April 4, 2023

MEMORANDUM

TO: **Council Members**

FROM: **Leslie Bach and Daniel Hua**

SUBJECT: **Basin Climate and Water Supply Outlook**

BACKGROUND:

Presenter: Dr. Henry Pai, Senior Hydrologist, Northwest River Forecast Center, NOAA

Summary: Dr. Pai will provide an update on current hydrologic and climatic conditions and seasonal water supply forecasts for the Columbia Basin. He will provide a brief background on the methods used by NOAA to develop the forecasts, and discuss the current conditions and expectations for the upcoming water management season. This information is critical for informing decisions regarding dam management, hydropower production and fisheries operations across the Basin.

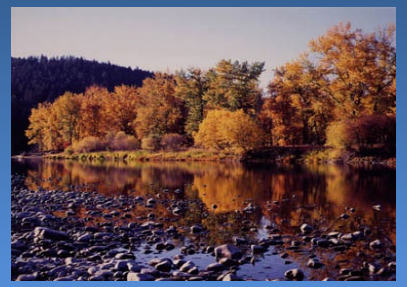
Relevance: The Mainstem Hydrosystem Flow and Passage strategy and the Climate Change strategy of the 2014/2020 Fish and Wildlife Program both call for the federal agencies to implement measures to better understand and track climate and river conditions and to use that information to identify and implement hydrosystem management actions that protect and improve conditions for fish. In addition, several applications of water supply forecasting for various seasonal time periods of a water year, which begins in October and ends in the following September, are in hydro-regulation planning studies. These include: (1) Biological Opinion (BiOP) operations at various hydropower projects such as setting the amount of spill, minimum and maximum flow constraints or flow in

turbines; (2) flood control operations which determine how much to draft various reservoirs to absorb the freshet runoff; (3) estimating the volume and timing of water to be released from Canadian reservoirs according the Columbia River Treaty; and (4) setting hydro-regulations to ensure a high probability of refill for all reservoirs at the end of the water year. Results from these studies enable planners to determine operations of the hydrosystem projects, which include hydropower generation over the water year.

Background: Climate and water supply forecasting is a critical component of annual water management for Columbia River system operations. It also informs long-term planning and decision-making on operations that affect both hydropower supply and fish passage and survival. Annual planned actions for reservoir operations and fish passage during the fish migration seasons are described in the Corps of Engineers' Water Management Plan and Fish Operations Plan. In-season adjustments on dam and reservoir operations to accommodate changing conditions are discussed and considered through regional forum processes such as the Technical Management Team. All of these discussion and decision-making processes utilize the information provided on Basin water supply and runoff forecasting.

More Info: Forecast information and maps are available on the Northwest River Forecast Center website.

Northwest River Forecast Center



April 2023 Northwest Power and Conservation Council Meeting

Henry Pai
NWRFC.watersupply@noaa.gov

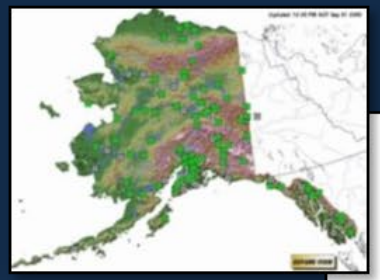
NOAA - NWS - RFC Missions

NOAA Mission: To understand and predict changes in the Earth's environment … to meet our Nation's economic, social, and environmental needs

NWS Mission: The NWS provides weather, hydrologic, and climate forecasts and warnings … for the protection of life and property and the enhancement of the national economy

RFC Role: The River Forecast Centers carries out the NOAA and NWS missions by providing streamflow forecasts and information datasets for the well being of the public

NWS River Forecast Centers

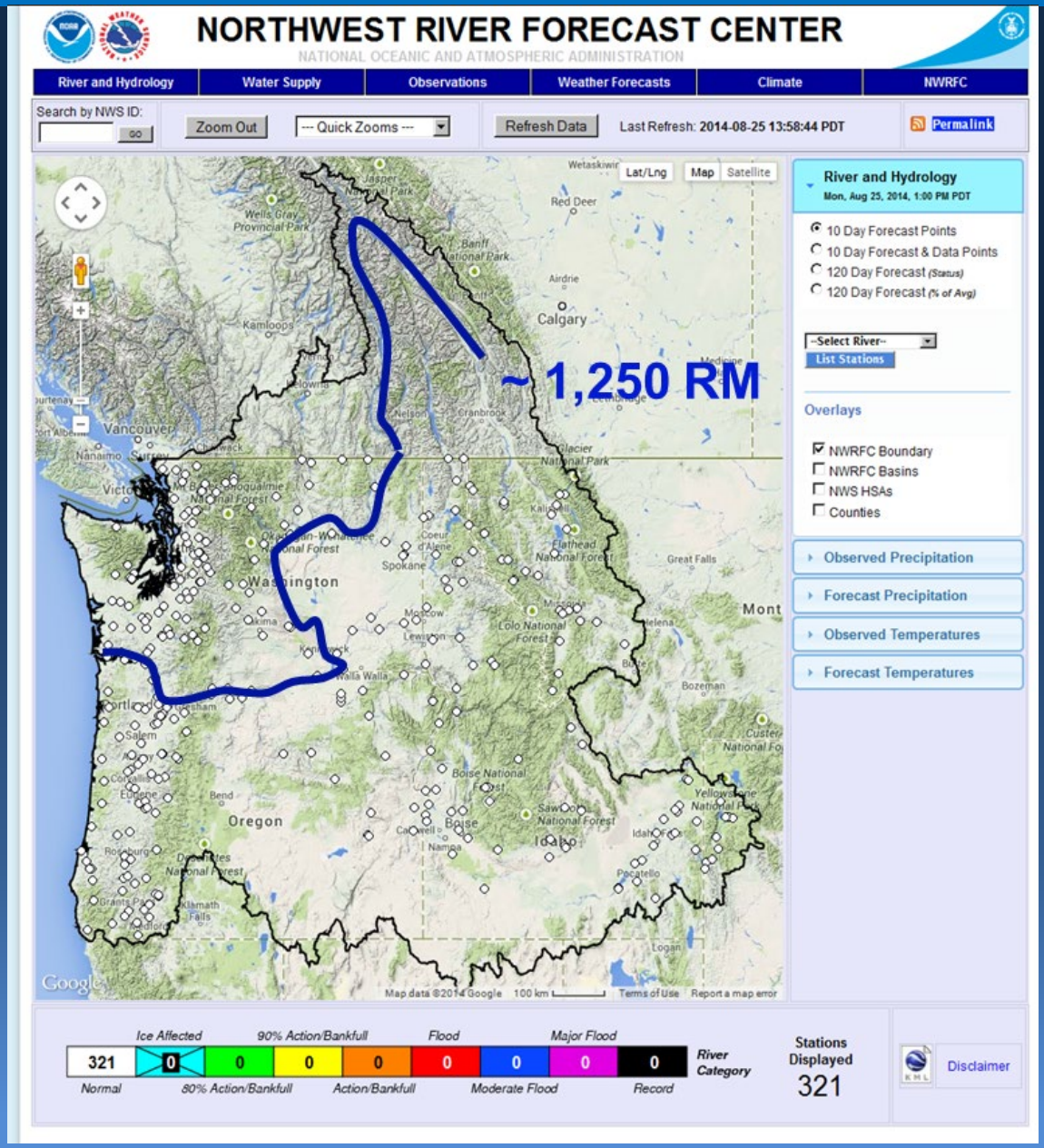


Northwest RFC:

- Includes portions of 8 States and British Columbia
- Basin Area = 326,127 square miles
- Entire Columbia River Basin
- Coastal Rivers of Oregon and Washington

NWRFC Domain and Forecast Services

- 10-day deterministic forecasts
  - Issued twice daily
  - Updated as needed
- Seasonal probabilistic forecasts
- ~350 locations
- Use conceptual hydrologic modeling
- Coordinate with USACE, USBR, BPA, and others on streamflow regulation



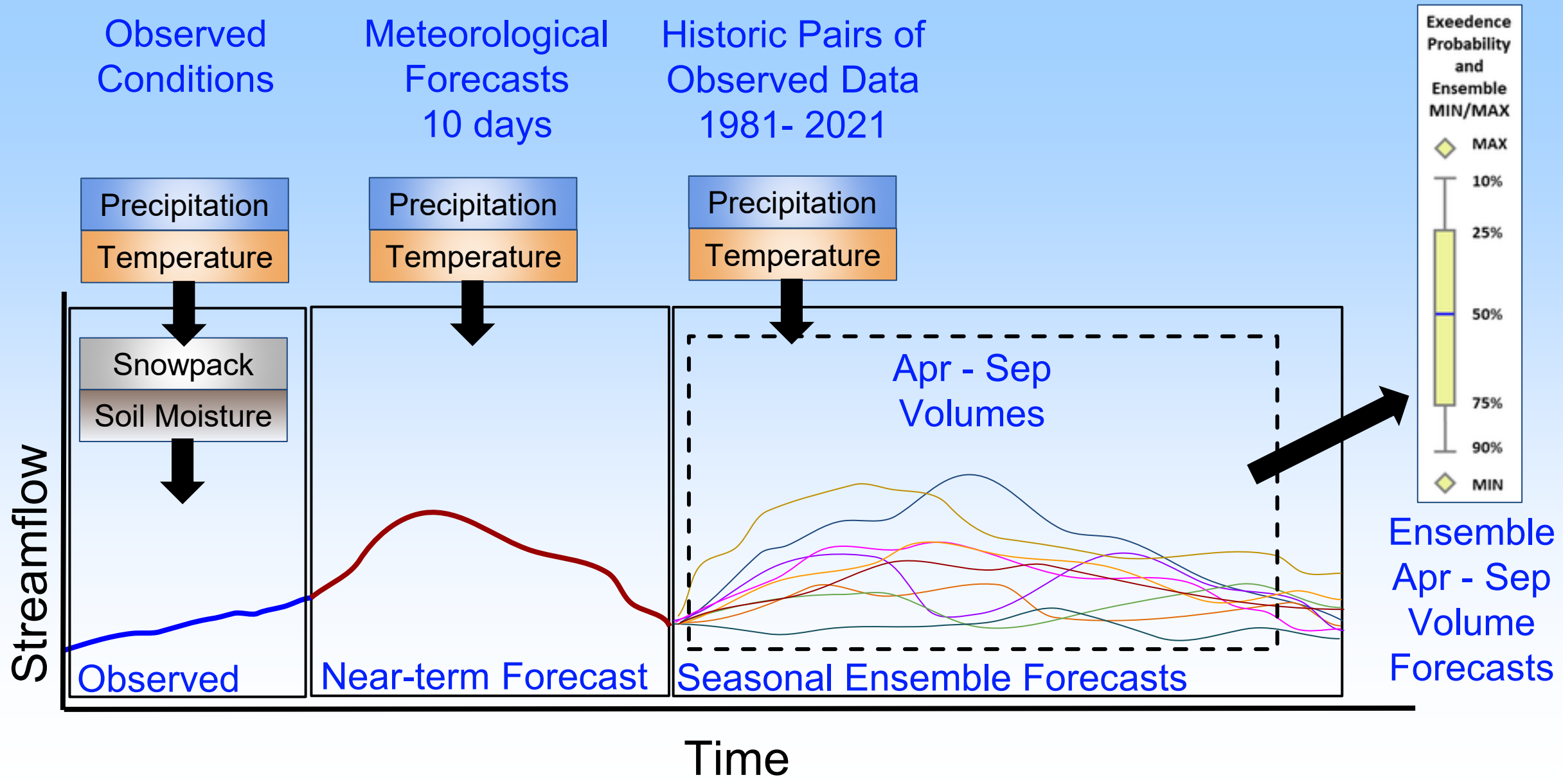
Water Supply Take Home Messages

Cooler temperatures since November have kept snowpack conditions elevated relative to seasonal precipitation values.

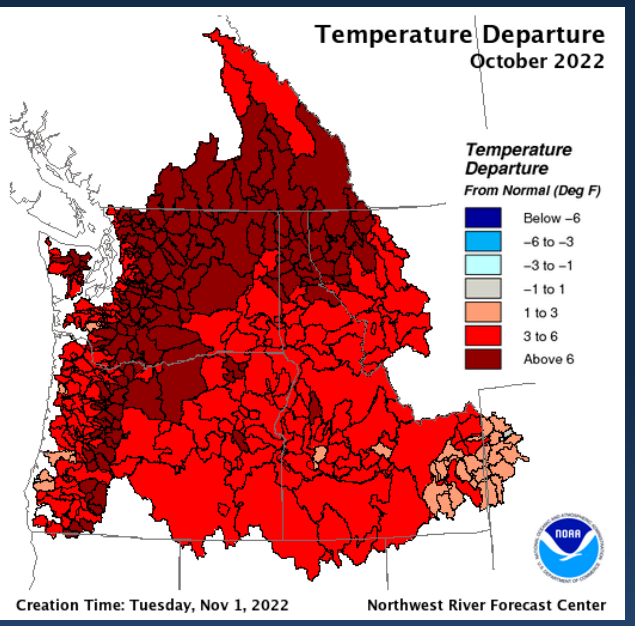
Decreased melt and rain have caused observed runoff to date to remain well below normal.

