BUREAU OF RECLAMATION

2022 Klamath Project Hydrologic Forecast

December 14, 2021

Assumptions

<u>UKL Net Inflow (UKLNI)</u> <u>Projections</u>

- Ensemble traces based on **period-of-record (POR) water year (WY)** analogs
  - Selected WYs based on:
    - Distribution pattern & volume
    - La Niña/El Niño index forecasts (Oregon Department of Agriculture)
    - Streamflow forecasts **(California-Nevada River Forecast Center (CNRFC))**
    - Antecedent/current hydrologic conditions
    - In-house observations & analyses
  - Best fit WY analogs are colorized

- Traces categorized into 25%, 50%, 75%, 90%, 10% **probability of exceedance (POE)** levels
- Current hydrologic conditions inform short-range (<2 week) UKLNI projection
- Current meteorological forecasts inform short-range UKLNI projection

<u>Accretions</u>

- *Lost River:* set to 0% contribution to Klamath River → Iron Gate Dam flows
- *Lake Ewauna:* volume & pattern set to historical percentile -or- WY analog; downscaled to account for Lost River
- *F/FF Pumping Plant:* volume & pattern set to historical percentile -or- analog WY
- *Keno-Iron Gate:* volume & pattern set to multi-model forecast through March 2022, then set to historical percentile -or- WY analog through September 2022

Assumptions cont.

2022 Spring/Summer (March 2022 – September 2022)

- Project Supply
  - Allocation calculation in accordance with current BiOp policy
  - CNRFC KLAO3 UKLNI Mar-Sep 2022 volumetric forecast informs analysis

CNRFC – KLAO3 UKL Net Inflow Accumulation		
Forecast Issuance Date		12/14/2021
Forecast Period		Mar-Sep 2022
Exceedance	Volume (ac-ft)	% of POR Avg
90%	309,584	50%
75%	362,600	58%
50%	506,263	82%
25%	667,533	108%
10%	808,876	130%

- Simulated Project Supply and EWA allocations computed on *March 1 only*
- Simulated end-of-season minimum elevation reflects full utilization of computed Project Supply and EWA (including augmentation when set by allocation logic)
- Surface flushing flows are set and triggered in accordance with current BiOp policy
  - If set, trigger date = April 15
  - Flow rate = 6030 CFS, 3 days continuous, followed by BiOp ramp down rates -OR- maximum Link release capacity, 3 days continuous, followed by BiOp ramp down rates

Assumptions cont.

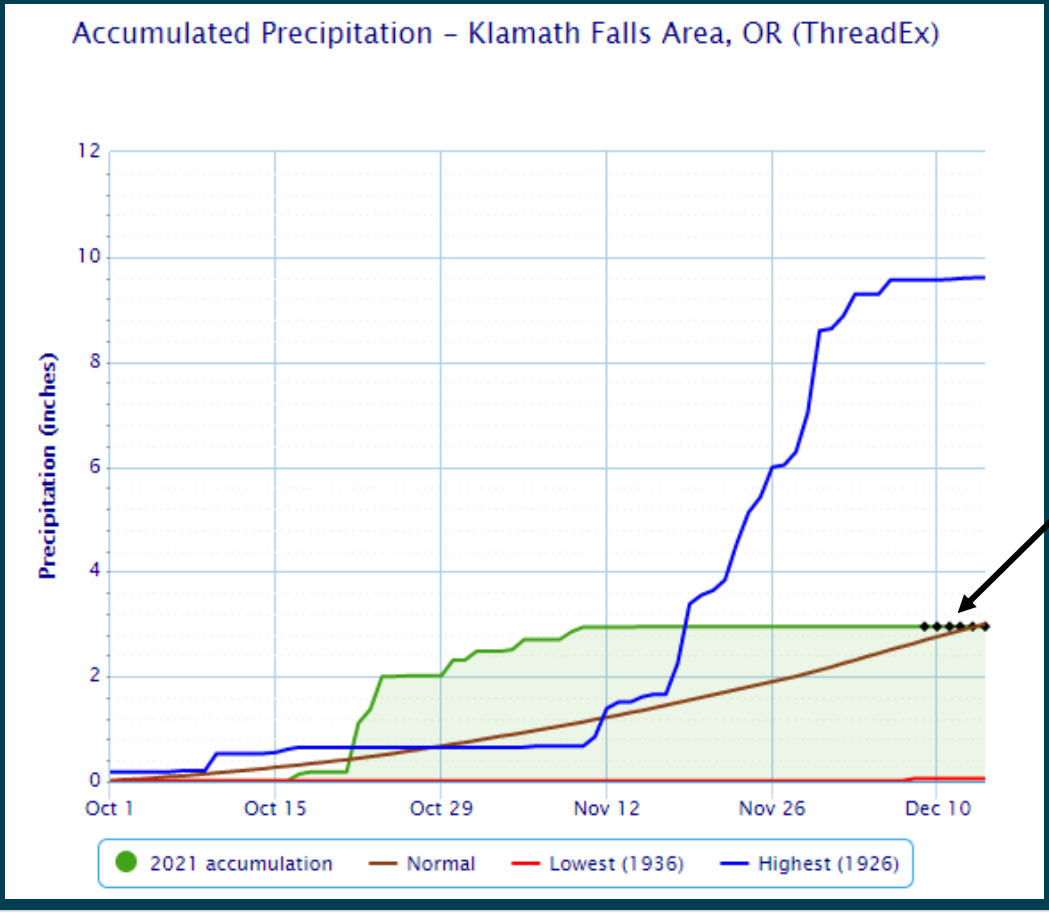
2021-2022 Fall/Winter (Nov 2021 – Feb 2022) Deliveries & Demand

