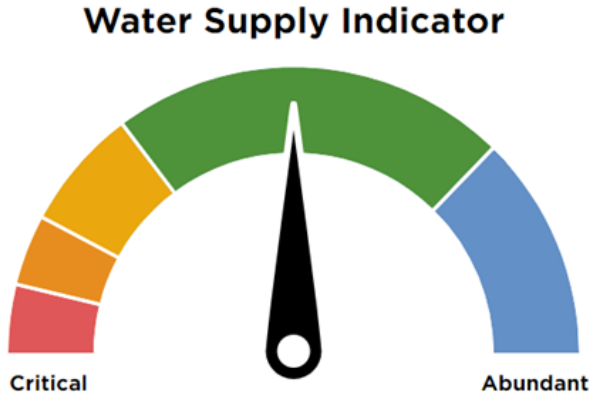
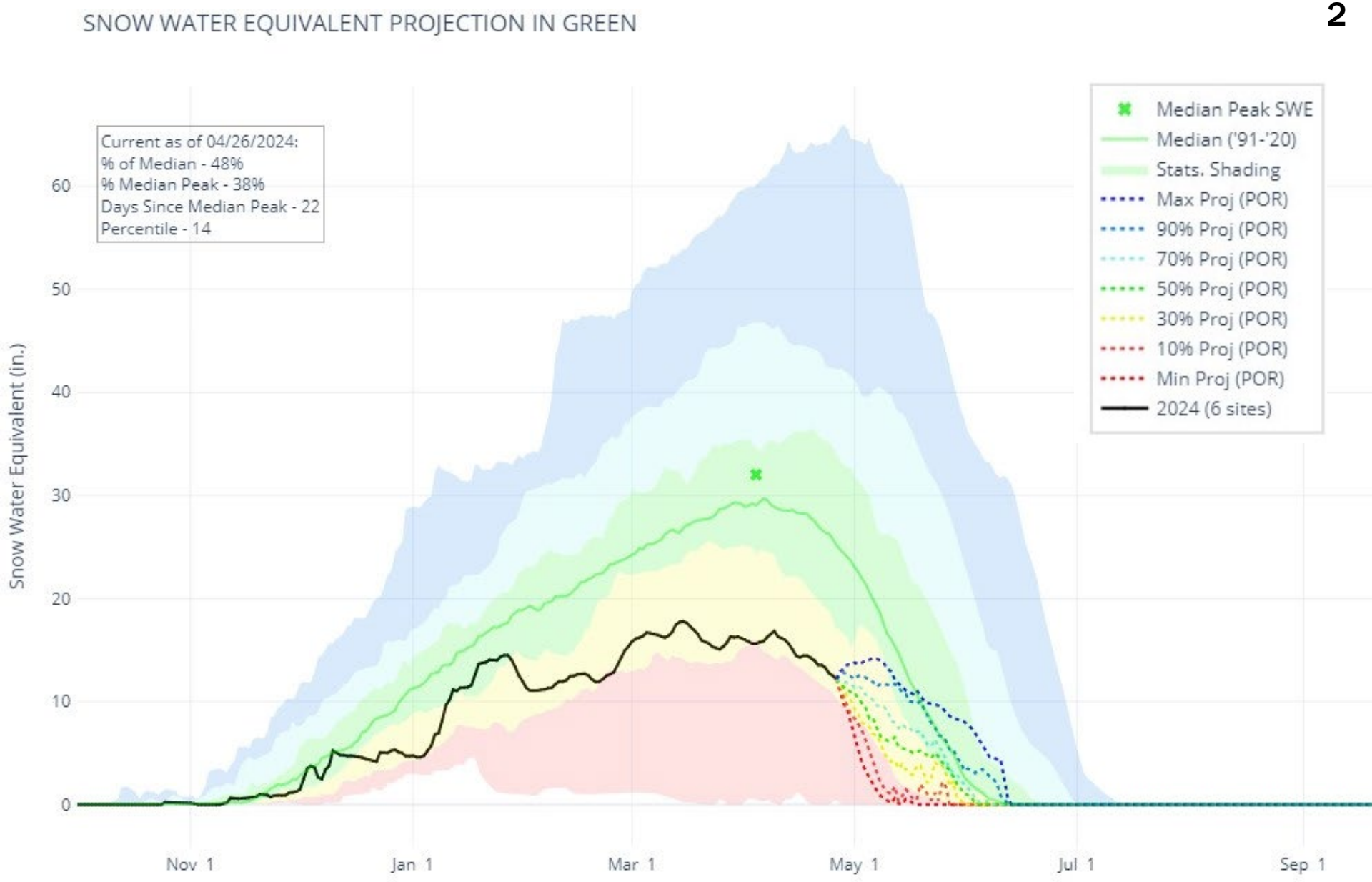
Water Supply Outlook 5/2/2024

Water Supply Indicator: 50/100 (Ample)