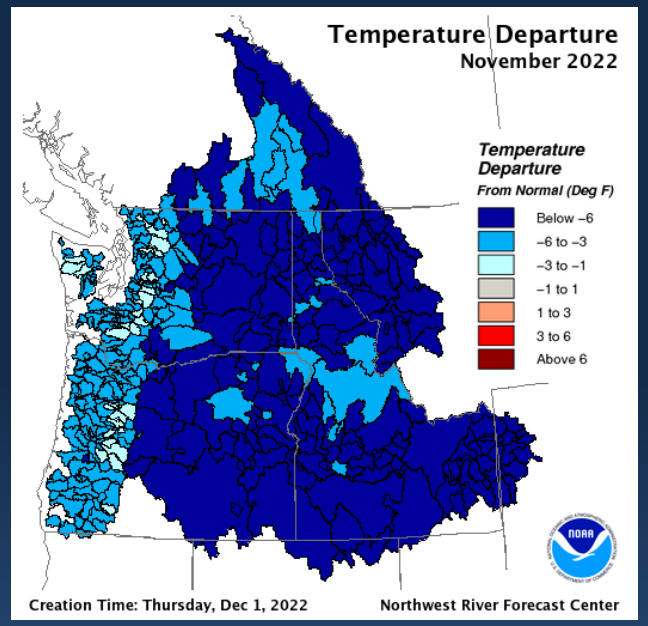
Apr-Sep water supply forecasts remain mostly normal to below normal, with exception in southern Idaho where forecasts are much higher than normal.

