 2023

Explanation - Percentile classes

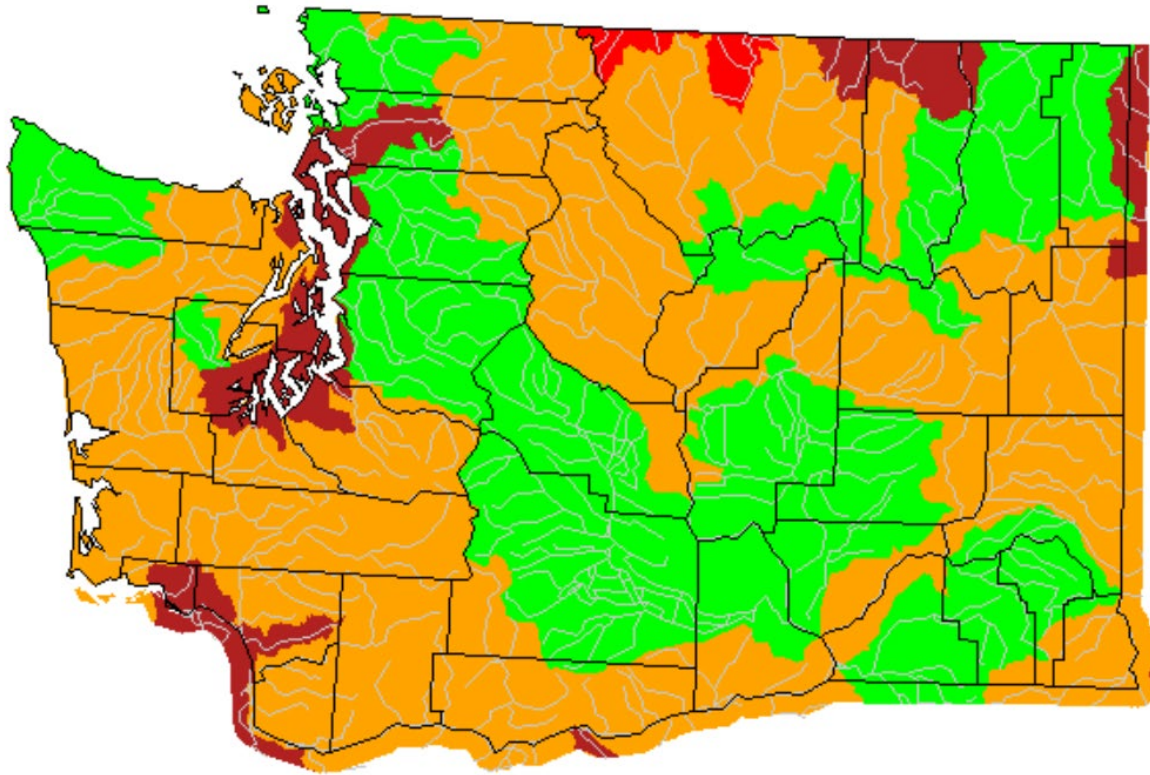
Explanation - Percentile classes					
Low	<10	10-24	25-75	76-90	>90
	Much below normal	Below normal	Normal	Above normal	Much above normal
					High



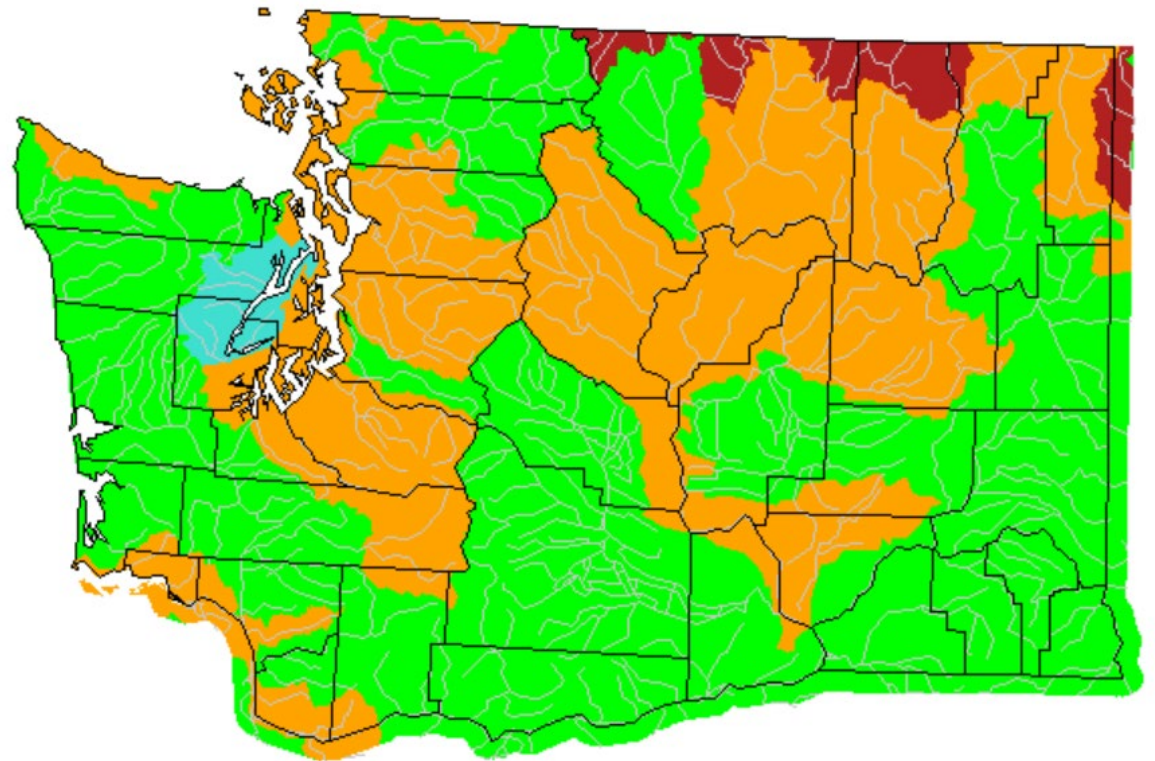
# Monthly average streamflow compared to historical

## January and February 2023

February 2023



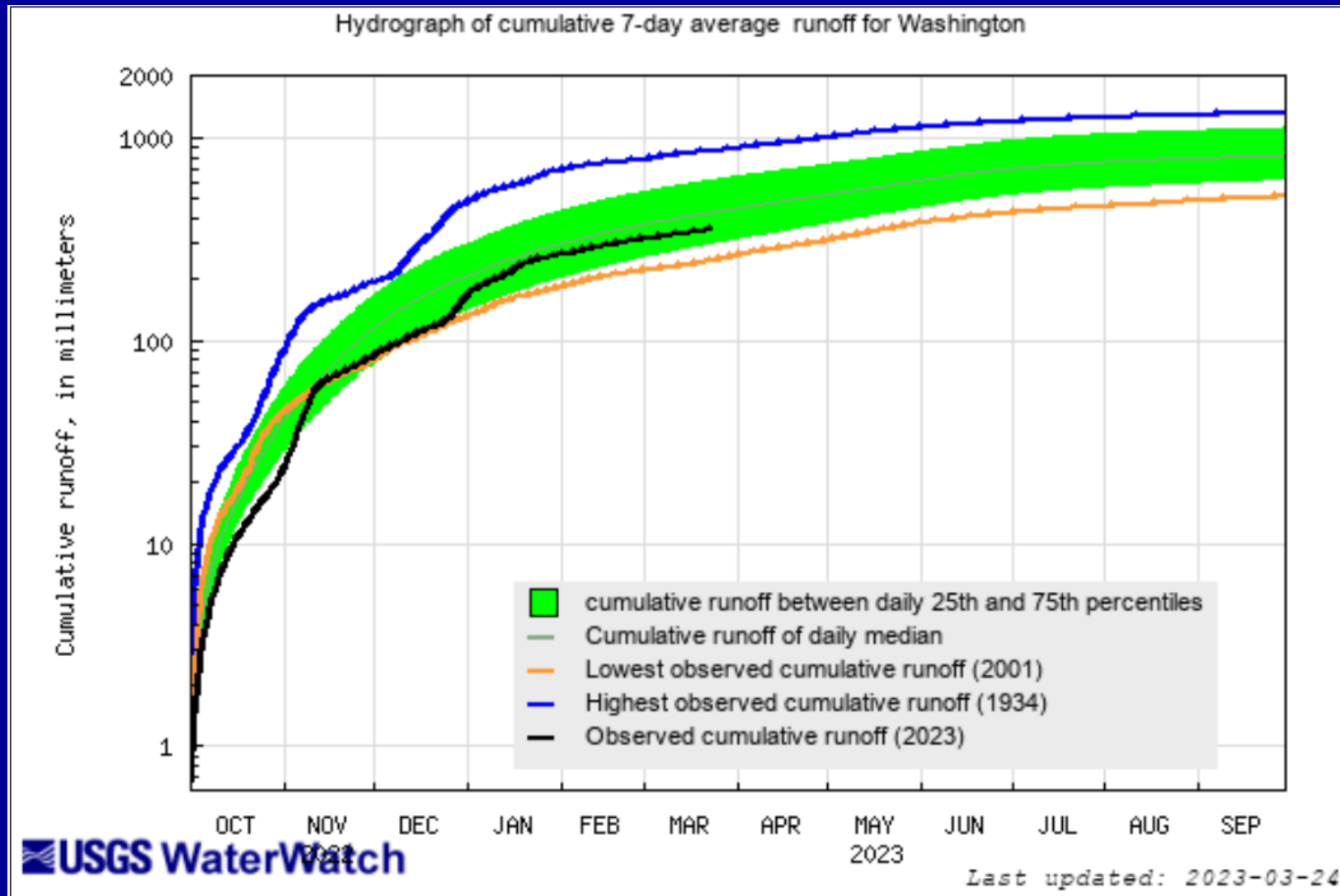
January 2023



Explanation - Percentile classes						
	<10	10-24	25-75	76-90	>90	
Low	Much below normal	Below normal	Normal	Above normal	Much above normal	High

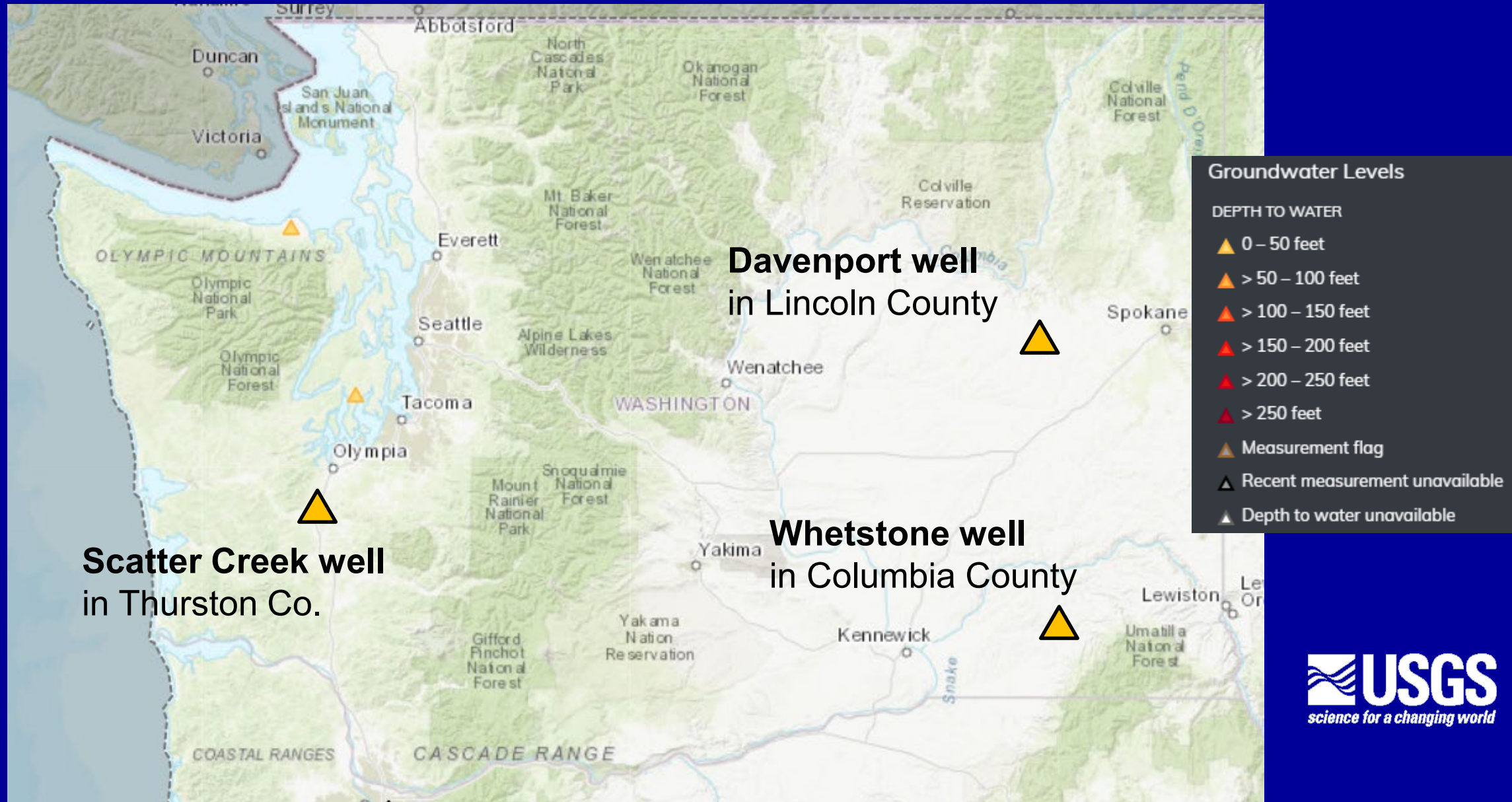
# Hydrograph of cumulative 7-day average Area-based Hydrograph, Washington State

2023 Water year (as of 24 March 2023) is normal



USGS WaterWatch --  
[Streamflow conditions](#)

# Three index groundwater wells in Washington



# Scatter Creek Well Groundwater Conditions (24 March 2023)

**16N/02W-29L02P2 - 465033122570202**

March 24, 2022 - March 24, 2023

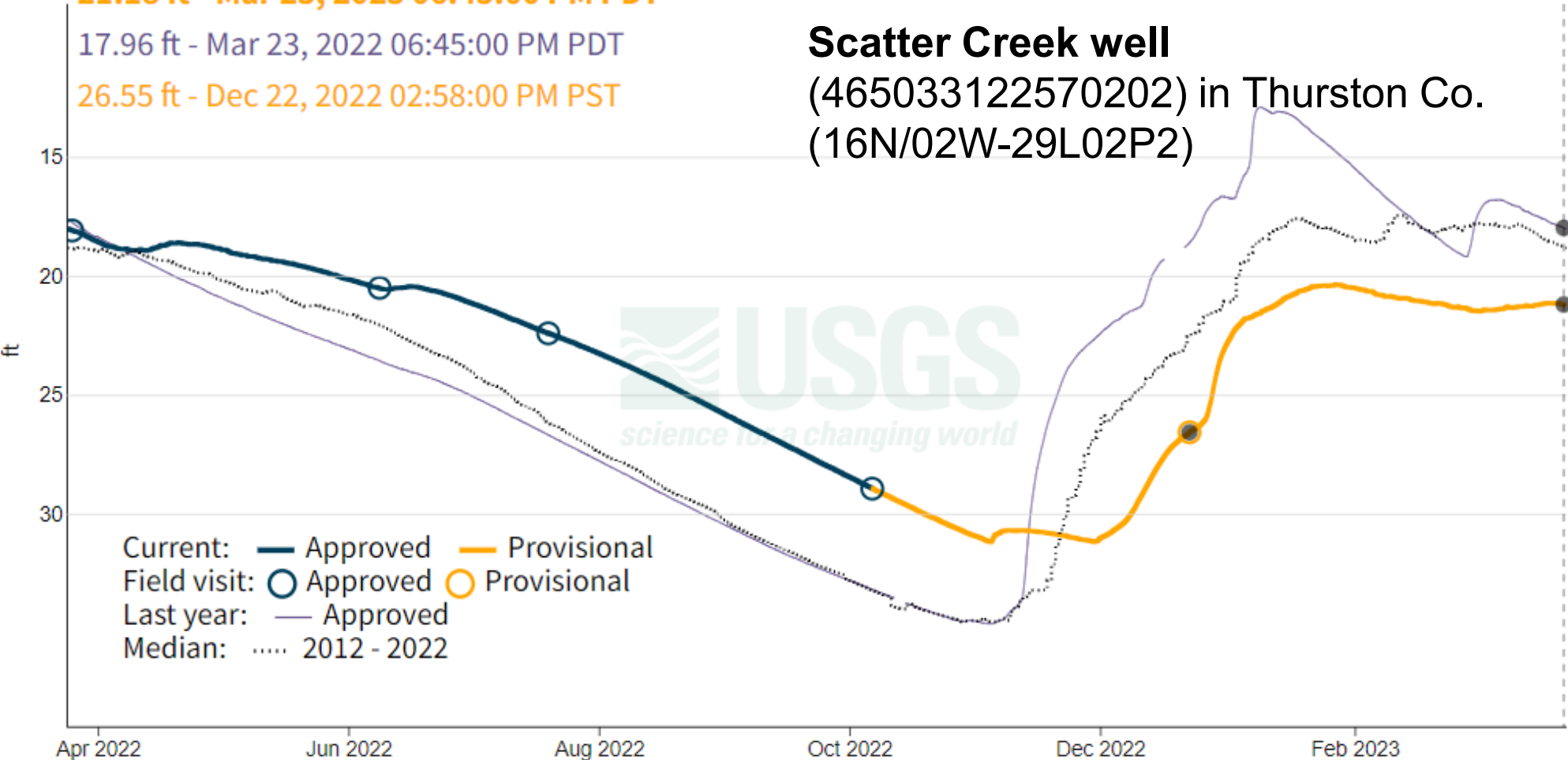
**Depth to water level, ft below land surface** ⓘ