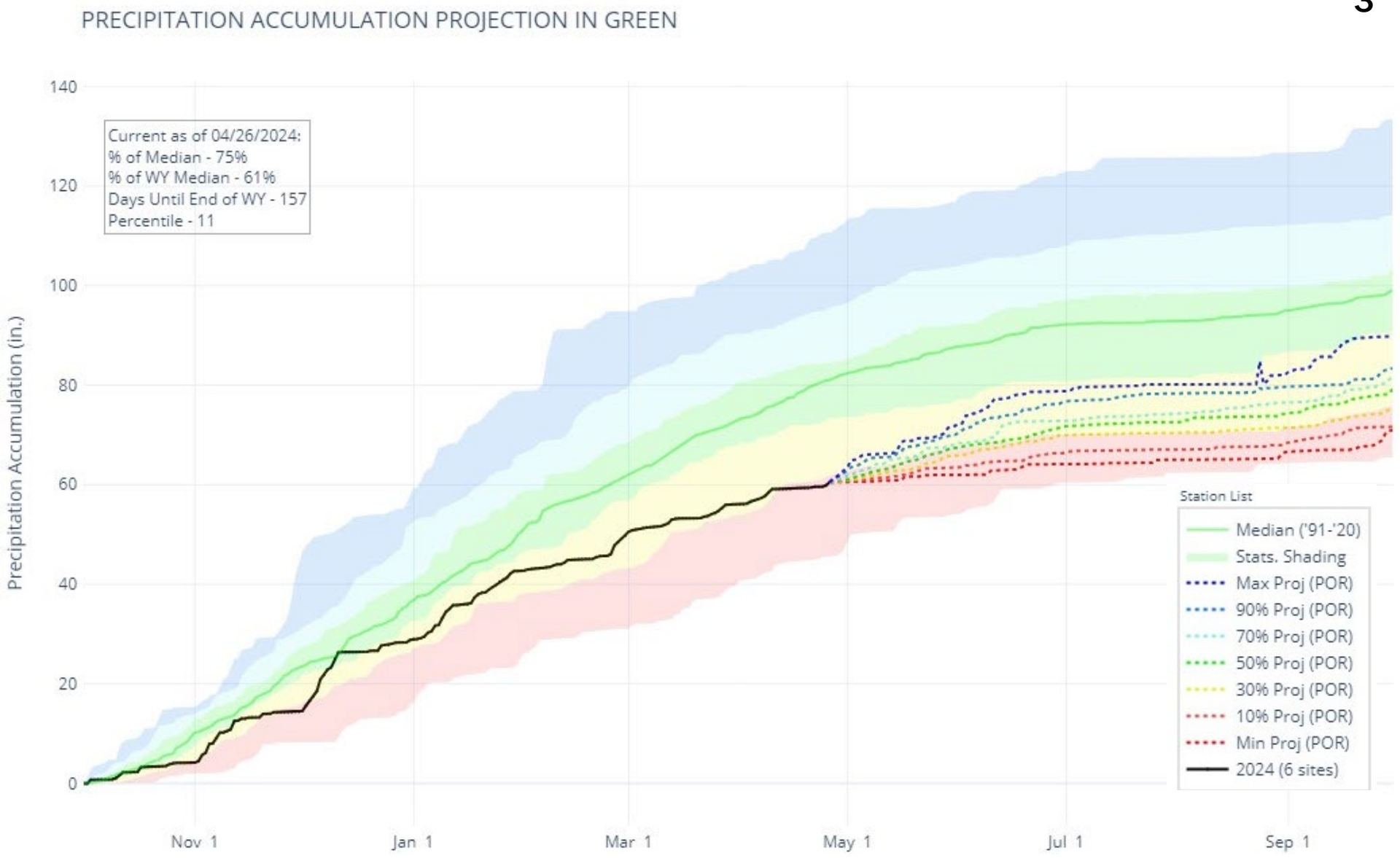


- *The first half of April was very dry, but much of the second half is forecast to be wet, which will help water supply.*
- *Snowpack peaked in March with about half of average snow accumulation in the Green River watershed. River levels remain below normal.*
- *Although a drought was recently declared for most of Washington State, Tacoma's municipal supply remains adequate to meet our anticipated consumption needs.*
- *We will continue to monitor river recession rates and overall water supply as we transition into summer usage patterns; spring rainfall may improve conditions in May.*
- *El Niño conditions are weakening but remain present, which statistically trend toward warmer and drier weather in Washington.*
  - *Current ENSO forecasts show La Niña may develop by late summer or early fall.*
- *Daily water consumption is below our "old" winter average.*
- *We continue to recommend customers use water wisely.*



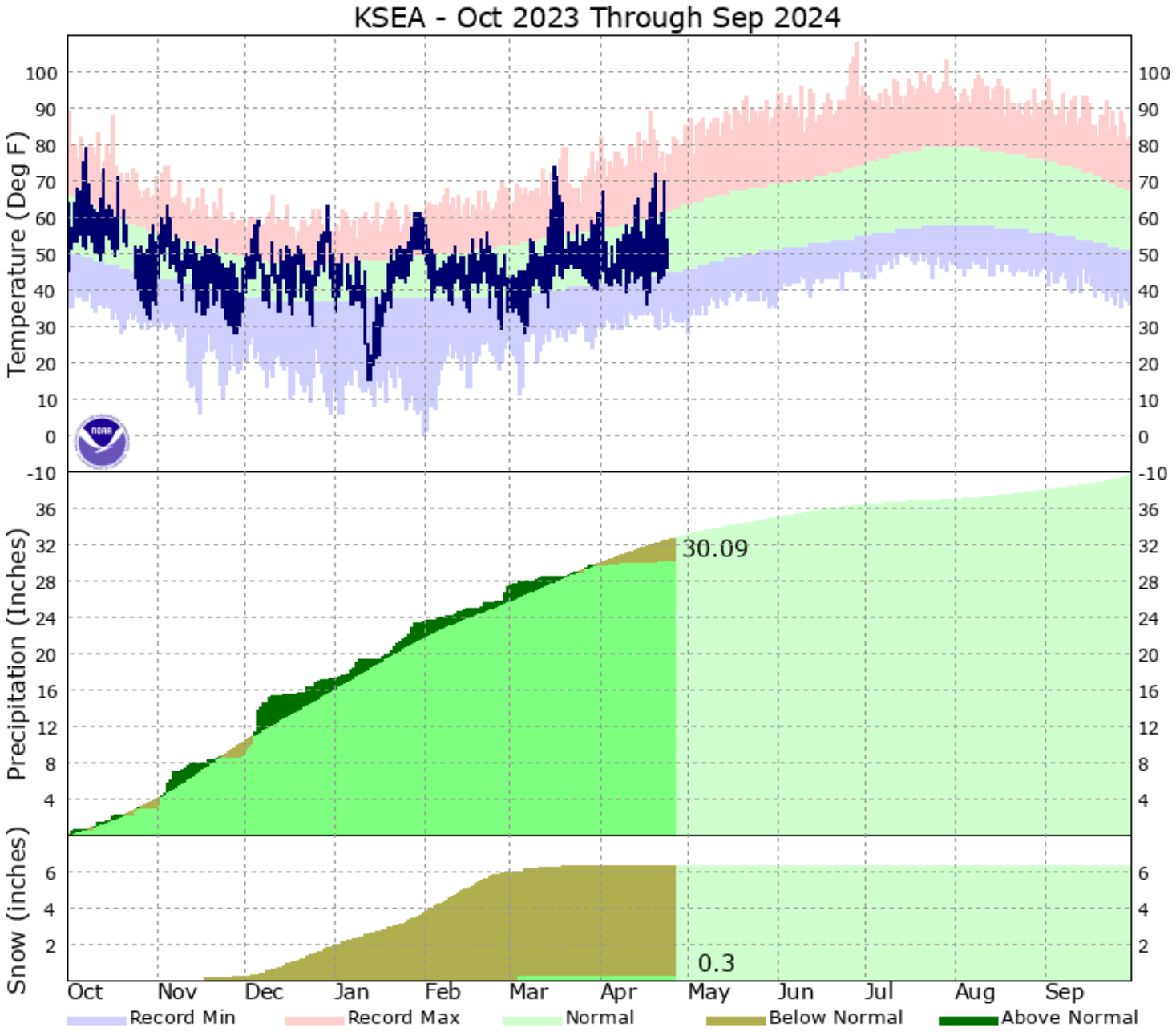
Snow water equivalent in the Green River watershed is now 48% of the 30-year (1991-2020) median.

- https://nwcc-apps.sc.egov.usda.gov/awdb/basin-plots/Proj/WTEQ/assocHUCwa2_8/green.html
- https://nwcc-apps.sc.egov.usda.gov/basin-plots/#WA



Precipitation in the Green River watershed is now 75% of the 30-year median for the water year.