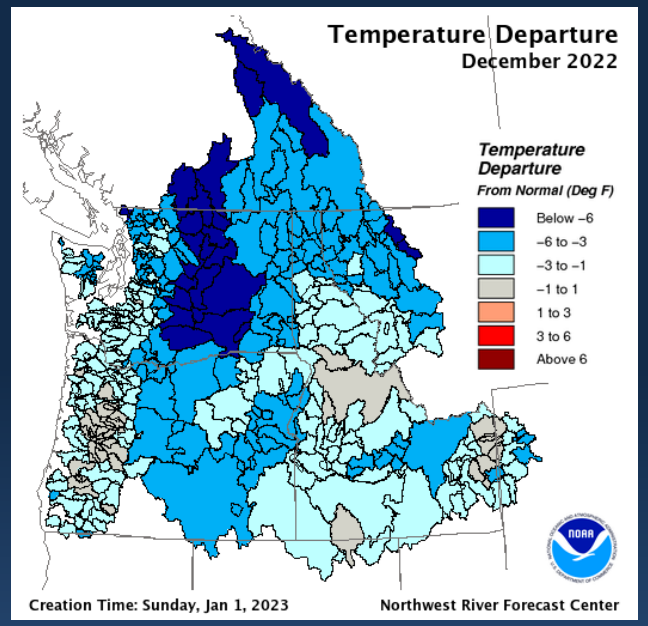
NWRFC Forecast Technique

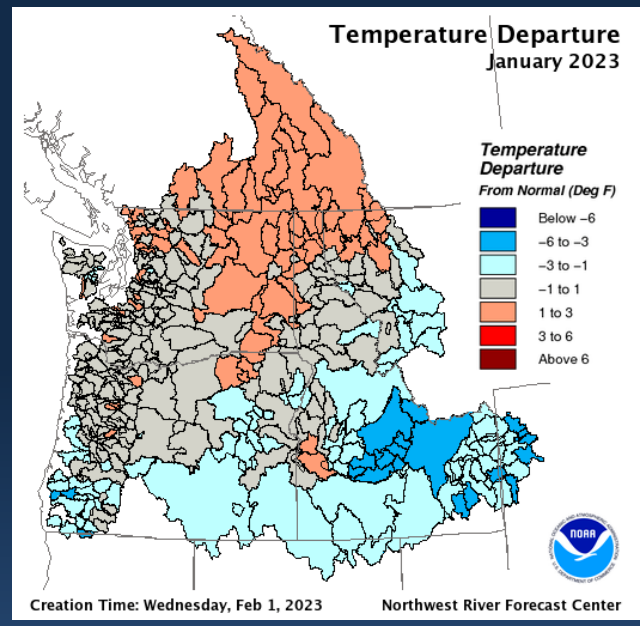


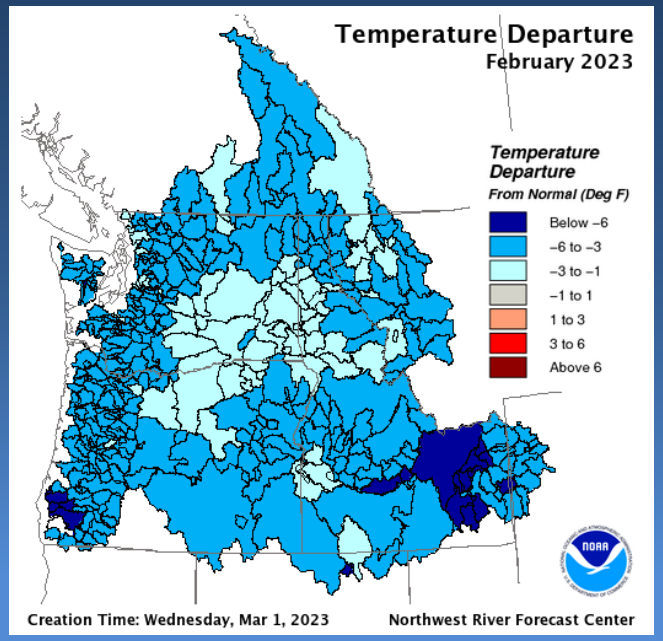
Temperature for Water Year to Date

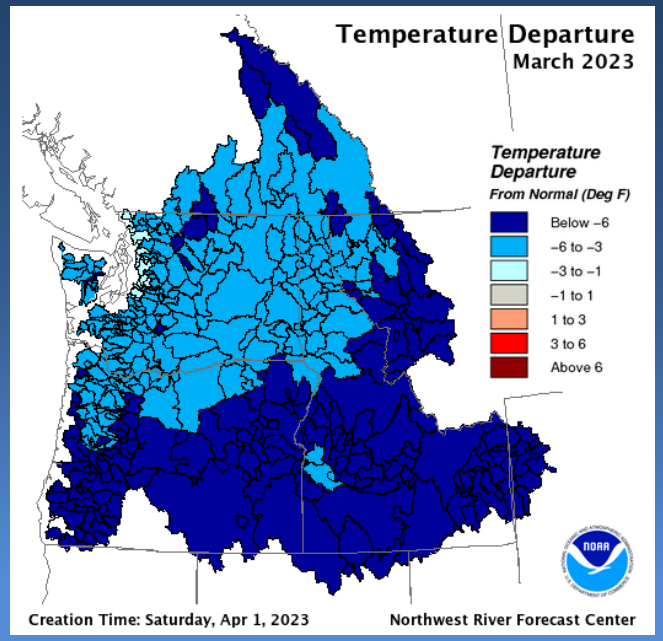


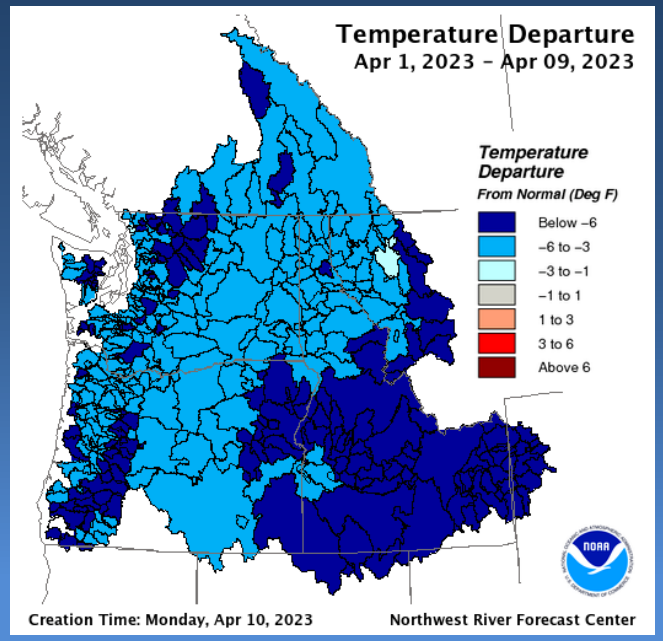




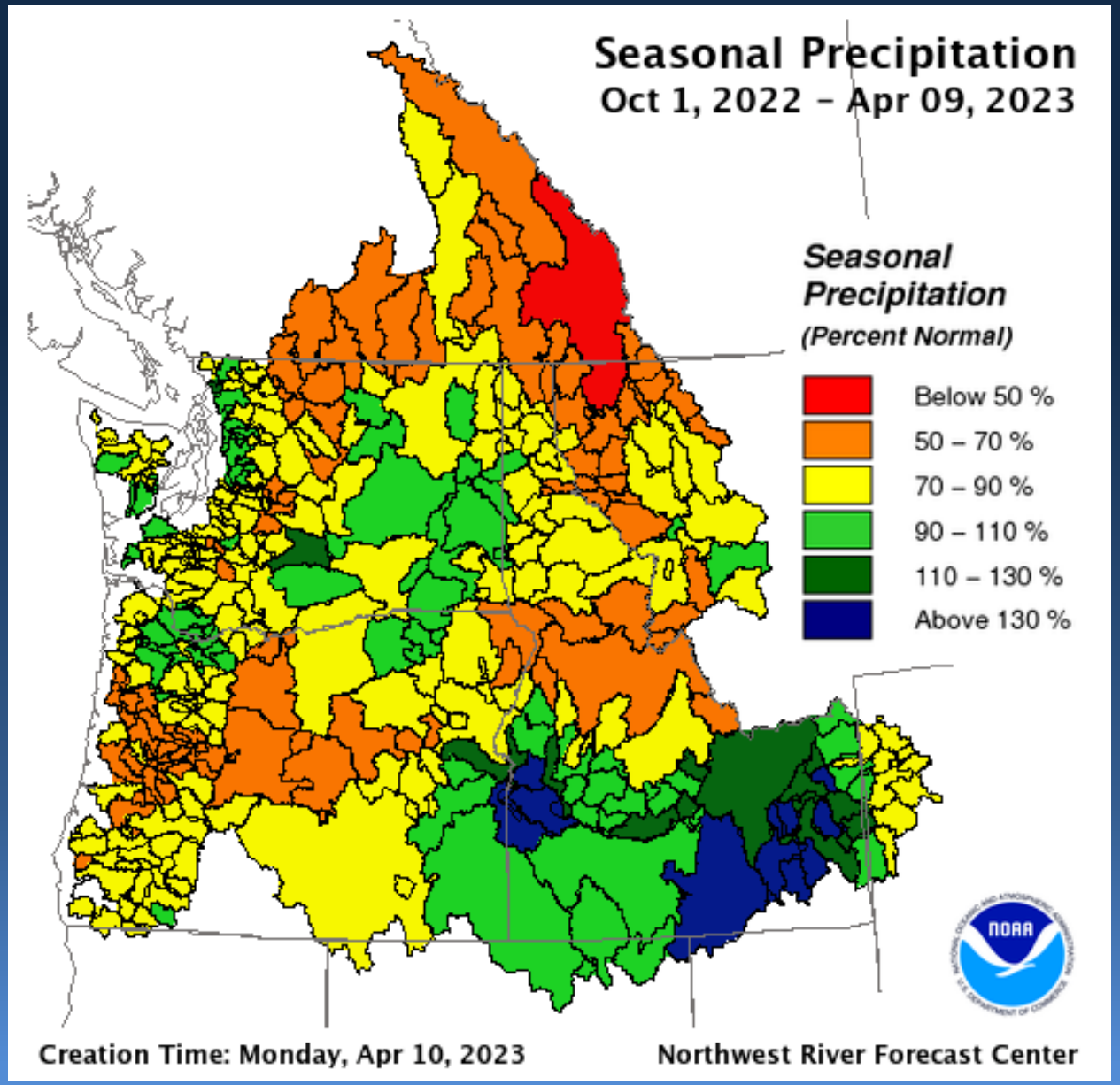


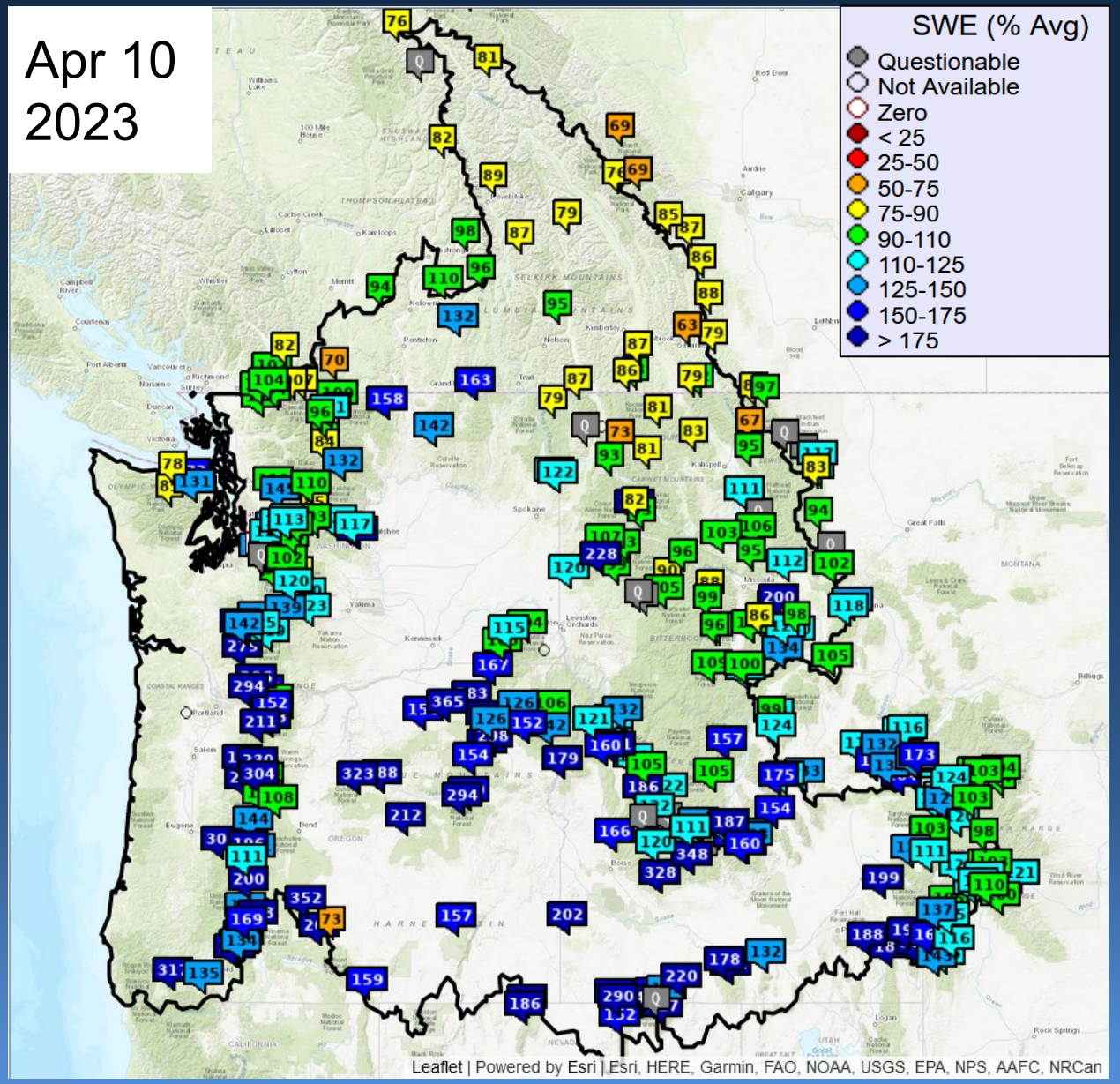




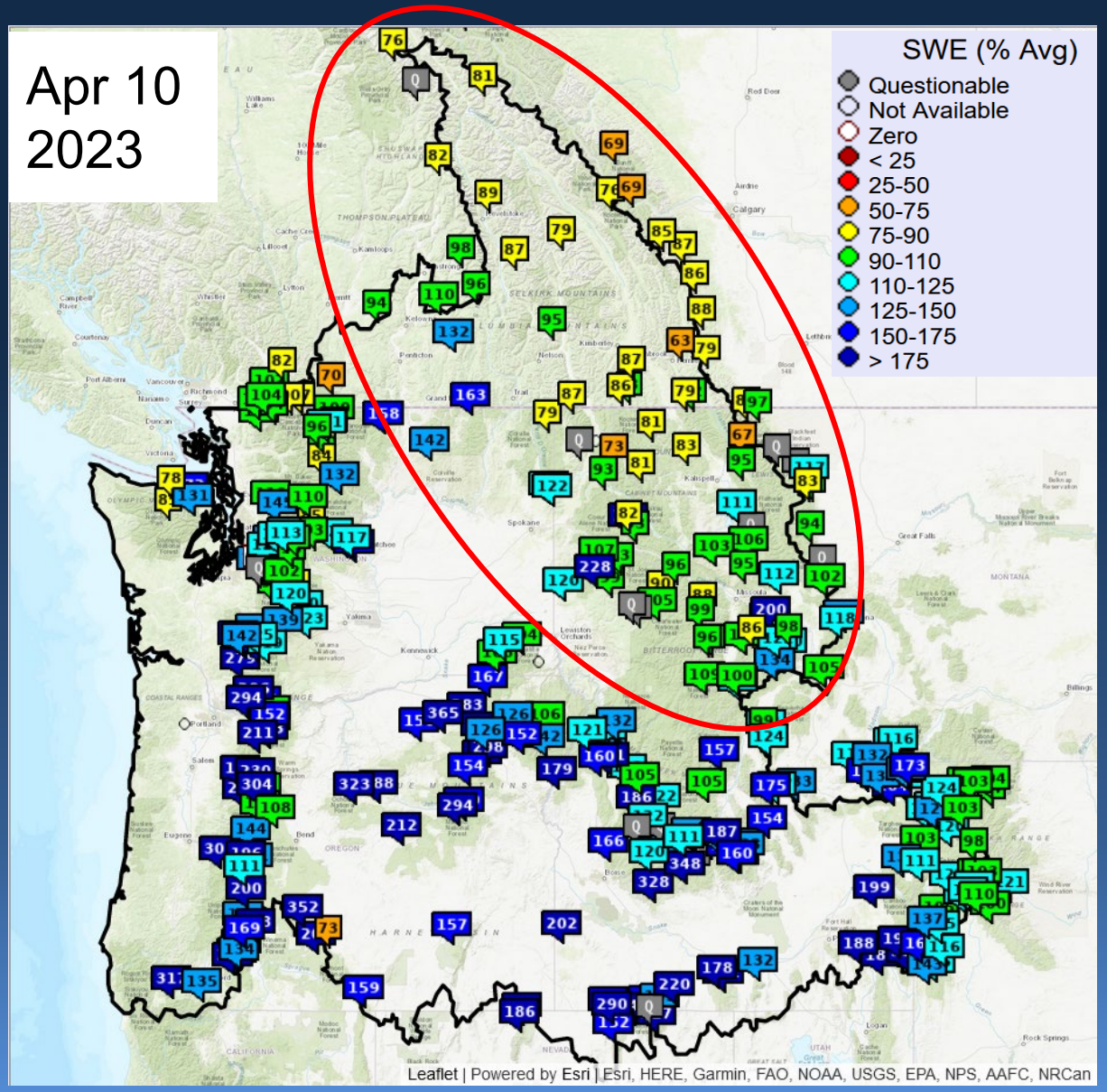


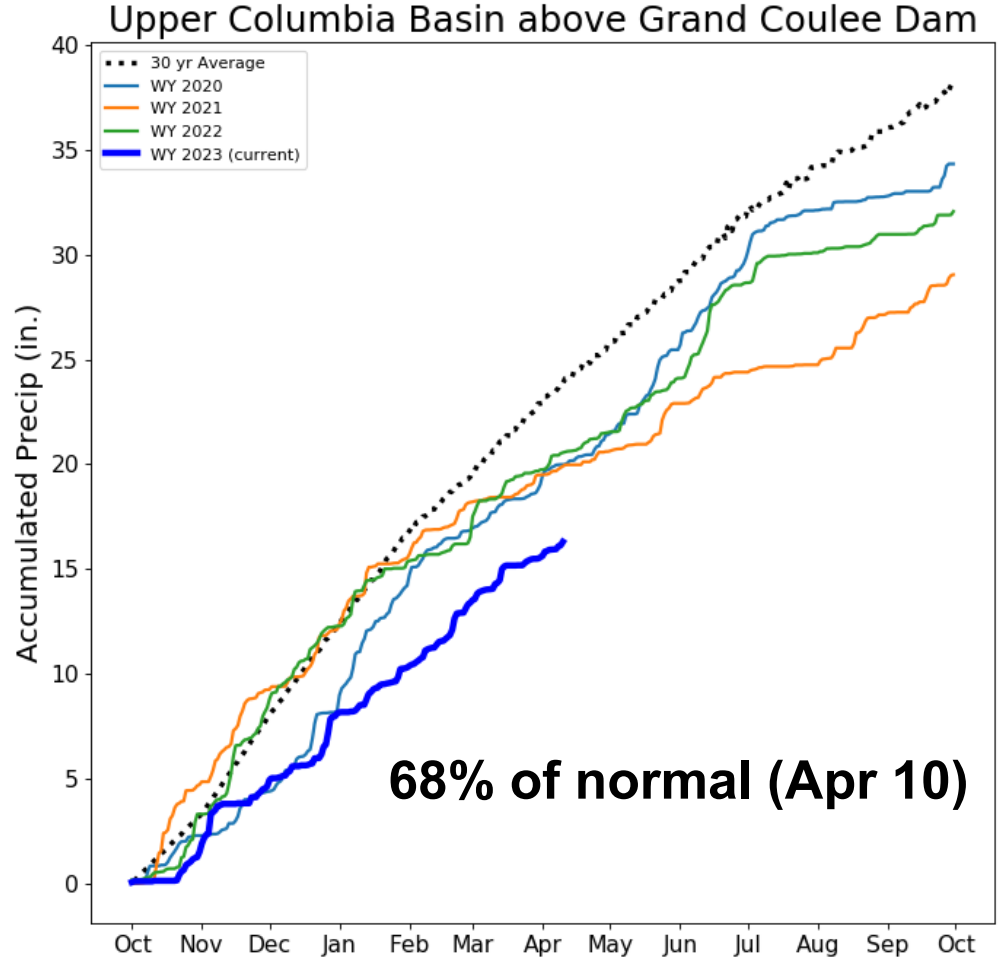
Precipitation and Snow





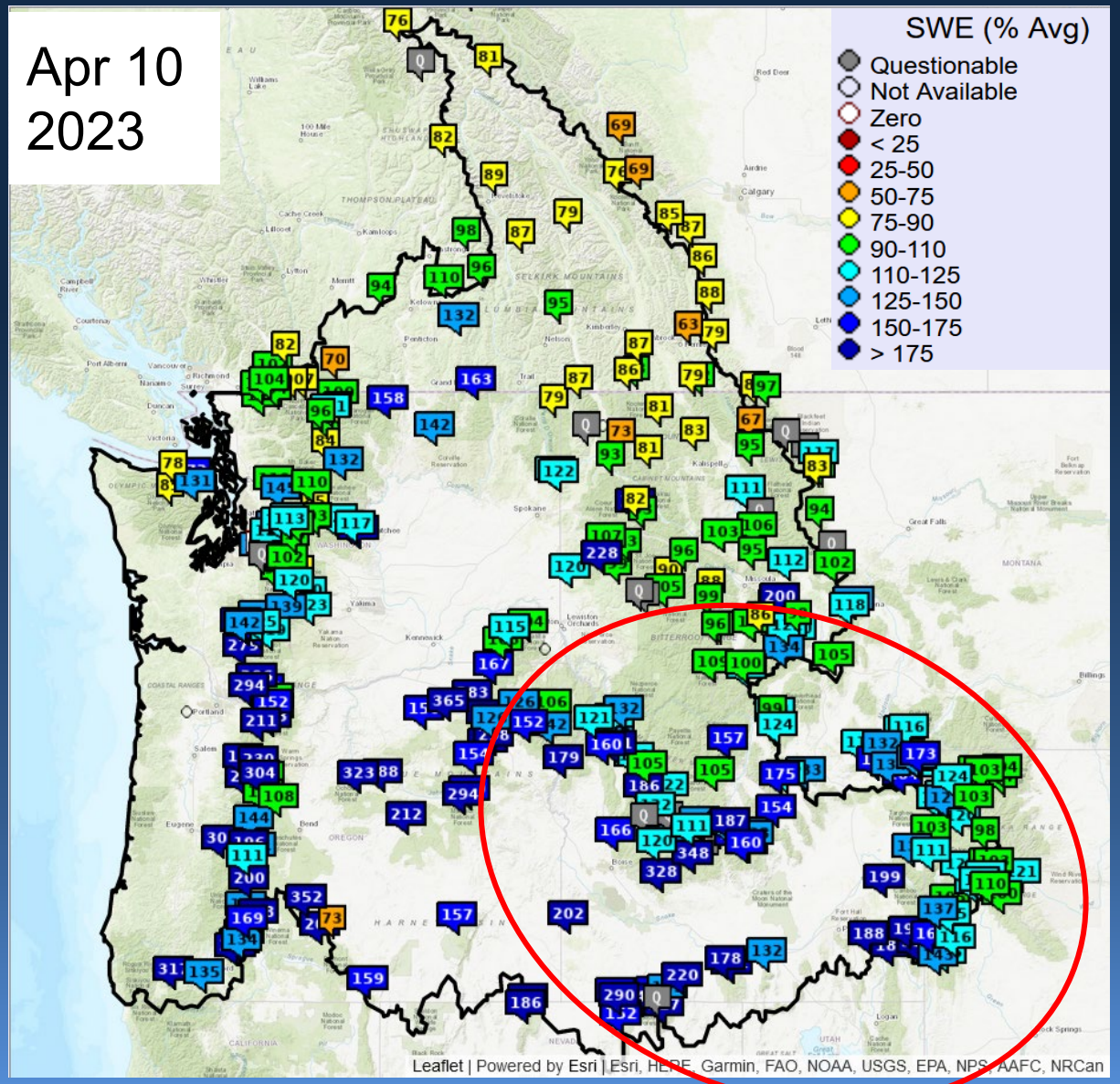
Snow and Precipitation

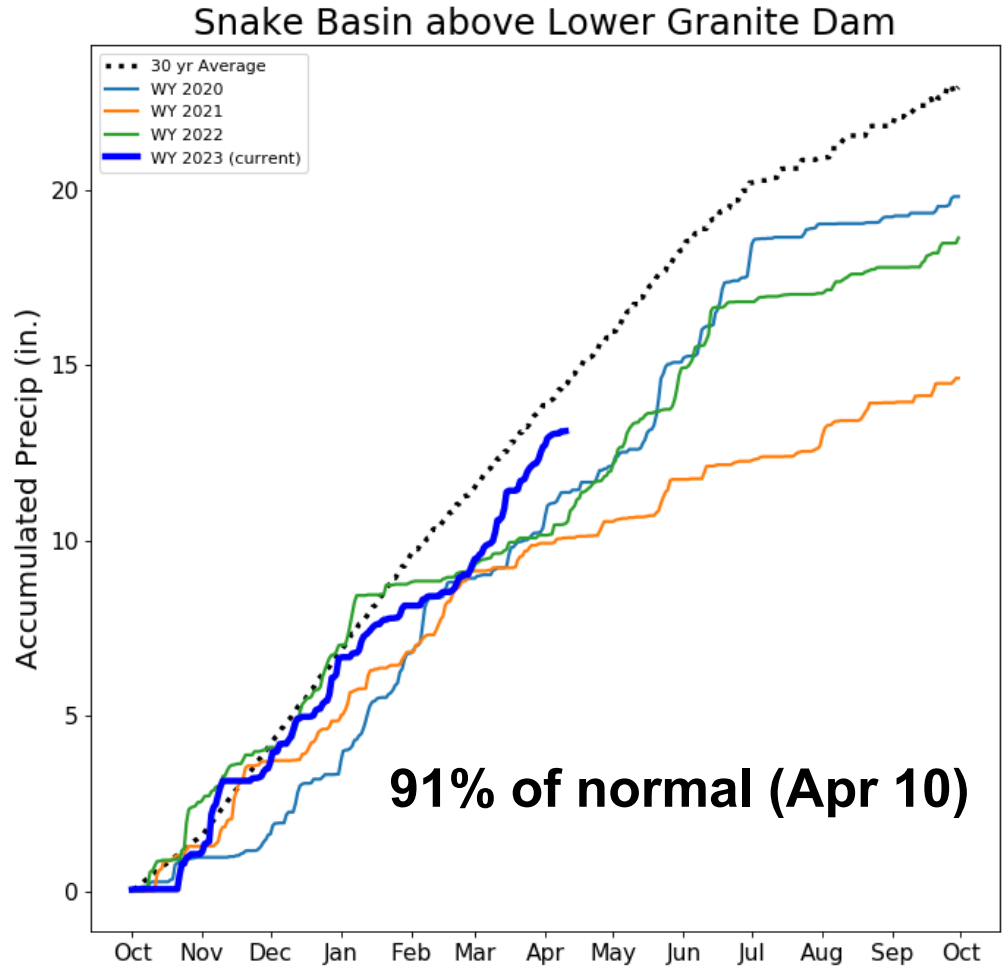




Snow data from NRCS, BC Hydro, and Alberta Environment and Parks. Precip averages from PRISM OSU and PCIC.

