BUREAU OF RECLAMATION

Sacramento River Temperature Task Group

Thursday, August 27, 2020 1:00 pm – 3:00 pm

Conference Call:

+1(623)4049000

Meeting ID: 1497574502# (US West)

Join from PC, Mac, Linux, iOS or Android: https://meetings.ringcentral.com/j/1497574502

Agenda

1:00 pm	Introductions
1:10 pm	Purpose and Objective
1:12 pm	Prior Action Items
1:17 pm	Communications
1:20 pm	Long Term Operations Implementation - Update
1:25 pm	River Fish Monitoring: carcass surveys, redd counts, stranding and dewatering surveys and sampling at rotary screw traps
1:35 pm	Fish Distribution/Forecasts: Estimated percentage of the population upstream of Red Bluff Diversion Dam for steelhead, winter-run and spring-run Chinook salmon, steelhead update and Livingston Stone Hatchery.
1:45 pm	Recommendations: Agencies provide feedback and information to Reclamation regarding fish monitoring/operations
1:50 pm	Hydrology Update
1:55 pm	Operations Update and Forecasts
2:00 pm	Storage/Release Management Conditions
2:05 pm	Temperature Management
2:15 pm	Temperature Dependent Mortality

2:25 pm Trinity and Whiskeytown Updates

2:30 pm Recommendations: Agencies provide feedback and information to Reclamation regarding temperature management operations

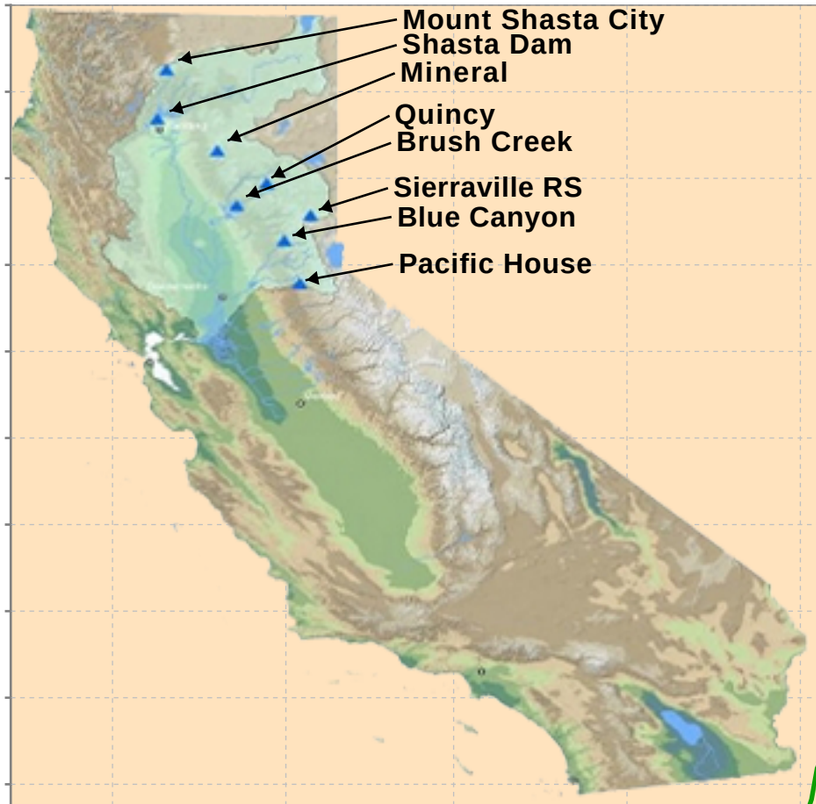
2:45 pm Seasonal Topics

2:50 pm Discussion

2:55 pm Review Action Items

2:59 pm Next Meeting Scheduling

Northern Sierra Precipitation: 8-Station Index, August 26, 2020



Percent of Average for this Date: 63%

2016-2017 Daily Precip (wettest) 94.7

1982-1983 (2nd wettest) 88.5

1997-1998 82.4

2018-2019 Daily Precip 70.7

Average (1966-2015) 51.8

2017-2018 Daily Precip 41.0

2014-2015 Daily Precip 37.2

Current: 31.9

1976-1977(2nd driest & driest thru Aug) 19.0

Cumulative Daily/Monthly Precipitation (inches)

Total Water Year Precipitation

0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100

Oct 1 Nov 1 Dec 1 Jan 1 Feb 1 Mar 1 Apr 1 May 1 Jun 1 Jul 1 Aug 1 Sep 1 Oct 1

Water Year (October 1 - September 30)

UNITED STATES DEPARTMENT OF THE INTERIOR
U.S. BUREAU OF RECLAMATION-CENTRAL VALLEY PROJECT-CALIFORNIA

DAILY CVP WATER SUPPLY REPORT

AUGUST 25, 2020

RUN DATE: August 26, 2020

RESERVOIR RELEASES IN CUBIC FEET/SECOND

RESERVOIR	DAM	WY 2019	WY 2020	15 YR MEDIAN
TRINITY	LEWISTON	473	463	473
SACRAMENTO	KESWICK	10,414	8,518	9,554
FEATHER	OROVILLE (SWP)	7,500	2,100	4,000
AMERICAN	NIMBUS	3,254	2,490	2,490
STANISLAUS	GOODWIN	491	202	231
SAN JOAQUIN	FRIANT	400	428	350

STORAGE IN MAJOR RESERVOIRS IN THOUSANDS OF ACRE-FEET

RESERVOIR	CAPACITY	15 YR AVG	WY 2019	WY 2020	% OF 15 YR AVG
TRINITY	2,448	1,531	2,133	1,522	99
SHASTA	4,552	2,699	3,721	2,395	89
FOLSOM	977	529	771	488	92
NEW MELONES	2,420	1,405	2,059	1,584	113
FED. SAN LUIS	966	258	488	223	86
TOTAL NORTH CVP	11,363	6,423	9,172	6,212	97
MILLERTON	520	300	424	223	74
OROVILLE (SWP)	3,538	1,940	2,721	1,714	88

ACCUMULATED INFLOW FOR WATER YEAR TO DATE IN THOUSANDS OF ACRE-FEET

RESERVOIR	CURRENT WY 2020	WY 1977	WY 1983	15 YR AVG	% OF 15 YR AVG
TRINITY	456	205	2,845	1,153	40
SHASTA	3,076	2,359	10,449	4,959	62
FOLSOM	1,434	327	6,361	2,610	55
NEW MELONES	610	----	2,682	1,026	59
MILLERTON	880	319	4,463	1,562	56

ACCUMULATED PRECIPITATION FOR WATER YEAR TO DATE IN INCHES

RESERVOIR	CURRENT WY 2020	WY 1977	WY 1983	AVG (N YRS)	% OF AVG	LAST 24 HRS
TRINITY AT FISH HATCHERY	20.54	13.87	56.20	31.54 (58)	65	0.00
SACRAMENTO AT SHASTA DAM	34.51	17.35	114.16	61.35 (63)	56	0.00
AMERICAN AT BLUE CANYON	39.50	16.96	103.88	66.06 (45)	60	0.00
STANISLAUS AT NEW MELONES	22.35	----	45.73	27.34 (42)	82	0.00
SAN JOAQUIN AT HUNTINGTON LK	28.25	17.50	83.00	41.46 (45)	68	0.00

Upper Sacramento River Summary Conditions – August (On-going):

Storage/Release Management Conditions:

- Reservoir Inflow Uncertainty: Shorter term forecasts (8-14 day) suggest near normal chance of precipitation
- Longer term forecasts (one-month outlook) suggest below normal chance of precipitation
- Observed Shasta inflow for August is tracking about equal to the 90% inflow exceedance probability estimate for the month (153 TAF)
- Releases from Keswick Dam: August 27 through August 28 releases are decreasing from 8,250 cfs to 7,750 cfs for storage conservation
- Long-term conservative (inflow hydrology) projections suggest improved end of September Shasta storage volumes (2.159 MAF) due to increased inflows