**21.18 ft - Mar 23, 2023 06:45:00 PM PDT**

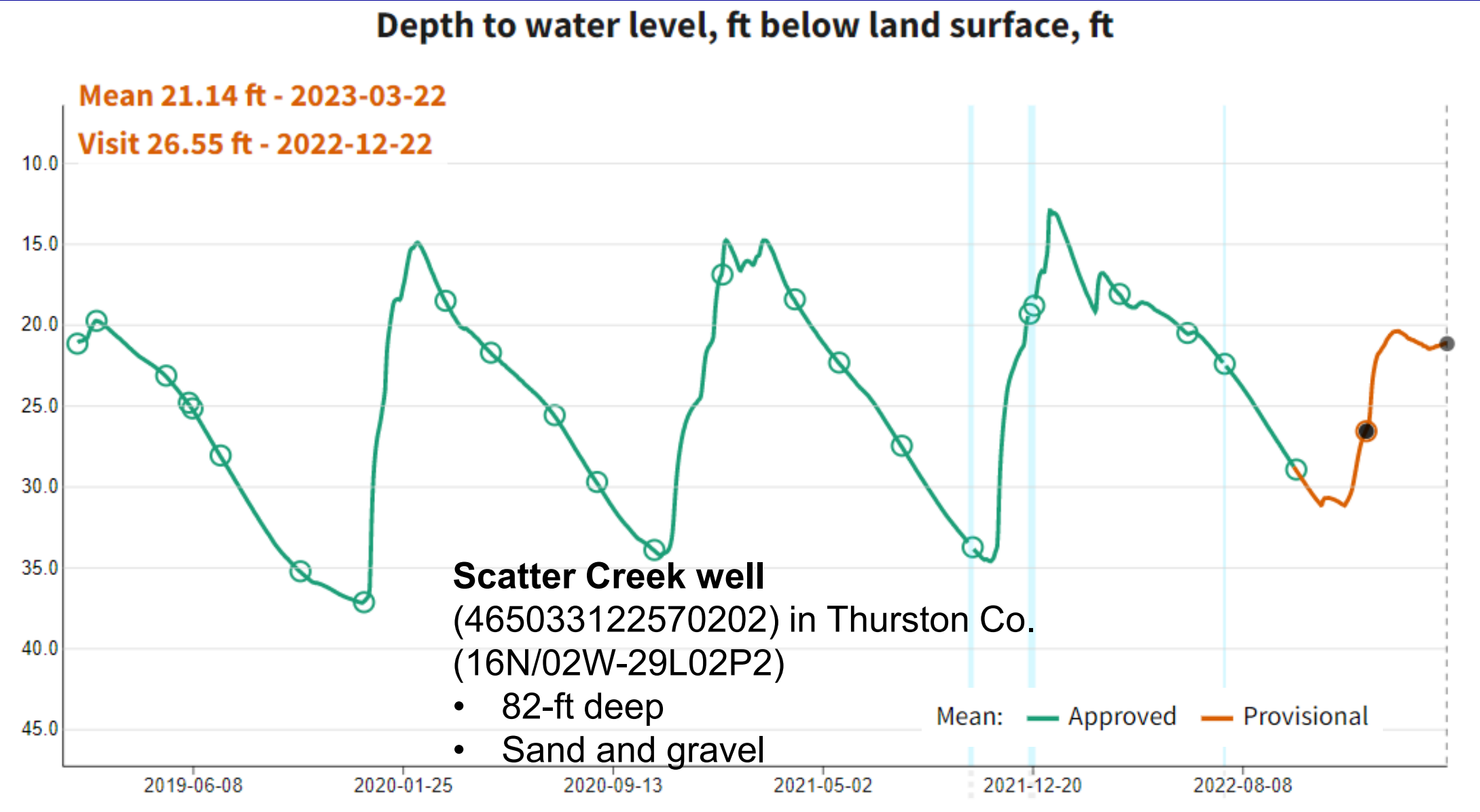
17.96 ft - Mar 23, 2022 06:45:00 PM PDT

26.55 ft - Dec 22, 2022 02:58:00 PM PST

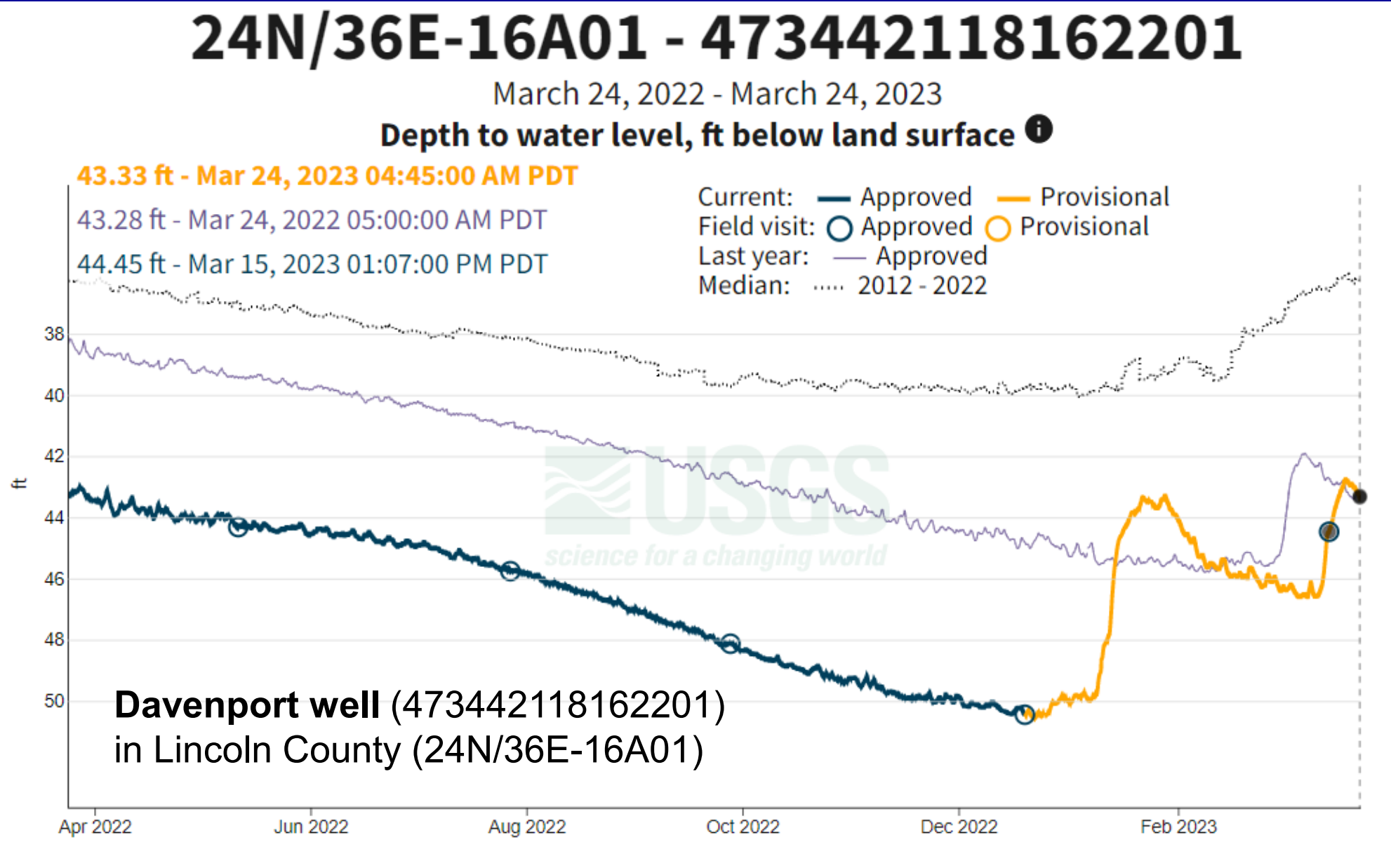
**Scatter Creek well**  
(465033122570202) in Thurston Co.  
(16N/02W-29L02P2)



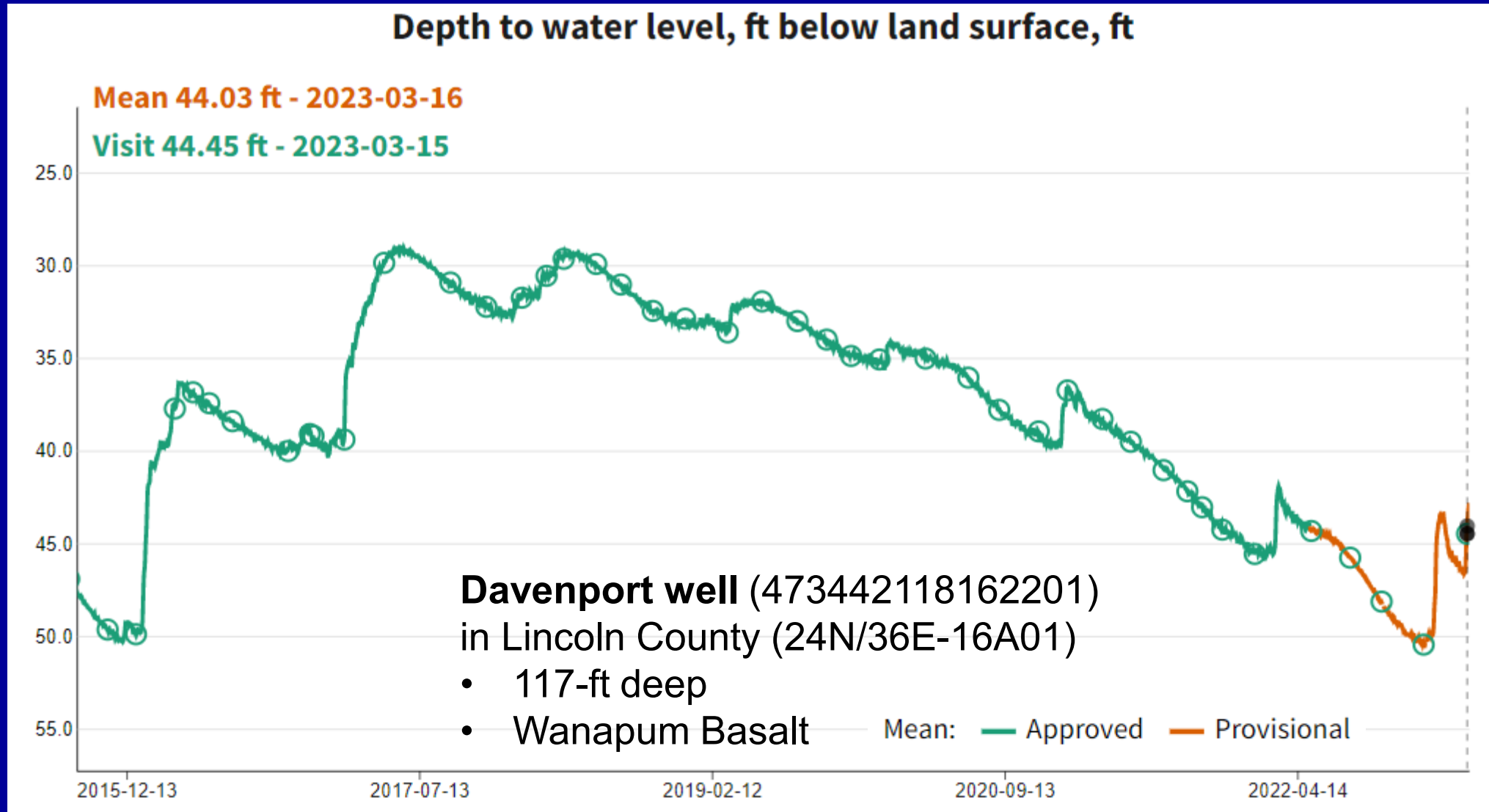
# Scatter Creek Well Groundwater Conditions (24 March 2023)