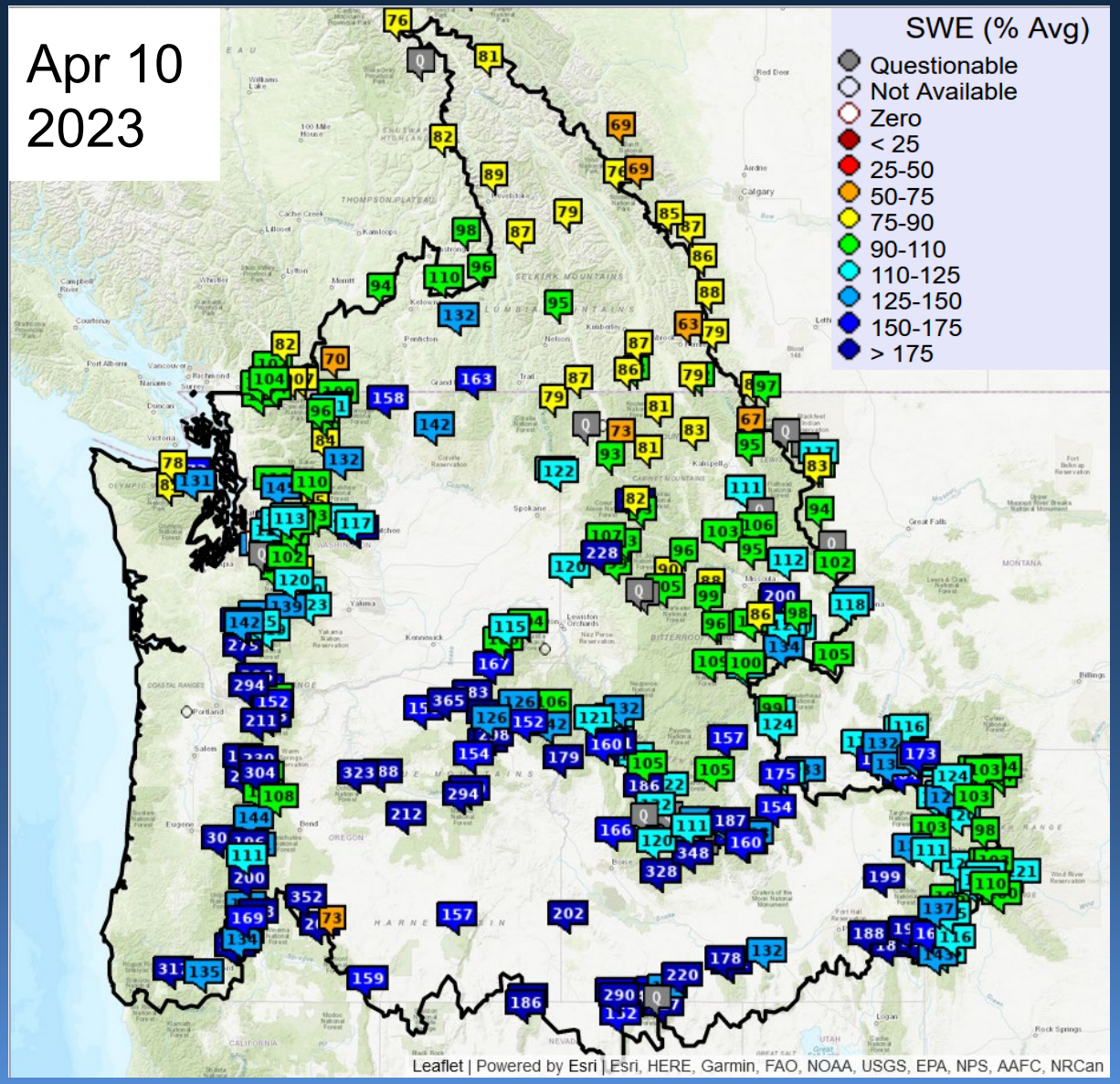
Snow and Precipitation

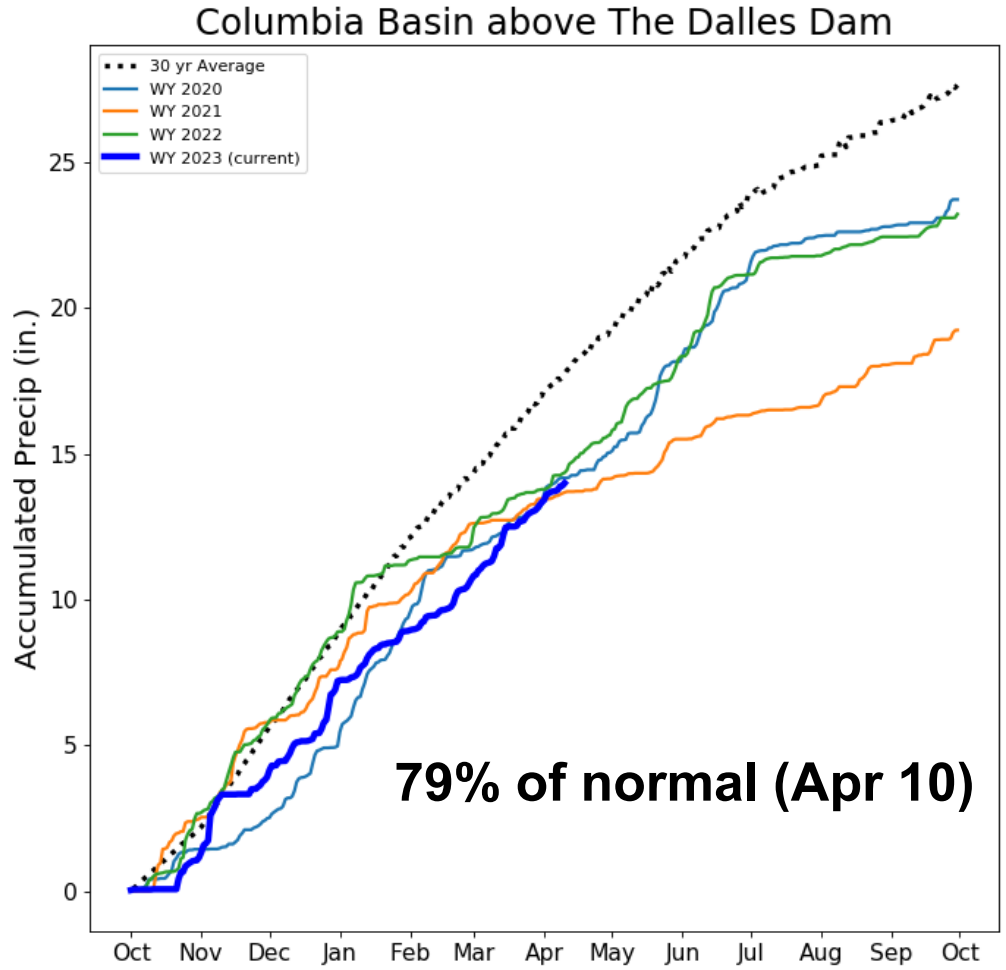




Snow data from NRCS, BC Hydro, and Alberta Environment and Parks. Precip averages from PRISM OSU and PCIC.

Snow and Precipitation

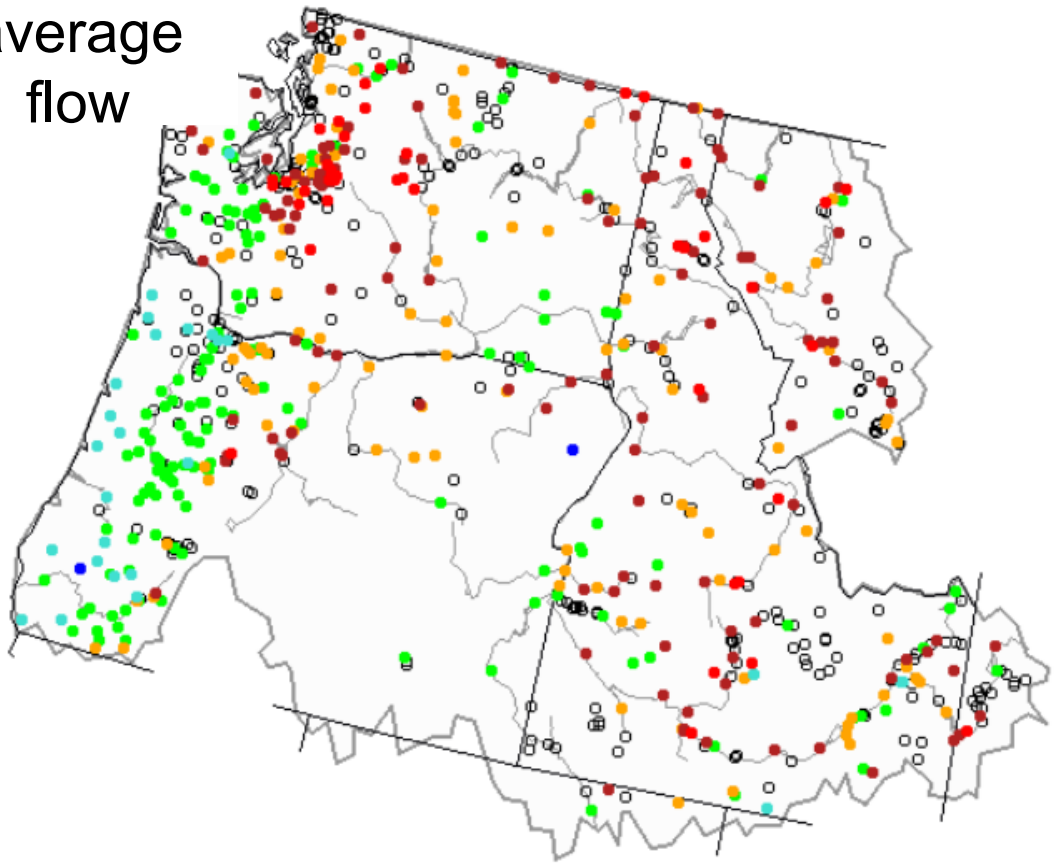




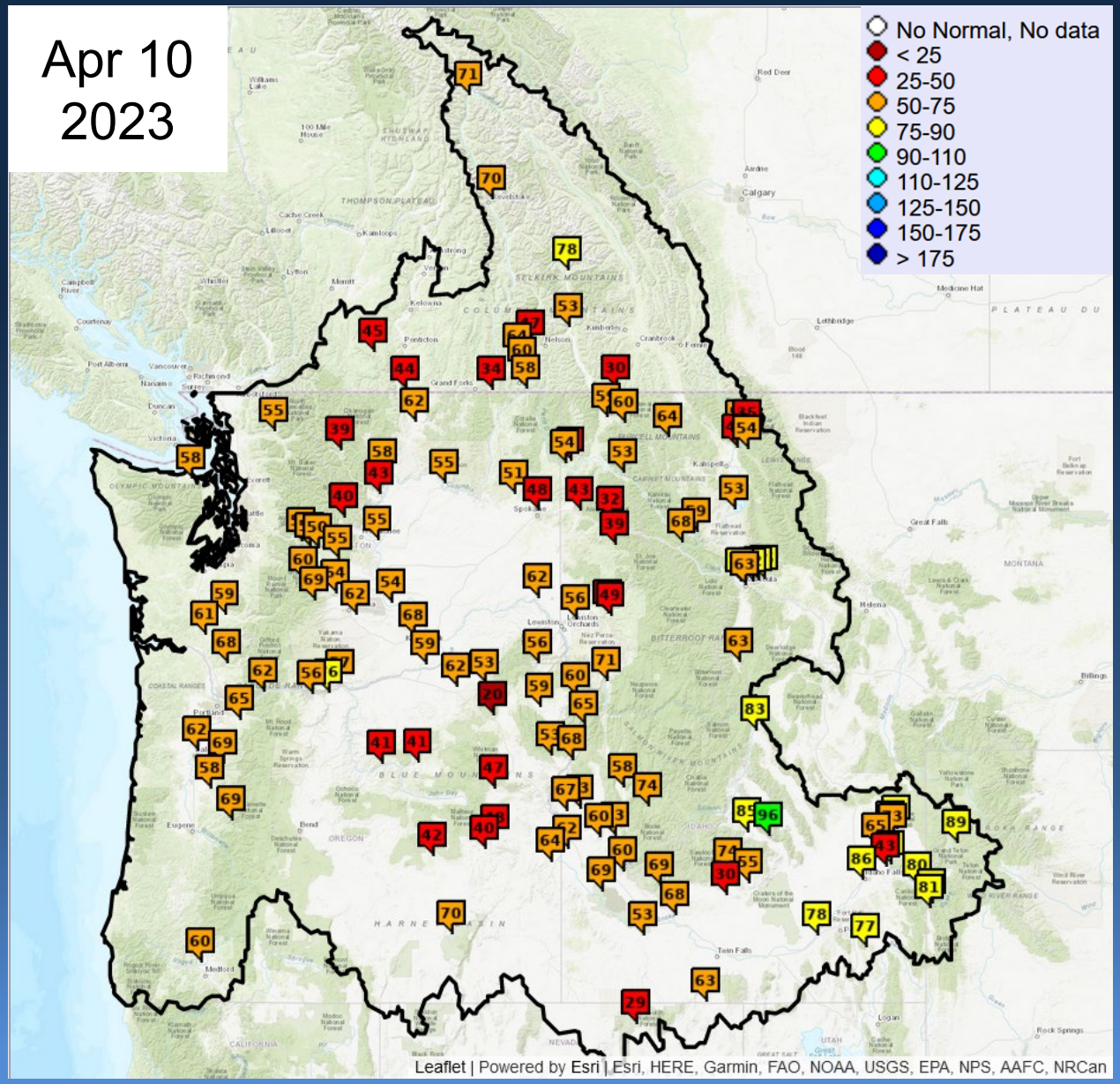
Snow data from NRCS, BC Hydro, and Alberta Environment and Parks. Precip averages from PRISM OSU and PCIC.