- https://nwcc-apps.sc.egov.usda.gov/awdb/basin-plots/Proj/PREC/assocHUCwa2_8/green.html

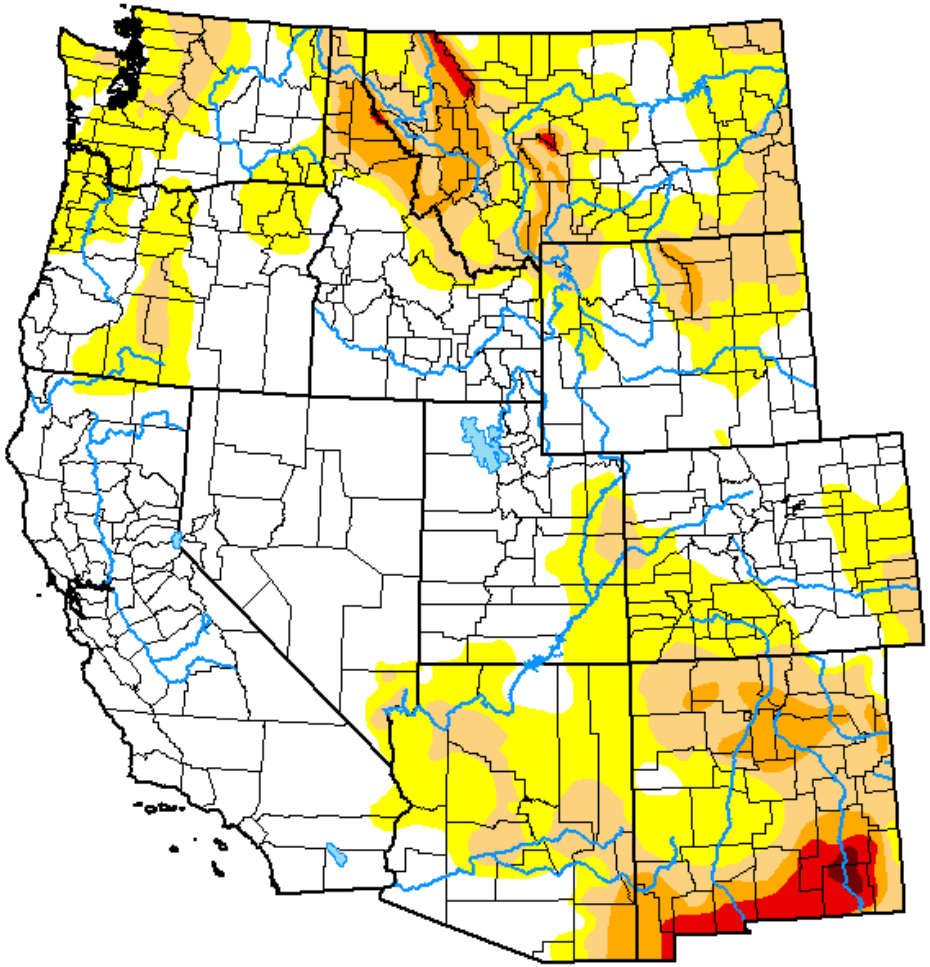


Temps have had spikes to well above normal; precipitation at SeaTac has now fallen below average.

https://www.wrh.noaa.gov/climate/yeardisp.php?wfo=sew&stn=KSEA

U.S. Drought Monitor
West

April 23, 2024
(Released Thursday, Apr. 25, 2024)
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:

David Simeral
Western Regional Climate Center

droughtmonitor.unl.edu

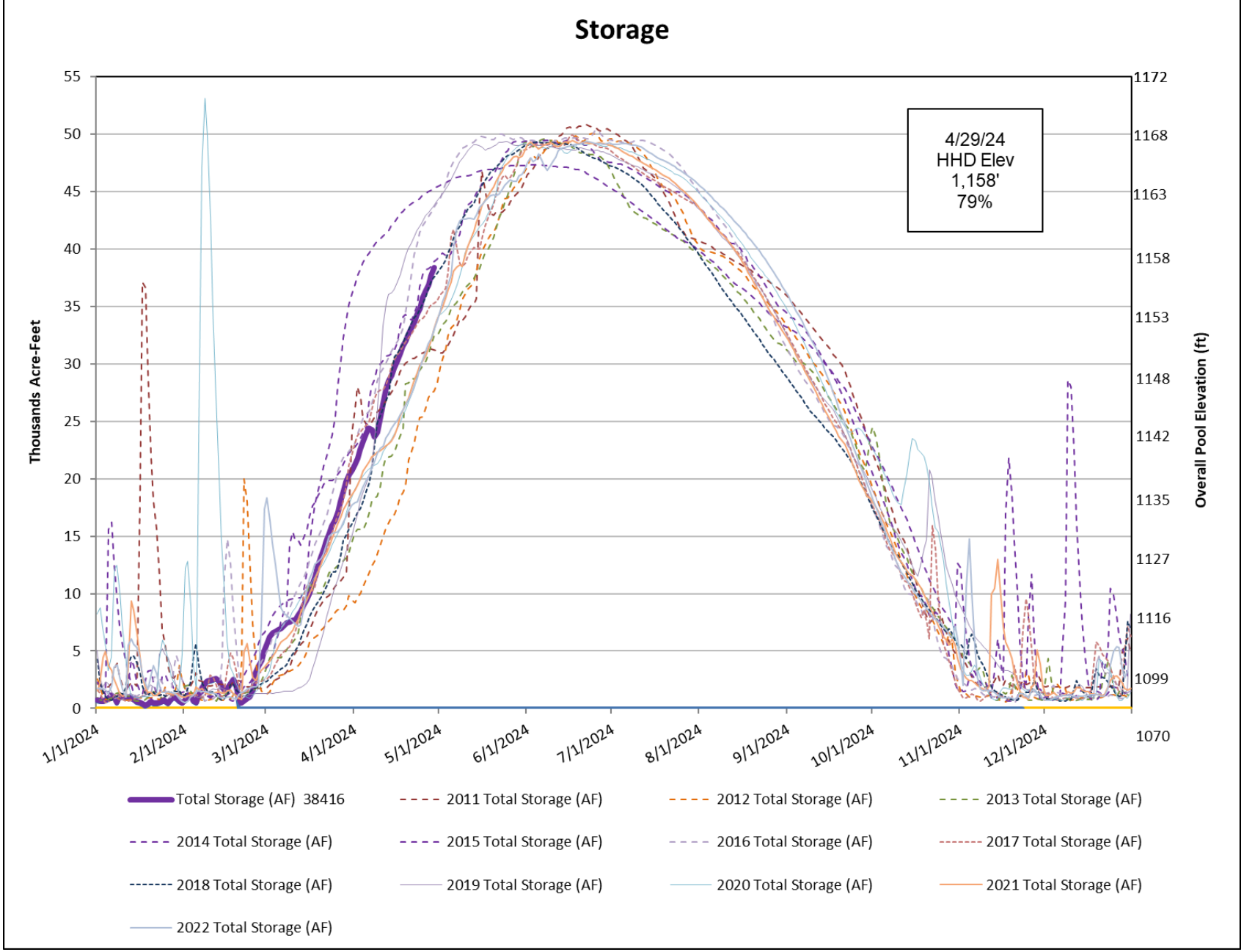
The National Weather Service shows most of western WA as abnormally dry or in moderate drought.

https://www.cpc.ncep.noaa.gov/products/Drought/

Washington Drought Declaration

On April 16, the Department of Ecology declared a drought emergency for most of Washington, except the Tacoma, Seattle, and Everett metro areas.