# Davenport Well Groundwater Conditions (24 March 2023)



# Davenport Well Groundwater Conditions (24 March 2023)

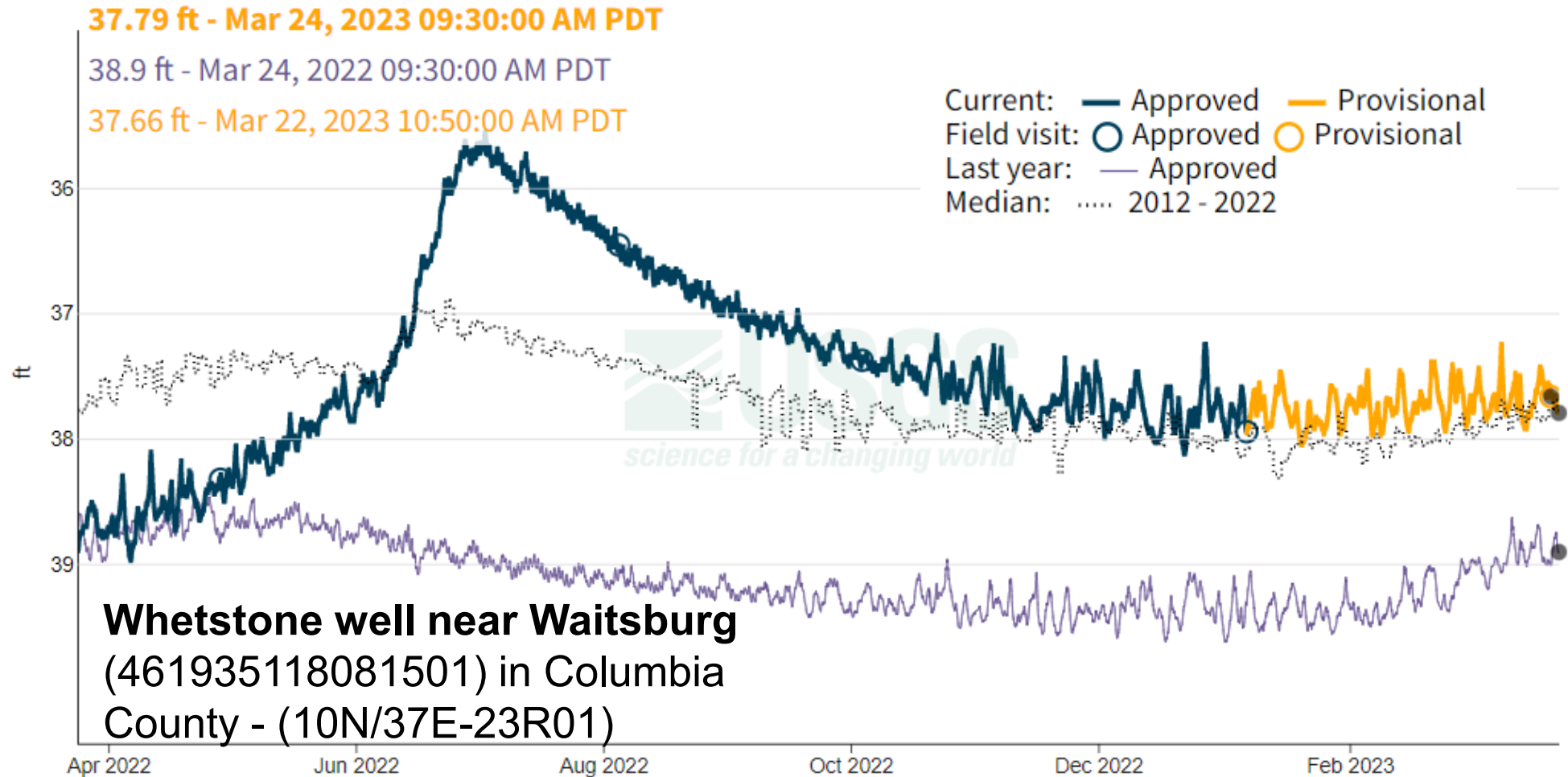


# Whetstone Well Groundwater Conditions (24 March 2023)

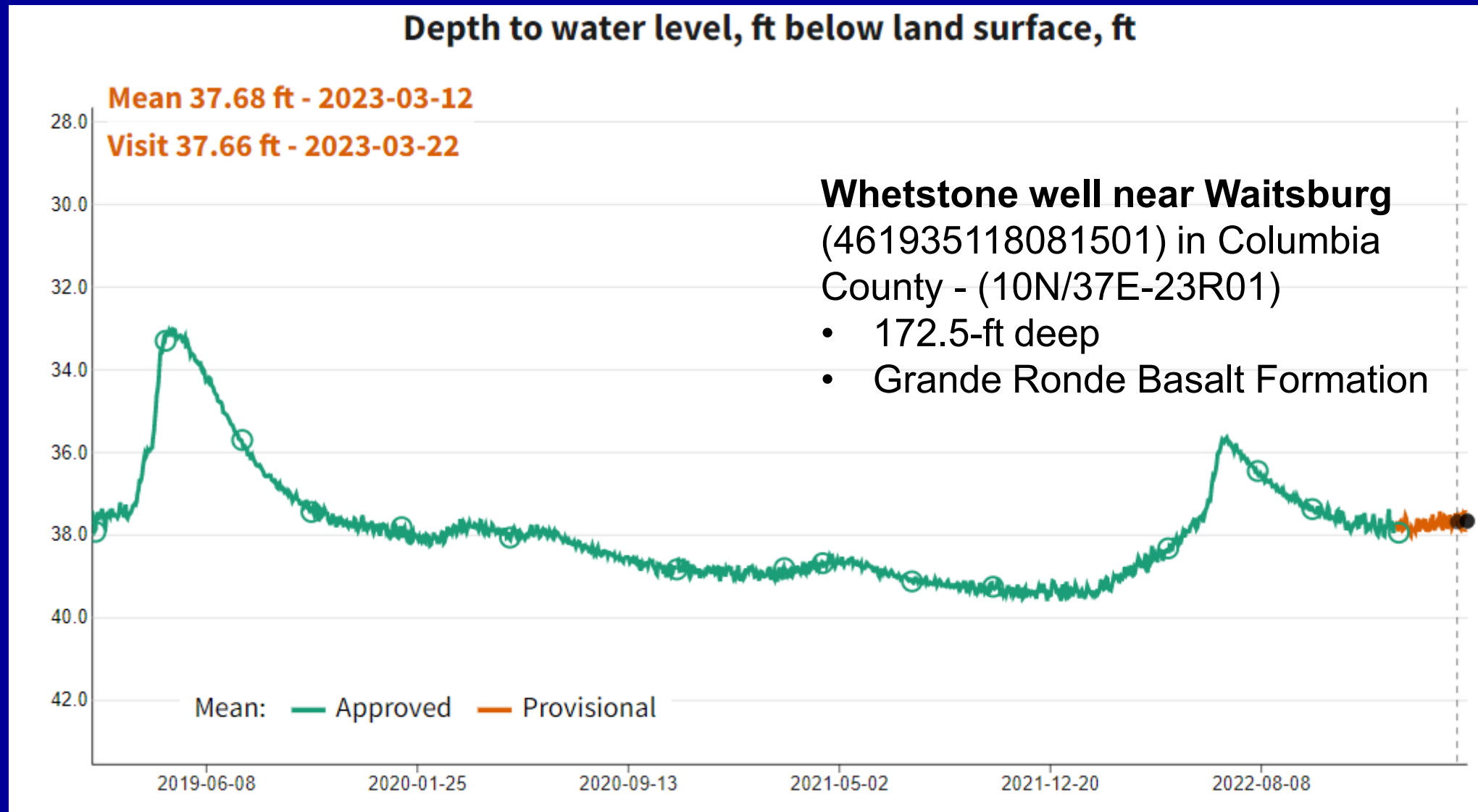
## 10N/37E-23R01 - 461935118081501

March 24, 2022 - March 24, 2023

Depth to water level, ft below land surface ⓘ

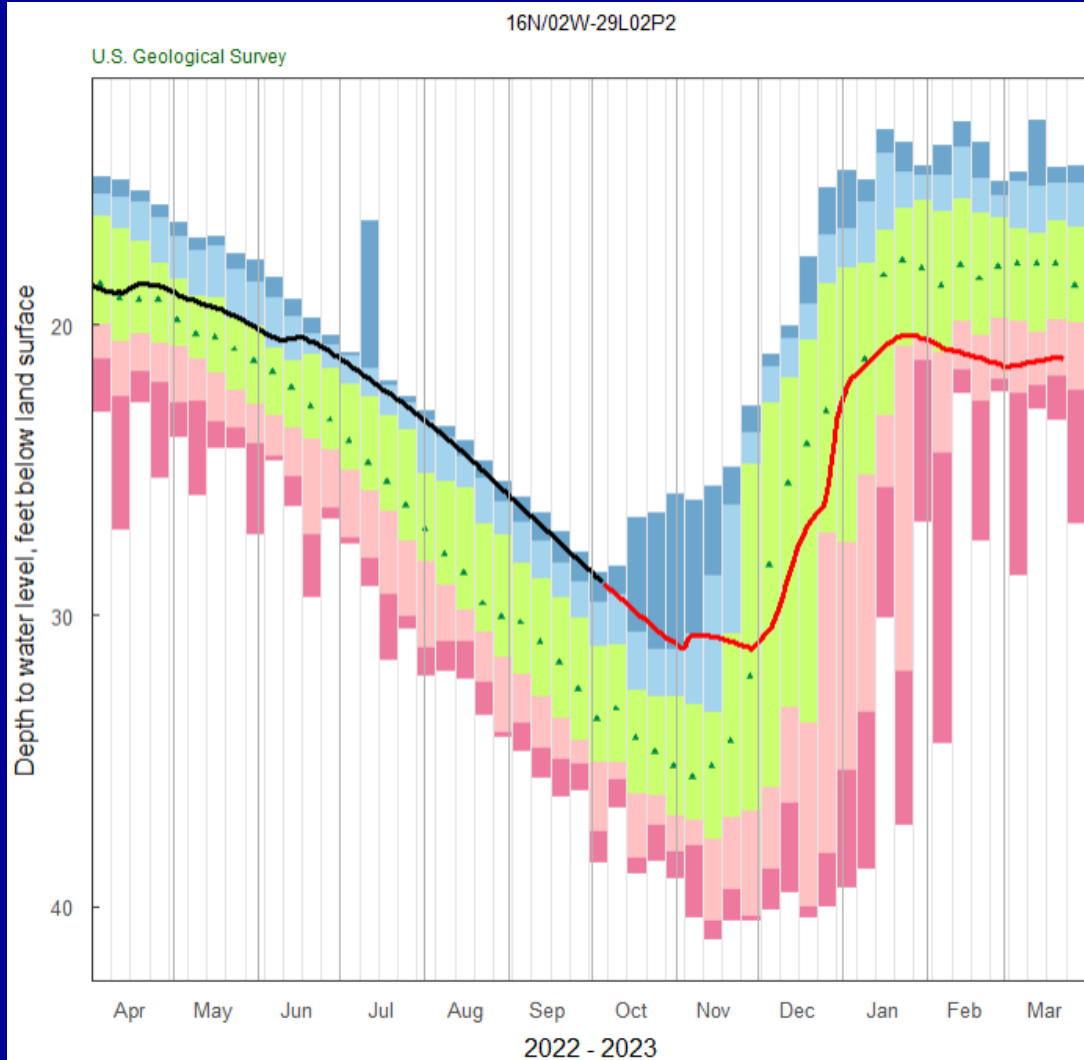


# Whetstone Well Groundwater Conditions (24 March 2023)

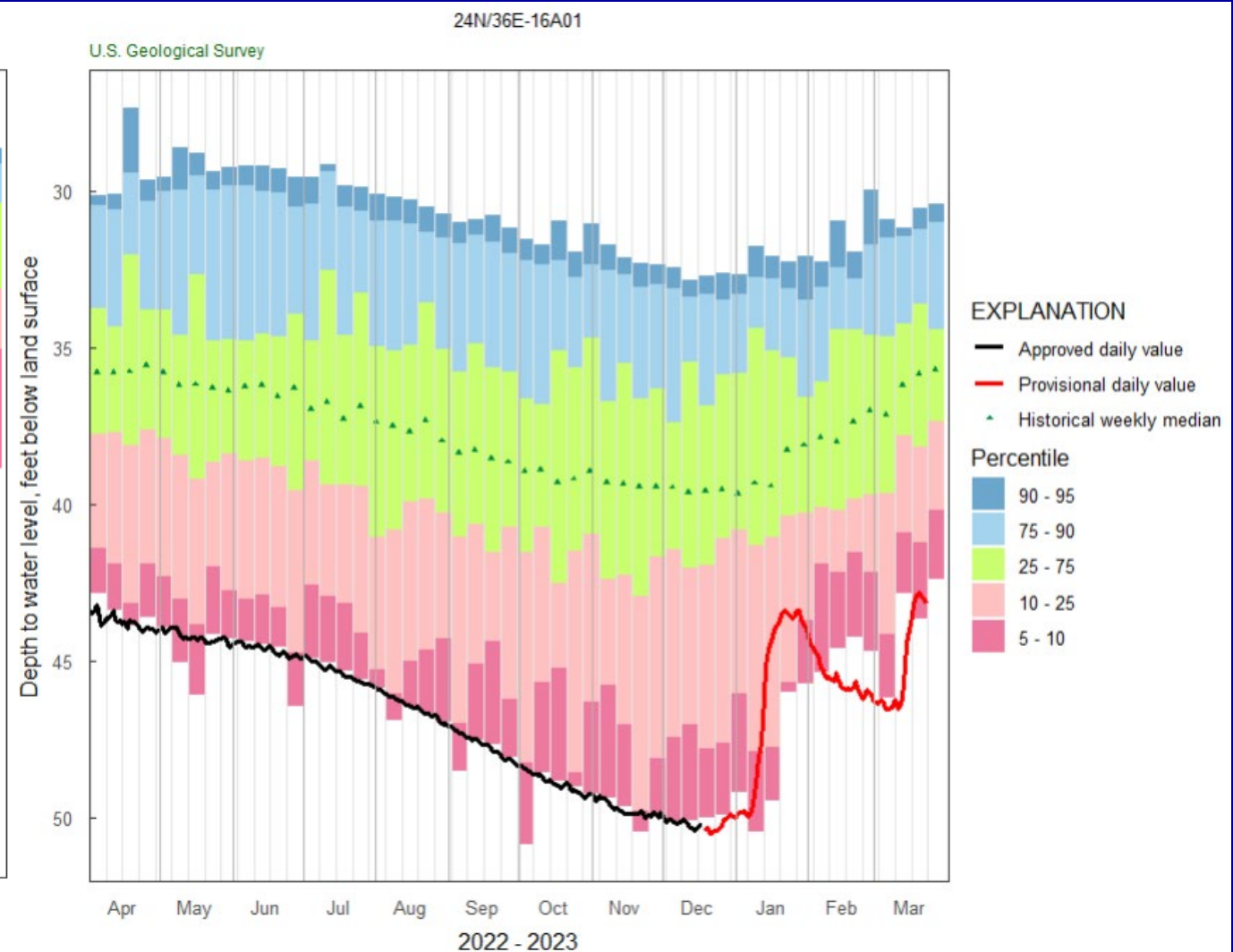


# WA Current Groundwater Condition (24 March 2023)

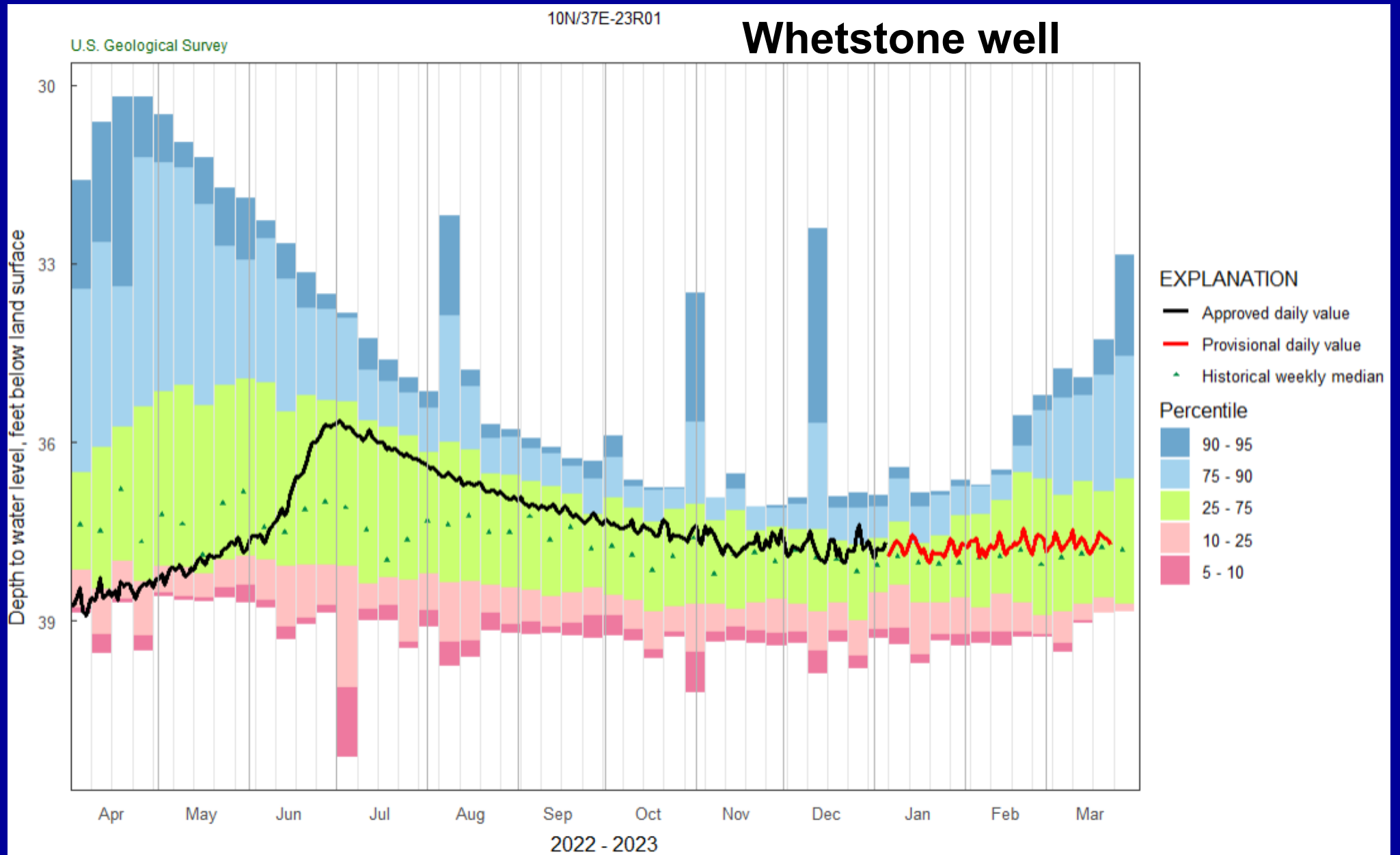
## Scatter Creek well



## Davenport well



# WA Current Groundwater Conditions (24 March 2023)



# Summary of Washington Streamflow & GW conditions as of 24 March 2023

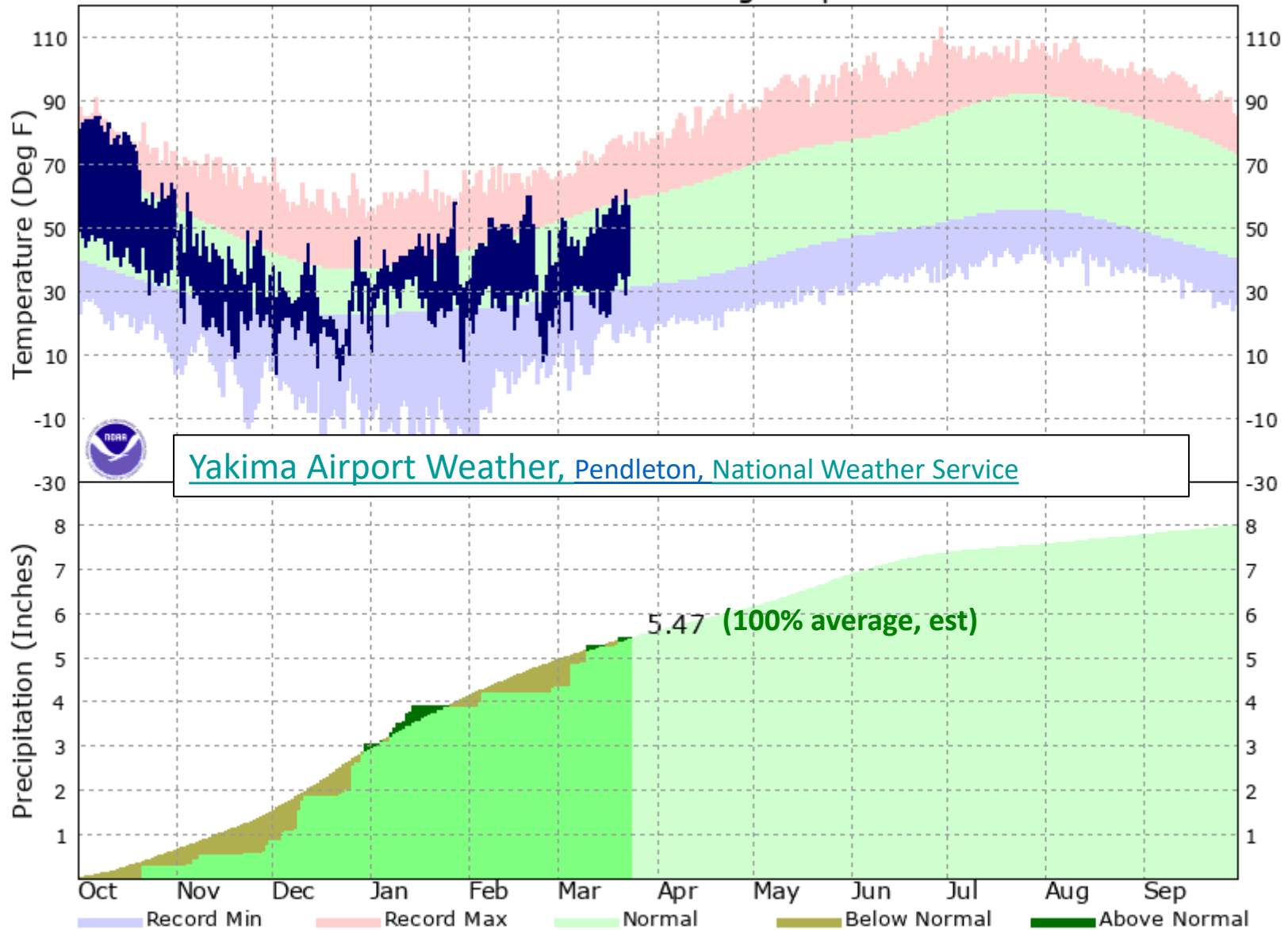
- 7-day average streamflow statewide is below normal
- 7-day average streamflow at eight index gaging stations:
  - Northern WA
    - NF Nooksack River – Much below Normal
    - Puyallup River nr. Orting – Much Below Normal
    - Quinault River – Below Normal
    - American River - Iced Over
    - Hangman Creek – Normal
    - Chehalis River nr. Grand Mound – Normal
    - Walla Walla River – Normal
    - EF Lewis River – Normal
- Index groundwater sites: (below normal)
  - Scatter Creek well (west) – Below Normal
  - Davenport well (east) – Much Below normal
  - Whetstone well (southeast) - Normal