Observed Streamflow and Adjusted Runoff

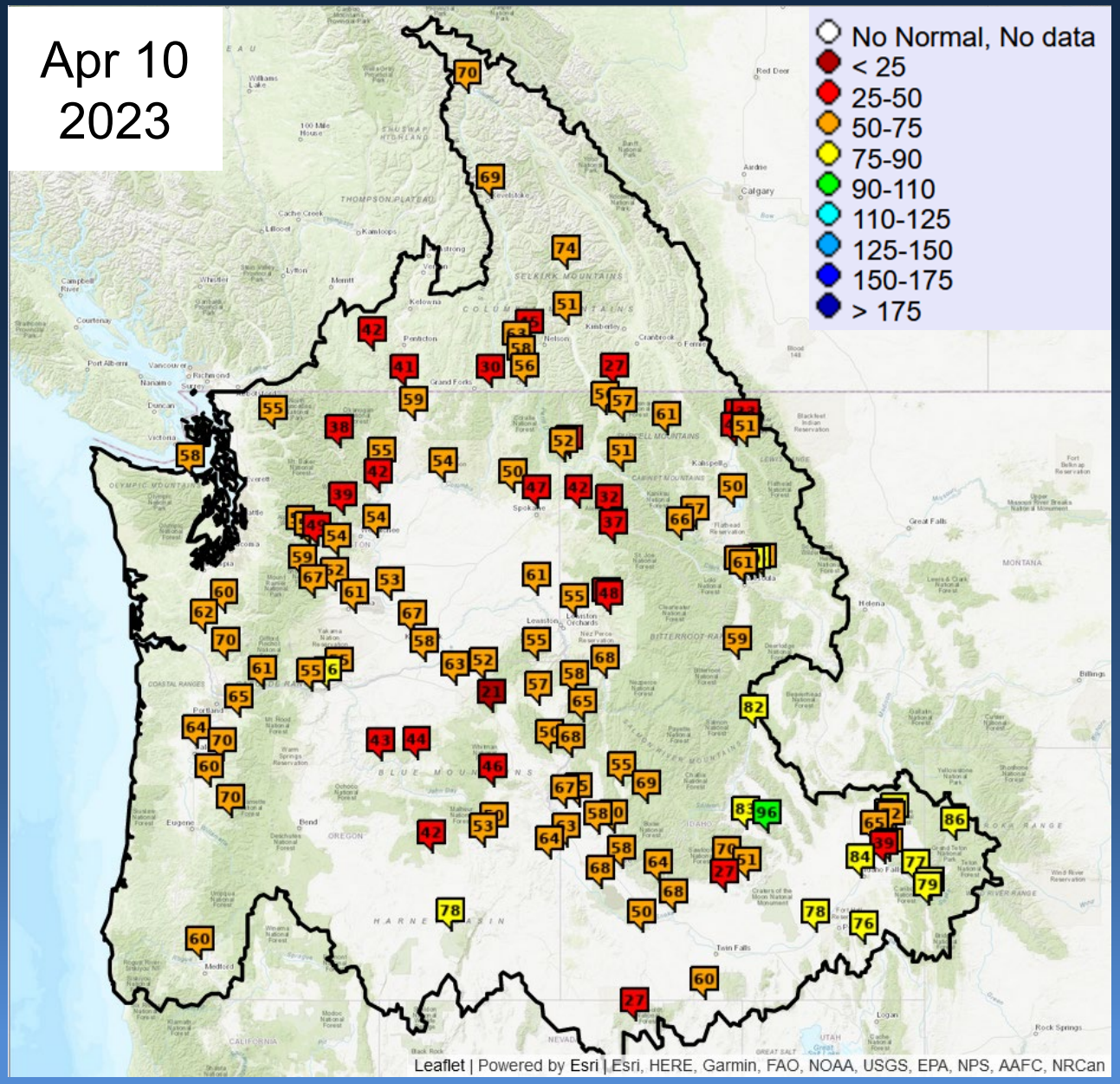
28-day average flow



Apr 10 2023



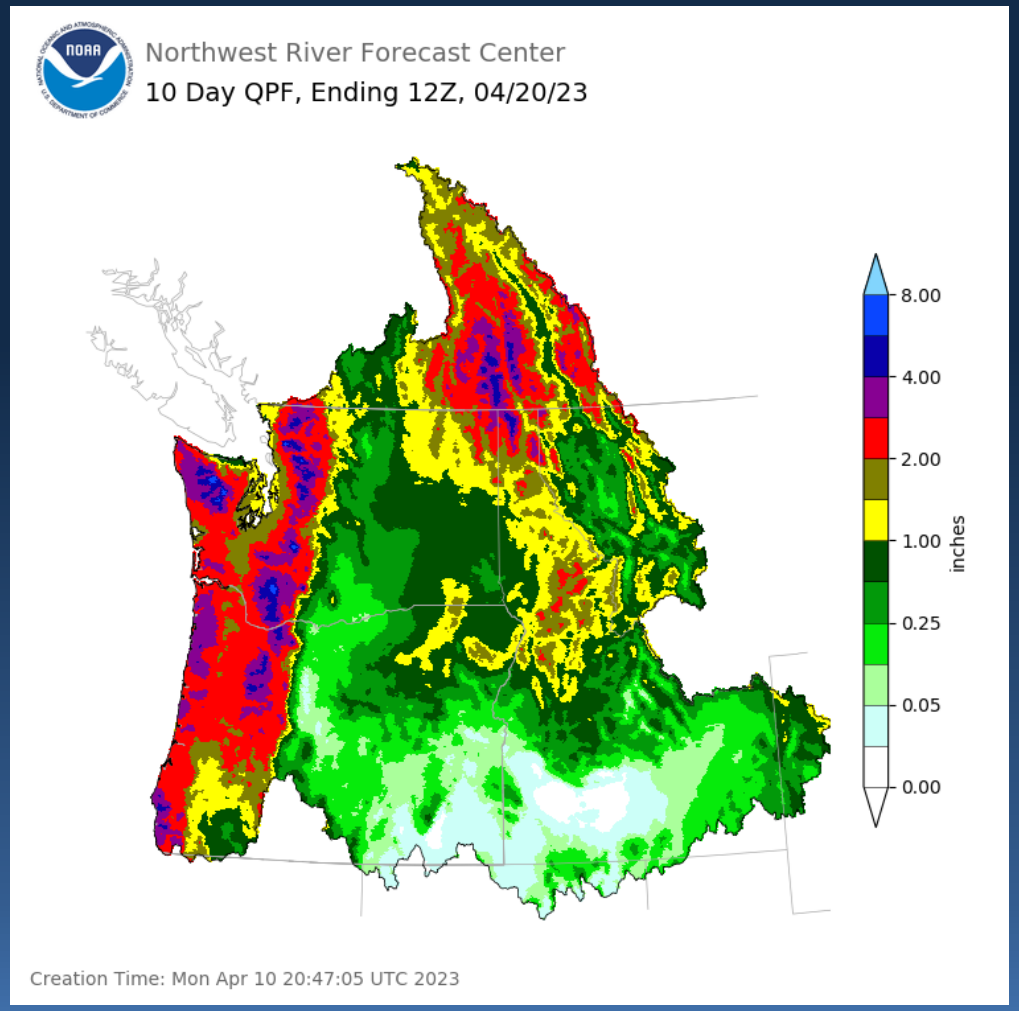
Water Year to Date Adjusted Runoff

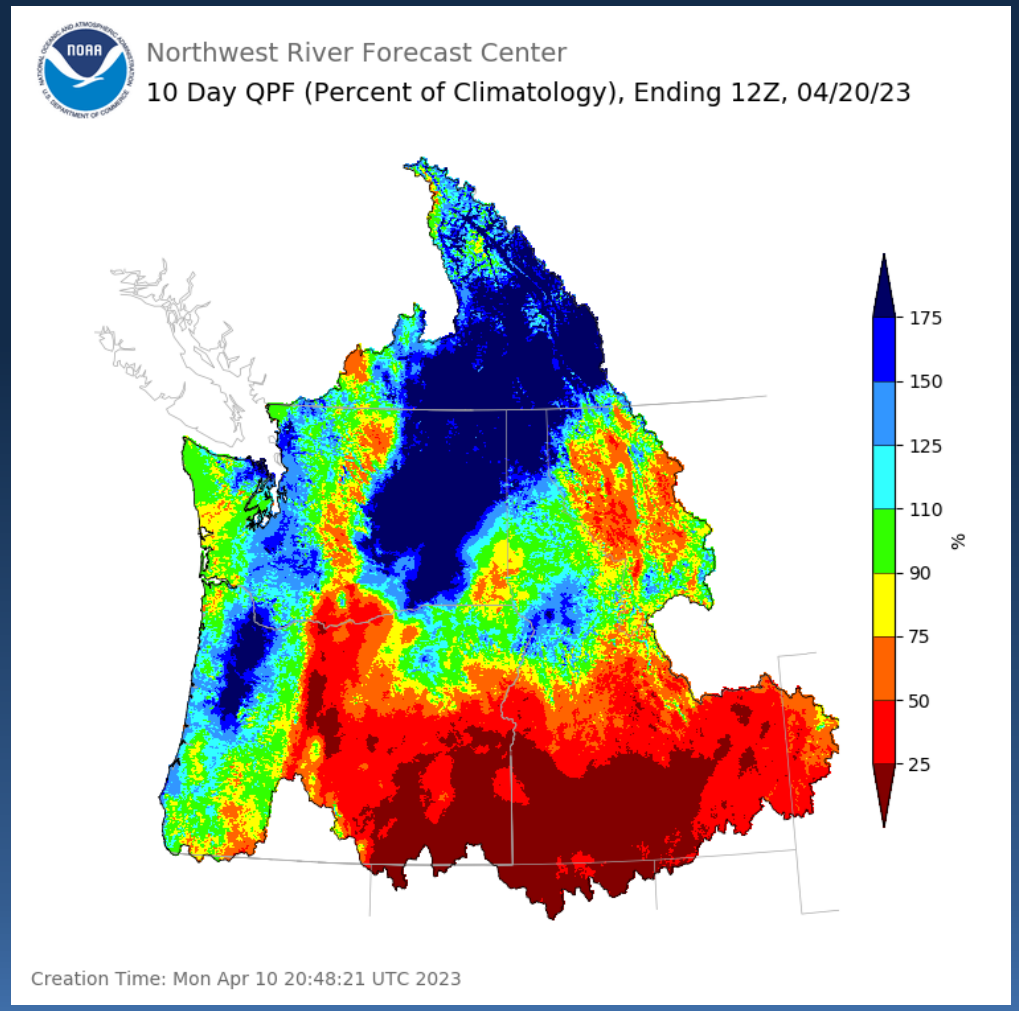


% Normal Runoff Oct 1- Apr 10

Upper Columbia Basin	
Mica	70
Duncan	74
Queens Bay	51
Libby	61
Hungry Horse	51
Grand Coulee	54
Snake River Basin	
American Falls	78
Lucky Peak	58
Dworshak	47
Lower Granite	61
Lower Columbia Basin	
The Dalles	55