- KDD
  - KDD diversion rates in compliance with/do not exceed **Central Tendency (CT)**-controlled reductions
  - Daily distribution proportions reflect historical diversion patterns

- LKNWR
  - LKNWR diversion rates in compliance with/do not exceed CT-controlled reductions
  - Daily distribution proportion forced to CT-controlled maxima

Current Conditions

NWS Klamath Falls Airport Met Station WY 2022



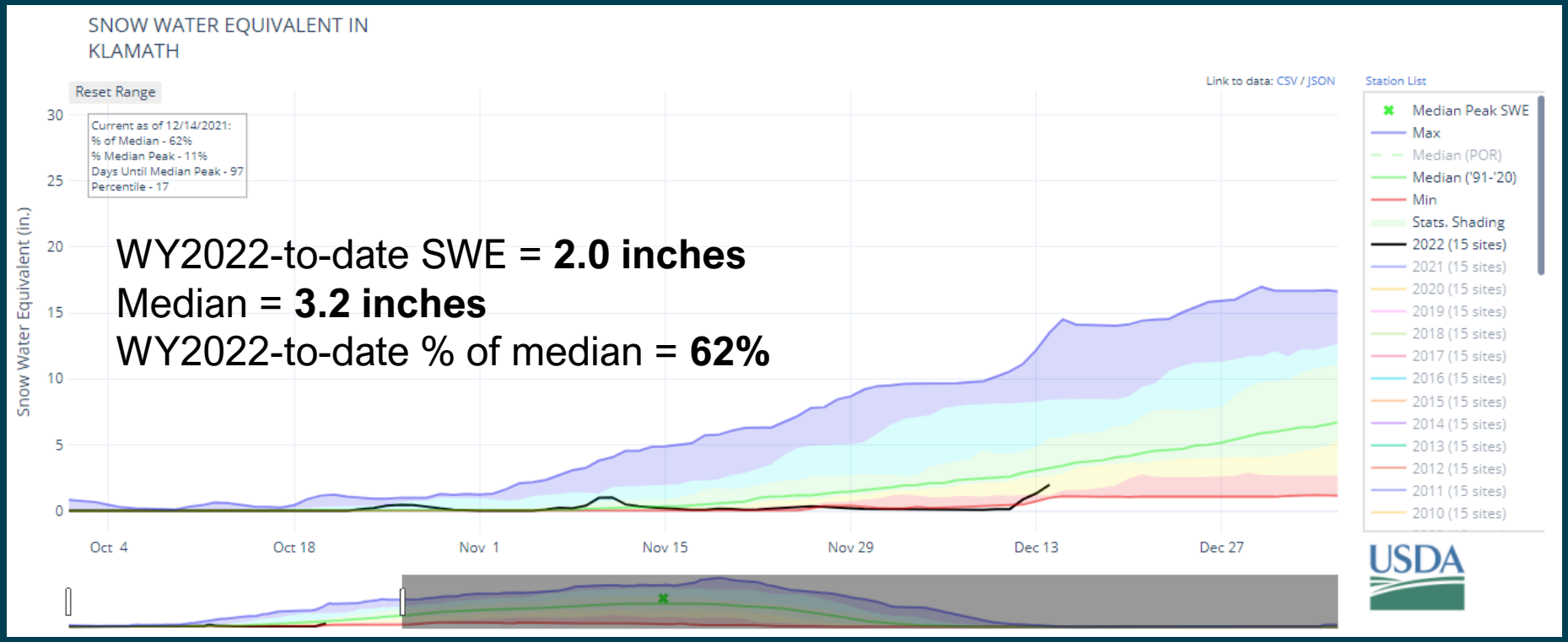
Black diamonds indicate missing data

NWS - Klamath Falls International Airport (KLMT)