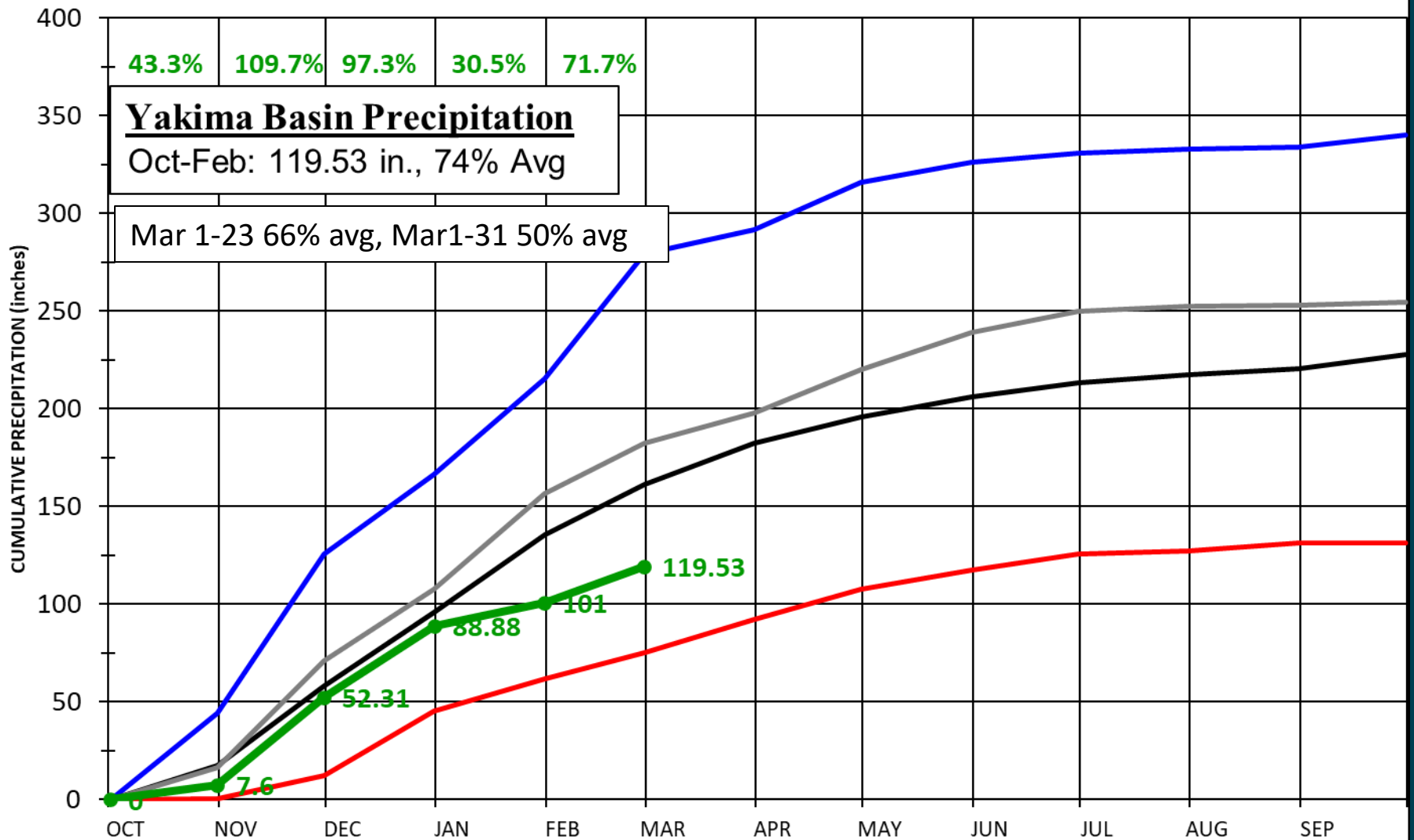


# Yakima River Operations & Water Supply for WaWSAC

Yakima Basin, Washington  
Mar 9, 2023, WY 2023

## KYKM - Oct 2022 Through Sep 2023

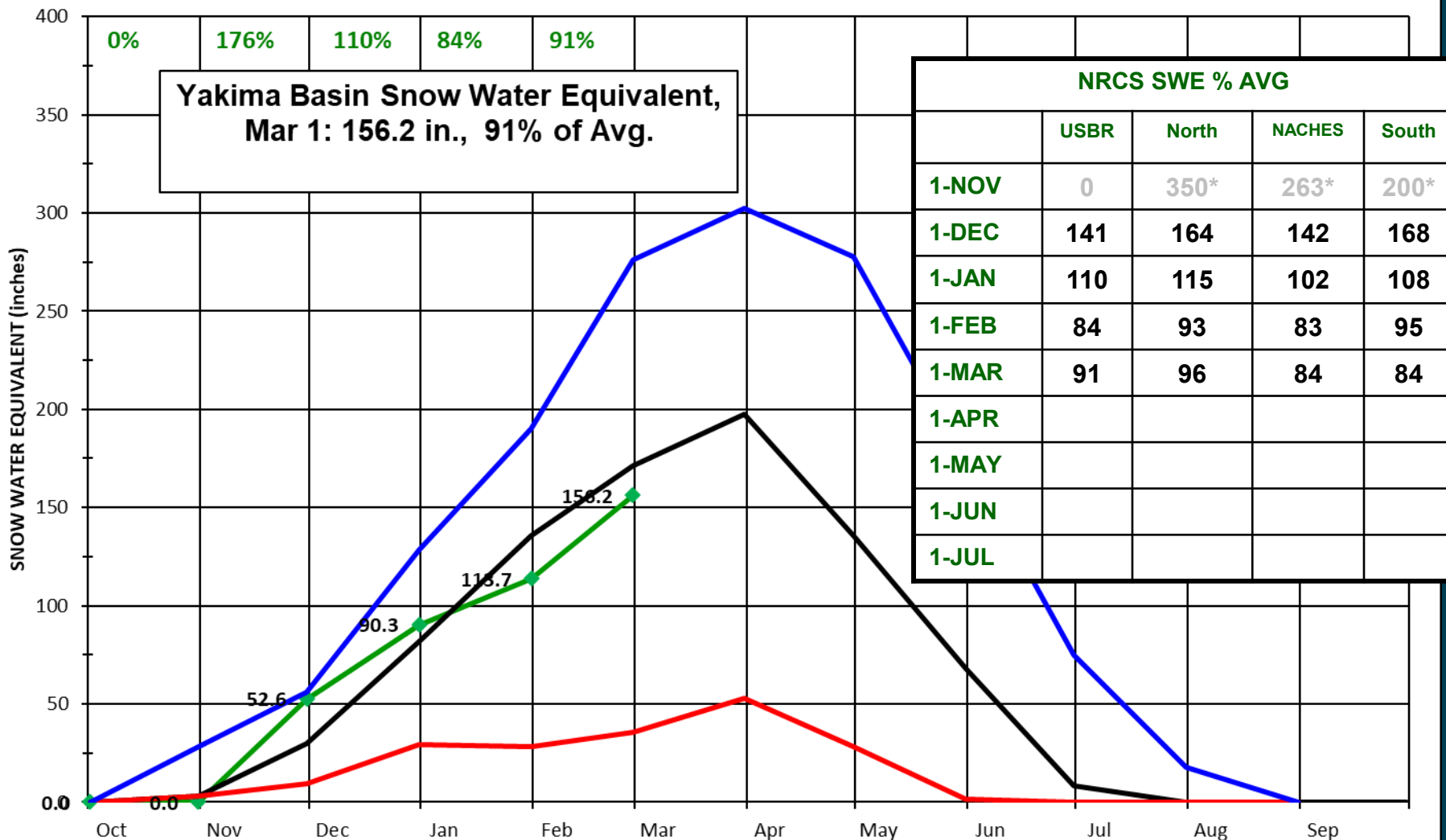




— Maximum    — Average  
 — Minimum    — WY2022  
 —●— WY 2023

**YAKIMA BASIN**  
 Combined Cumulative Precipitation  
 5 Reservoir Sites  
 WATER YEARS 1981-2010

UNITED STATES  
 DEPARTMENT OF THE INTERIOR  
 BUREAU OF RECLAMATION  
 YAKIMA FIELD OFFICE  
 1917 MARSH ROAD  
 YAKIMA, WA 98901



◆ Water Year 2023  
— Average  
— Low Year (2005)  
— High Year (1999)

**YAKIMA BASIN WATER YEAR  
SNOW WATER EQUIVALENT**

Average based on greater of 1981-2010 or POR-1995  
 Totals derived from 8 Yakima forecast sites  
 Corral, Stampede, Olallie, Fish, Bumping, Domerie, & Tunnel Avenue

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# SNOW WATER EQUIVALENT IN YAKIMA

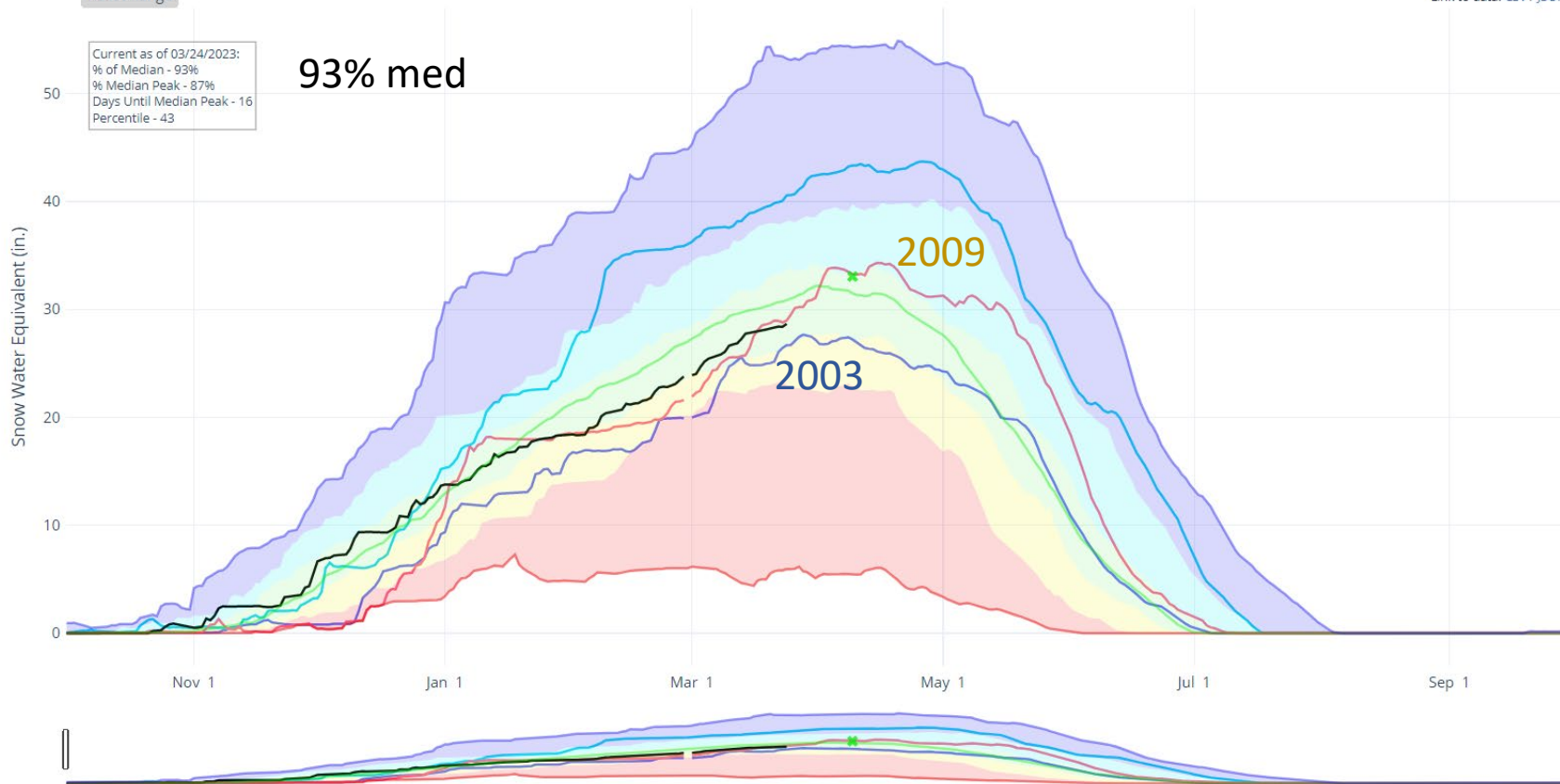
Reset Range

[Link to data: CSV / JSON](#)

Station List

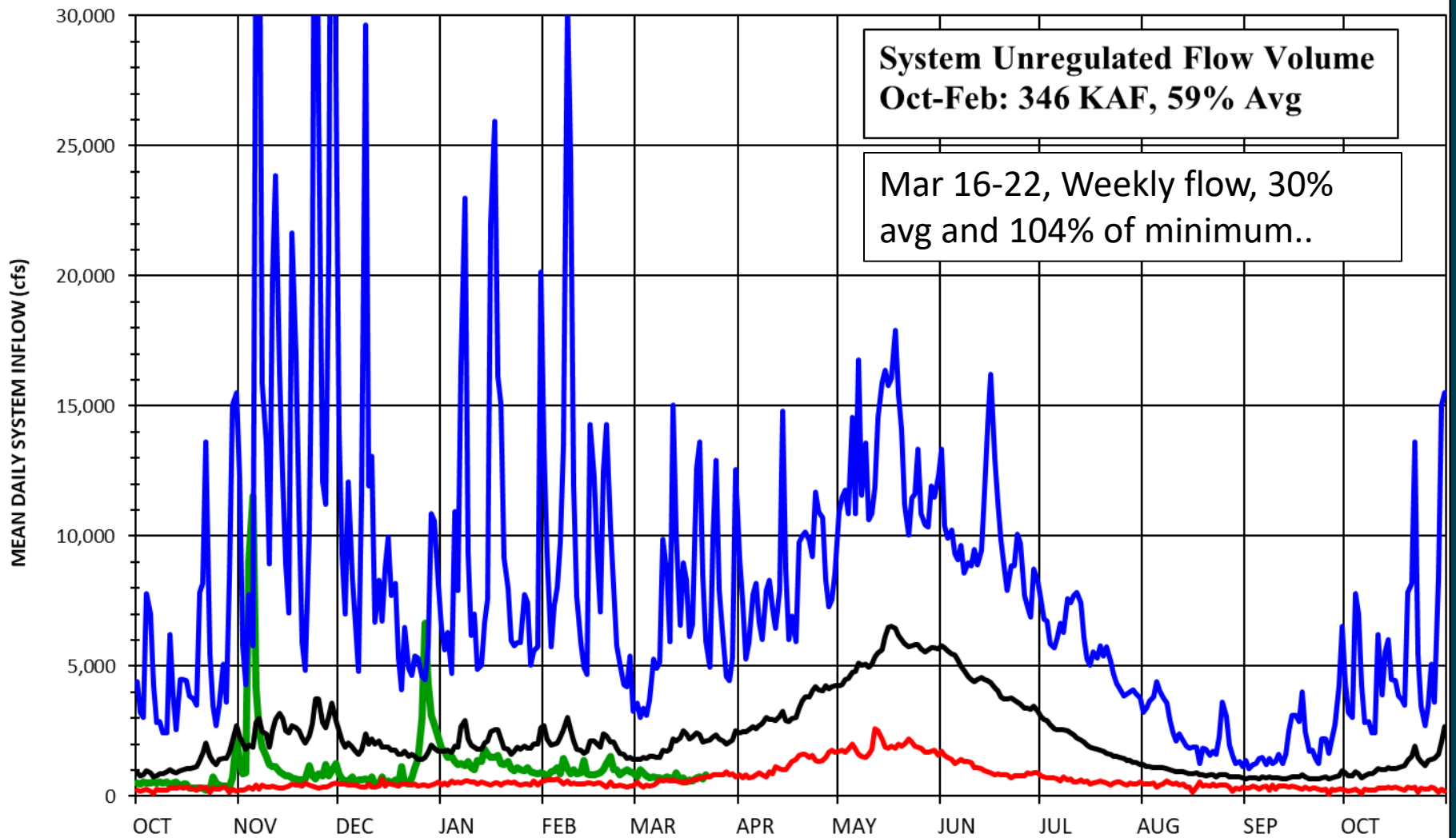
Current as of 03/24/2023:  
% of Median - 93%  
% Median Peak - 87%  
Days Until Median Peak - 16  
Percentile - 43

93% med



- ★ Median Peak SW
- Max
- Median (POR)
- Median ('91-'20)
- Min
- Stats. Shading
- 2023 (17 sites)
- 2022 (17 sites)
- 2021 (16 sites)
- 2020 (17 sites)
- 2019 (17 sites)
- 2018 (16 sites)
- 2017 (17 sites)
- 2016 (17 sites)
- 2015 (17 sites)
- 2014 (17 sites)
- 2013 (17 sites)
- 2012 (17 sites)
- 2011 (17 sites)
- 2010 (17 sites)
- 2009 (16 sites)
- 2008 (16 sites)
- 2007 (16 sites)
- 2006 (14 sites)
- 2005 (14 sites)
- 2004 (14 sites)
- 2003 (14 sites)
- 2002 (14 sites)