10 Day Precipitation Forecast Used in ESP10

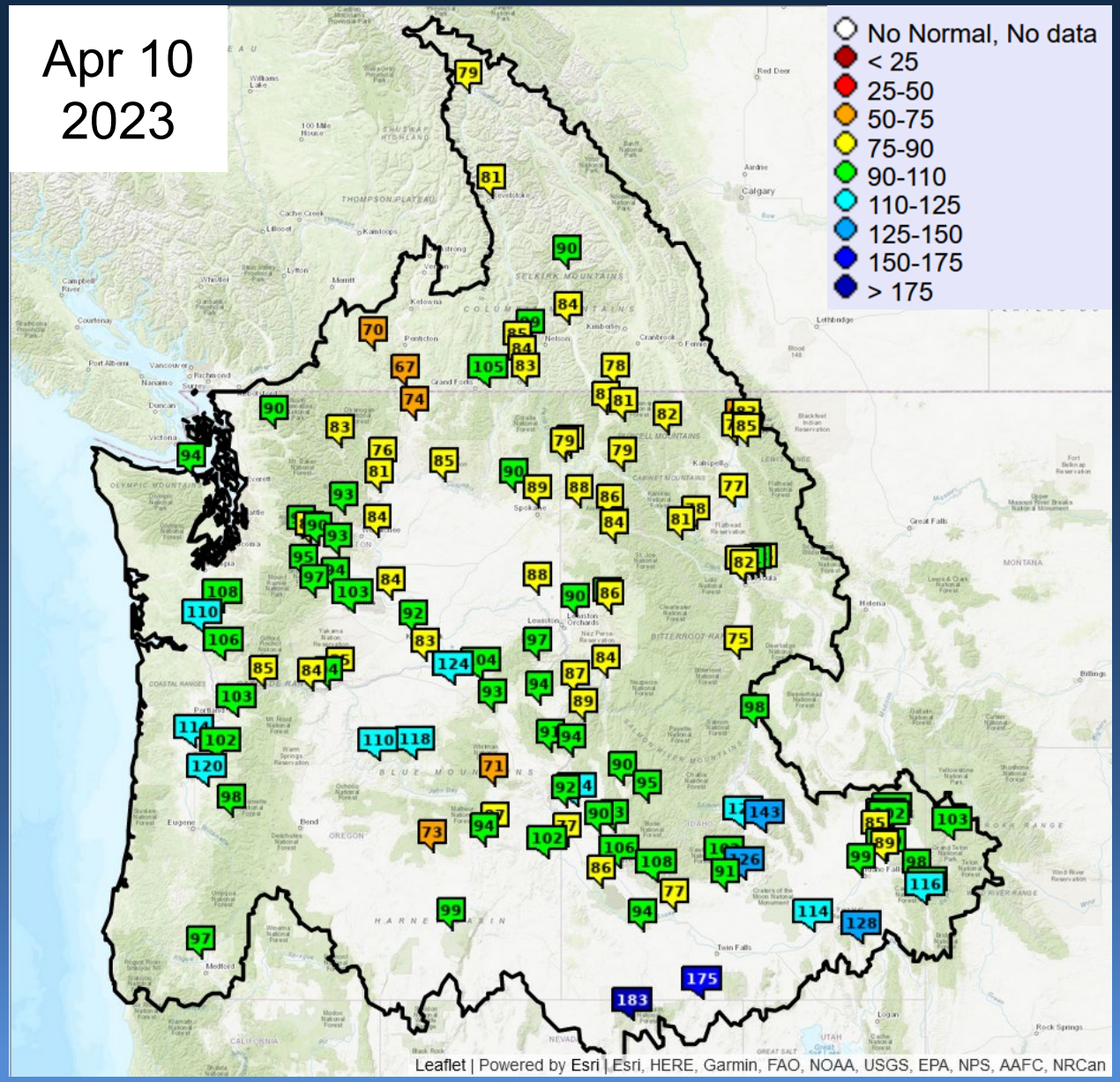




Quantitative Precipitation Forecast (QPF) Sources:

- Days 1 - 2 NWS Weather Forecast Offices (WFO) in the US, WPC in BC
- Days 3 - 7 NWS Weather Prediction Center (WPC)
- Days 8 - 10 NWS National Blend of Models (NBM)

Water Supply Forecasts



% Normal Apr-Sep Volume

Upper Columbia Basin

Mica	79
Duncan	90
Queens Bay	84
Libby	82
Hungry Horse	85
Grand Coulee	85

Snake River Basin

American Falls	114
Lucky Peak	106
Dworshak	93
Lower Granite	88

Lower Columbia Basin

The Dalles	84

Water Supply Forecasts

COLUMBIA - GRAND COULEE DAM (GCDW1)
Forecasts for Water Year 2023

Official Water Supply

ESP with 10 Days QPF **Ensemble:** 2023-04-10 **Issued:** 2023-04-10

Forecast Period	Forecasts Are in KAF				30 Year Average (1991-2020)
	90 %	50 %	% Average	10 %	
APR-SEP	48242	52354	85	58735	61483
APR-JUL	39509	43482	82	49893	52774
APR-AUG	44804	48863	84	55533	58186
JAN-SEP	53263	57376	81	63757	70457
JAN-JUL	44531	48503	79	54914	61749
OCT-SEP	58127	62239	79	68620	78842

Experimental Water Supply

HEFS with 15 days EQPF **Ensemble:** 2023-04-10 **Issued:** 2023-04-10

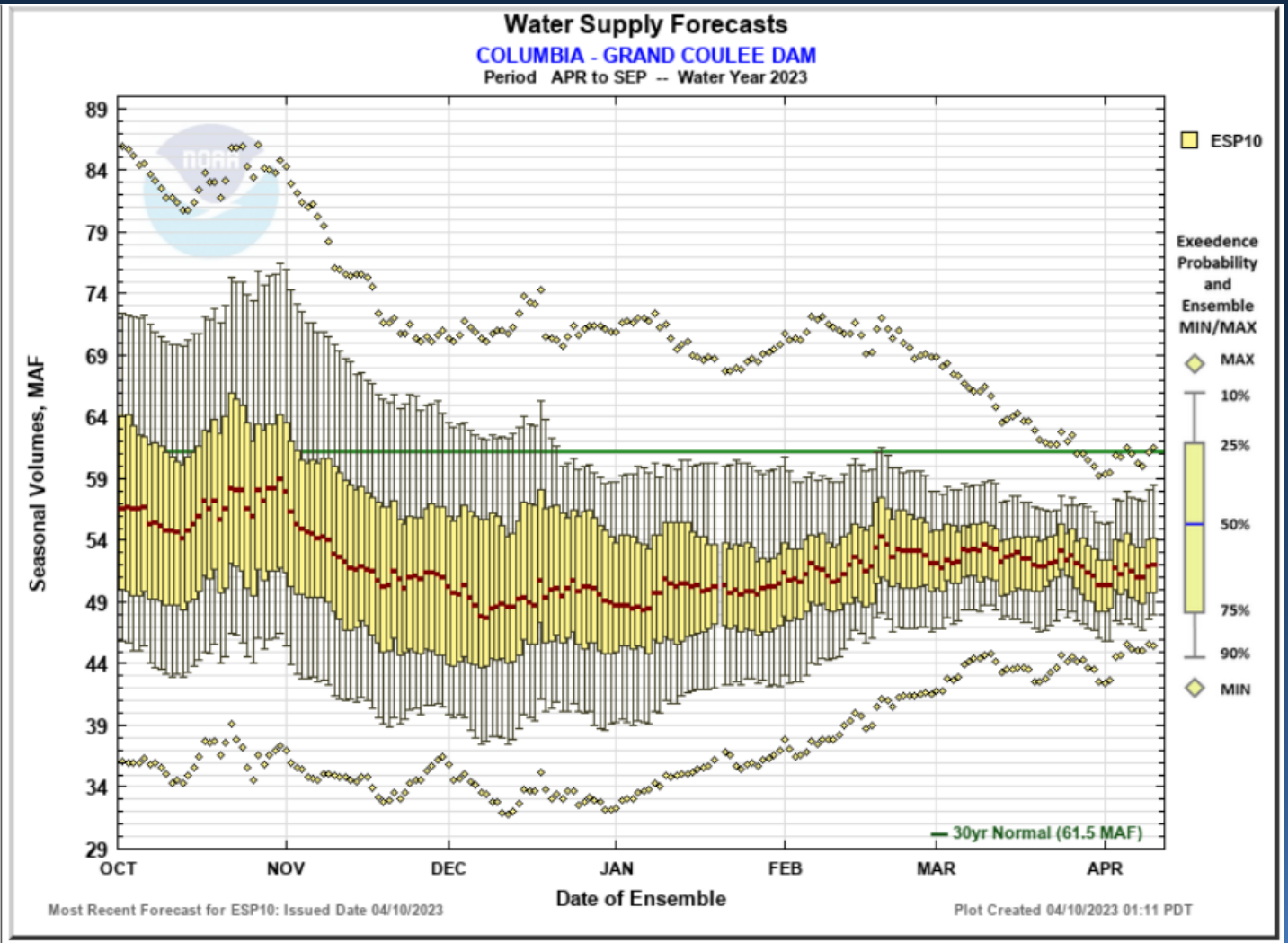
APR-SEP	48015	51907	84	57703	61483
APR-JUL	39391	43466	82	49272	52774
APR-AUG	44793	48488	83	54643	58186
JAN-SEP	53036	56928	81	62724	70457
JAN-JUL	44412	48487	79	54293	61749
OCT-SEP	57900	61792	78	67588	78842

Reference

ESP with 0 Days QPF **Ensemble:** 2023-04-10 **Issued:** 2023-04-10

APR-SEP	46679	51062	83	55997	61483
APR-JUL	38082	42156	80	47486	52774
APR-AUG	42988	47736	82	52915	58186
JAN-SEP	51700	56083	80	61018	70457
JAN-JUL	43104	47177	76	52507	61749
OCT-SEP	56564	60947	77	65882	78842

Move the mouse over the desired "Forecast Period" to display a graph.



www.nwrfc.noaa.gov/water_supply/ws_forecasts.php?id=GCDW1

Water Supply Forecasts

SNAKE - LOWER GRANITE DAM (LGDW1)
Forecasts for Water Year 2023

Official Water Supply

ESP with 10 Days QPF ***Ensemble:*** 2023-04-10 ***Issued:*** 2023-04-10

Forecast Period	Forecasts Are in KAF				30 Year Average (1991-2020)
	90 %	50 %	% Average	10 %	
APR-SEP	17097	19458	88	23159	22232
APR-JUL	14778	16885	85	20406	19946
APR-AUG	15957	18252	86	21884	21121
JAN-SEP	21224	23585	79	27285	29736
JAN-JUL	18905	21012	77	24532	27450
OCT-SEP	24693	27054	79	30754	34287

Experimental Water Supply

HEFS with 15 days EQPF ***Ensemble:*** 2023-04-10 ***Issued:*** 2023-04-10

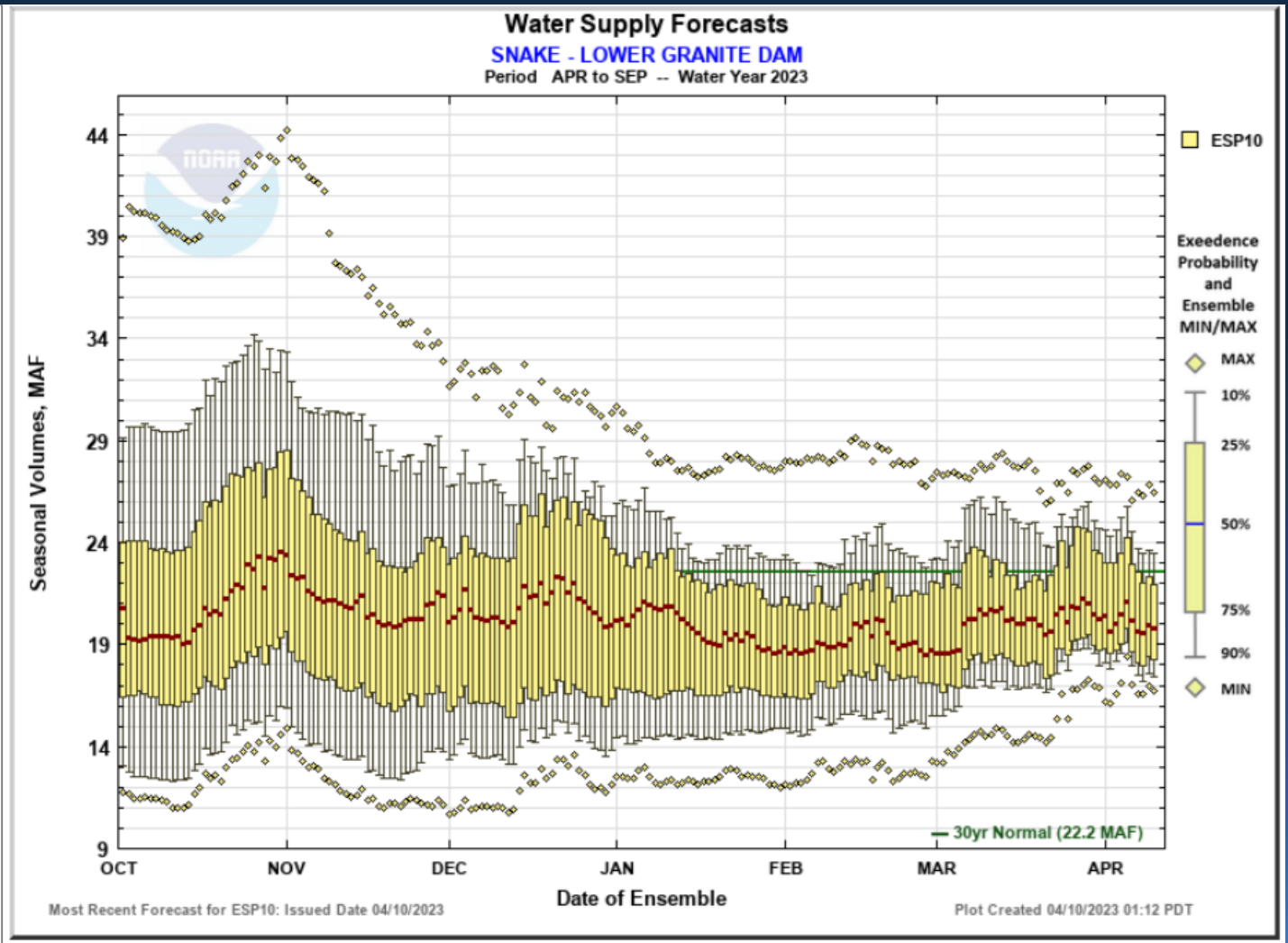
APR-SEP	17382	19461	88	23723	22232
APR-JUL	15049	16791	84	20910	19946
APR-AUG	16255	18092	86	22389	21121
JAN-SEP	21509	23588	79	27850	29736
JAN-JUL	19176	20918	76	25037	27450
OCT-SEP	24978	27057	79	31319	34287