Unit: inch

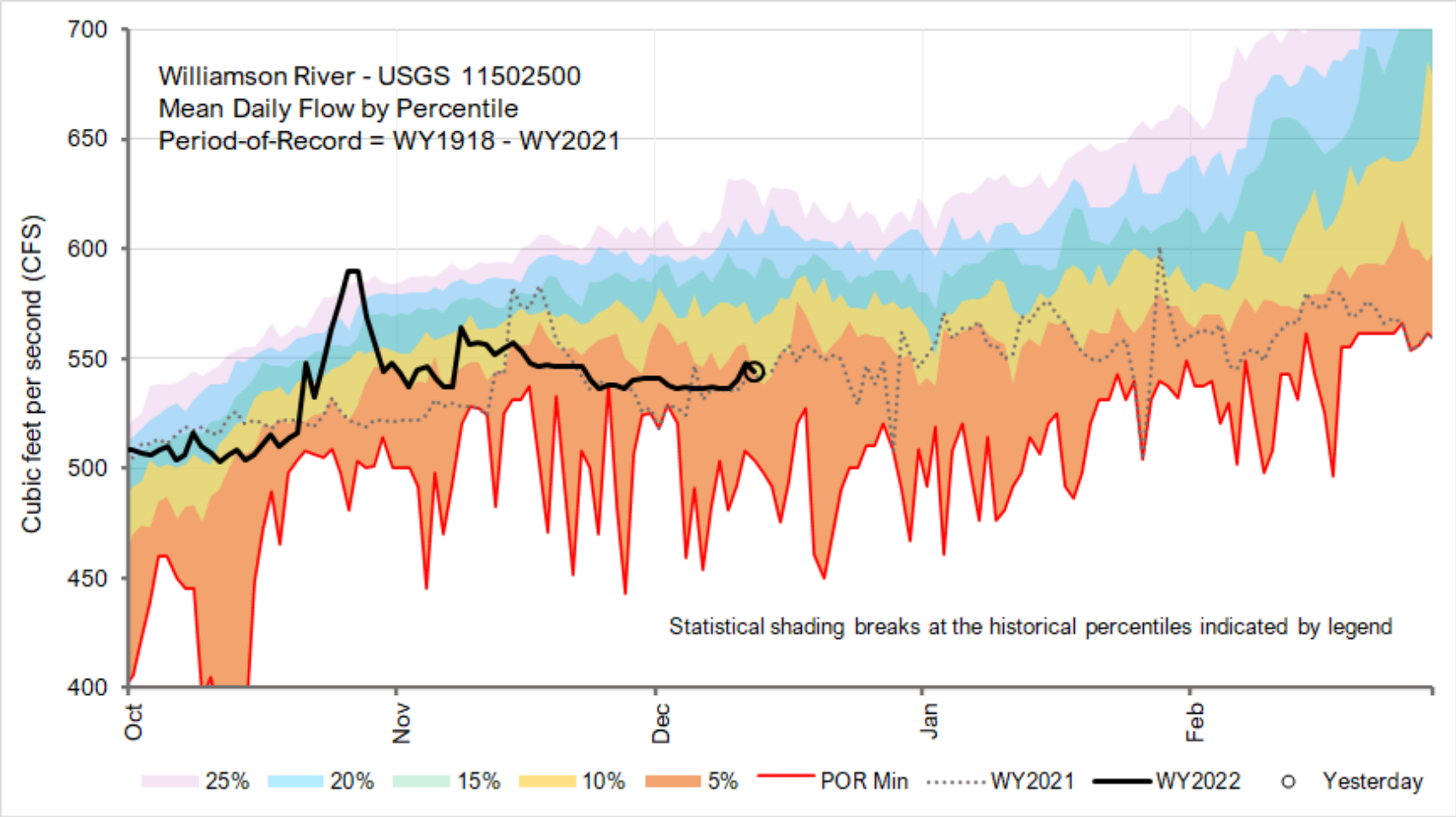
Water Year	Month	Monthly Total	Monthly Departure	Monthly Normal	% Monthly Normal	WY Total	WY Departure	WY Normal	% WY Normal
2022	Oct	2.31	1.57	0.74	312%	2.31	1.57	0.74	312%
	Nov	0.64	-0.74	1.38	46%	2.95	0.83	2.12	139%
	as of Dec 14	0.07	-0.75	0.82	9%	3.02	0.08	2.94	103%

NRCS Klamath River Basin SNOTEL WY 2022 Snow Water Equivalent (SWE)



Statistical shading breaks at 10th, 30th, 50th, 70th, and 90th Percentiles

Williamson River Flows
WY 2022



UKL Cumulative Net Inflow - WY2022 & POR

as of 14 December 2021

WY	Cumulative UKL Net Inflow (TAF)
2021	156.511
2014	159.446
1991	163.723
2003	164.890
1995	165.101
1992	168.146
2019	170.962
2022	171.925
2020	179.456
2004	180.225
2016	180.805
2010	185.337
2015	186.877
1993	189.796
1994	190.181
2012	192.789
1990	200.576
2009	201.258
2005	204.824
2018	206.869
2008	211.188

WY	Cumulative UKL Net Inflow (TAF)
2002	212.255
1981	216.624
2001	220.505
2011	222.627
1996	222.787
1989	223.299
1988	224.644
2017	224.751
2007	226.892
2006	229.184
2013	229.320
1998	238.828
2000	251.431
1987	253.566
1982	263.242
1986	272.817
1983	272.951
1997	307.882
1999	328.830
1984	353.608
1985	386.496