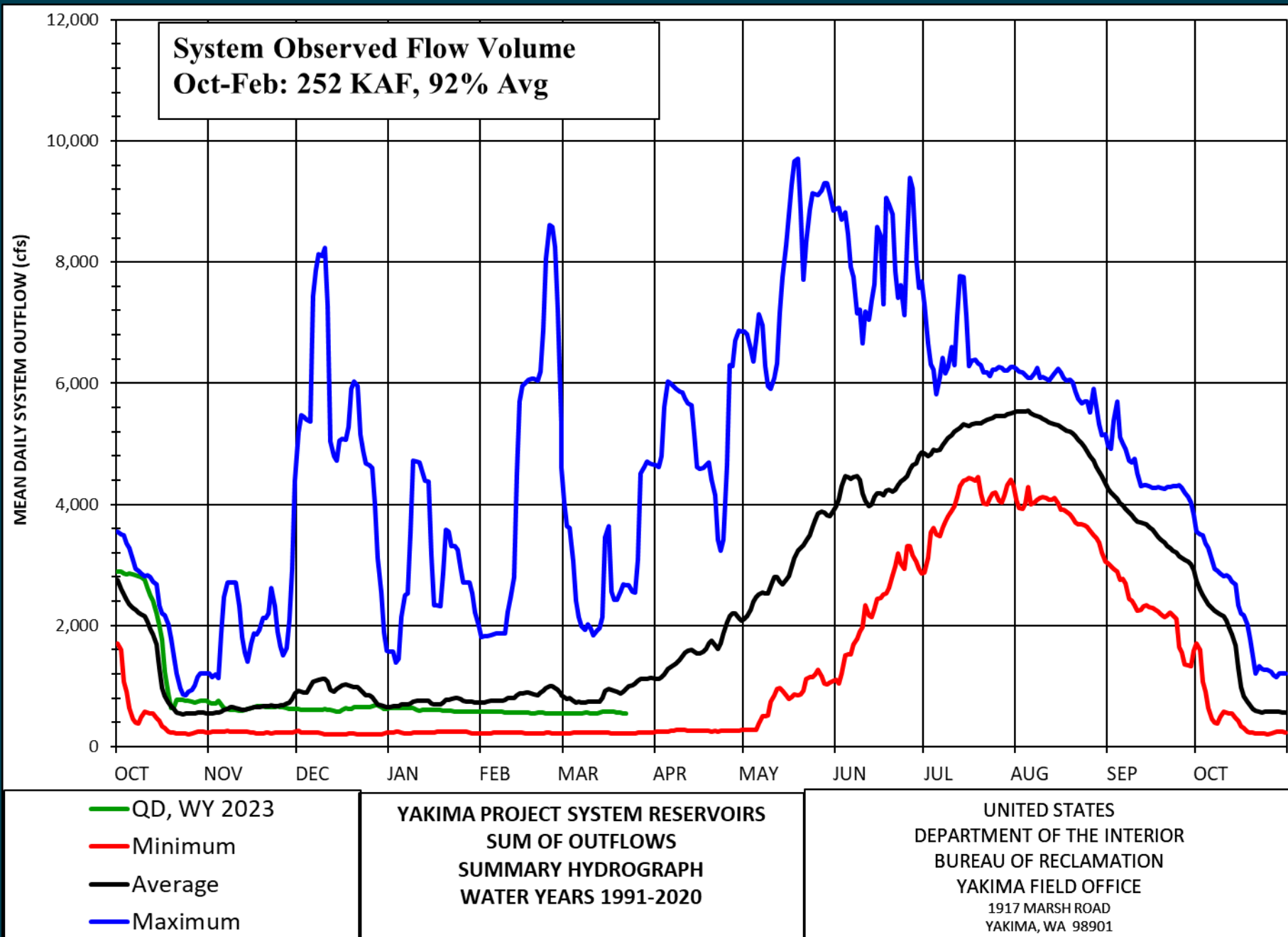


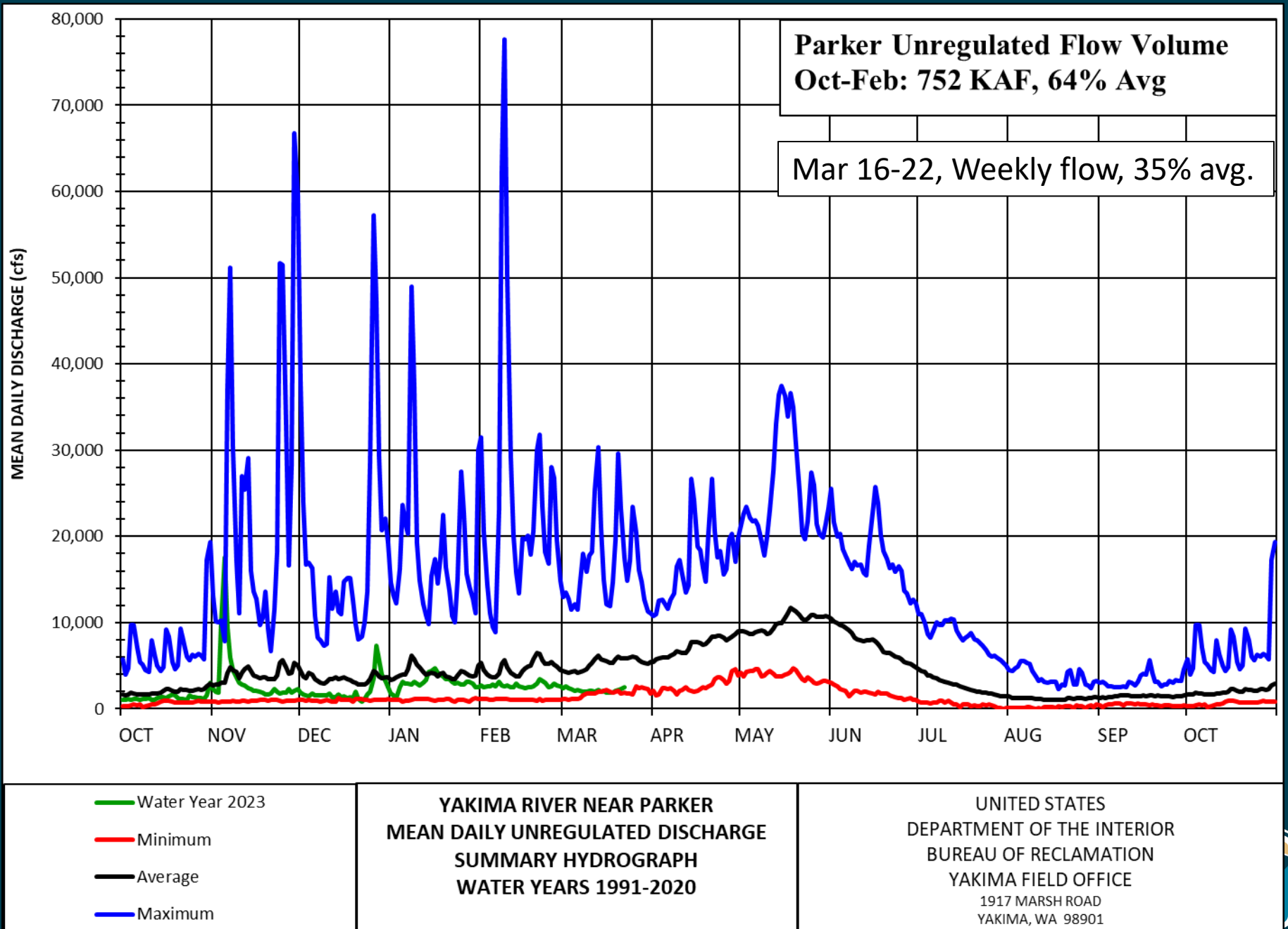


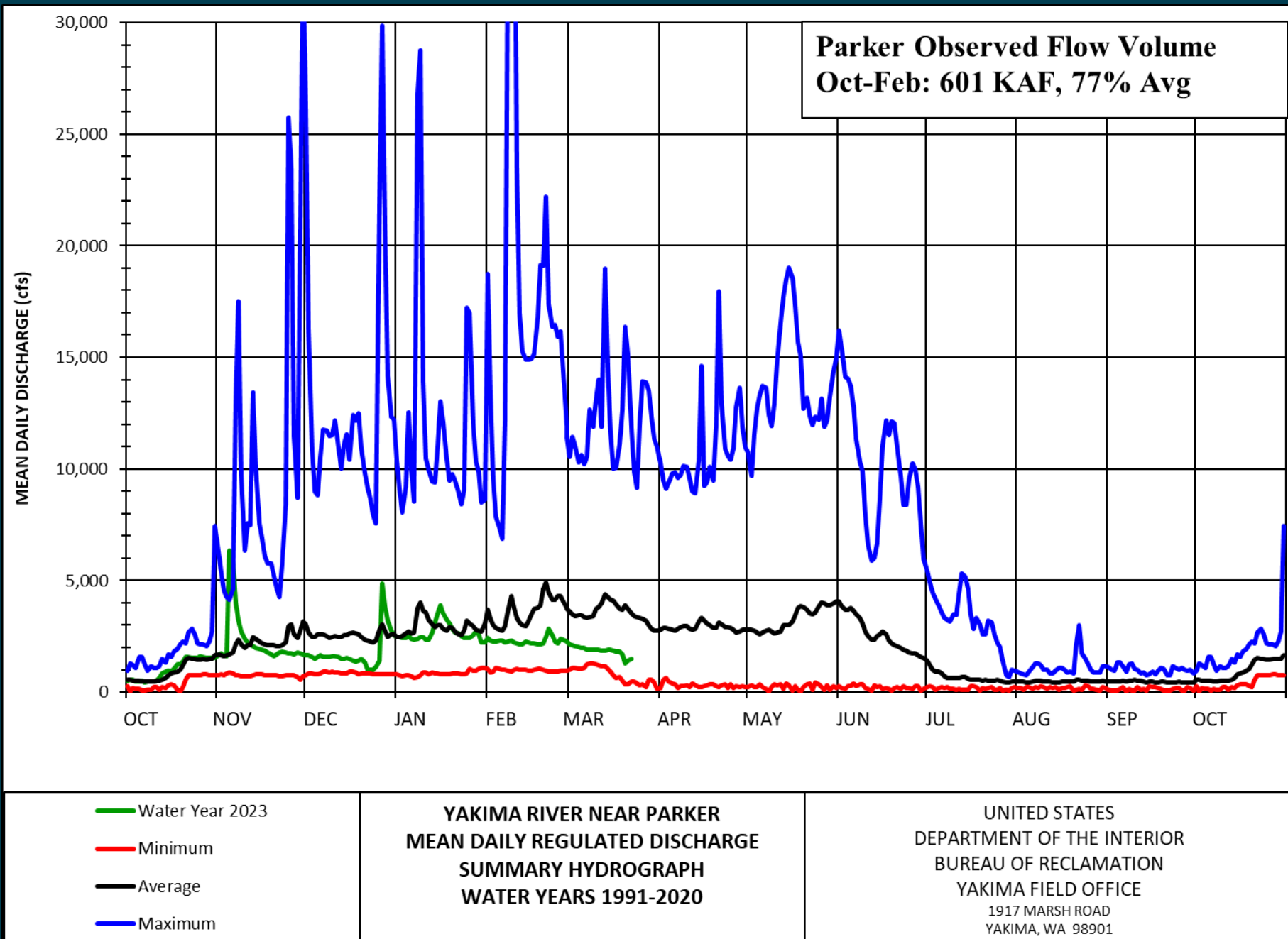
— Water Year 2023  
— Min  
— Avg  
— max

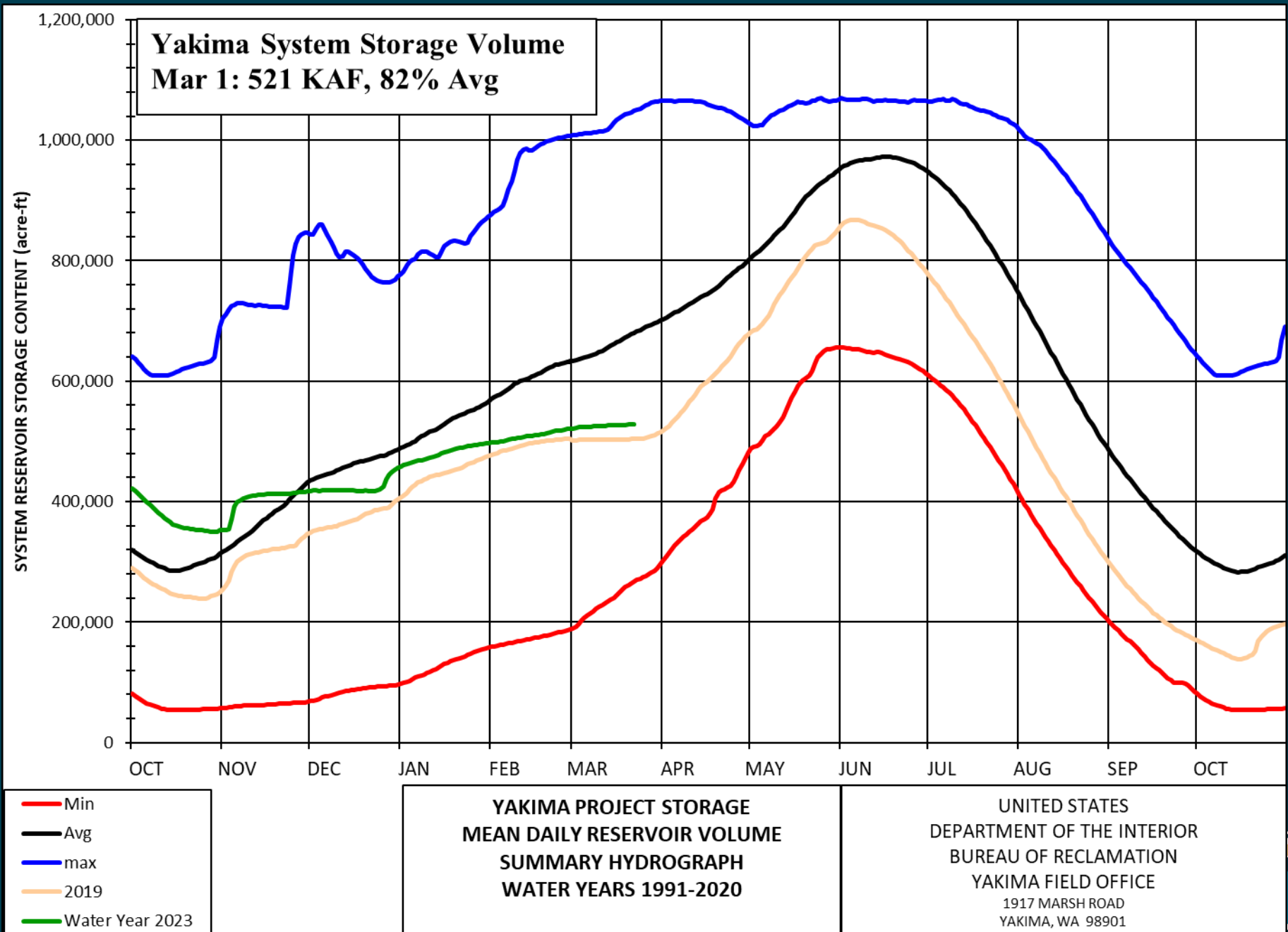
**YAKIMA PROJECT**  
**SYSTEM RESERVOIRS**  
**SUM OF INFLOWS**  
**SUMMARY HYDROGRAPH**  
**WATER YEARS 1991-2020**

UNITED STATES  
 DEPARTMENT OF THE INTERIOR  
 BUREAU OF RECLAMATION  
 YAKIMA FIELD OFFICE  
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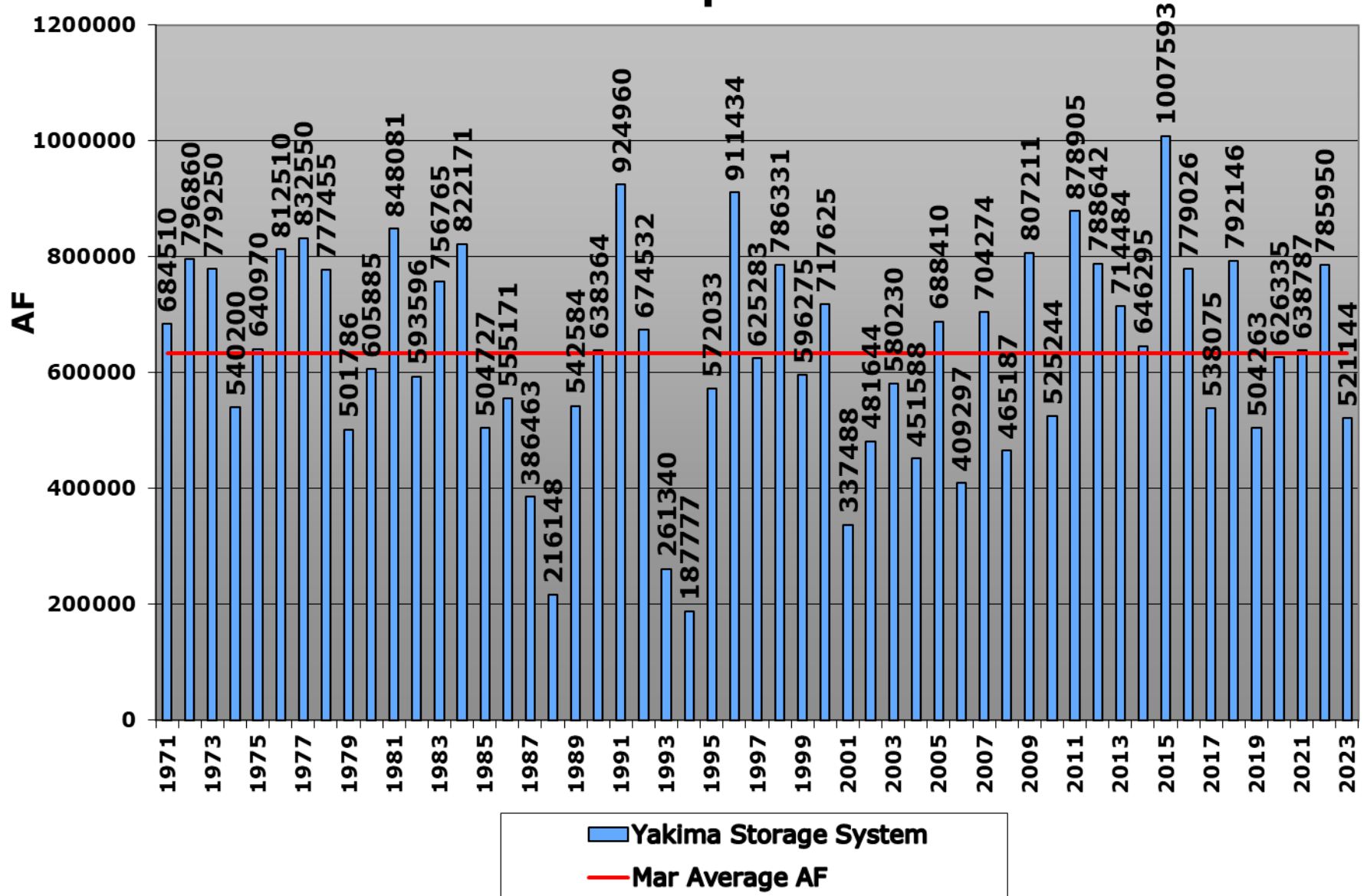