Reference

ESP with 0 Days QPF ***Ensemble:*** 2023-04-10 ***Issued:*** 2023-04-10

APR-SEP	17480	19828	89	23977	22232
APR-JUL	15119	17215	86	21234	19946
APR-AUG	16352	18567	88	22648	21121
JAN-SEP	21607	23954	81	28103	29736
JAN-JUL	19245	21342	78	25360	27450
OCT-SEP	25076	27423	80	31573	34287

Move the mouse over the desired "Forecast Period" to display a graph.



www.nwrfc.noaa.gov/water_supply/ws_forecasts.php?id=LGDW1

Water Supply Forecasts

COLUMBIA - THE DALLES DAM (TDAO3)
Forecasts for Water Year 2023

Official Water Supply

ESP with 10 Days QPF ***Ensemble:*** 2023-04-10 ***Issued:*** 2023-04-10

Forecast Period	Forecasts Are in KAF				30 Year Average (1991-2020)
	90 %	50 %	% Average	10 %	
APR-SEP	74535	79447	84	90019	94166
APR-JUL	61985	67552	82	78210	81933
APR-AUG	69558	74891	84	85312	89196
JAN-SEP	86146	91058	79	101631	115946
JAN-JUL	73596	79163	76	89822	103714
OCT-SEP	96530	101442	77	112014	132314

Experimental Water Supply

HEFS with 15 days EQPF ***Ensemble:*** 2023-04-10 ***Issued:*** 2023-04-10

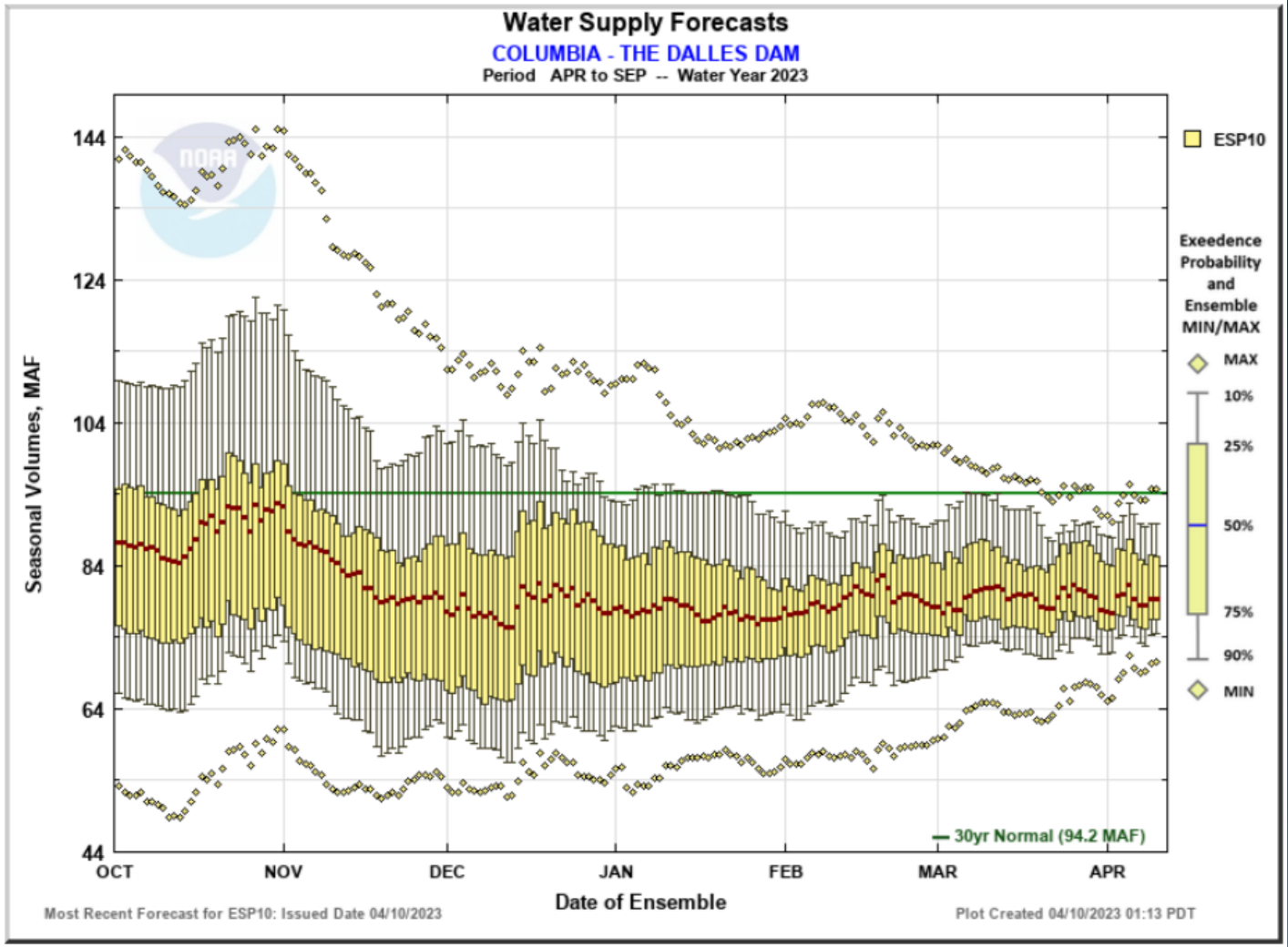
APR-SEP	73741	80059	85	90269	94166
APR-JUL	62962	67862	83	78242	81933
APR-AUG	68765	74532	84	85482	89196
JAN-SEP	85353	91671	79	101881	115946
JAN-JUL	74574	79474	77	89854	103714
OCT-SEP	95736	102054	77	112264	132314

Reference

ESP with 0 Days QPF ***Ensemble:*** 2023-04-10 ***Issued:*** 2023-04-10

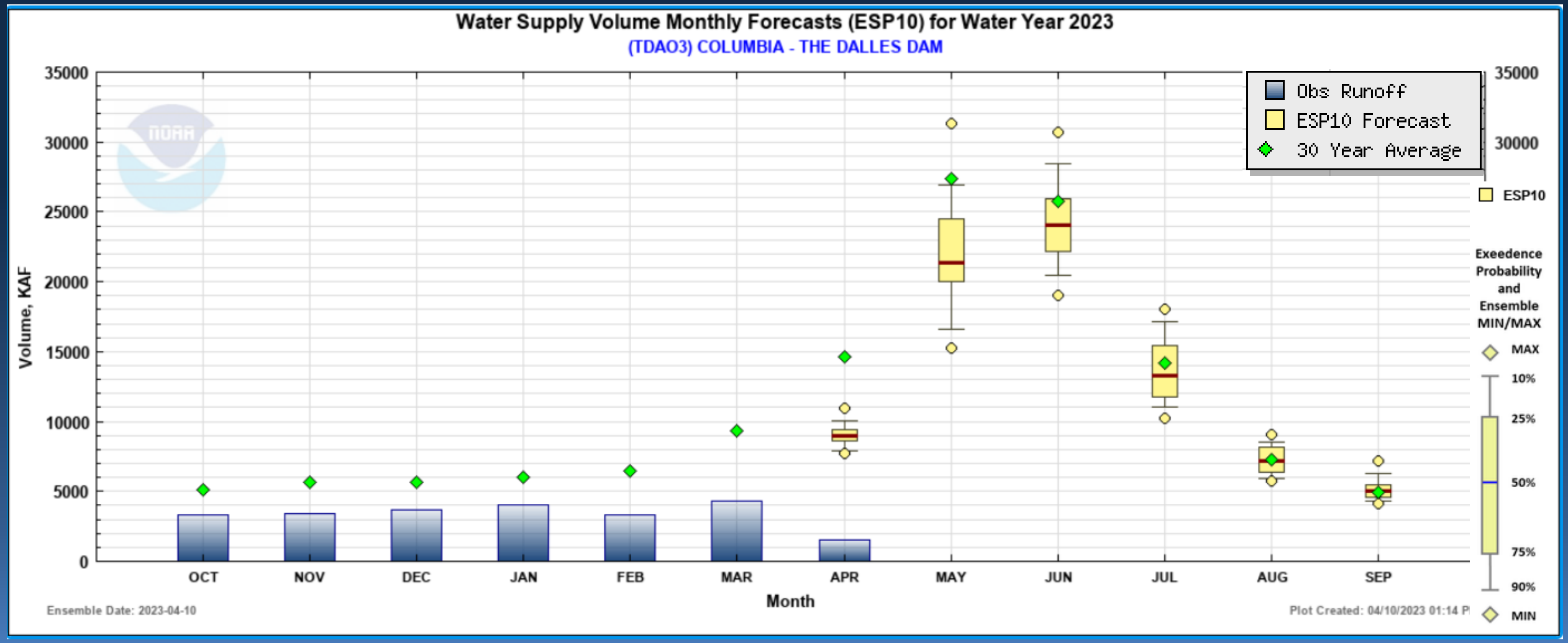
APR-SEP	72200	78875	84	88922	94166
APR-JUL	61238	67711	83	76791	81933
APR-AUG	67294	74024	83	84042	89196
JAN-SEP	83812	90487	78	100533	115946
JAN-JUL	72850	79322	76	88402	103714
OCT-SEP	94195	100870	76	110917	132314

Move the mouse over the desired "Forecast Period" to display a graph.



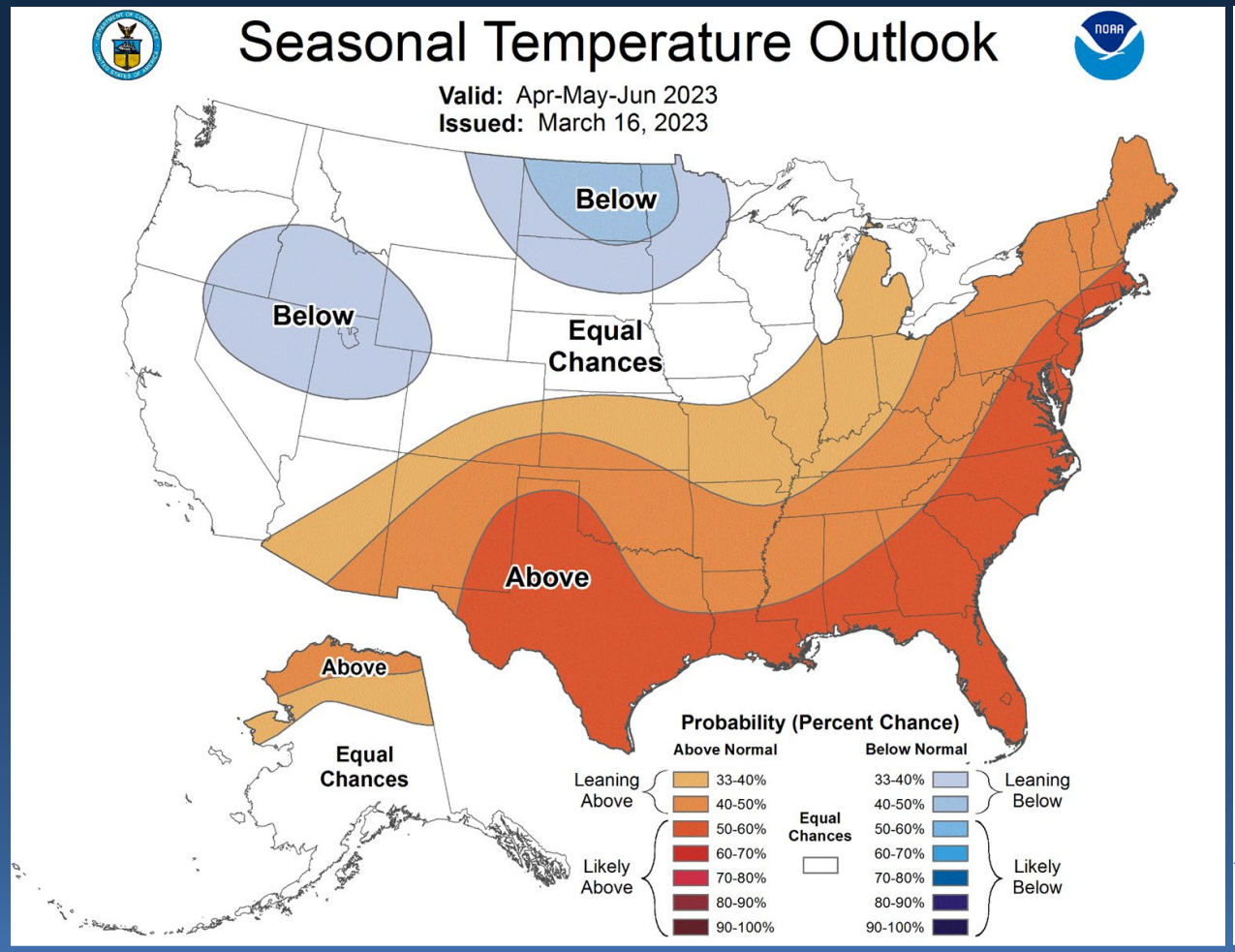
www.nwrfc.noaa.gov/water_supply/ws_forecasts.php?id=TDAO3