WY2022 % of POR average ≈ 78%

Data are provisional and subject to revision

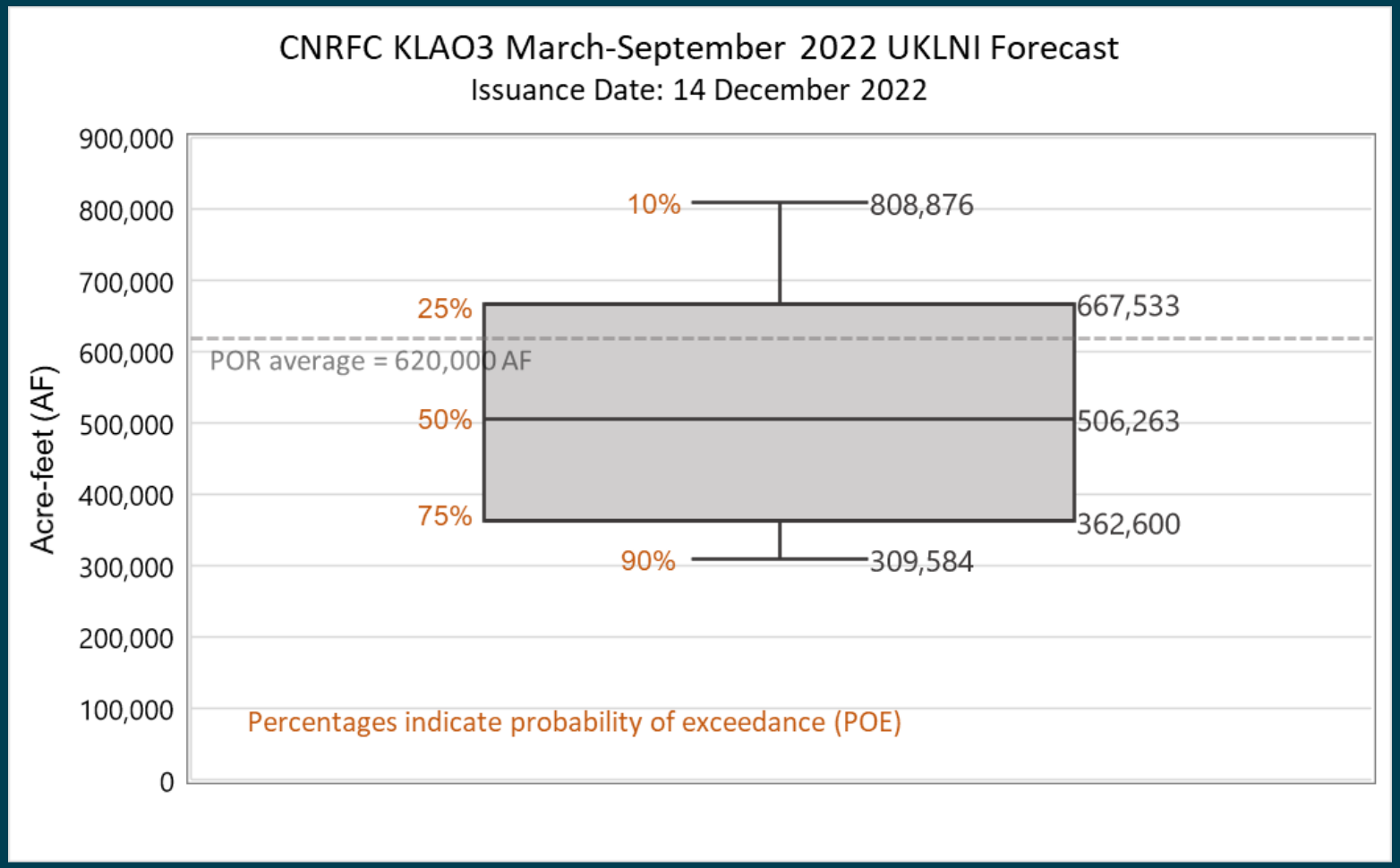
Forecasts

Water Year Analogs

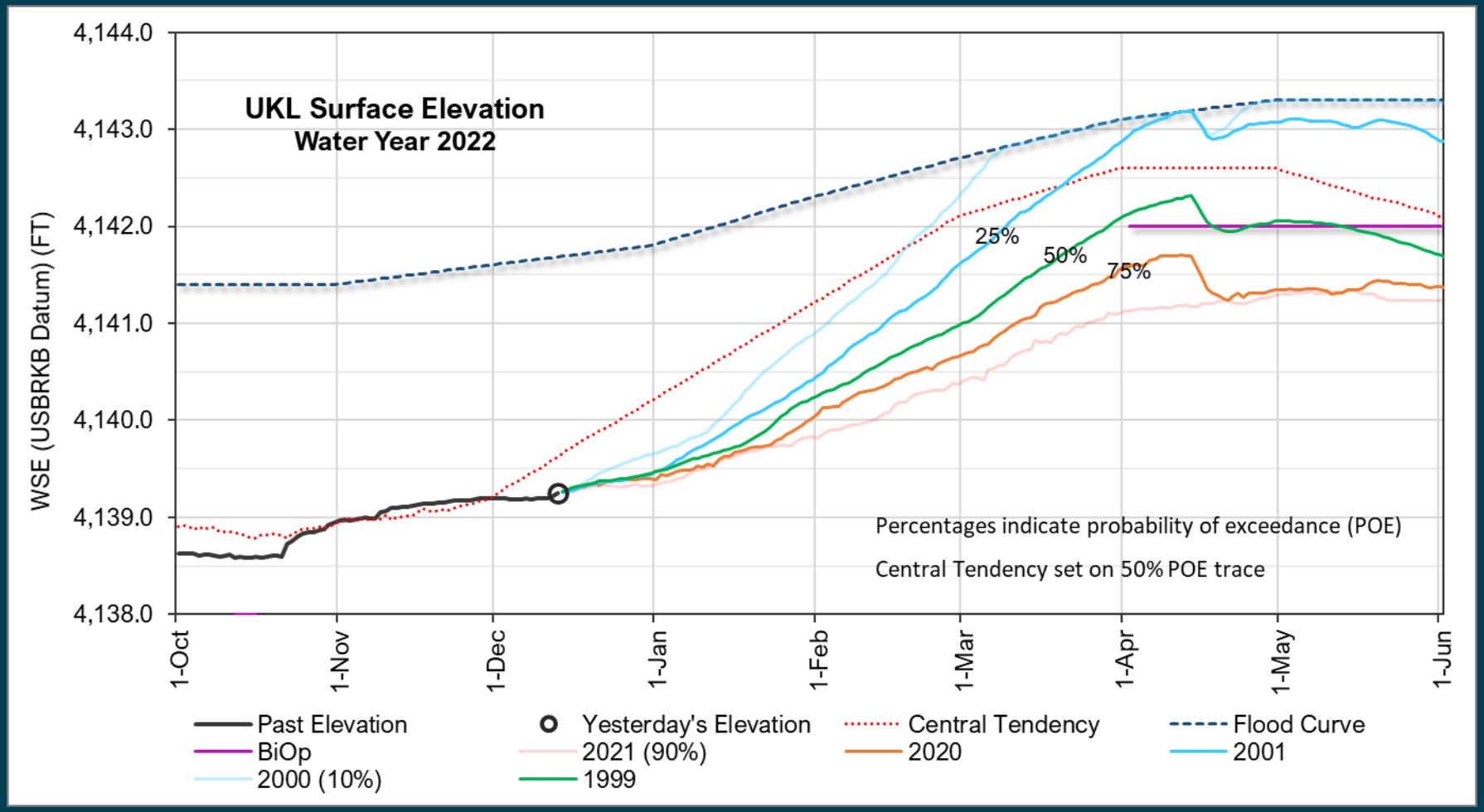
Probability of Exceedance (POE)	Water Year Analogs		
25%	1997	**2001**	2011
50%	**1999**	2009	2012
75%	2008	2018	**2020**
10%	2000		
90%	2021		