Temperature Management:

- Temperature management: Active draw on cold water pool for temperature management
- Selective withdrawal: Using cold-water-pool reserves. All five PRGs are open and one Side Gate is open.
- Reclamation continues to actively look for opportunities to conserve cold water pool using operational refinements
- Meteorological Uncertainty: Shorter term forecasts (8-14 day) suggest above normal temperatures
- Longer term forecasts (one-month outlook) suggest 50%-60%o probability of above normal temperatures

Resources:

- Reclamation Bay Delta website: https://www.usbr.gov/mp/bdo/lto/index.html
- Reclamation SRTTG website: https://www.usbr.gov/mp/bdo/sacramento-river-temperature-task-group.html
- Sacramento River Forum- Habitat Restoration: https://www.sacramentoriver.org/forum/index.php?id=channels
- LTO Proposed Action: https://www.usbr.gov/mp/bdo/docs/ba-chapter-4-proposed-action.pdf
- 2019 Biological Opinions: https://www.usbr.gov/mp/bdo/lto/biop.html
- California Nevada River Forecast Center: short term precipitation forecasts, overlay with burn areas, debris flow potential, etc: https://www.cnrfc.noaa.gov/
- CDFW Upper Sacramento fishery information: https://www.calfish.org/ProgramsData/ConservationandManagement/CentralValleyMonitoring/CDFWUpperSacRiverBasinSalmonidMonitoring.aspx
- SacPAS: Central Valley Prediction & Assessment of Salmon: http://www.cbr.washington.edu/sacramento/
- DWR Bulletin 120 Forecast Updates: http://cdec.water.ca.gov/b120up.html

CVP Northern System Operation Outlooks: Draft August 2020

90% Runoff Exceedance Outlook

End of Month Storage/Elevation	Aug	Sep	Oct	Nov	Dec	Jan
Shasta Volume (TAF)	2319	2159	2060	2047	2099	2226
Shasta Elevation (Feet)	975	966	961	960	963	970

Monthly Average River Release	Aug	Sep	Oct	Nov	Dec	Jan
Sacramento (CFS)	9750	6500	5500	4373	3557	3250
Clear Creek (CFS)	150	150	200	200	200	200

Trinity Diversions	Aug	Sep	Oct	Nov	Dec	Jan
Carr Power Plant (TAF)	100	100	24	30	21	15
Spring Creek PP (TAF)	90	90	45	20	12	10

50% Runoff Exceedance Outlook

End of Month Storage/Elevation	Aug	Sep	Oct	Nov	Dec	Jan
Shasta Volume (TAF)	2332	2189	2130	2205	2395	2792
Shasta Elevation (Feet)	976	968	965	969	979	998

Monthly Average River Release	Aug	Sep	Oct	Nov	Dec	Jan
Sacramento (CFS)	9700	6500	5500	4000	3250	3250
Clear Creek (CFS)	150	150	200	200	200	400

Trinity Diversions	Aug	Sep	Oct	Nov	Dec	Jan
Carr Power Plant (TAF)	99	99	23	20	9	0
Spring Creek PP (TAF)	90	90	45	15	12	10

Notes: Inflow is based on the DWR B120 90% or 50% inflow exceedance Outlook; Historical inflows are used in the month of October and future months.

CVP actual operations do not follow any forecasted operation or outlook; actual operations are based on real-time conditions.

CVP operational forecasts or outlooks consider general system-wide dynamics and do not necessarily address specific watershed/tributary details.

CVP releases represent monthly averages.

CVP operations are updated monthly as new hydrology information is made available December through May.

Estimated CVP Operations 90% Exceedance

Storages

Federal End of the Month Storage/Elevation (TAF/Feet)

		Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Trinity	**1630**	**1475**	**1319**	**1278**	**1242**	**1225**	**1223**	**1250**	**1310**	**1366**	**1394**	**1300**	**1183**
	Elev.	2301	2287	2284	2280	2279	2278	2281	2287	2292	2294	2286	2274
Whiskeytown	**238**	**238**	**238**	**206**	**206**	**206**	**206**	**206**	**206**	**238**	**238**	**238**	**238**
	Elev.	1209	1209	1199	1199	1199	1199	1199	1199	1209	1209	1209	1209
Shasta	**2678**	**2319**	**2159**	**2060**	**2047**	**2099**	**2226**	**2420**	**2731**	**2771**	**2593**	**2233**	**1740**
	Elev.	975	966	961	960	963	970	980	995	997	989	970	941
Folsom	**555**	**456**	**381**	**374**	**364**	**363**	**377**	**400**	**481**	**580**	**651**	**633**	**458**
	Elev.	411	400	399	398	398	400	403	414	426	434	432	411
New Melones	**1638**	**1564**	**1520**	**1479**	**1481**	**1485**	**1488**	**1487**	**1486**	**1449**	**1360**	**1270**	**1177**
	Elev.	1010	1005	1001	1001	1001	1002	1002	1002	998	988	977	966
San Luis	**204**	**249**	**354**	**356**	**396**	**434**	**636**	**610**	**564**	**485**	**345**	**150**	**106**
	Elev.	439	446	441	454	472	498	486	476	464	444	406	382
Total		6299	5971	5754	5737	5812	6156	6372	6778	6889	6581	5824	4902

Monthly River Releases (TAF/cfs)

Trinity	TAF	53	52	23	18	18	18	17	18	36	92	47	28
	cfs	**857**	**870**	**373**	**300**	**300**	**300**	**300**	**300**	**600**	**1,498**	**783**	**450**
Clear Creek	TAF	9	9	12	12	12	12	11	17	12	16	11	9
	cfs	**150**	**150**	**200**	**200**	**200**	**200**	**200**	**275**	**200**	**265**	**190**	**150**
Sacramento	TAF	599	387	338	260	219	200	194	215	416	523	678	768
	cfs	**9750**	**6500**	**5500**	**4373**	**3557**	**3250**	**3500**	**3500**	**7000**	**8500**	**11400**	**12500**
American	TAF	154	119	46	52	55	49	80	91	107	103	90	215
	cfs	**2503**	**2004**	**752**	**876**	**888**	**800**	**1439**	**1473**	**1802**	**1669**	**1520**	**3500**
Stanislaus	TAF	12	12	39	12	12	13	12	12	27	55	12	12
	cfs	**200**	**200**	**635**	**200**	**200**	**219**	**221**	**200**	**460**	**887**	**200**	**200**

Trinity Diversions (TAF)

	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Carr PP	100	100	24	30	21	15	10	7	44	25	99	100
Spring Crk. PP	**90**	**90**	**45**	**20**	**12**	**10**	**10**	**10**	**15**	**15**	**90**	**90**

Delta Summary (TAF)

		Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Tracy		265	260	132	97	75	240	44	50	48	49	74	257
USBR Banks		39	29	0	0	0	0	0	0	0	0	0	9
Contra Costa		8.3	9.5	10.5	12.6	13.8	13.7	10.5	10.5	9.5	9.5	9.5	7.4
Total USBR		312	299	143	110	89	254	55	61	57	59	84	273
COA Balance		38	53	22	4	4	4	-19	-73	-53	-19	-5	-5
Vernalis	TAF	40	46	108	83	83	92	82	82	105	135	43	45
Vernalis	cfs	655	772	1758	1393	1355	1504	1482	1339	1767	2194	721	737
Old/Middle River Std.													
Old/Middle R. calc.		-4,746	-5,207	-2,022	-3,232	-3,247	-5,095	-1,053	-1,372	-1,073	-877	-1,864	-4,346
Computed DOI		3741	3362	4994	5009	6003	6051	11400	11403	9497	6865	7800	5124
Excess Outflow		0	0	0	0	0	1545	0	0	0	0	0	130
% Export/Inflow		43%	51%	29%	41%	40%	55%	10%	12%	12%	15%	15%	36%
% Export/Inflow std.		65%	65%	65%	65%	65%	65%	45%	35%	35%	35%	35%	65%