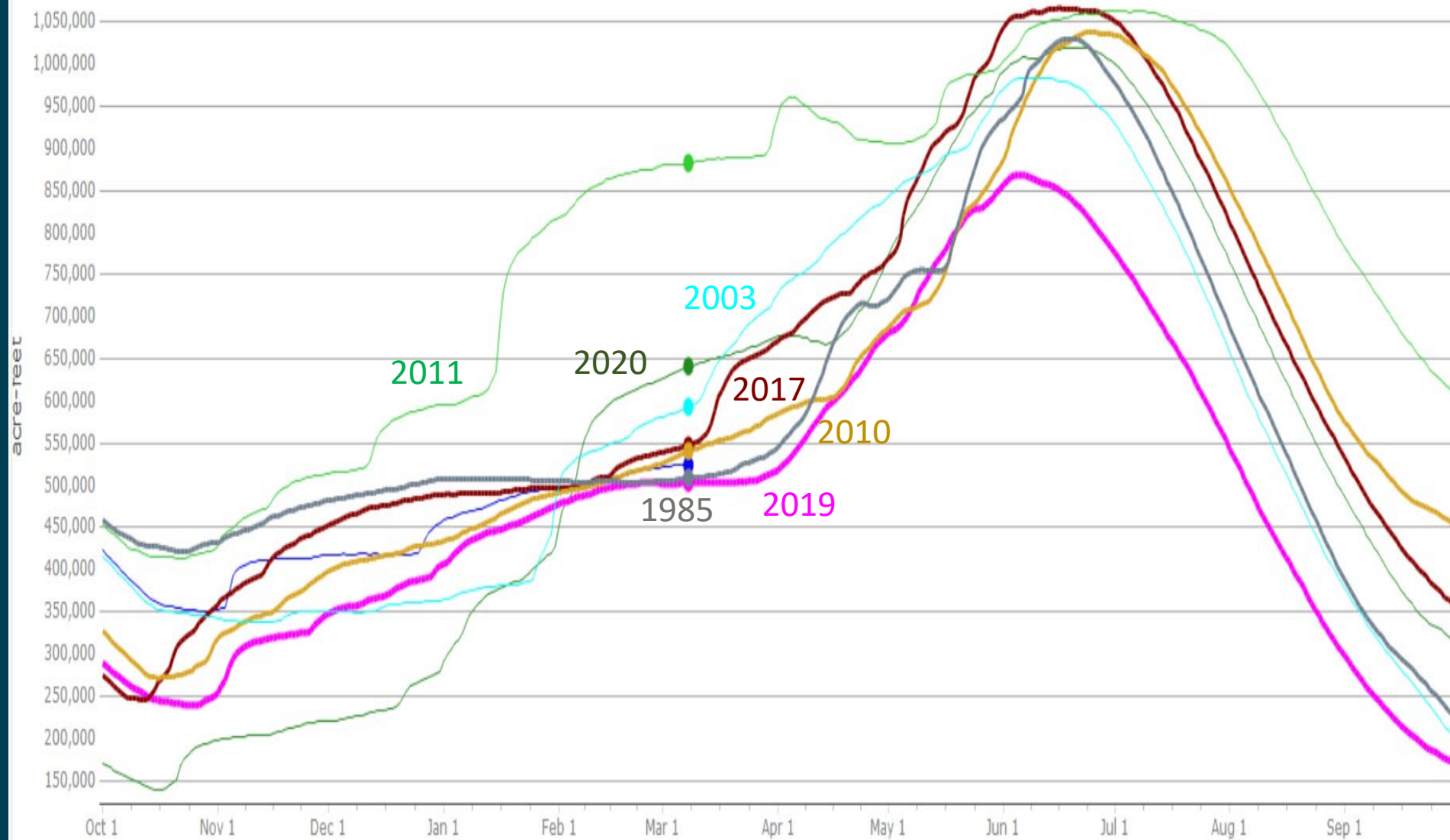


# Yakima Basin Storage, Historical Comparison

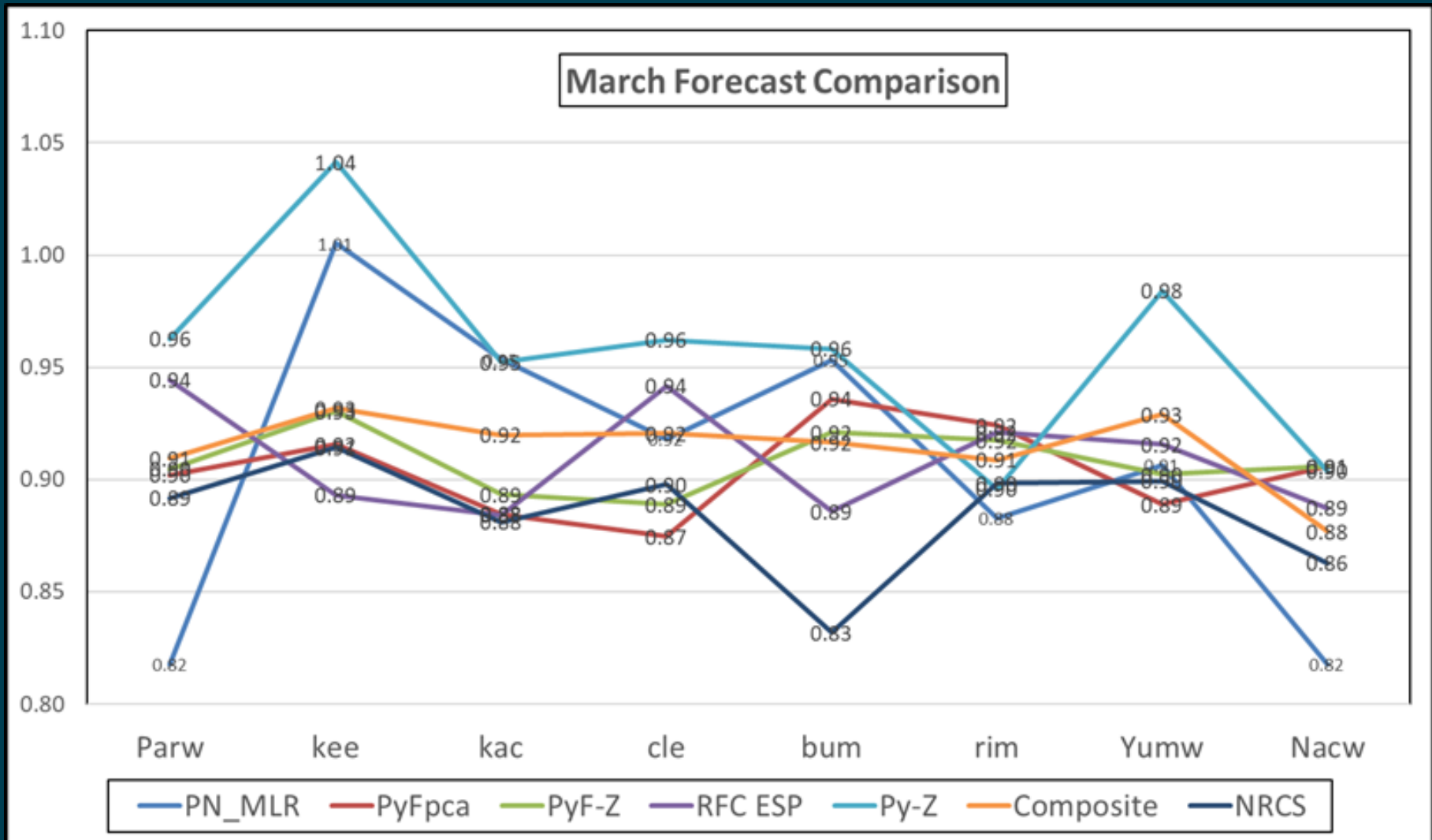


Elevation:

— 2023 — 2020 ■ 2019 ■ 2017 — 2011 — 2010 — 2003 — 1985



# Yakima Subbasin forecasts



# Yakima Subbasin forecasts

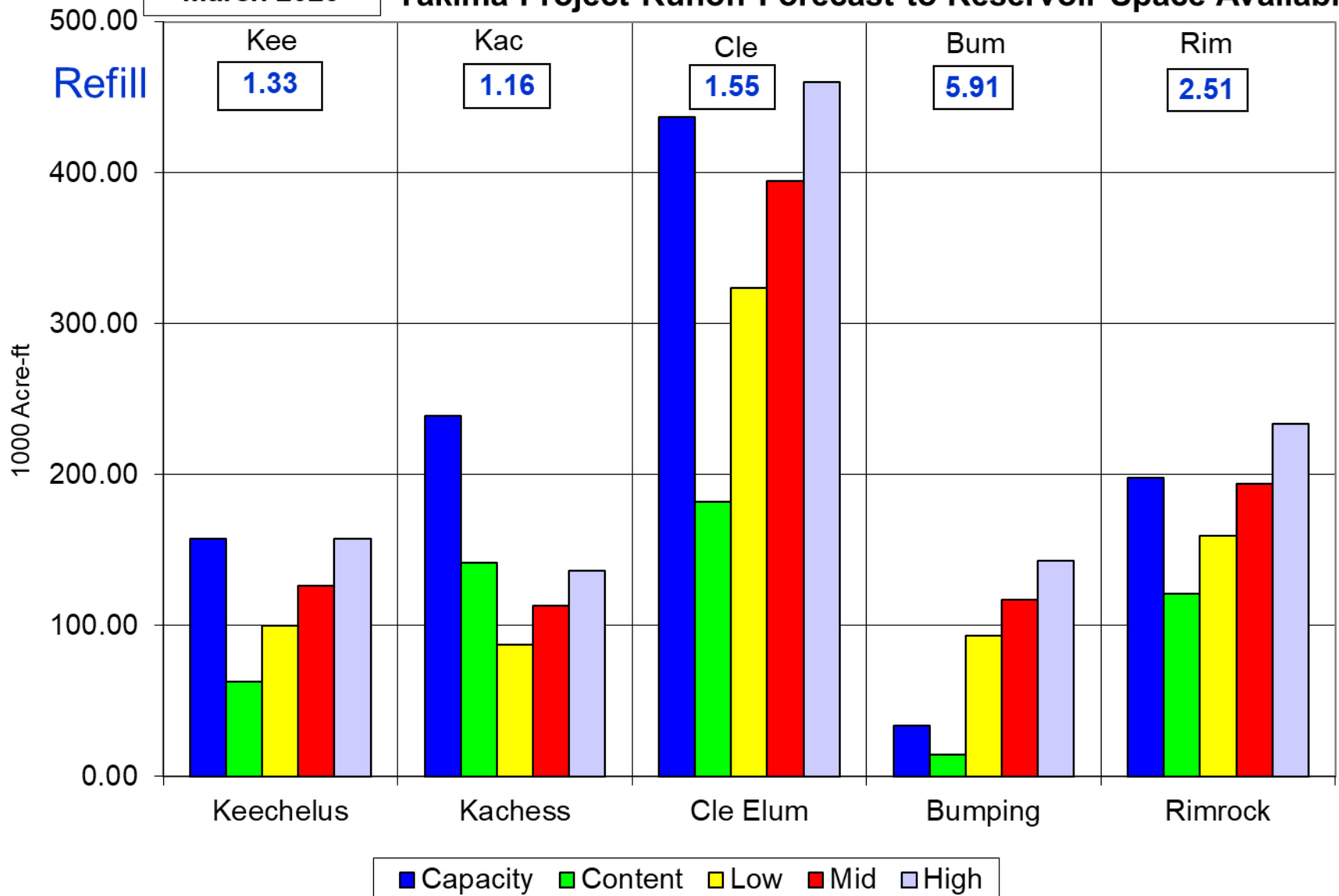
## Yakima Basin Forecasts, Mar-Jul, AF

Mar, 2023	Low	Composite	High	Low	Adopted	High
<b>Parw</b>	1397428	<b>1803852</b>	2222884	70%	<b>91%</b>	112%
<b>kee</b>	99841	<b>126067</b>	157656	74%	<b>93%</b>	117%
<b>kac</b>	87560	<b>112969</b>	136054	71%	<b>92%</b>	111%
<b>cle</b>	323376	<b>394710</b>	459740	75%	<b>92%</b>	107%
<b>bum</b>	92951	<b>117001</b>	142983	73%	<b>92%</b>	112%
<b>rim</b>	159167	<b>193735</b>	233311	75%	<b>91%</b>	109%
<b>Yumw</b>	640013	<b>815323</b>	966148	73%	<b>93%</b>	110%
<b>Nacw</b>	552691	<b>705228</b>	898448	69%	<b>88%</b>	112%
<b>System</b>	762896	<b>944483</b>	1129746	74%	<b>92%</b>	110%



March 2023

## Yakima Project Runoff Forecast to Reservoir Space Available



# Reservoir Refill (March, 2023 outlook)

- Cle spillway+2' Late May or early June.
- Cle: 21% chance of filling
- Kee: very unlikely to fill, 0 to 5% chance
- Kac: 5% to 20% chance of filling
- Bum: 99% chance of filling
- Rim: 84% chance of filling



# March's April 1, 2023 TWSA ESTIMATE

April 1 - September 30

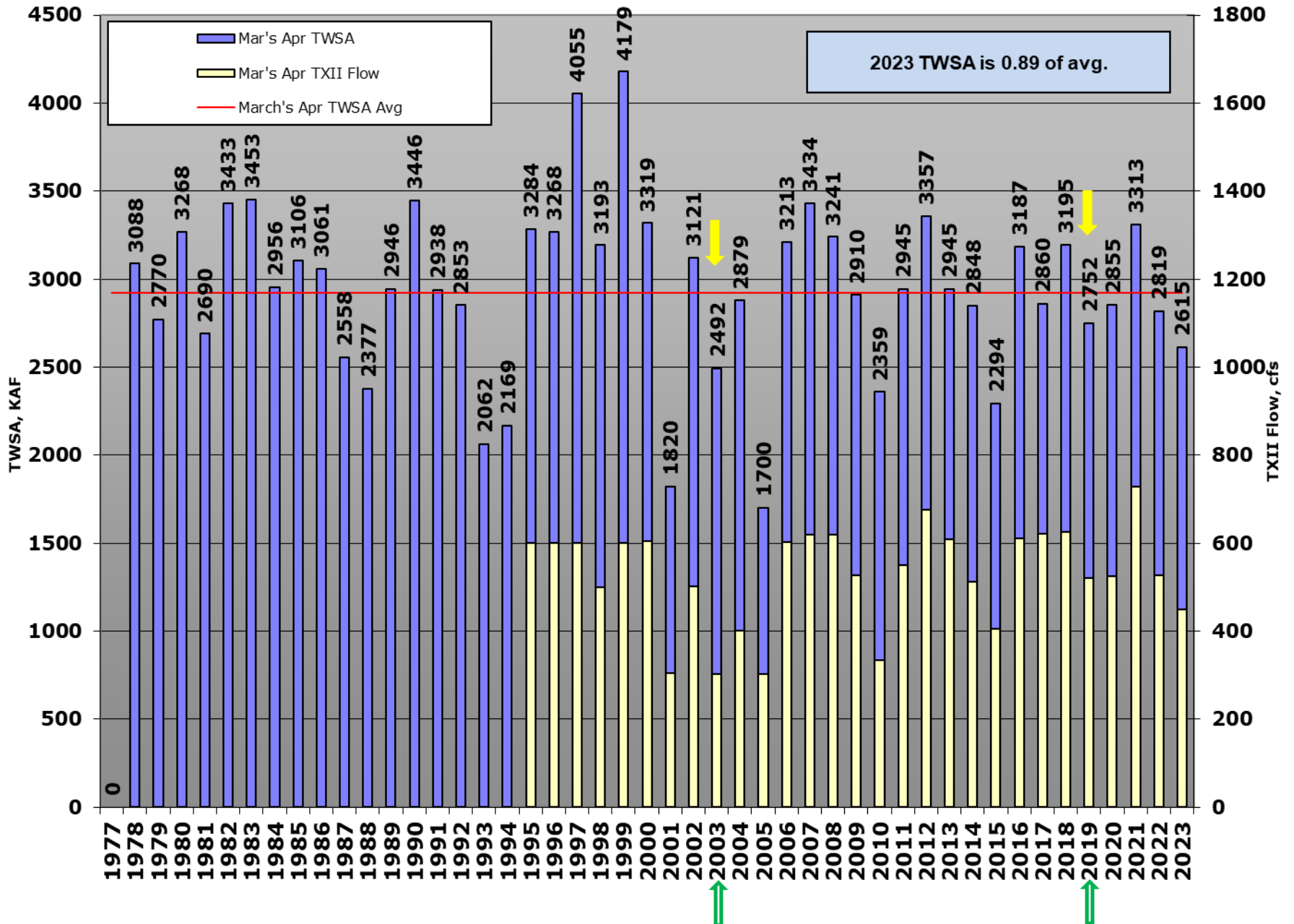
Parameter*	+/-/=	Low	Adopted	High
Apr 1-Sep 30 Natural Flow at Parker est.	+	1301	1675	2061
Return Flow Estimate, est	+	330	340	350
April 1, Reservoir Content, est	+	580	600	620
TWSA	=	<b>2211</b>	<b>2615</b>	<b>3031</b>
SEP 30 EST RESERVOIR CONTENT	-	76	76	143
FLOW OVER SUNNYSIDE DAM	-	300	400	580
TWSA FOR IRRIGATION	=	<b>1835</b>	<b>2139</b>	<b>2309</b>
NONPRORATABLE ENTITLEMENT	-	1070	1070	1070
REMAINING TWSA	=	<b>765</b>	<b>1069</b>	<b>1239</b>
PRORATABLE ENTITLEMENT		1239	1239	1239
% RATIO= REMAINING TWSA/PRORATABLE ENTITLEMENT		<b>62%</b>	<b>86%</b>	<b>100%</b>
TITLE XII FLOW TARGET, cfs	April	<b>300</b>	<b>300</b>	<b>500</b>
Added flow available, cfs ***		<b>142</b>	<b>149</b>	<b>154</b>
Non-storeable Portion of added flow, cfs		<b>39</b>	<b>39</b>	<b>39</b>
Storable portion of added flow, cfs		<b>102</b>	<b>110</b>	<b>114</b>

\*Values are in 1,000 ac-ft unless otherwise specified.