Highlighted years 1999, 2021 and 2020 are considered best fit for their respective exceedance level forecast.

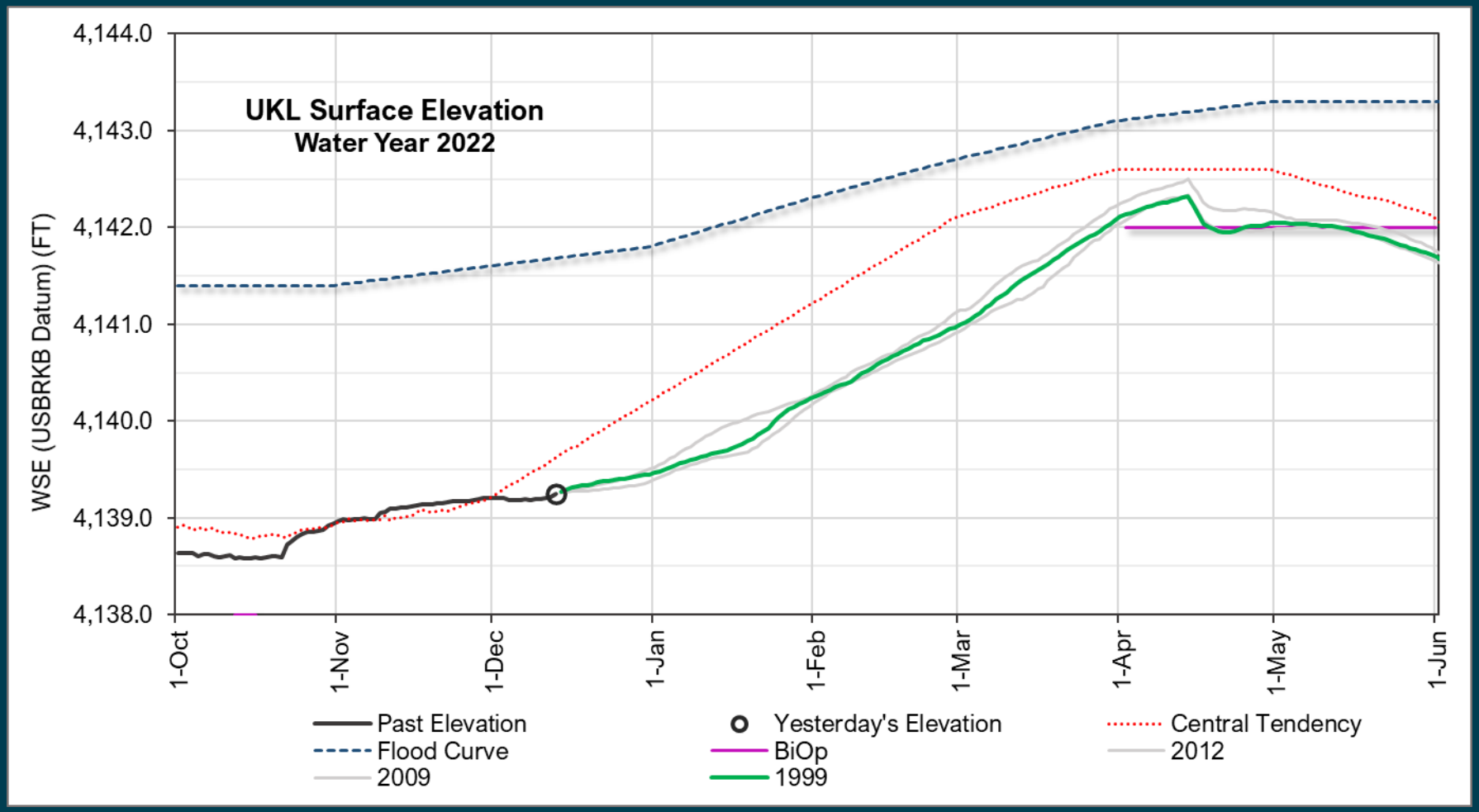
CNRFC UKL Net Inflow Forecast
March-September 2022