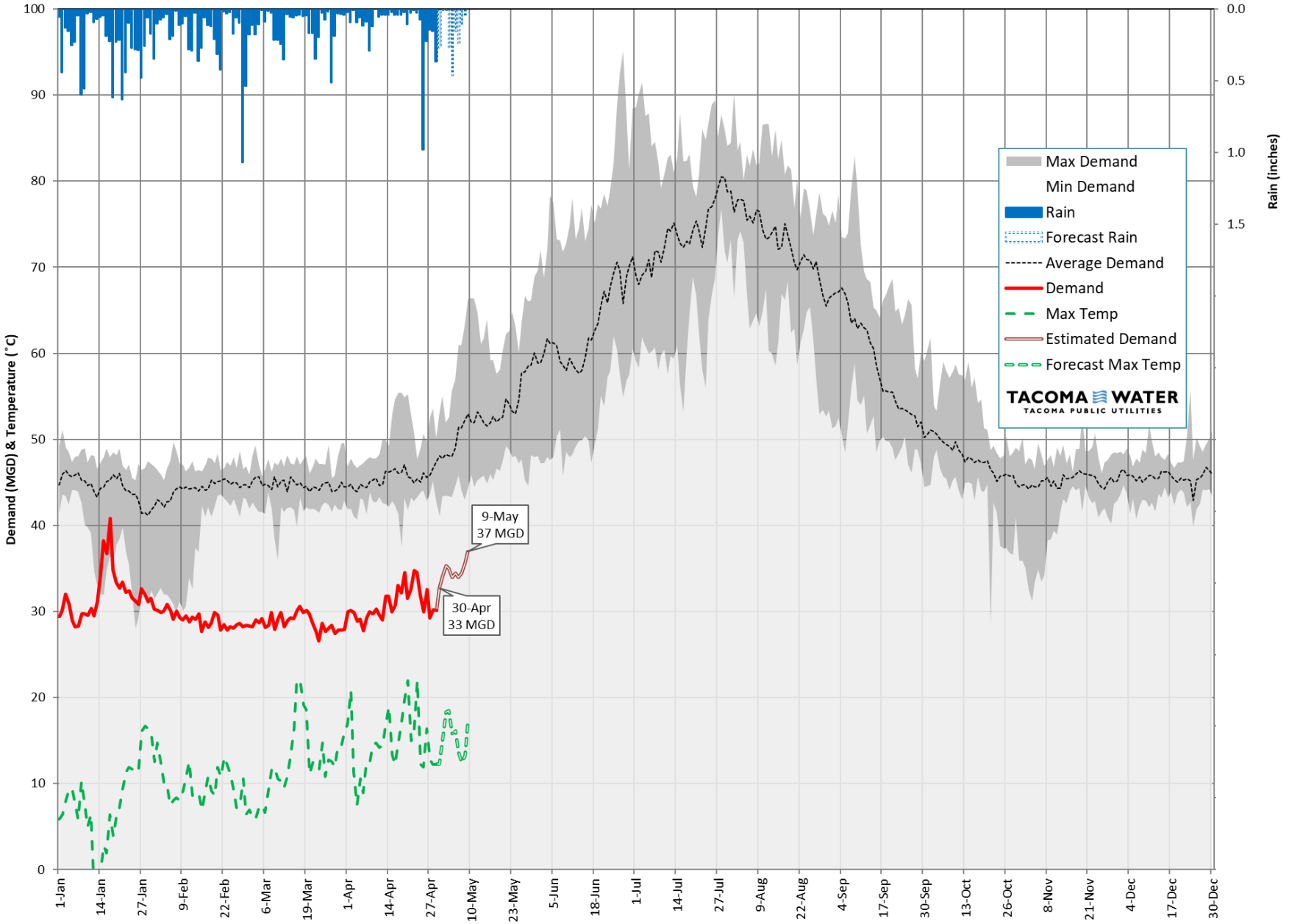
https://ecology.wa.gov/about-us/who-we-are/news/2024-news-stories/april-16-drought-declaration
https://ecology.wa.gov/water-shorelines/water-supply/water-availability/statewide-conditions/drought-response



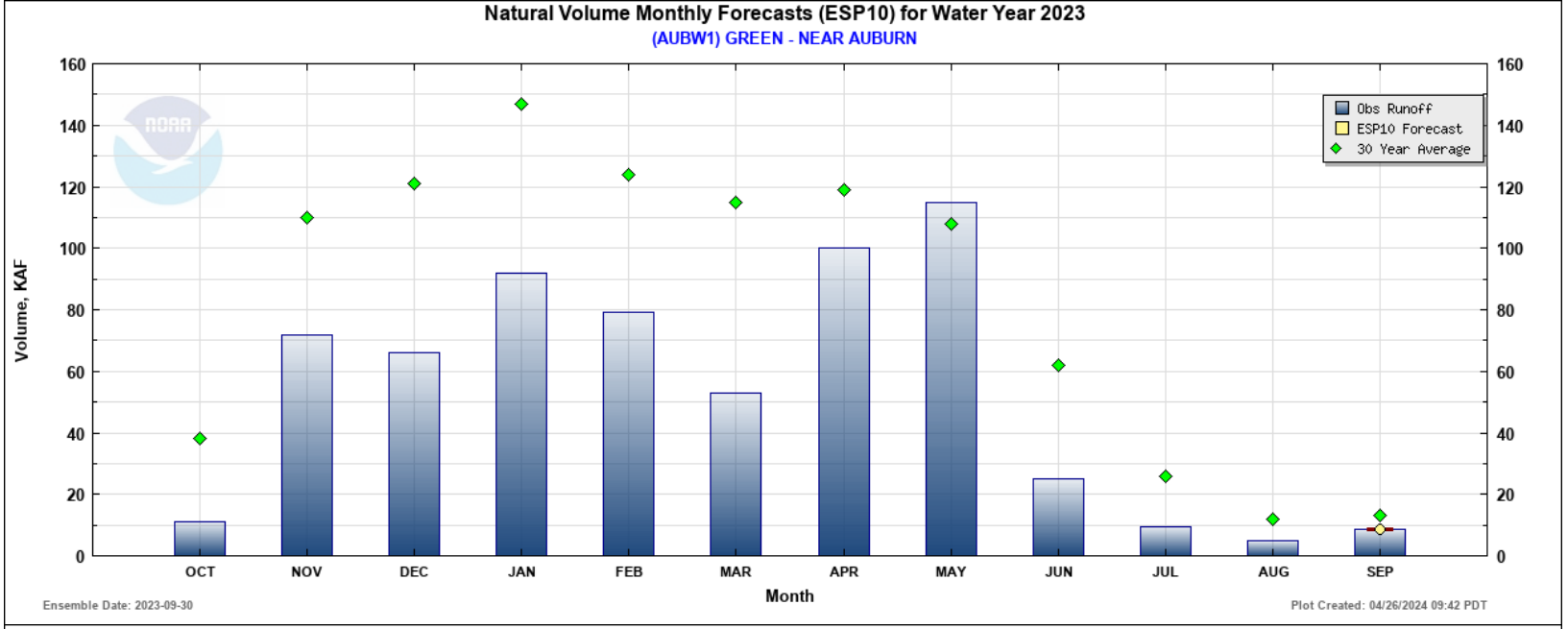
The Corps is refilling behind Howard Hanson Dam; the pool is now 79% full.