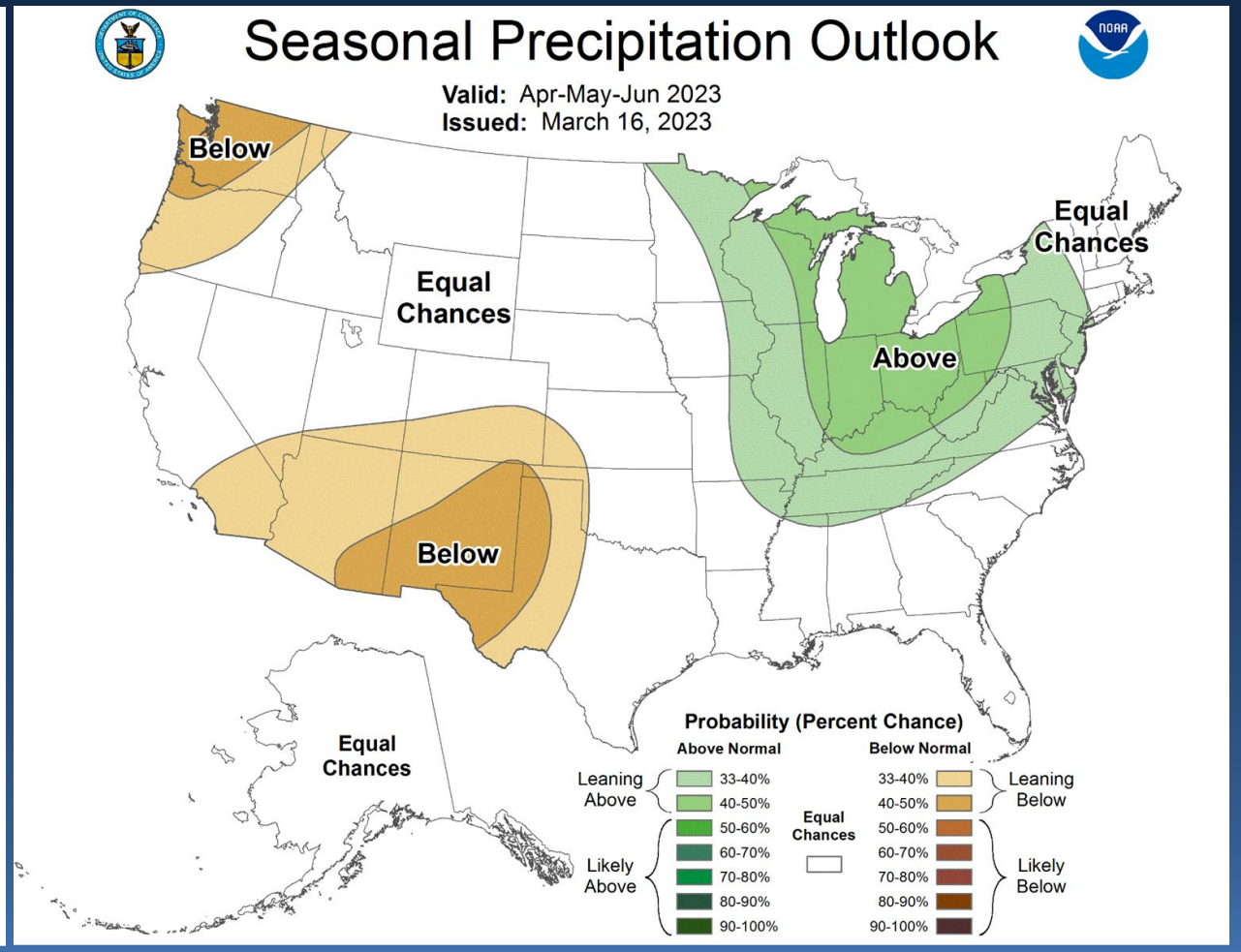
Monthly Water Supply Forecasts



https://www.nwrfc.noaa.gov/water_supply/monthly/monthly_forecasts.php?id=TDAO3

Climate Prediction Center Seasonal Outlook





www.cpc.ncep.noaa.gov

Climate Prediction Center Model Predictions

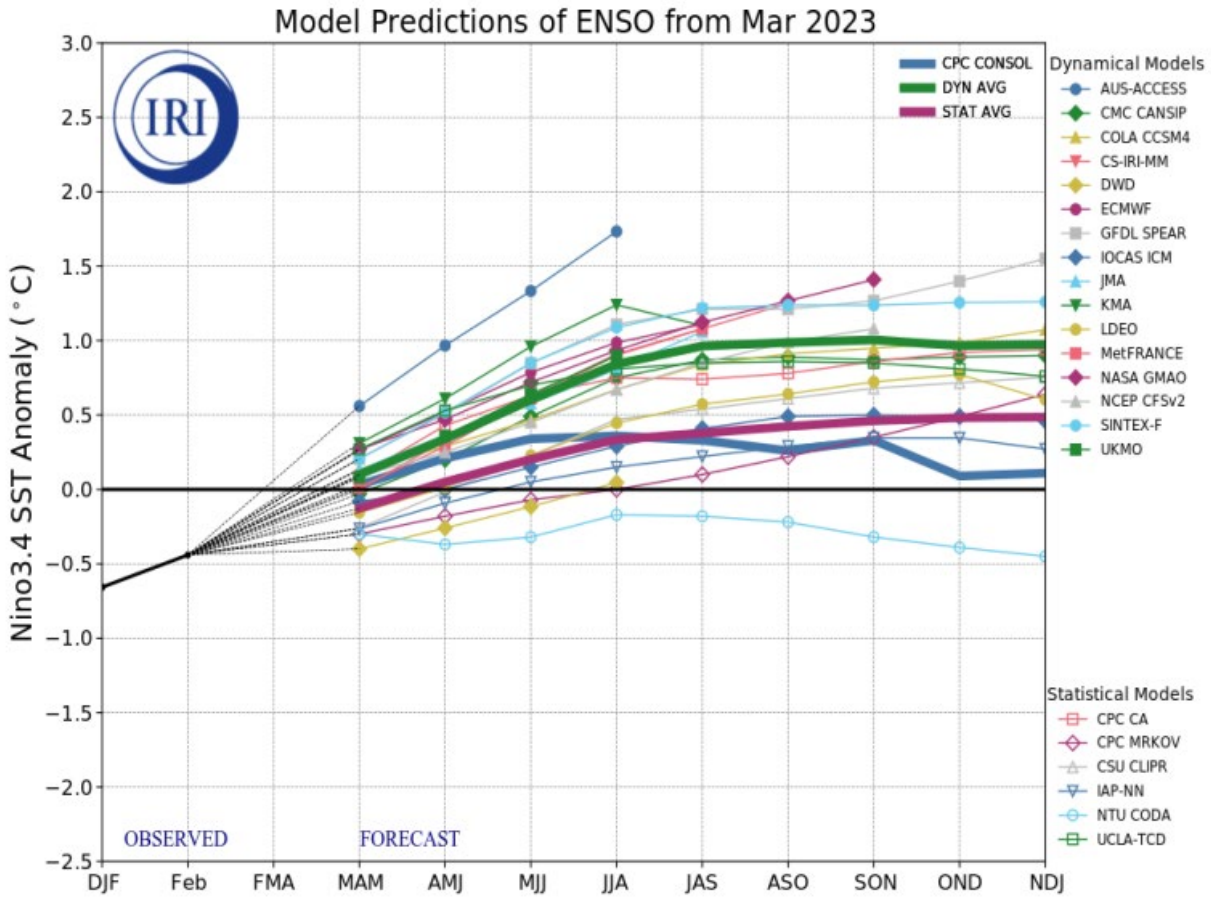
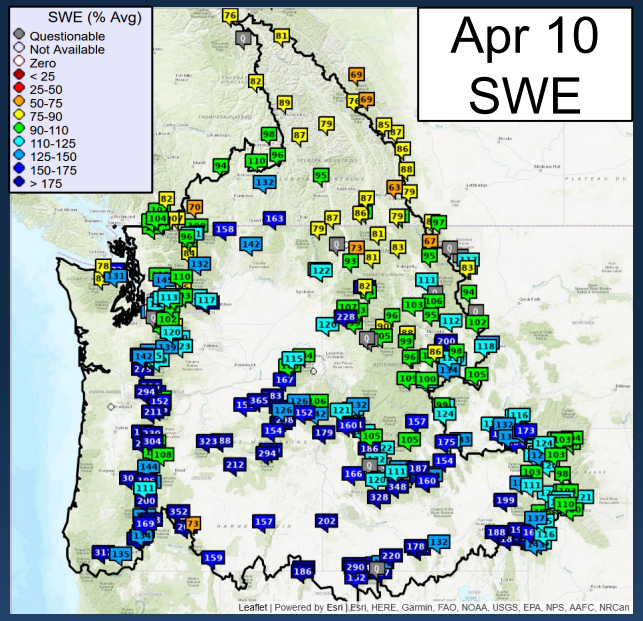


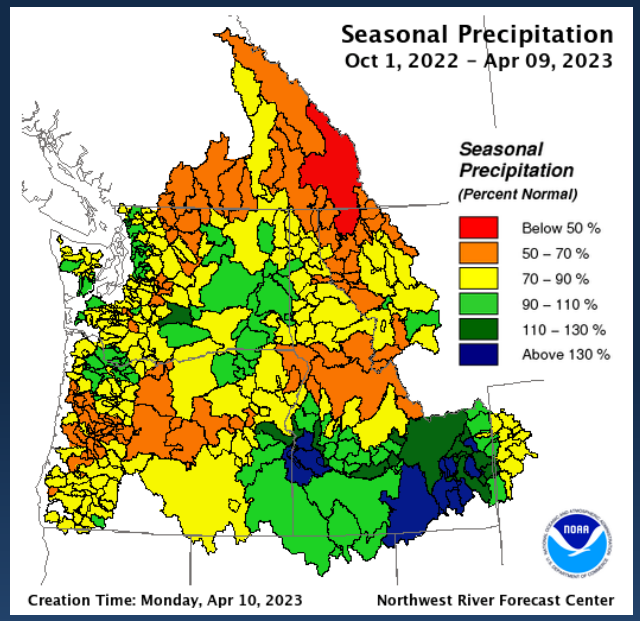
Figure provided by the International Research Institute (IRI) for Climate and Society (updated 20 March 2023).

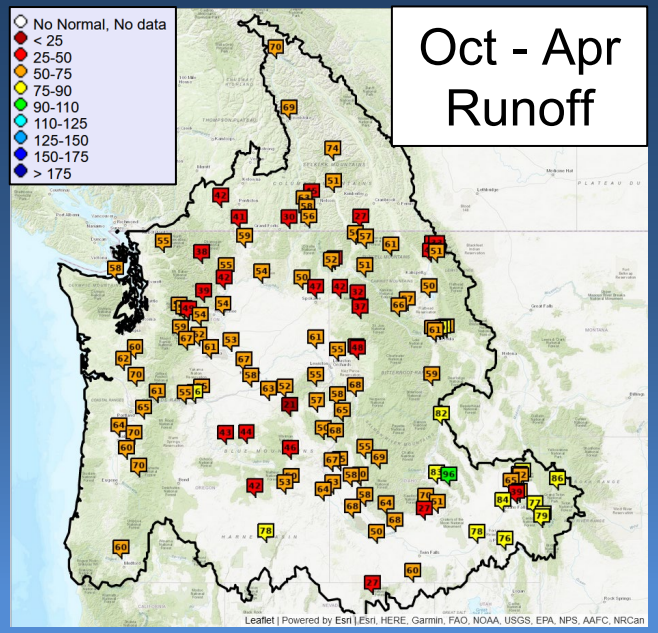
By May-July 2023, the dynamical models suggest a potential return to El Niño, while the statistical models indicate the continuation of ENSO-neutral into the Northern Hemisphere summer, before warming up to borderline El Niño conditions in the late summer/fall 2023.

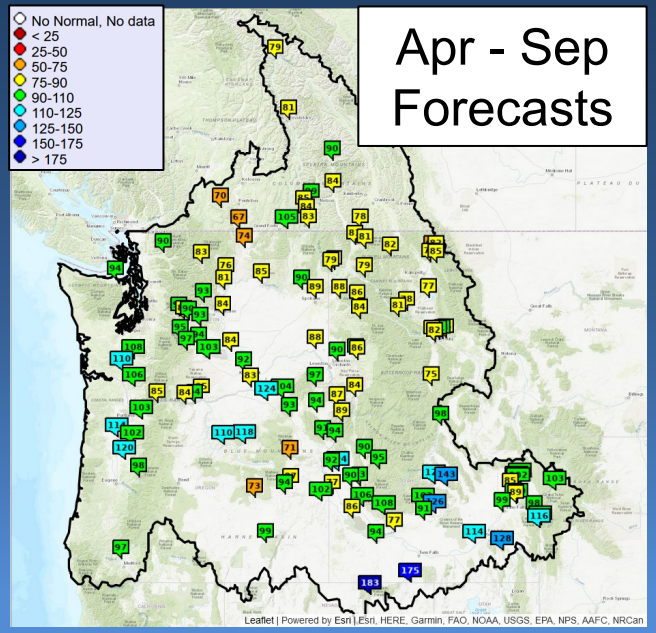
www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/enso_evolution-status-fcsts-web.pdf

SWE, Precipitation, Runoff and Water Supply Forecasts









Water Supply Take Home Messages

Cooler temperatures since November have kept snowpack conditions elevated relative to seasonal precipitation values.

Decreased melt and rain have caused observed runoff to date to remain well below normal

Apr-Sep water supply forecasts remain mostly normal to below normal, with exception in southern Idaho where forecasts are much higher than normal.

WY2022 Schedule for Live Water Supply Briefings	
May	Jun
4	TBD
All presentations held at 10:00 am Pacific Time unless noted otherwise	

https://www.nwrfc.noaa.gov/water_supply/ws_schd.cgi?version=20190204v1