Upper Klamath Lake Water Surface Elevation WY2022



50% Probability Of Exceedance

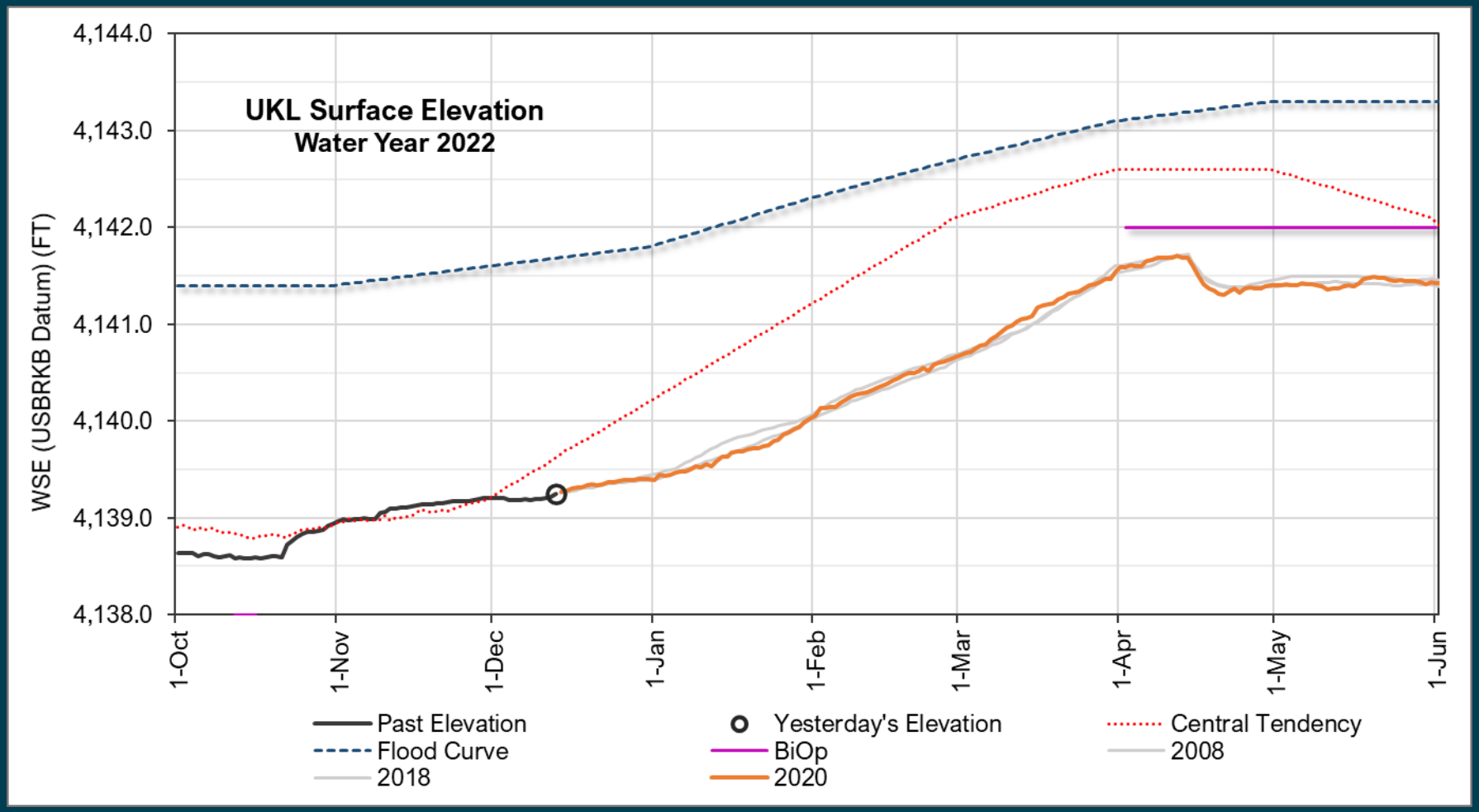


50% Probability Of Exceedance

OPS 50% - WY1999		OPS 50% - WY2009		OPS 50% - WY2012	
2022 proj EOF elev (FT)	4140.98	2022 proj EOF elev (FT)	4141.11	2022 proj EOF elev (FT)	4141.02
2022 proj Prj Supp (TAF)	197	2022 proj Prj Supp (TAF)	207	2022 proj Prj Supp (TAF)	200
2022 proj EWA (TAF)	407	2022 proj EWA (TAF)	407	2022 proj EWA (TAF)	407
2022 proj min elev (FT)	4138.45	2022 proj min elev (FT)	4138.47	2022 proj min elev (FT)	4138.52
KDD F/W proj total supp (TAF)	19.310	KDD F/W proj total supp (TAF)	19.310	KDD F/W proj total supp (TAF)	19.310
LKNWR F/W proj total supp (TAF)	1.833	LKNWR F/W proj total supp (TAF)	1.833	LKNWR F/W proj total supp (TAF)	1.833

EOF = End-of-February
Prj Supp = Project Supply
EWA = Environmental Water Account
Min elev = Seasonal minimum elevation
F/W = Fall/Winter