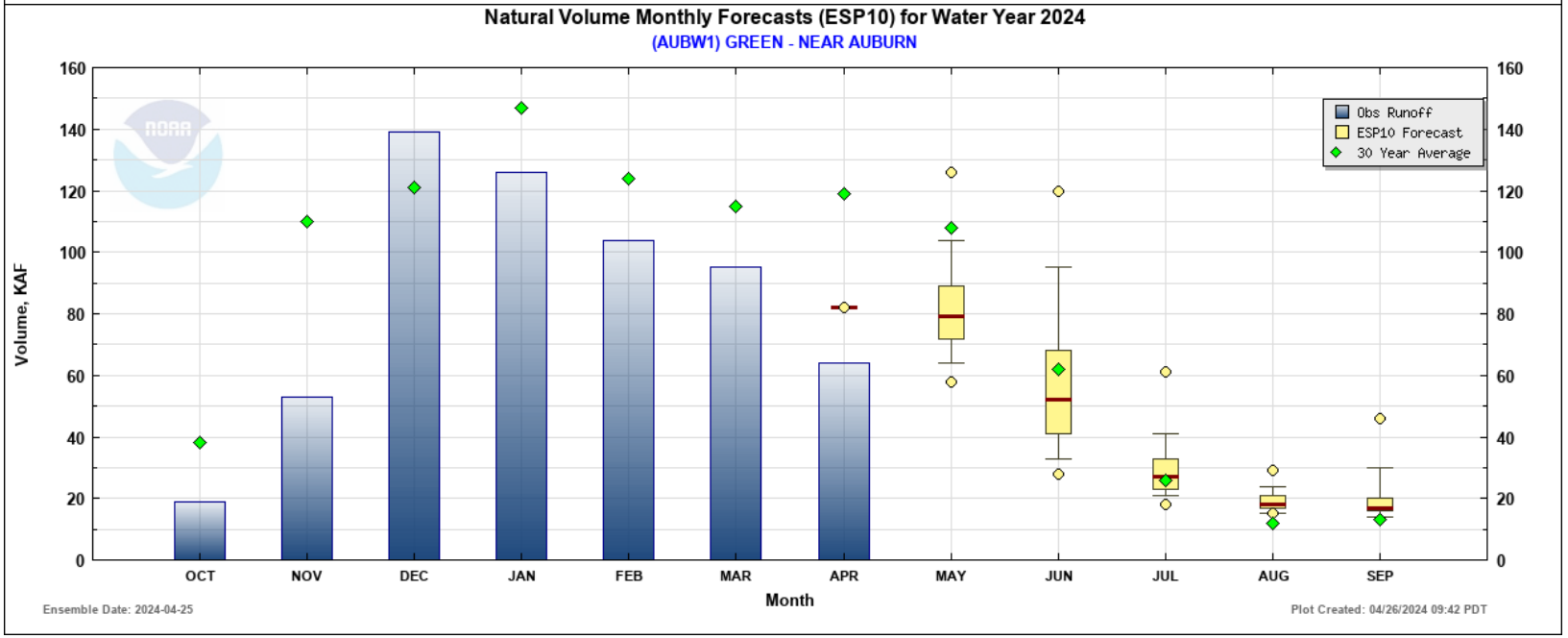
MyTPU.org/RWSS or MyTPU.org/AWSP

Daily Demand, Excluding Partners



Tacoma demand so far this year is **32%** below average, mostly due to the WestRock closure.





Streamflow is forecast to stay below average this spring, due to below average snowpack.

https://www.nwrfc.noaa.gov/natural/plot/monthly/monthly_natural_forecasts.php?id=AUBW1

GREEN - HOWARD HANSON DAM (HHDW1)
Period Rankings - 1949 to 2024
APR-SEP Normal -- 262 (KAF)

Rank	Year	Period Volume (KAF)	Percent of Normal	Exceedance Probability*
58	2023	219.37	84	75.325 %
59	1963	212.39	81	76.623 %
60	2007	212.00	81	77.922 %
61	1986	204.30	78	79.221 %
62	1983	204.00	78	80.519 %
63	1987	201.42	77	81.818 %
64	1996	200.10	76	83.117 %
65	1978	199.20	76	84.416 %
66	2019	196.77	75	85.714 %
67	2016	191.83	73	87.013 %
68	1994	191.02	73	88.312 %
69	1998	188.03	72	89.610 %
70	2024	185.72	71	90.909 %
71	2005	184.39	70	92.208 %
72	2003	177.81	68	93.506 %
73	1973	168.96	65	94.805 %
74	1995	151.63	58	96.104 %
75	1992	138.32	53	97.403 %
76	2015	95.40	36	98.701 %

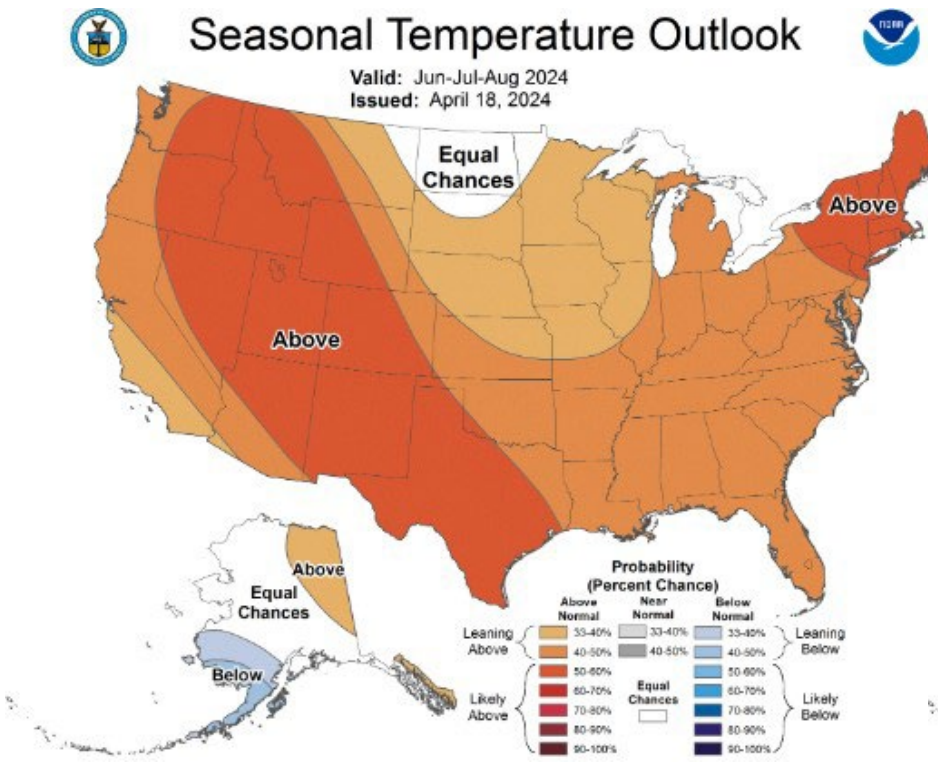
*__Exceedance Probability:__ The probability that a specific seasonal volume will be exceeded.