Hydrology

	Trinity		Shasta		Folsom		New Melones	
Water Year Inflow (TAF)	463		3,261		1,483		639	
Year to Date + Forecasted % of mean	38%		59%		54%		60%	

CVP actual operations do not follow any forecasted operation or outlook; actual operations are based on real-time conditions.
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8/19/2020

Estimated CVP Operations 50% Exceedance

Storages

Federal End of the Month Storage/Elevation (TAF/Feet)

		Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Trinity	**1630**	**1476**	**1322**	**1287**	**1279**	**1309**	**1374**	**1485**	**1613**	**1728**	**1592**	**1467**	**1320**
	Elev.	2301	2288	2285	2284	2287	2292	2302	2312	2321	2311	2300	2287
Whiskeytown	**238**	**238**	**238**	**206**	**206**	**206**	**206**	**206**	**206**	**238**	**238**	**238**	**238**
	Elev.	1209	1209	1199	1199	1199	1199	1199	1199	1209	1209	1209	1209
Shasta	**2678**	**2332**	**2189**	**2130**	**2205**	**2395**	**2792**	**3374**	**3928**	**4234**	**4298**	**3993**	**3523**
	Elev.	976	968	965	969	979	998	1024	1045	1056	1058	1047	1030
Folsom	**555**	**462**	**432**	**415**	**415**	**435**	**509**	**566**	**753**	**901**	**961**	**967**	**844**
	Elev.	412	408	405	405	408	418	424	445	459	465	465	454
New Melones	**1638**	**1574**	**1533**	**1502**	**1519**	**1543**	**1575**	**1629**	**1688**	**1671**	**1752**	**1762**	**1679**
	Elev.	1011	1007	1003	1005	1008	1011	1017	1023	1021	1029	1030	1022
San Luis	**204**	**228**	**324**	**456**	**602**	**813**	**966**	**965**	**965**	**886**	**734**	**707**	**653**
	Elev.	441	452	470	496	530	544	543	543	532	514	509	501
Total		6309	6038	5996	6226	6701	7423	8224	9153	9658	9575	9133	8257

Monthly River Releases (TAF/cfs)

Trinity	TAF	53	52	23	18	18	18	17	18	36	258	126	68
	cfs	**857**	**870**	**373**	**300**	**300**	**300**	**300**	**300**	**600**	**4,189**	**2,120**	**1,102**
Clear Creek	TAF	9	9	12	12	12	25	11	12	12	16	11	9
	cfs	**150**	**150**	**200**	**200**	**200**	**400**	**200**	**200**	**200**	**265**	**190**	**150**
Sacramento	TAF	596	387	338	238	200	200	180	277	339	492	678	768
	cfs	**9700**	**6500**	**5500**	**4000**	**3250**	**3250**	**3250**	**4500**	**5700**	**8000**	**11400**	**12500**
American	TAF	154	89	92	89	92	77	205	123	274	400	210	234
	cfs	**2500**	**1500**	**1500**	**1502**	**1500**	**1250**	**3700**	**2000**	**4600**	**6500**	**3526**	**3805**
Stanislaus	TAF	12	12	39	12	12	14	13	12	91	55	22	15
	cfs	**200**	**200**	**635**	**200**	**200**	**226**	**229**	**200**	**1536**	**887**	**363**	**250**

Trinity Diversions (TAF)

	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Carr PP	99	99	23	20	9	0	2	1	55	92	95	99
Spring Crk. PP	**90**	**90**	**45**	**15**	**12**	**10**	**35**	**26**	**35**	**90**	**90**	**90**

Delta Summary (TAF)

		Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Tracy		265	260	265	205	250	195	75	100	54	57	256	265
USBR Banks		41	36	0	0	0	0	0	0	0	0	0	11
Contra Costa		12.7	14.0	16.8	18.4	18.3	14.0	14.0	12.7	12.7	12.7	9.8	11.1
Total USBR		319	310	282	223	268	209	89	113	66	70	266	287
COA Balance		97	102	81	45	45	45	45	45	45	45	92	173
Vernalis	TAF	49	54	108	83	83	93	112	57	169	113	69	54
Vernalis	cfs	802	906	1758	1393	1355	1511	2012	932	2843	1833	1153	884
Old/Middle River Std.													
Old/Middle R. calc.	cfs	-5,286	-5,839	-5,170	-5,301	-5,996	-3,781	-2,653	-2,960	-630	-1,104	-5,453	-5,867
Computed DOI		3741	3362	4994	5009	7955	15405	23539	21619	17381	11550	7447	4994
Excess Outflow		0	0	0	0	1952	9403	12139	10216	7884	3741	0	0
% Export/Inflow		45%	54%	50%	53%	48%	25%	13%	14%	7%	10%	39%	44%
% Export/Inflow std.		65%	65%	65%	65%	65%	65%	45%	35%	35%	35%	35%	65%

Hydrology

	Trinity		Shasta		Folsom		New Melones	
Water Year Inflow (TAF)	464		3,288		1,514		652	
Year to Date + Forecasted % of mean	38%		59%		56%		62%	

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8/17/2020

BUREAU OF RECLAMATION

CVP Aug 2020 90% Exceedance Operations Outlook Information

General Information:

Central Valley Project (CVP) reservoir operations are re-assessed monthly for a one-year period into the future at varied hydrologic conditions on a monthly time-step. Because future watershed hydrology is not known with certainty, estimates for inflow are typically updated using a spread of likely outcomes. These values can range anywhere from 1 percent to 99 percent runoff exceedance probabilities by using meteorological or historical precipitation and snow trends. The CVP commonly uses a 90 percent and 50 percent runoff exceedance probability hydrology. The 90 percent runoff exceedance probability hydrology suggests a conservative, or relatively "dry" condition in which it's expected that in any particular year, nine out of ten years the conditions for the year will be "wetter" than presented. Similarly, the 50 percent hydrology suggest a less conservative, or relatively "wet" condition in which it's expected that in any particular year, equal chances or five out of ten years will be "wetter" or "drier" than presented. The designation to view the former a "dry" outlook and the latter a "wet" one can be somewhat misleading. For the months of October and November, there is typically little to no data (snowpack), and the inflow hydrology set which is used is derived from a long term average of historic data. In that case, the 90% is dry and 50% is the median of historic data, which is slightly drier than the long term average due to the skew produced by a few very large events. Once National Weather Service (NWS) and California Department of Water Resources (DWR) forecasts become available (usually December through May), the hydrology switches from long term averages to more specific projections pertaining to the current water year. It is derived from monthly snowpack measurements and statistical runoff curves and is published at several probability levels for the current year. It is important to note that for these hydrology sets, a 90% is not necessarily dry, nor is the 50% (median) necessarily anywhere close to the long term average. They are simply runoff projections based upon probabilities. For example, in a parched year with poor snowpack, the 50% (median) runoff forecast might be very dry by any standard, and conversely, in a year high runoff and large snowpack, the 90% (drier) forecast could be very wet. In summary, for the December through May outlooks, the 90% can be viewed as "drier" (but not necessarily dry) and the 50% (median) as "wetter" but not necessarily wet. Generally, the differences between the NWS/DWR 90% and 50% runoff forecasts diminish as the water year progresses and more information becomes available. In December, with little of the annual snowpack in place there are usually very large differences between the 90% and 50% runoff forecasts. By April or May, much (if not all) of the snowpack has accumulated, and the 90% and 50% runoff forecasts typically have relatively small differences between them.