75% Probability Of Exceedance



75% Probability Of Exceedance

OPS 75% - WY2008		OPS 75% - WY2018		OPS 75% - WY2012	
2022 proj EOF elev (FT)	4140.69	2022 proj EOF elev (FT)	4140.62	2022 proj EOF elev (FT)	4140.66
2022 proj Prj Supp (TAF)	74	2022 proj Prj Supp (TAF)	69	2022 proj Prj Supp (TAF)	72
2022 proj EWA (TAF)	407	2022 proj EWA (TAF)	407	2022 proj EWA (TAF)	407
2022 proj min elev (FT)	4138.97	2022 proj min elev (FT)	4138.98	2022 proj min elev (FT)	4138.95
KDD F/W proj total supp (TAF)	19.310	KDD F/W proj total supp (TAF)	19.310	KDD F/W proj total supp (TAF)	19.310
LKNWR F/W proj total supp (TAF)	1.833	LKNWR F/W proj total supp (TAF)	1.833	LKNWR F/W proj total supp (TAF)	1.833

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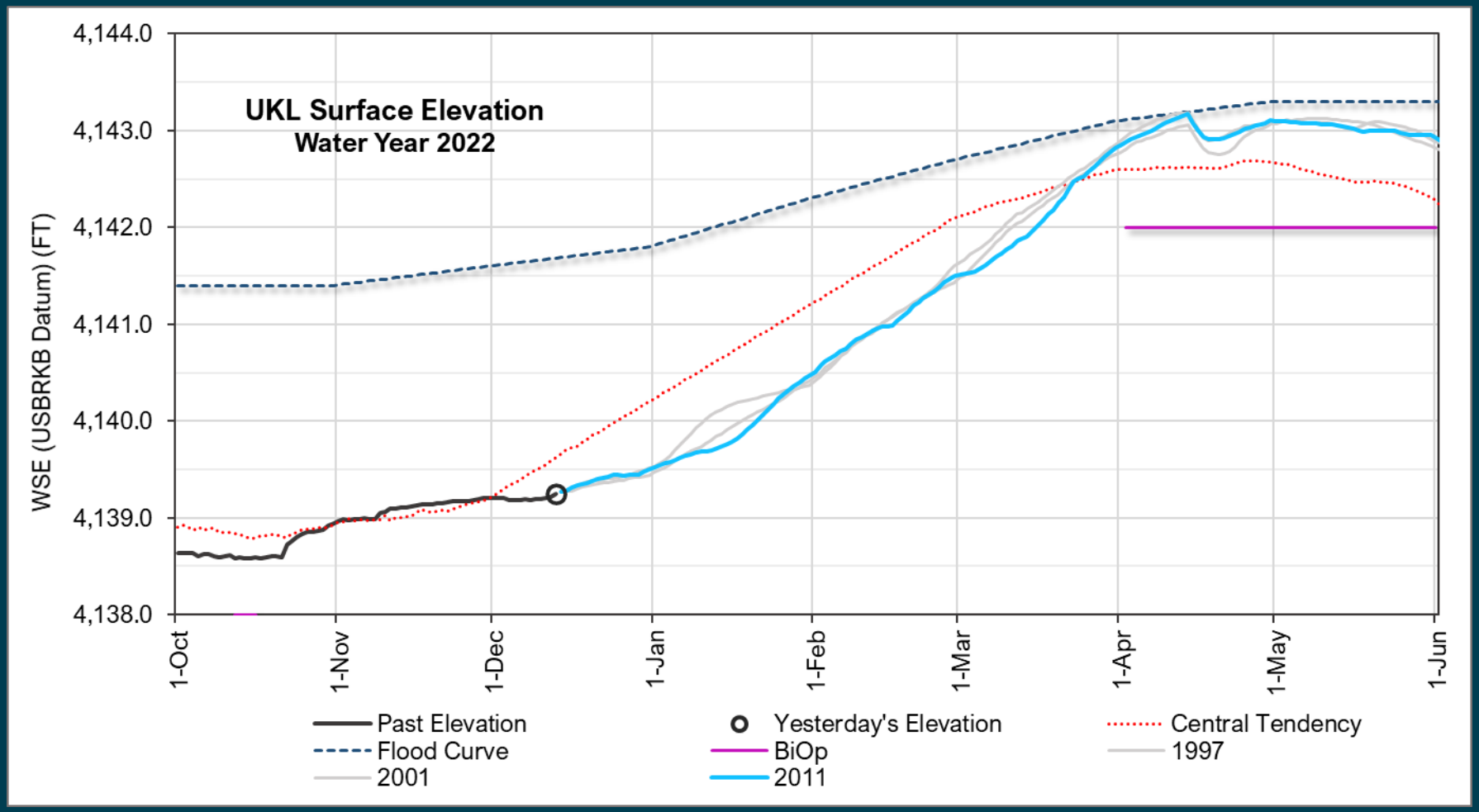
25% Probability Of Exceedance



25% Probability Of Exceedance

OPS 25% - WY1997		OPS 25% - WY2018		OPS 25% - WY2012	
2022 proj EOF elev (FT)	4141.43	2022 proj EOF elev (FT)	4141.60	2022 proj EOF elev (FT)	4141.50
2022 proj Prj Supp (TAF)	263	2022 proj Prj Supp (TAF)	267	2022 proj Prj Supp (TAF)	265
2022 proj EWA (TAF)	512	2022 proj EWA (TAF)	523	2022 proj EWA (TAF)	516
2022 proj min elev (FT)	4139.29	2022 proj min elev (FT)	4139.39	2022 proj min elev (FT)	4139.41
KDD F/W proj total supp (TAF)	19.310	KDD F/W proj total supp (TAF)	19.310	KDD F/W proj total supp (TAF)	19.310
LKNWR F/W proj total supp (TAF)	1.833	LKNWR F/W proj total supp (TAF)	1.833	LKNWR F/W proj total supp (TAF)	1.833