Natural streamflow below HH Dam is forecast to be below average and 71% of Normal for Apr-Sep.

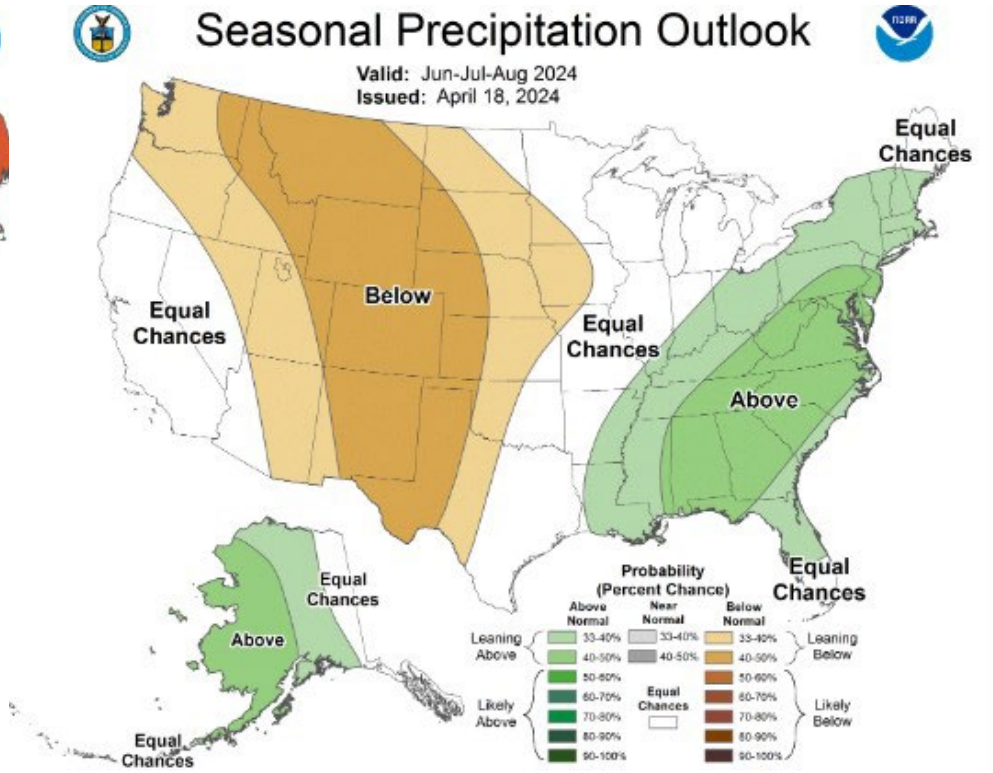
https://www.nwrfc.noaa.gov/natural/nat_ranking.cgi?id=HHDW1

CPC Summer Forecast

Temperature



Precipitation



Probability of above normal temperatures, and below normal precipitation, are forecast for summer.

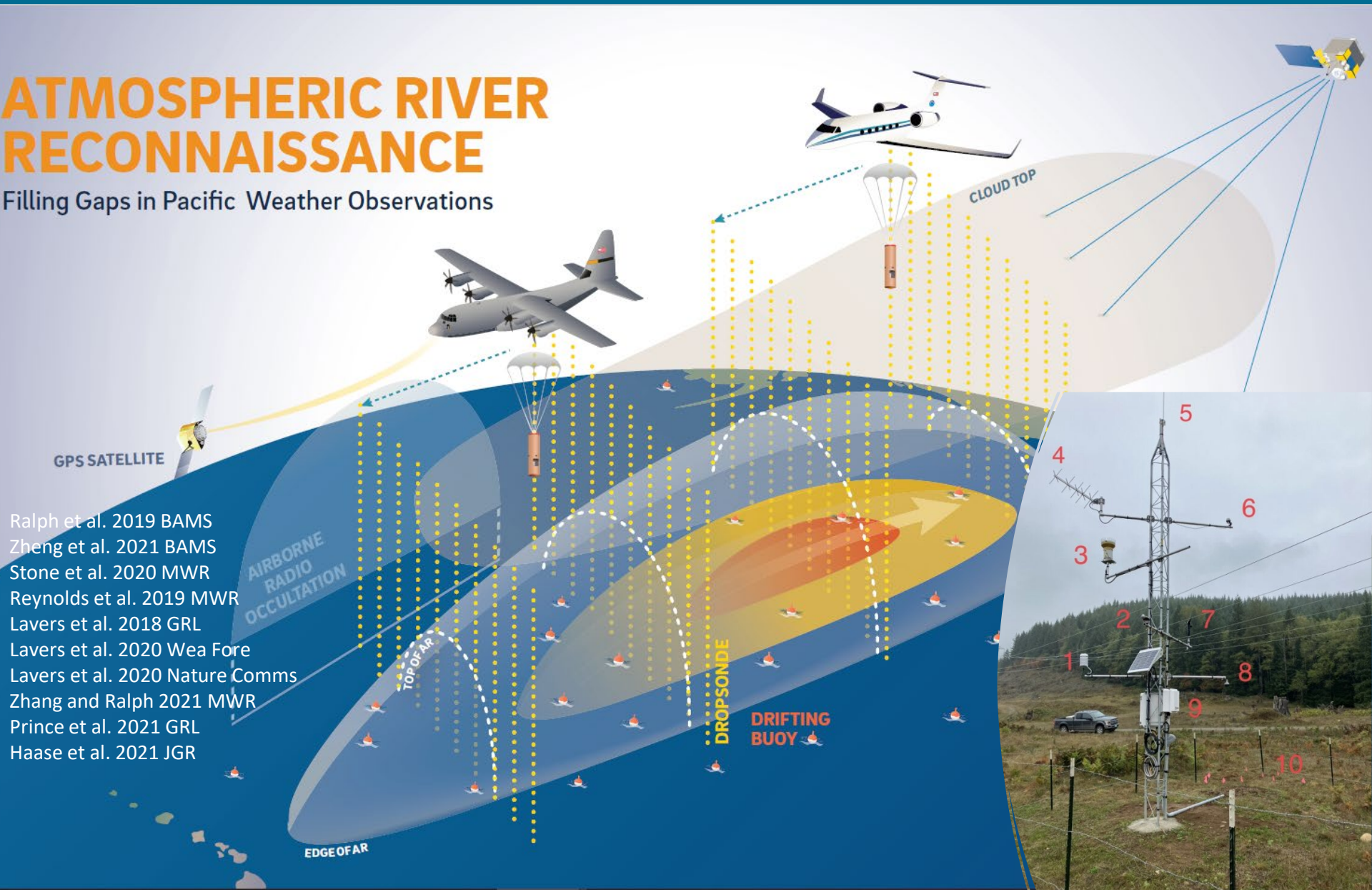
Climate Prediction Center - Seasonal Outlook (noaa.gov)

Other Water Supply Information

- Second Diversion run-of-river water has been generally been available since November 4.
  - Current forecasts of Howard Hanson Dam inflow and outflow indicate Second Diversion run-of-river will likely be maintained at least through the next 2 weeks (at this time of year, this is as far out as we forecast).
- A transition from El Niño to ENSO-neutral is likely by April-June (85% chance), with the odds of La Niña developing by June-August (60% chance).
  - El Niño generally brings weather to the PNW that tends toward warmer temperatures, modestly less precipitation, and below normal snow.
  - La Niña generally brings weather to the PNW that tends toward cooler temperatures, more precipitation, and therefore above normal snow.