The assumed uncertain hydrology sets are used to simulate, including, but not limited to, projected storage, releases, exports, and features of the Sacramento and San Joaquin Delta performance. These estimates serve as useful operational guides for both CVP and DWR State Water Project (SWP) operations to jointly manage the system according to shared coordination framework (Coordinated Operations Agreement) for various conditions. This coordinated effort ensures that DWR and Reclamation supply required quantity and quality of water in the Delta to support agricultural, environmental, and water quality goals according to water right permit conditions (D-1641). The CVP system balances available resources to meet regulatory obligations, environmental requirements, senior water right holders, and CVP service contracts including agricultural, municipal and industrial, and wildlife refuge water delivery demands. Reclamation considers the factors that go into the outlooks to guide export opportunities and capabilities. Central Valley Operation staff combine their institutional knowledge and experience, and optimize reservoir and export operations given the system, regulatory, and environmental constraints which are applicable in the current water year. The final step in the analysis process is to select an allocation and demand set which fully utilizes San Luis storage by drawing the reservoir down to absolute minimums in late summer. Per requirements, the 90% outlook is used to determine allocations, and the 50% outlook is provided for informational purposes.

These operation outlooks do not suggest a certain actual future outcome, but rather the statistical likelihood of projected outcomes and represent levels of CVP operational risk. Thus, the outlooks do not provide exact or anticipated end-of-month storages, flow rates, but general projections that would be expected if actual conditions matched this uncertain future hydrology. However, actual operations are generally expected to fall within the bracketed 90 percent and 50 percent hydrology projections. Outlooks represent general system-wide dynamics and do not necessarily address specific watershed/tributary details and releases and export values are represented as monthly averages. Actual operations are based on real-time conditions.

Inputs:

- Reservoir Inflow Hydrology: Final Issue of the Bulletin 120 Water Supply Forecast Update June 10, 2020, DWR
- Sacramento Valley Accretion Depletion Hydrology: Sacramento River at Freeport forecast for June 2020, DWR. Per personal communication with DWR, values were adjusted conservatively due to late season toolset limitations.
- Operations: Personal communication with DWR, SWP Operations

Assumptions:

- Reservoir inflows are adjusted to date of forecasting to approximate actual conditions
- SWRCB D1641 permit conditions for outflow and salinity requirements are met for compliance
- Coordinated Operations Agreement (COA) classification: Dry – CVP 65% Sharing responsibility for meeting Sacramento Valley inbasin use with storage withdrawals during balanced water conditions
- Delta salinity/outflow requirements control through August 15 at Emmaton/Jersey Point, Delta Outflow approximately 3,700 cfs

- Delta controls: Anticipated water quality goals at Emmaton/Jersey Point through mid-August, then water quality goals for Rock Slough for the remainder of dry season
- Sacramento River water year type classification for requirements: Dry
- San Joaquin River water year type classification for requirements: Dry
- Stanislaus River classification for minimum release: Dry
- American River classification for minimum release: based on forecasted inflows to Folsom reservoir
- Trinity River Record of Decision (ROD) water year type classification: Critically Dry
- Sacramento River Settlement Contractors allocation classification: Shasta Non-Critical 100%
- North of Delta Water Service Contractor allocation for agriculture: 50%
- North of Delta Municipal and Industrial allocation: 75%
- North of Delta Refuge allocation: 100%
- American River Water Rights allocation: 100%
- South of Delta Water Rights allocation: 100%
- South of Delta Water Service Contractor allocation for agriculture: 20%
- CVP South of Delta Municipal and Industrial allocation: 70%
- South of Delta Refuge allocation: 100%
- Feather River Service Area allocation: 100%

Notes:

- A Shasta Non-Critical determination was made June 8, 2020 based on DWR Bulletin 120 Forecast Update June 2, 2020.
- Based on the COA and year classification, the CVP is responsible for 65% of water released from storage to meet all inbasin uses (entitlements) in the Sacramento River watershed under balanced conditions (SWP is responsible for 35%). To determine the magnitude of this responsibility, DWR estimates the Sacramento River watershed inbasin use by applying a mass balance calculation over the entire basin. This is because specific or individual diversion and return flows from the Sacramento River are not metered or measured and an aggregate based on historical information is used instead. Historical water gains (returns or accretion) and uses (diverted, losses or depleted) out of the Sacramento River watershed contain water year type associated patterns. This outlook contains an updated accretion/depletion calculation. The Shasta Non-Critical assumption is imbedded within this mass balance calculation and captures a 100% allocation to the Sacramento River Settlement Contractors (SRSC).
- Sacramento River accretion/depletion assumptions have been crossed checked with diversion estimates from the SRSC. Per personal communication with the SRSC, year 2020 summer (June through September) diversion patterns are similar between the 100% and 75% allocations due to the late season determination. Discussions are on-going to adjust an increase in SRSC demand in October for rice decomposition.
- South of Delta Water Rights and Refuge allocations are assumed to be 100%.
- The North of Delta water service contractor's allocation for agriculture (50%) was set by provisions of the WIIN Act, Section 4005 (e)(1)(A)(iv), which states that allocations shall be

not less than 50% of the contract quantity in a Dry year preceded by a Below Normal, Above Normal or Wet year.

Northern CVP Water Temperature Report

August - 2020

BUREAU OF RECLAMATION

All Data in this Report is Preliminary and Subject to Change

DATE	Mean Daily Water Temperatures (°F)													Mean Daily Release (CFS)			Mean Daily Air Temperatures (°F)			
	TCD[1]	SHD	SPP[1]	KWK	SAC	CCR	BSF[2]	JLF	BND	RDB	IGO	LWS	-----	Shasta Generation	Spring Creek P.P.	Keswick Total	RDD	BSF	RDB	LWS
Jul	51.9	51.0	55.0	52.9	53.3	53.9	55.5	56.7	57.6	58.6	58.6	53.0	-	10212	1501	12074	84.1	79.5	79.6	-
08/01	51.4	50.2	56.1	52.5	53.1	53.6	**55.3**	56.4	57.3	58.5	# -	51.2	-	9154	1467	11066	83.0	77.9	78.0	-
08/02	51.6	50.3	56.2	52.5	53.1	53.7	**55.3**	56.5	57.3	58.4	# -	51.1	-	8824	1574	11111	82.5	78.5	78.3	-
08/03	51.8	50.4	56.2	52.6	53.3	53.8	**55.5**	56.7	57.5	58.7	# -	51.3	-	8969	1554	11111	85.0	81.4	81.1	-
08/04	51.8	? 50.4	56.2	52.9	53.5	54.1	**55.7**	56.9	57.8	58.9	# -	51.4	-	8745	1485	11098	84.0	79.3	79.0	-
08/05	51.8	50.6	56.3	52.7	53.4	54.1	**55.8**	57.1	58.1	59.3	# -	51.3	-	9194	1304	11108	81.5	76.0	75.1	-
08/06	51.2	50.1	56.3	52.9	53.6	54.2	**55.8**	57.0	57.8	59.1	# -	51.5	-	8821	1514	11106	78.5	75.1	73.4	-
08/07	50.9	49.9	56.5	52.7	53.5	54.3	**56.1**	57.4	58.2	59.3	# -	51.6	-	8454	1687	10901	86.5	81.1	80.6	-
08/08	51.0	50.0	56.4	52.2	53.0	53.7	**55.6**	57.1	58.0	59.4	# -	51.5	-	8584	1542	10561	85.5	81.7	81.2	-
08/09	51.1	50.1	56.5	52.4	53.0	53.7	**55.4**	56.9	57.7	59.0	# -	51.2	-	8469	1539	10562	90.0	85.0	84.9	-
08/10	51.1	50.1	56.6	52.5	53.2	53.9	**55.6**	57.0	57.8	59.1	# -	51.1	-	8969	1786	10551	91.0	84.8	84.6	-
08/11	51.0	50.2	56.7	52.5	53.3	53.9	**55.8**	57.3	58.0	59.3	# -	51.1	-	7724	1838	10261	85.5	79.5	78.7	-
08/12	51.1	50.1	? 56.7	52.7	53.4	54.0	**55.8**	57.2	58.0	59.2	# -	50.9	-	8187	1354	10185	82.0	78.2	78.0	-
08/13	50.7	50.0	56.9	52.0	52.9	53.5	**55.3**	56.7	57.6	58.9	# -	51.3	-	8988	965	10313	84.0	78.6	80.3	-
08/14	50.8	50.0	56.9	52.1	52.8	53.4	**54.9**	56.2	57.0	58.4	# -	? 51.3	-	8340	1638	10269	88.0	82.3	84.9	-
08/15	50.9	50.1	56.9	52.3	53.0	53.8	**55.4**	56.8	57.5	58.6	# -	51.4	-	7326	1851	10107	91.5	84.5	86.7	-
08/16	50.6	50.0	57.0	! -	53.2	53.8	**55.1**	56.4	57.2	58.5	# -	51.1	-	7997	1688	10036	90.0	82.0	82.5	-
08/17	50.4	? 49.5	57.1	# -	52.7	53.1	**54.4**	55.6	56.3	57.1	# -	50.8	-	7765	1540	9984	84.5	76.1	80.7	-
08/18	50.4	49.6	57.1	# -	52.5	53.1	**54.6**	55.8	56.4	57.2	# -	50.7	-	8205	1582	10022	92.0	85.4	87.6	-
08/19	50.6	49.8	57.0	# -	52.6	53.1	**54.4**	55.5	56.2	57.3	# -	50.1	-	7165	1363	9965	91.0	77.9	79.5	-
08/20	50.5	49.8	56.9	! -	52.5	53.0	**54.1**	55.1	55.6	56.0	# -	50.9	-	7947	1337	9460	78.0	71.9	73.0	-
08/21	50.7	49.7	56.8	51.9	52.5	53.0	**54.1**	54.9	55.3	55.6	# -	51.2	-	8191	1287	9269	77.5	68.9	67.6	-
08/22	50.8	? 49.9	56.8	52.1	52.6	53.0	**54.2**	55.2	55.7	56.0	# -	51.2	-	7063	1286	8962	79.5	72.3	74.3	-
08/23	50.9	? 49.9	56.8	52.3	52.8	53.2	**54.6**	55.6	56.1	56.5	# -	50.9	-	6751	1643	9065	82.5	75.3	76.3	-
08/24	50.8	? 49.8	56.9	52.4	52.9	53.3	**54.9**	56.2	56.9	57.5	# -	50.3	-	6449	1771	8736	85.0	78.3	78.7	-
08/25	50.6	49.8	56.8	52.3	52.8	53.2	**54.6**	55.9	? 56.6	? 57.7	# -	50.2	-	6462	1726	8518	80.5	75.7	77.0	-
08/26																				
08/27																				
08/28																				
08/29																				
08/30																				
08/31																				
Aug	51.0	50.0	56.7	52.4	53.0	53.6	55.1	56.4	57.1	58.1	-	51.1	-	8110	1533	10173	84.8	78.7	79.3	-
													Total CFS	202743	38321	254327				
													Total AF	402132	76008	504447				