EOF = End-of-February
Prj Supp = Project Supply
EWA = Environmental Water Account
Min elev = Seasonal minimum elevation
F/W = Fall/Winter

90% & 10% Probability Of Exceedance

90%

OPS 90% - WY2021	
2022 proj EOF elev (FT)	4140.37
2022 proj Prj Supp (TAF)	17
2022 proj EWA (TAF)	407
2022 proj min elev (FT)	4139.29
KDD F/W proj total supp (TAF)	19.310
LKNWR F/W proj total supp (TAF)	1.833

10%

OPS 10% - WY2000	
2022 proj EOF elev (FT)	4142.30
2022 proj Prj Supp (TAF)	343
2022 proj EWA (TAF)	707
2022 proj min elev (FT)	4139.46
KDD F/W proj total supp (TAF)	22.682
LKNWR F/W proj total supp (TAF)	2.894

EOF = End-of-February
Prj Supp = Project Supply
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Min elev = Seasonal minimum elevation
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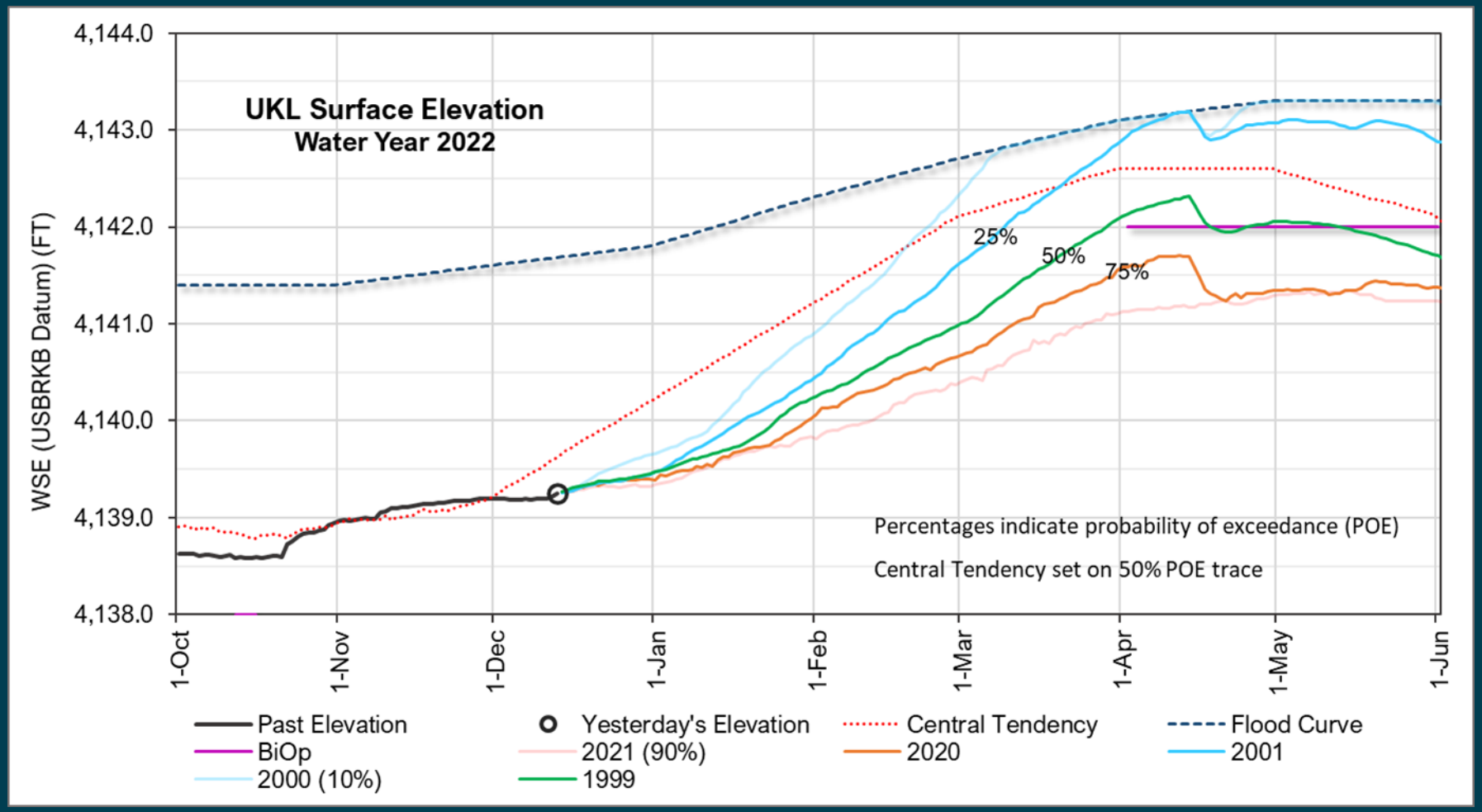
Upper Klamath Lake Water Surface Elevation WY2022



Thank you