- We will continue to monitor the health of our water supply, and so far, indications are that we will continue to adequate water supply for our customers.

FIRO: Observations



Ralph et al. 2019 BAMS
Zheng et al. 2021 BAMS
Stone et al. 2020 MWR
Reynolds et al. 2019 MWR
Lavers et al. 2018 GRL
Lavers et al. 2020 Wea Fore
Lavers et al. 2020 Nature Comms
Zhang and Ralph 2021 MWR
Prince et al. 2021 GRL
Haase et al. 2021 JGR

FIRO: Observations – Radiosonde Campaign

- WY2024 radiosonde campaign
  - Launched a total of **110** radiosondes from McMillin Reservoir
- Sounding summaries and trip summaries are sent after each trip. Interested? email *CW3E-Fieldwork-g@ucsd.edu*

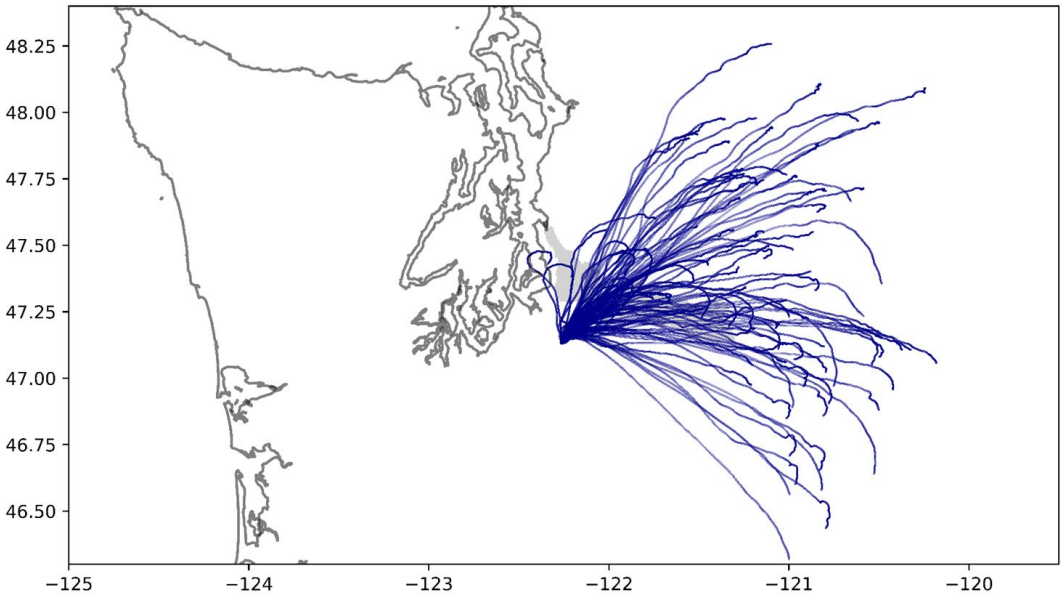
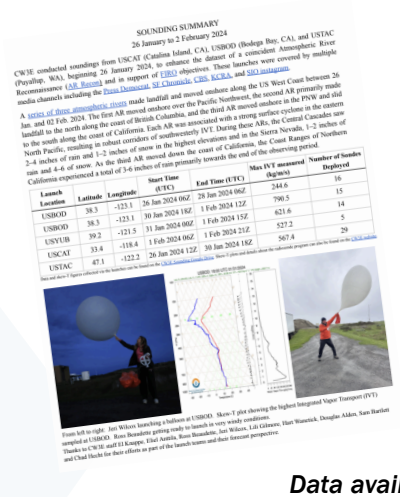


Figure by El Knappe



SOUNDING SUMMARY
26 January to 2 February 2024

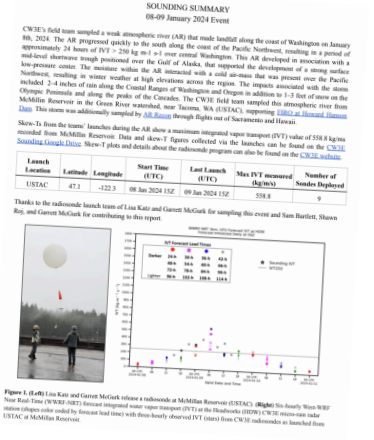
CW3E conducted soundings from USCAT (Catalina Island, CA), USBOD (Bodega Bay, CA), and USTAC (Puyallup, WA), beginning 26 January 2024, to enhance the dataset of a coincident Atmospheric River Reconnaissance (AR Recon) and in support of FIRO objectives. These launches were covered by multiple media channels including the Press Democrat, SF Chronicle, CBS, KCRA, and SIO instagram.

A series of three atmospheric rivers made landfall and moved onshore along the US West Coast between 26 Jan. and 02 Feb. 2024. The first AR moved onshore over the Pacific Northwest, the second AR primarily made landfall to the north along the coast of British Columbia, and the third AR moved onshore in the PNW and slid to the south along the coast of California. Each AR was associated with a strong surface cyclone in the eastern North Pacific, resulting in robust corridors of southwesterly IVT. During these ARs, the Central Cascades saw 2–4 inches of rain and 1–2 inches of snow in the highest elevations and in the Sierra Nevada, 1–2 inches of rain and 4–6 of snow. As the third AR moved down the coast of California, the Coast Ranges of Northern California experienced a total of 3-6 inches of rain primarily towards the end of the observing period.

Launch Location	Latitude	Longitude	Start Time (UTC)	End Time (UTC)	Max IVT measured (kg/m/s)	Number of Sondes Deployed
USBOD	38.3	-123.1	26 Jan 2024 06Z	28 Jan 2024 06Z	244.6	16
USBOD	38.3	-123.1	30 Jan 2024 18Z	1 Feb 2024 12Z	790.5	15
USBOD	38.3	-123.1	31 Jan 2024 00Z	1 Feb 2024 15Z	621.6	14
USYUB	39.2	-121.5	1 Feb 2024 06Z	1 Feb 2024 21Z	527.2	5
USCAT	33.4	-118.4	26 Jan 2024 12Z	30 Jan 2024 18Z	567.4	29
USTAC	47.1	-122.2				

Data and skew-T figures collected via the launches can be found on the CW3E website. Skew-T plots and details about the radiosonde program can also be found on the CW3E website.