Legend

? = 1-9 hours of data missing (Average includes estimations)
! = 10 or more hours of data missing (Average not calculated)
= Station out of service
↑ = Record high air temperature
↓ = Record low air temperature
= Monthly Averages

Notes

[1] Temperatures are weighted averages based on individual penstock flow and temperature
Highlighted cells in the TCD column indicate a TCD change was made on that day
[2] Current control point (see page 3 for more details)
[3] Column not used this month

DATE	Redding (RDD) Daily Air Temperatures (°F)																																			
	Actual			Forecasted																																		
	Previous Day			Current Day			1 Day			2 Days			3 Days			4 Days			5 Days			6 Days			7 Days			8 Days			9 Days			10 Days		
	↓	↑	Avg	↓	↑	Avg	↓	↑	Avg	↓	↑	Avg	↓	↑	Avg	↓	↑	Avg	↓	↑	Avg	↓	↑	Avg	↓	↑	Avg	↓	↑	Avg	↓	↑	Avg	↓	↑	Avg
08/01	64	101	82.5	63	102	82.5	64	102	83.0	65	101	83.0	65	100	82.5	64	96	80.0	63	98	80.5	65	99	82.0	67	97	82.0	66	96	81.0	67	95	81.0	63	96	79.5
08/02	63	103	83.0	65	102	83.5	65	101	83.0	65	100	82.5	63	95	79.0	63	97	80.0	64	98	81.0	64	101	82.5	67	100	83.5	67	101	84.0	69	99	84.0	65	98	81.5
08/03	64	101	82.5	67	101	84.0	65	101	83.0	63	94	78.5	62	95	78.5	64	99	81.5	64	101	82.5	67	103	85.0	66	101	83.5	67	99	83.0	68	97	82.5	64	96	80.0
08/04	67	103	85.0	68	101	84.5	63	94	78.5	61	94	77.5	64	99	81.5	66	104	85.0	68	105	86.5	68	104	86.0	68	99	83.5	66	99	82.5	66	97	81.5	64	97	80.5
08/05	67	101	84.0	69	93	81.0	59	93	76.0	63	99	81.0	65	104	84.5	68	107	87.5	69	105	87.0	67	101	84.0	67	96	81.5	65	94	79.5	65	95	80.0	64	97	80.5
08/06	69	94	81.5	64	94	79.0	64	100	82.0	65	104	84.5	67	107	87.0	69	106	87.5	68	100	84.0	65	98	81.5	65	97	81.0	65	96	80.5	66	96	81.0	64	96	80.0
08/07	63	94	78.5	72	100	86.0	65	104	84.5	68	107	87.5	69	106	87.5	68	100	84.0	65	98	81.5	64	99	81.5	67	96	81.5	64	99	81.5	64	97	80.5	65	98	81.5
08/08	71	102	86.5	71	104	87.5	67	107	87.0	70	107	88.5	68	101	84.5	65	99	82.0	64	100	82.0	65	100	82.5	66	103	84.5	67	102	84.5	66	99	82.5	64	96	80.0
08/09	66	105	85.5	72	107	89.5	70	108	89.0	68	99	83.5	65	99	82.0	63	101	82.0	65	103	84.0	67	102	84.5	65	100	82.5	65	100	82.5	65	98	81.5	63	96	79.5
08/10	70	110	90.0	74	109	91.5	69	100	84.5	65	100	82.5	64	102	83.0	65	105	85.0	67	106	86.5	65	106	85.5	63	99	81.0	65	102	83.5	65	98	81.5	64	98	81.0
08/11	73	109	91.0	74	100	87.0	64	97	80.5	63	100	81.5	65	106	85.5	70	105	87.5	72	103	87.5	68	102	85.0	68	108	88.0	70	102	86.0	69	99	84.0	64	98	81.0
08/12	74	97	85.5	69	96	82.5	62	100	81.0	65	105	85.0	70	108	89.0	70	104	87.0	69	103	86.0	67	103	85.0	64	97	80.5	62	99	80.5	64	96	80.0	63	95	79.0
08/13	67	97	82.0	68	101	84.5	64	106	85.0	70	109	89.5	72	105	88.5	73	107	90.0	71	109	90.0	71	107	89.0	72	104	88.0	67	100	83.5	65	94	79.5	63	93	78.0
08/14	66	102	84.0	69	106	87.5	73	108	90.5	73	106	89.5	76	106	91.0	74	107	90.5	76	107	91.5	69	105	87.0	67	102	84.5	65	98	81.5	64	94	79.0	63	94	78.5
08/15	67	109	88.0	73	111	92.0	74	108	91.0	74	107	90.5	75	108	91.5	70	106	88.0	67	105	86.0	66	102	84.0	67	99	83.0	66	101	83.5	67	100	83.5	65	99	82.0
08/16	72	111	91.5	77	105	91.0	74	109	91.5	74	108	91.0	72	106	89.0	66	102	84.0	65	103	84.0	66	103	84.5	67	103	85.0	68	101	84.5	69	99	84.0	65	97	81.0
08/17	76	104	90.0	76	103	89.5	74	108	91.0	70	104	87.0	63	100	81.5	64	104	84.0	66	104	85.0	67	104	85.5	67	104	85.5	65	104	84.5	65	98	81.5	63	96	79.5
08/18	75	94	84.5	75	105	90.0	69	101	85.0	62	98	80.0	63	100	81.5	65	103	84.0	67	104	85.5	67	105	86.0	67	101	84.0	64	101	82.5	65	98	81.5	64	98	81.0
08/19	75	109	92.0	75	102	88.5	62	97	79.5	63	97	80.0	65	100	82.5	66	101	83.5	66	101	83.5	66	101	83.5	68	98	83.0	66	100	83.0	66	98	82.0	63	98	80.5
08/20	73	109	91.0	63	98	80.5	64	98	81.0	66	101	83.5	66	101	83.5	67	98	82.5	65	97	81.0	65	99	82.0	64	98	81.0	63	101	82.0	64	98	81.0	61	96	78.5
08/21	61	95	78.0	63	98	80.5	65	101	83.0	65	101	83.0	67	100	83.5	65	96	80.5	64	98	81.0	65	100	82.5	64	99	81.5	64	98	81.0	63	96	79.5	61	95	78.0
08/22	63	92	77.5	65	97	81.0	65	98	81.5	66	98	82.0	64	97	80.5	65	98	81.5	64	101	82.5	66	101	83.5	65	99	82.0	63	93	78.0	62	93	77.5	60	95	77.5
08/23	64	95	79.5	67	99	83.0	68	98	83.0	66	98	82.0	67	96	81.5	65	100	82.5	65	101	83.0	66	103	84.5	65	99	82.0	63	96	79.5	63	95	79.0	62	96	79.0
08/24	67	98	82.5	75	98	86.5	65	97	81.0	65	97	81.0	65	98	81.5	66	102	84.0	66	101	83.5	65	99	82.0	64	101	82.5	64	104	84.0	66	101	83.5	65	99	82.0
08/25	73	97	85.0	68	97	82.5	65	96	80.5	65	98	81.5	66	102	84.0	66	101	83.5	66	100	83.0	65	100	82.5	65	103	84.0	63	105	84.0	64	99	81.5	62	97	79.5
08/26	67	94	80.5	69	95	82.0	65	98	81.5	65	103	84.0	66	98	82.0	65	100	82.5	66	99	82.5	64	98	81.0	63	102	82.5	62	102	82.0	64	99	81.5	63	98	80.5
08/27																																				
08/28																																				
08/29																																				
08/30																																				
08/31																																				