\*\*\* State & YRBWEP Trust, Acquisition, & Conservation added to Title XII flows from 142 to 154 cfs. Subject to updates



# Yakima Basin Historical TWSA's



# Yakima Basin Flows

Minimum Flow Targets, WY2023

<u>Location</u>	<u>Target Flow (cfs)</u>
Keechelus (KEE)	100
Easton (EASW)	250
Cle Elum (CLE)	220
Tieton River (TICW)	100
Rimrock	75
Bumping (BUM)	130 (range: inflow to 170+)
Parw	449 or 339 (TXII+added waters)
Yrpw	464 or 354 (TXII+added waters)

Yrpw subordination is 600 cfs (1000 Apr-Jun, TXII+tbd in Jul-Oct, 800 Oct-Nov, 600 Dec-Mar)

Rbdw subordination 500 (1300 Apr-May, 500 Jun-Oct, 500 Oct-Mar,)

# Yakima Basin Outmigration Flows

Table 2-14. Minimum volume of water (acre-feet) that will be available in April and May during years when water prorationing levels are equal to or greater than 70% to provide outmigration flows. Outmigration flows are measured at Tieton Dam (RIM), Cle Elum Dam (CLE), and Yakima River at Easton gage (EASW).

	Monthly Min. acre-feet for Outmigration Flows		
April TWSA (MAF)	< 2.36	2.36 - 3.13	> 3.13
May TWSA (MAF)	< 2.20	2.20 – 2.61	> 2.61
RIM	4,500	8,400	14,800
CLE	4,200	9,900	18,800
EASW	3,700	4,800	9,900

Mar's WY23 Apr TWSA=2.615 MAF

WY23 Apr TWSA=? MAF

Easton (EASW) can be met from unregulated local inflow below Kee and Kac.

# Hydrologic Summary

- January and February were “dry”
- Snowpack is below average but holding up
- System storage has not kept up with average.
  - Nov 7, 2022: 120% average.
  - Mar 1, 2023: 82% average. (only 49% full).
  - Mar 23, 2023: 78% average. (still 49.65% full)
- Natural stream flows have been below 30% avg.
- Adopted forecasts are in the low-90% range.
- TWSA is 2.615 MAF or 89% of average
- Title XII is 300 + 149 or 39 cfs
- Prorationing: 86% for Junior entitlements



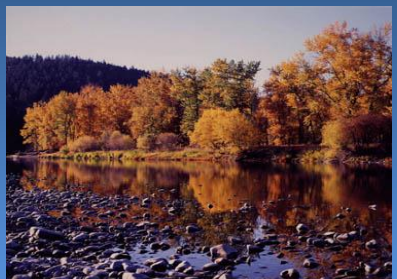
# Northwest River Forecast Center



## Mar 24, 2023 Washington Water Supply Availability Meeting



Amy Burke  
[NWRFC.watersupply@noaa.gov](mailto:NWRFC.watersupply@noaa.gov)





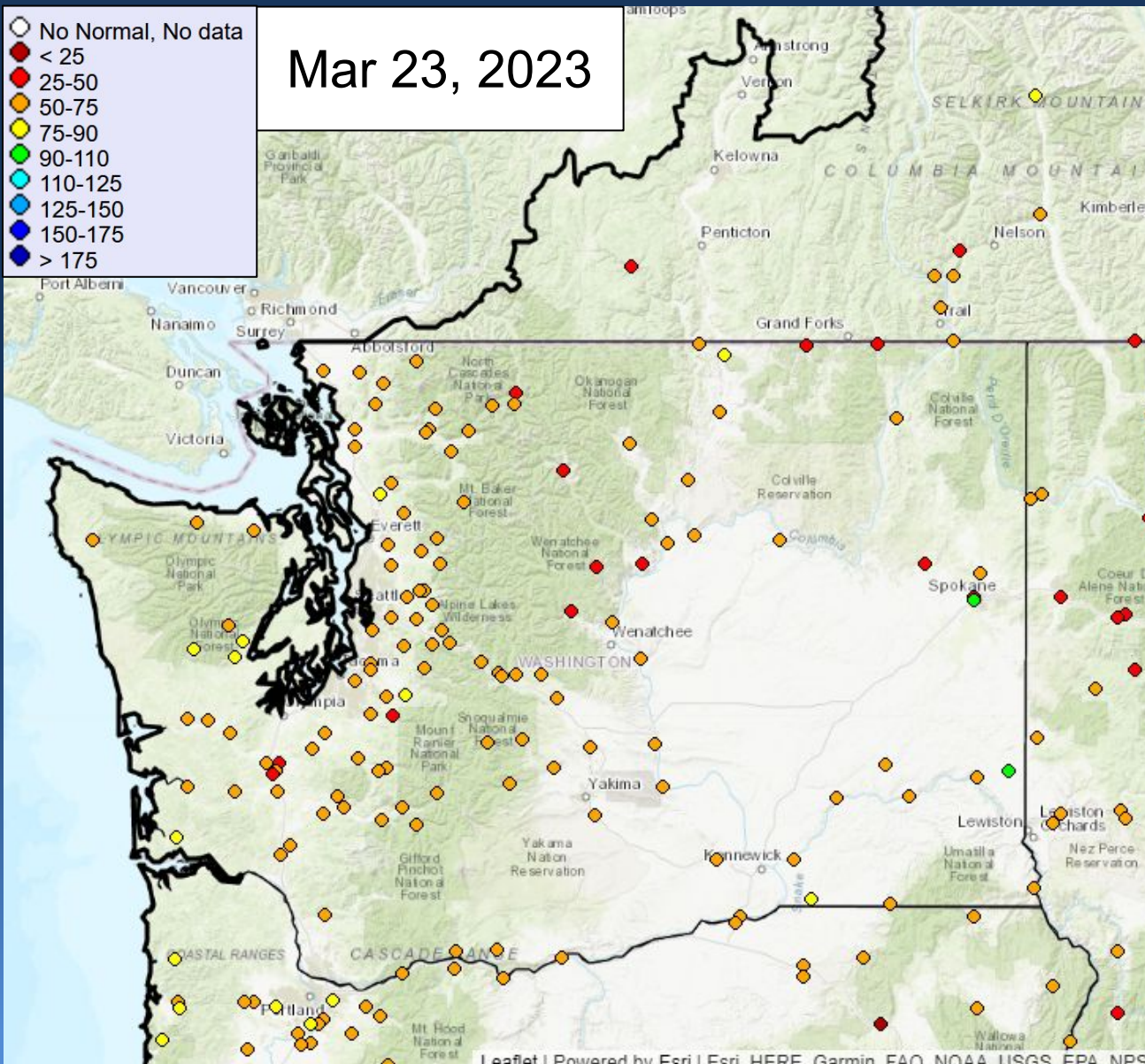
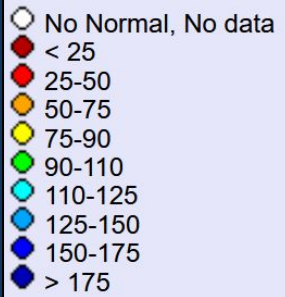
# Take Home Messages

- Adjusted Runoff to date remains well below normal
- 10 day QPF forecast is below normal
- 10 day QTF expected to remain cold for the
- ESP10 Natural Water Supply is a mix of normals and below normal



# YTD Adjusted Natural Runoff

Mar 23, 2023

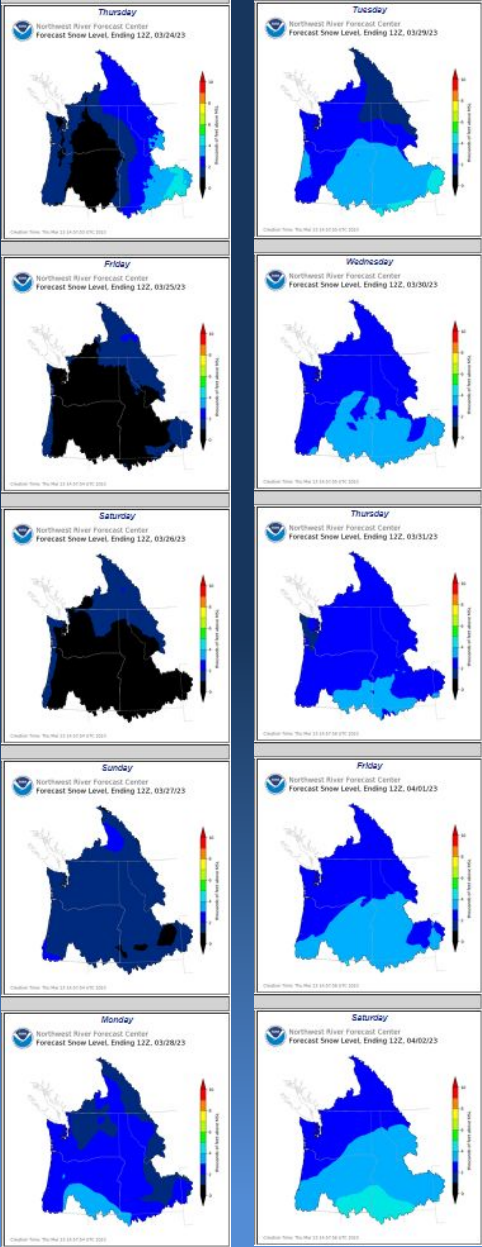
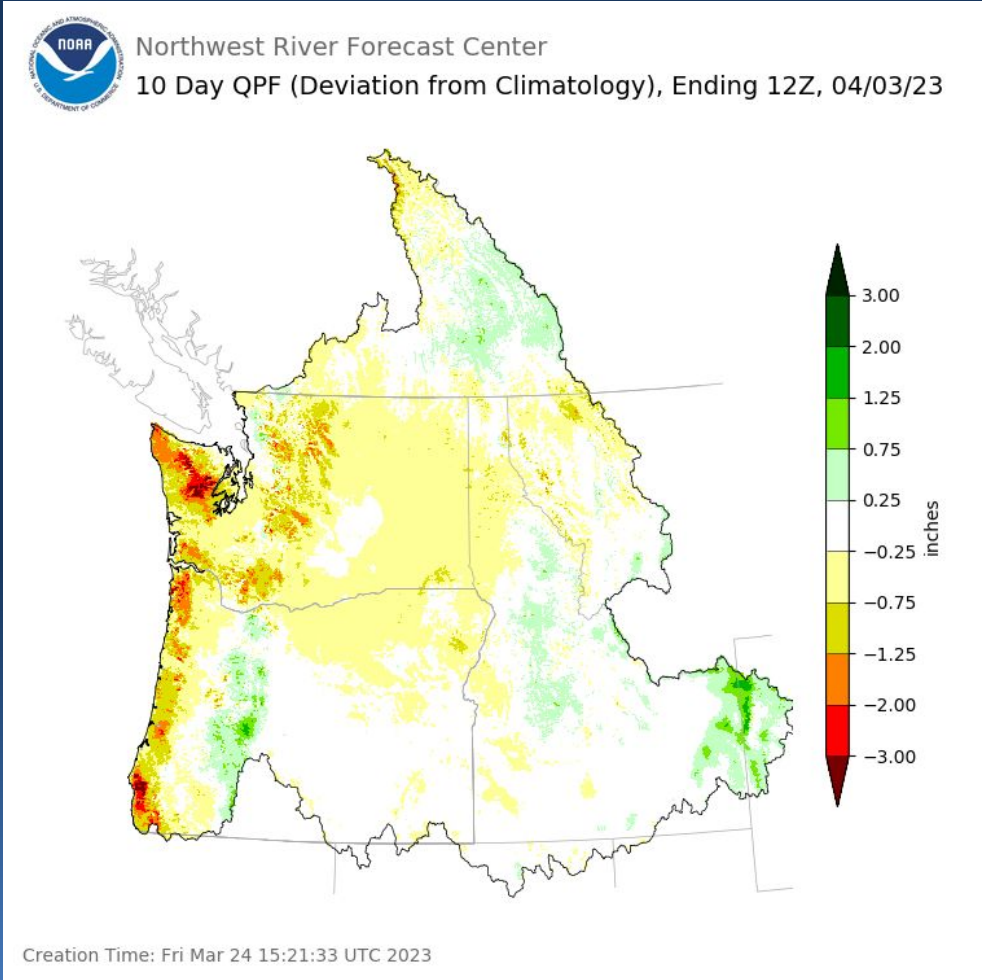
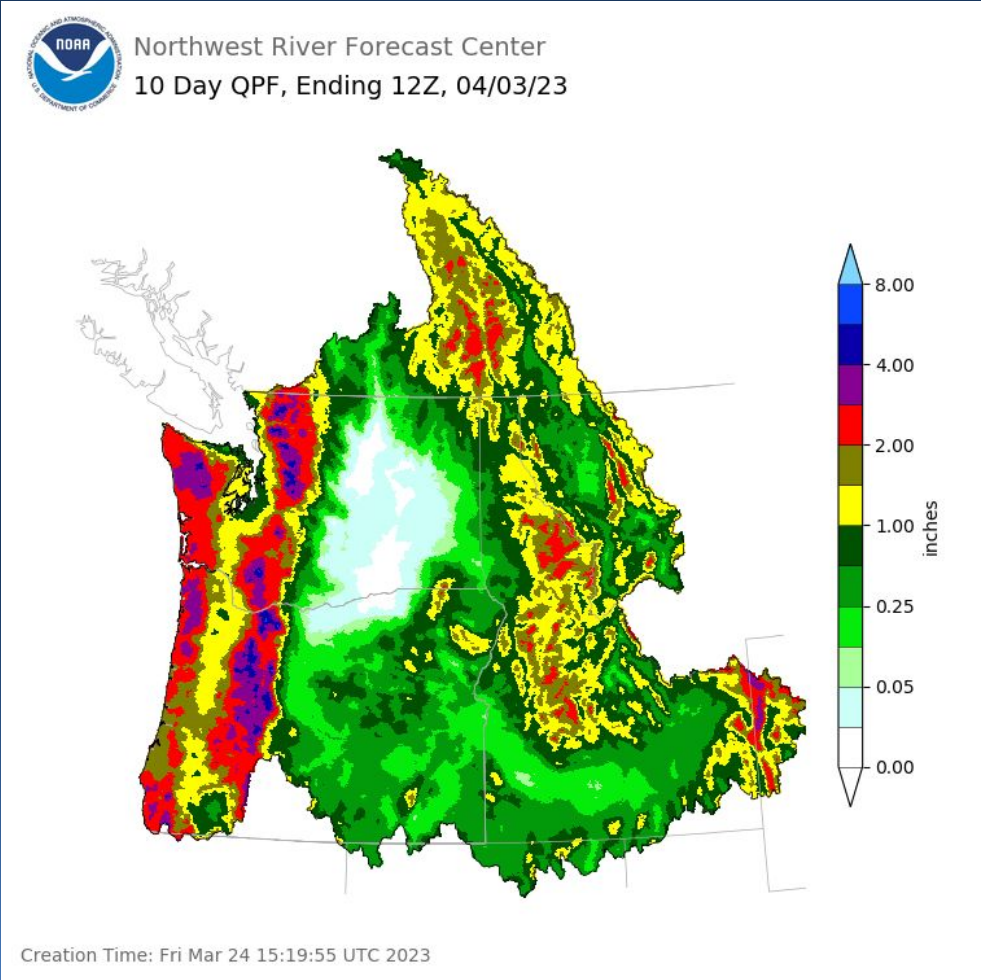


## % Normal Runoff Oct 1st – Mar 23<sup>th</sup> Washington

Skagit nr Mt Vernon	60
Dungeness nr Sequim	59
Chehalis at Porter	64
Okanogan at Malott	63
Methow nr Pateros	60
Yakima at Parker	62
Walla Walla nr Touchet	85