From left to right: Jan Wilcox launching a balloon at USBOD. Skew-T plot showing the highest Integrated Vapor Transport (IVT) sampled at USBOD. Ross Beaudette getting ready to launch in very windy conditions.
Thanks to CW3E staff El Knappe, Eliel Antilla, Ross Beaudette, Jan Wilcox, Lili Gilmore, Hart Wunsch, Douglas Alden, Sam Bartlett and Chad Hecht for their efforts as part of the launch teams and their forecast perspective.



SOUNDING SUMMARY
08-09 January 2024 Event

CW3E's field team sampled a weak atmospheric river (AR) that made landfall along the coast of Washington on January 8th, 2024. The AR progressed quickly to the south along the coast of the Pacific Northwest, resulting in a period of approximately 24 hours of IVT > 250 kg m-1 s-1 over central Washington. This AR developed in association with a mid-level shortwave trough positioned over the Gulf of Alaska, that supported the development of a strong surface low-pressure center. The moisture within the AR interacted with a cold air-mass that was present over the Pacific Northwest, resulting in winter weather at high elevations across the region. The impacts associated with the storm included 2–4 inches of rain along the Coastal Ranges of Washington and Oregon in addition to 1–3 feet of snow on the Olympic Peninsula and along the peaks of the Cascades. The CW3E field team sampled this atmospheric river from McMillin Reservoir in the Green River watershed, near Tacoma, WA (USTAC), supporting FIRO at Howard Hanson Dam. This storm was additionally sampled by AR Recon through flights out of Sacramento and Hawaii.

Skew-Ts from the teams' launches during the AR show a maximum integrated vapor transport (IVT) value of 558.8 kg/ms recorded from McMillin Reservoir. Data and skew-T figures collected via the launches can be found on the CW3E Sounding Google Drive. Skew-T plots and details about the radiosonde program can also be found on the CW3E website.

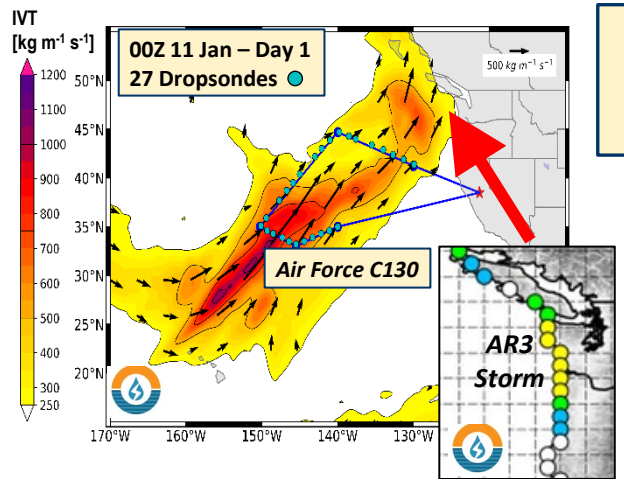
Launch Location	Latitude	Longitude	Start Time (UTC)	Last Launch (UTC)	Max IVT measured (kg/m/s)	Number of Sondes Deployed
USTAC	47.1	-122.3	08 Jan 2024 15Z	09 Jan 2024 15Z	558.8	9

Thanks to the radiosonde launch team of Lisa Katz and Garrett McGurk for sampling this event and Sam Bartlett, Shawn Roy, and Garrett McGurk for contributing to this report.

Figure 1. (Left) Lisa Katz and Garrett McGurk release a radiosonde at McMillan Reservoir (USTAC). (Right) Six-hourly Weas-WRF Near Real-Time (WWRF-NRT) forecast integrated water vapor transport (IVT) at the Headworks (HDW) CW3E micro-rain radar station (shapes color coded by forecast lead time) with three-hourly observed IVT (stars) from CW3E radiosondes as launched from USTAC at McMillan Reservoir.

Data available here: https://cw3e.ucsd.edu/cw3e_radiosondes/

FIRO: More confidence in forecasts



Atmospheric River Reconnaissance 2022

Preliminary Assessment of Impact on Heavy Precipitation Forecast in GFS During the Sequence of 3 days of AR Recon flights from 11-13 Jan 2022

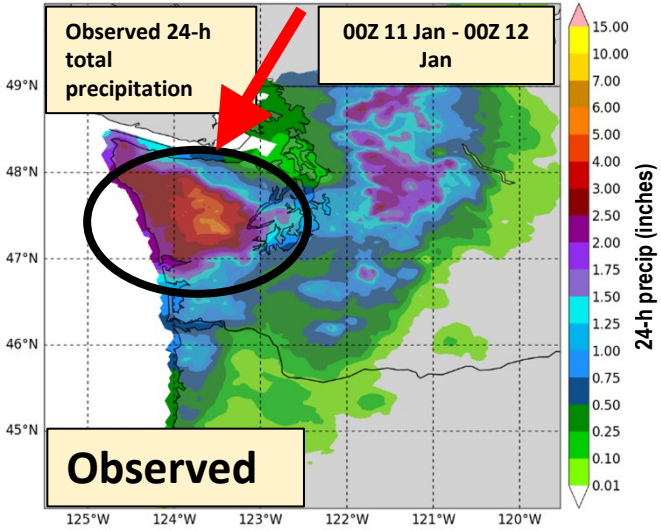
AR Recon flight substantially reduced errors in the 1-2-day lead-time forecast of heavy precipitation from an AR3 storm

The region had been experiencing flooding already this winter, and WA had requested a Presidential Disaster Declaration for earlier AR storms that had hit in Nov-Dec 2021, before AR Recon season began on 11 Jan 2022.

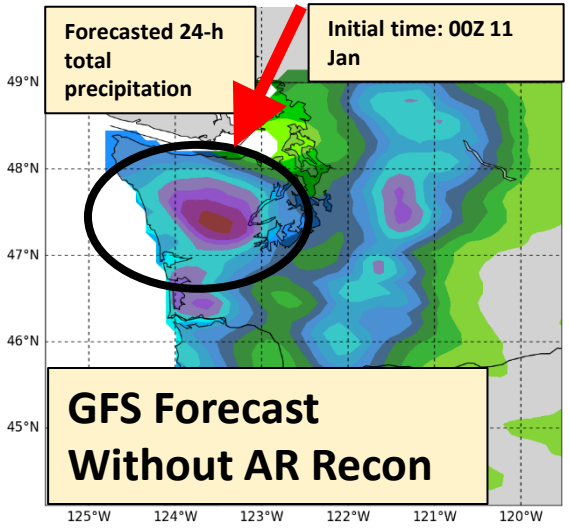
Center for Western Weather and Water Extremes

Research And Operations Partnership
F. Martin Ralph (UCSD/SIO/CW3E) - PI
Vijay Tallapragada (NWS/NCEP) - Co-PI

Max > 6 inches in 1 day



Max < half what was observed



Max > 5 inches in 1 day
Close to what was observed