Web Links

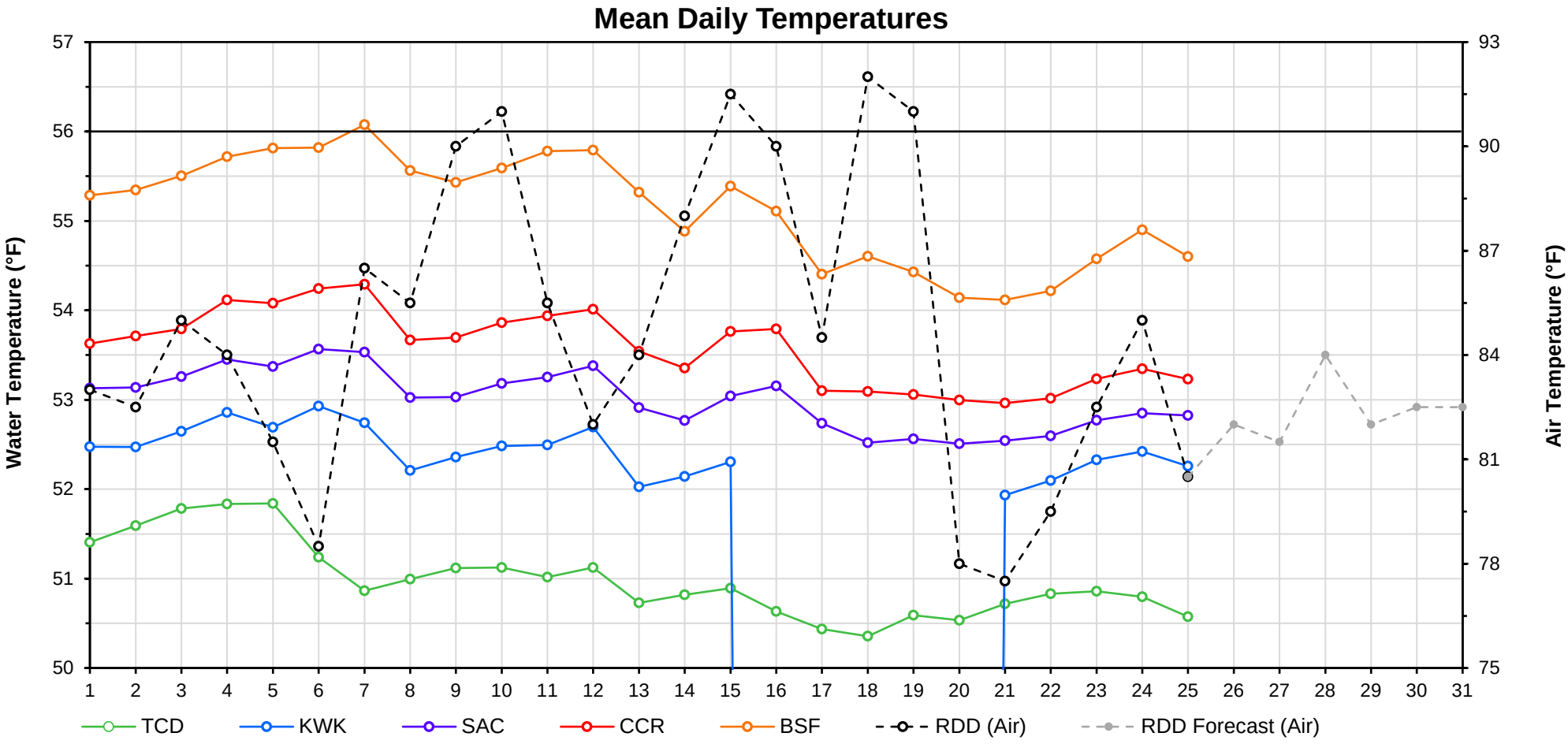
[10-Day Min/Max Forecast]

[Previous Days Min/Max Actuals]

Legend

NR = Forecasted temperatures not recorded

100 = Previous day actual temperatures in red and bolded indicate a record temperature for that date



Station Details			
Code	Body of Water	Location[1]	CDEC Link
TCD	N/A	Shasta Power Plant	N/A
SHD	Sacramento River	0.3 miles downstream of Shasta Power Plant	Click Here
SPP	N/A	Spring Creek Power Plant	N/A
KWK	Sacramento River	0.8 miles downstream of Keswick Dam	Click Here
SAC	Sacramento River	4.8 miles downstream of Keswick Dam	Click Here
CCR	Sacramento River	9.7 miles downstream of Keswick Dam	Click Here
BSF	Sacramento River	25 miles downstream of Keswick Dam	Click Here
JLF	Sacramento River	34 miles downstream of Keswick Dam	Click Here
BND	Sacramento River	41 miles downstream of Keswick Dam	Click Here
RDB	Sacramento River	58 miles downstream of Keswick Dam	Click Here
IGO	Clear Creek	7.3 miles downstream of Whiskeytown Dam	Click Here
LWS	Trinity River	1.1 miles downstream of Lewiston Dam	Click Here
DGC[2]	Trinity River	19 miles downstream of Lewiston Dam	Click Here
NFH[3]	Trinity River	38 miles downstream of Lewiston Dam	Click Here