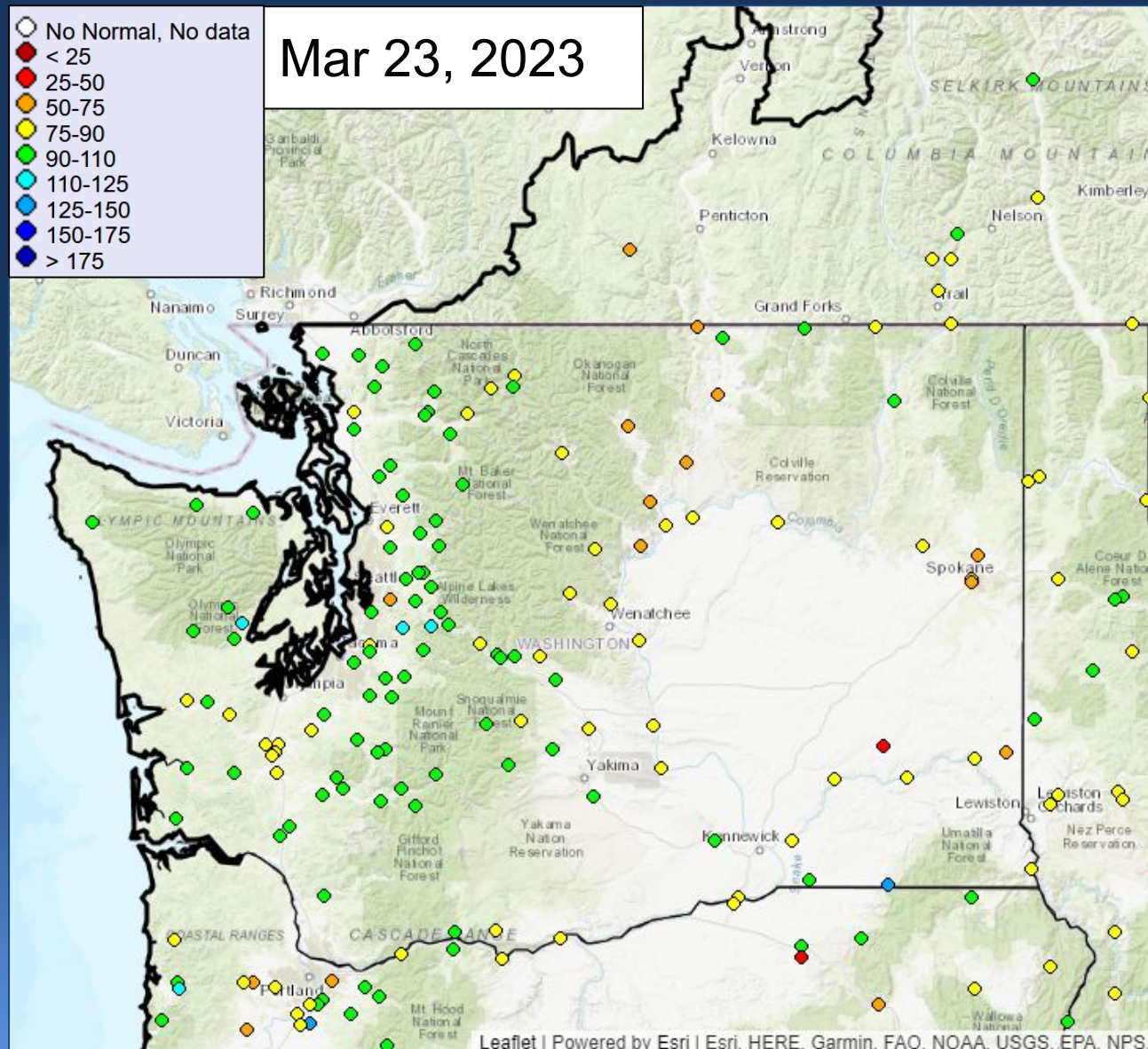


# 10 Day Precipitation Forecast





# ESP10 Natural Water Supply Forecasts

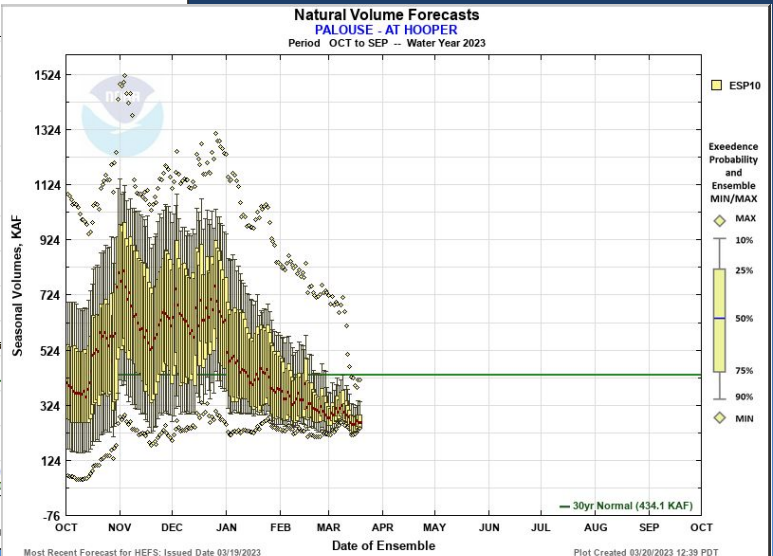
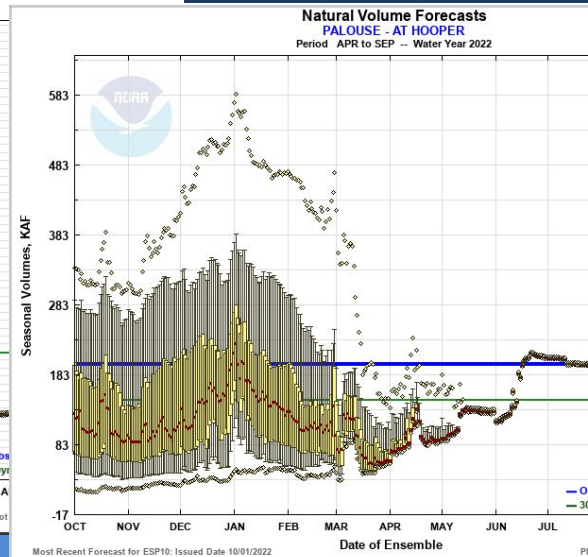
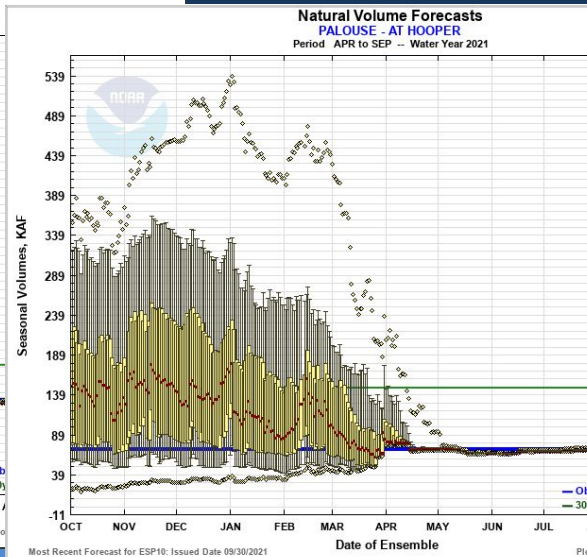
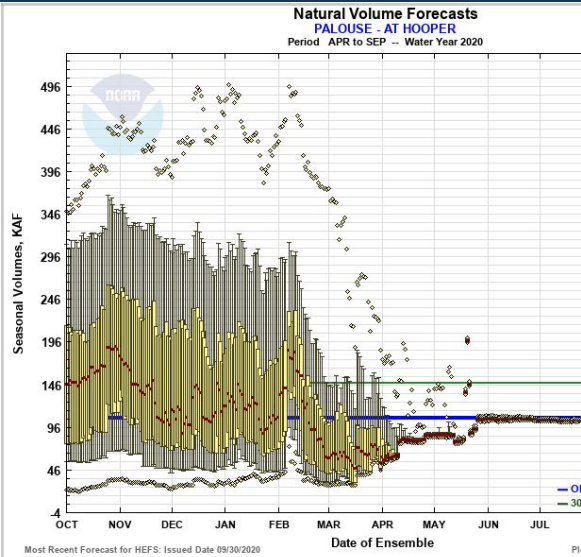
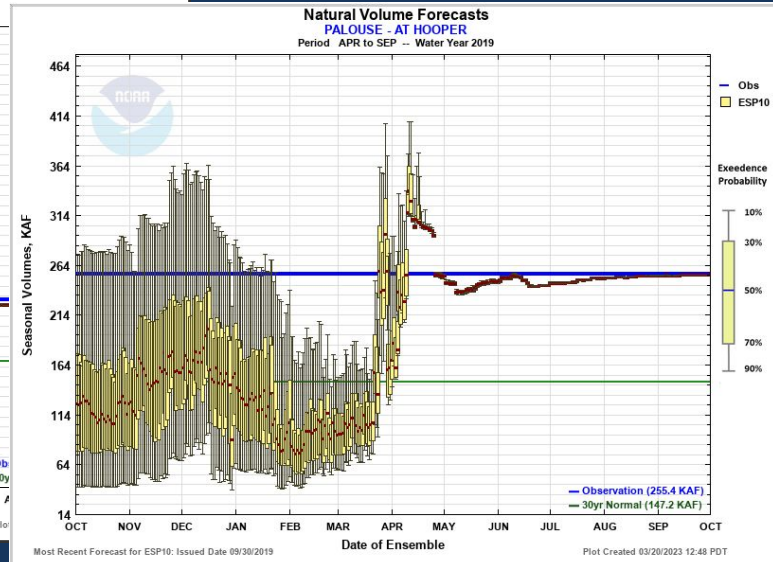
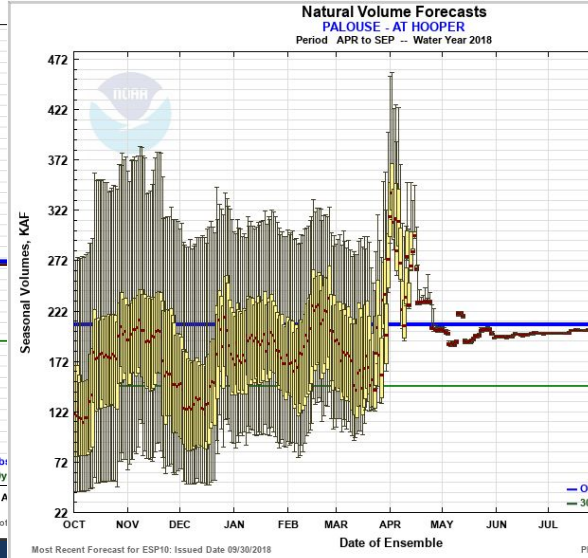
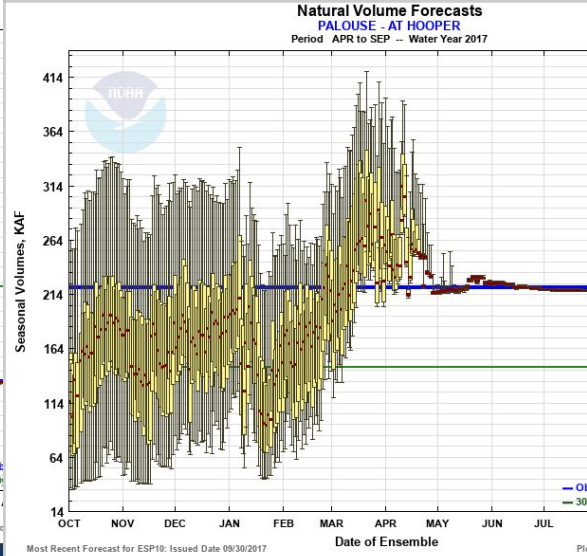
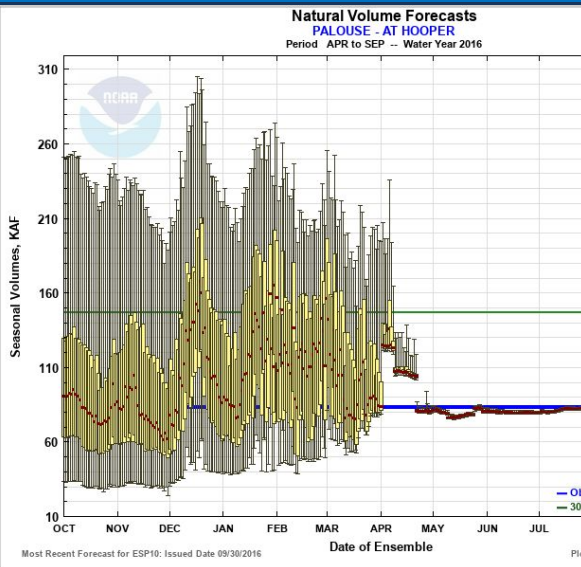


## % Normal Apr -Sep Volume Washington

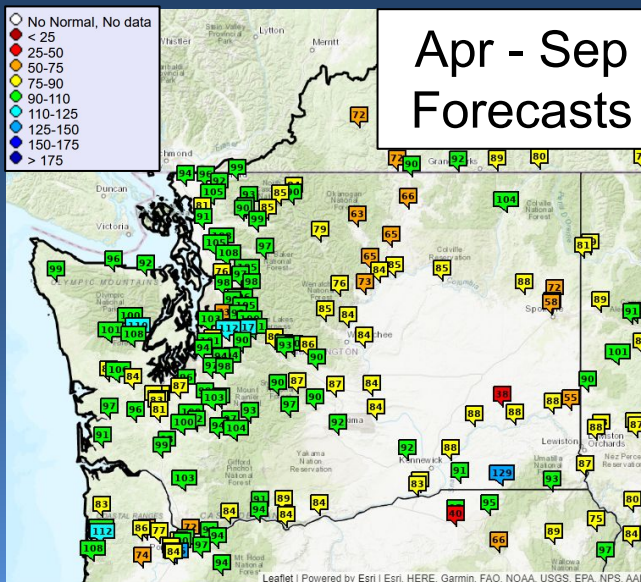
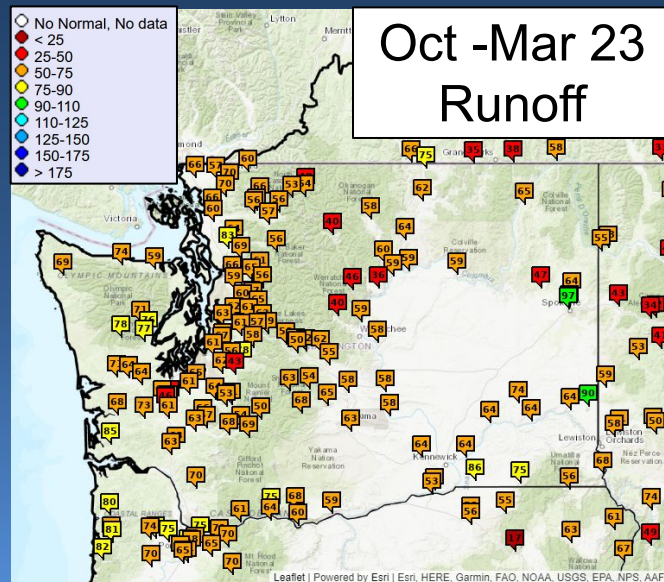
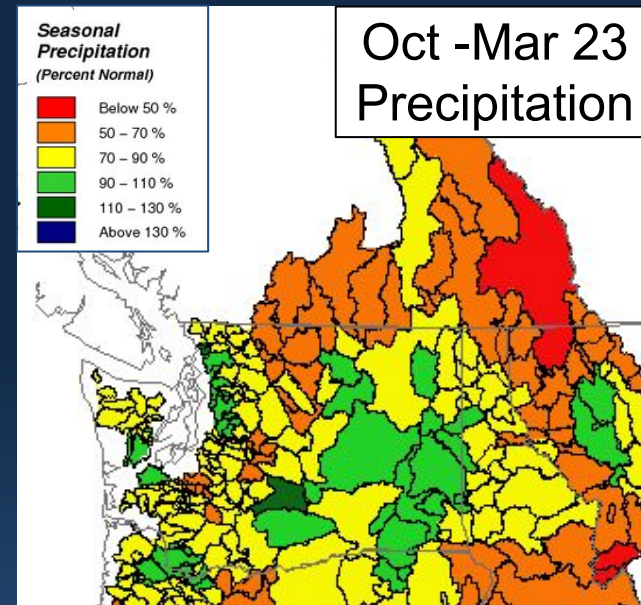
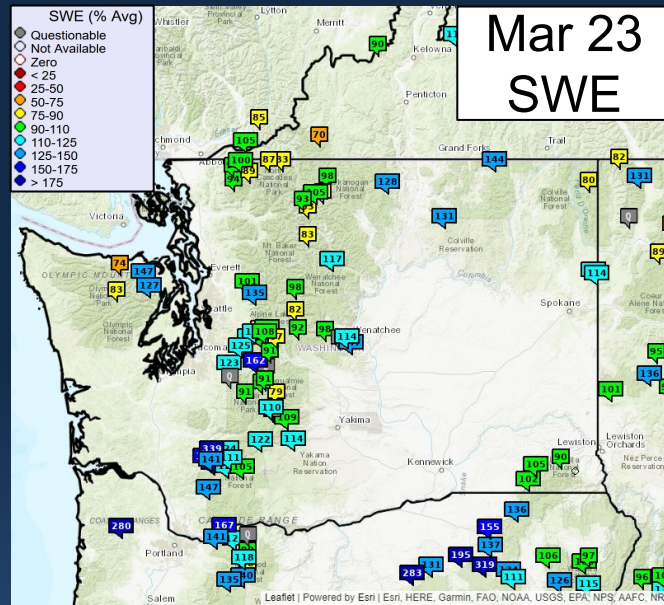
Skagit nr Mt Vernon	91
Dungeness nr Sequim	92
Chehalis at Porter	84
Okanogan at Malott	65
Methow nr Pateros	65
Yakima at Parker	92
Walla Walla nr Touchet	91



# ESP10 Natural Water Supply Forecasts



# SWE, Precip, Runoff and Water Supply Forecasts





# Take Home Messages

- Adjusted Runoff to date remains well below normal
- 10 day QPF forecast is below normal
- 10 day QTF expected to remain cold for the
- ESP10 Natural Water Supply is a mix of normals and below normal



## WY2022 Schedule for Live Water Supply Briefings

Apr

May

Jun

6

4

TBD

All presentations held at 10:00 am Pacific Time unless noted otherwise