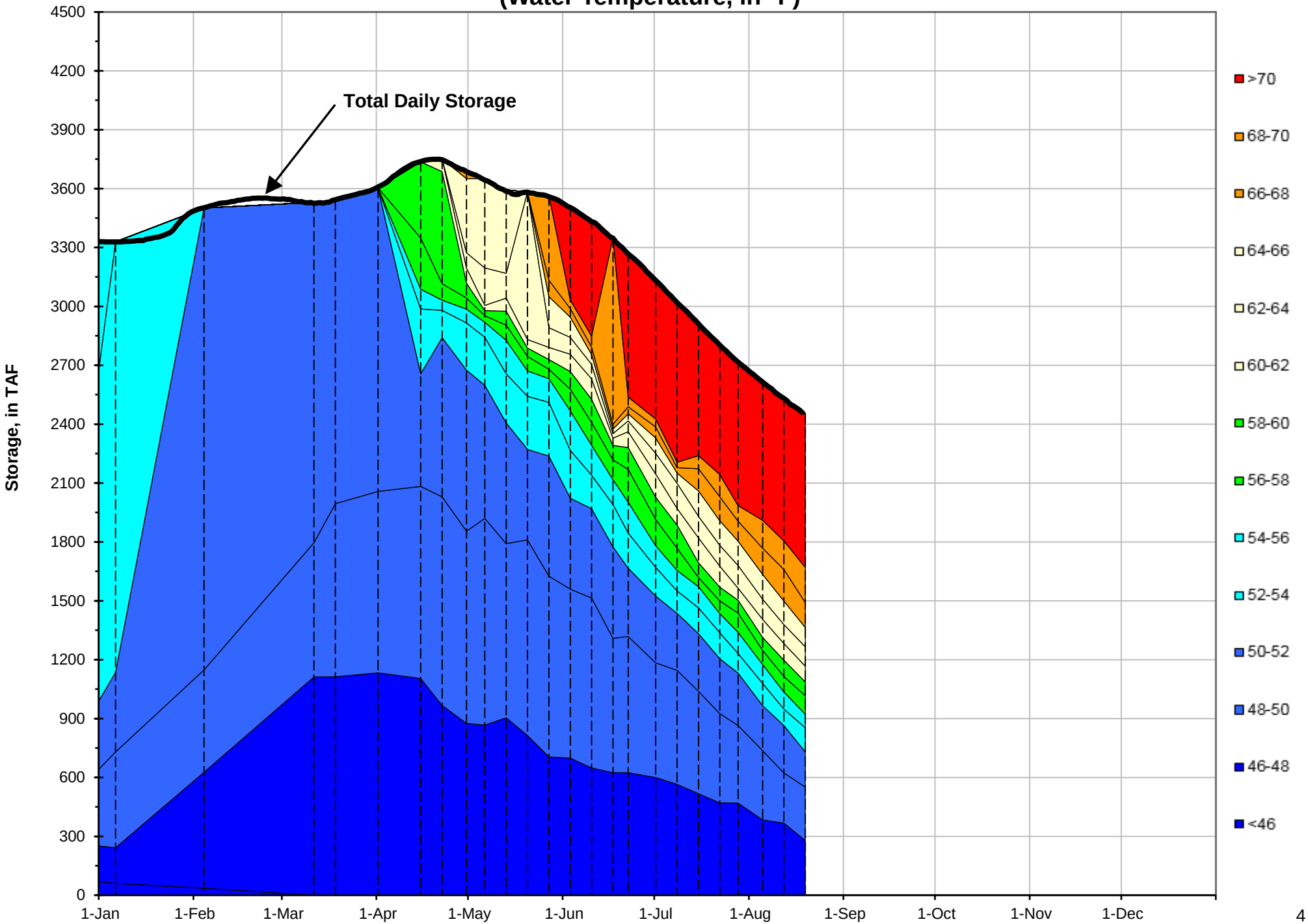
Temperature Control Point		
Point	Temp. (°F)	Begin Date
BSF	**56.0**	**5/15/2019**

Notes

[1] Distances are approximate
[2] DGC is only reported in September
[3] NFH is only reported in October, November and December

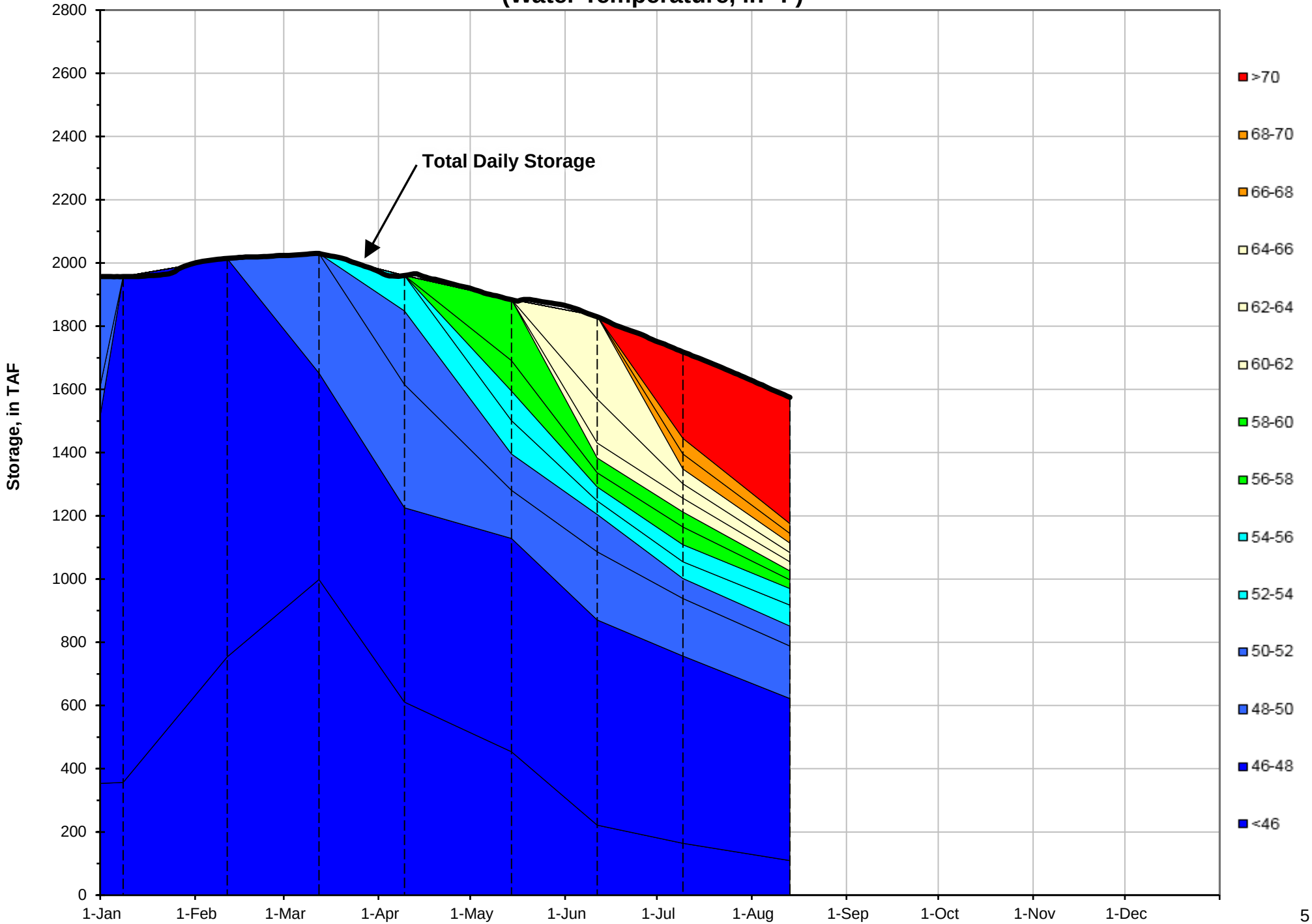
Latest Profile Date: 08/19/2020

Shasta Lake Isothermobaths - 2020
(Water Temperature, in °F)



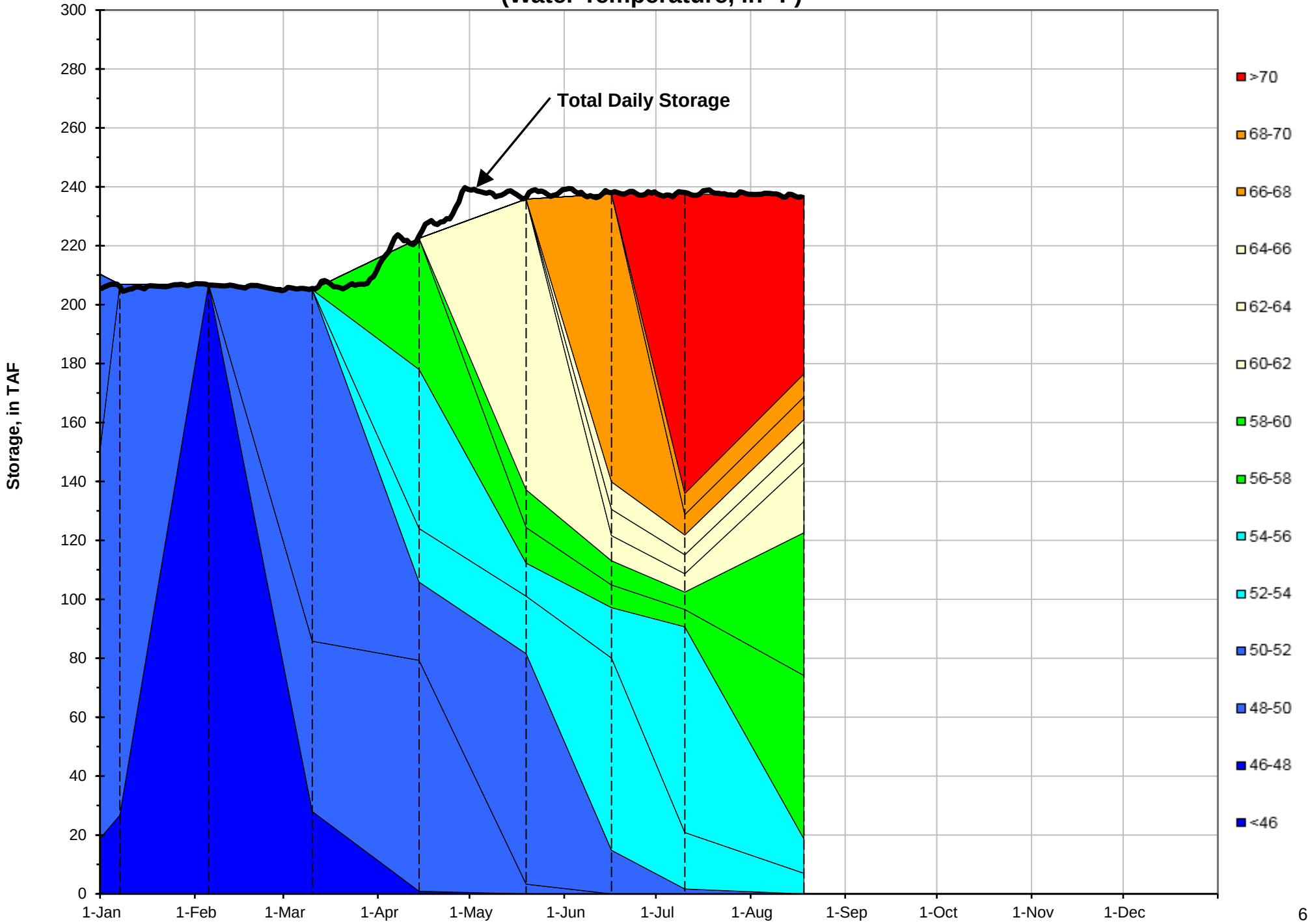
Latest Profile Date: 08/13/2020

Trinity Lake Isothermobaths - 2020
(Water Temperature, in °F)



Latest Profile Date: 08/18/2020

Whiskeytown Lake Isothermobaths - 2020
(Water Temperature, in °F)

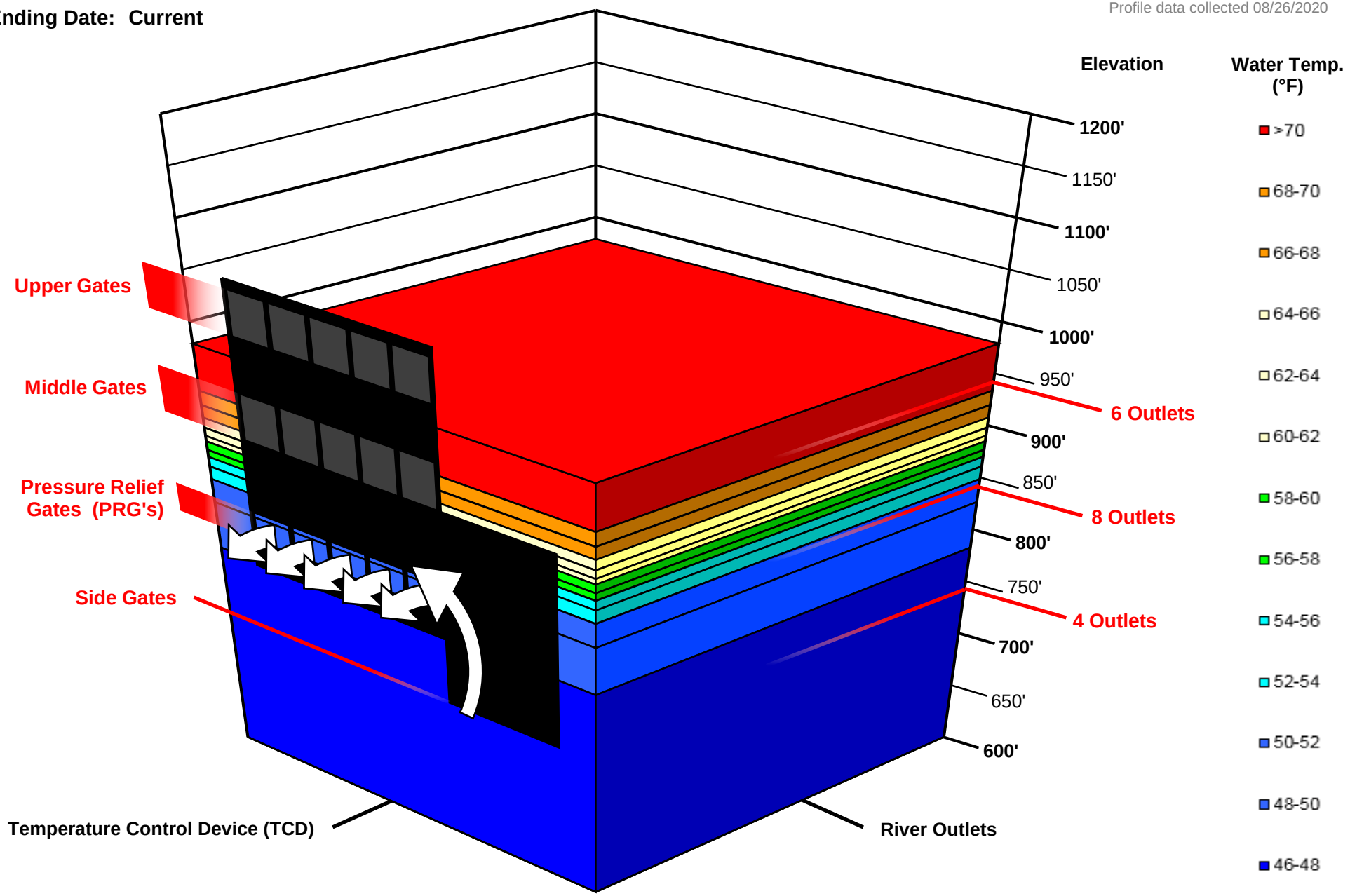


Shasta TCD Configuration

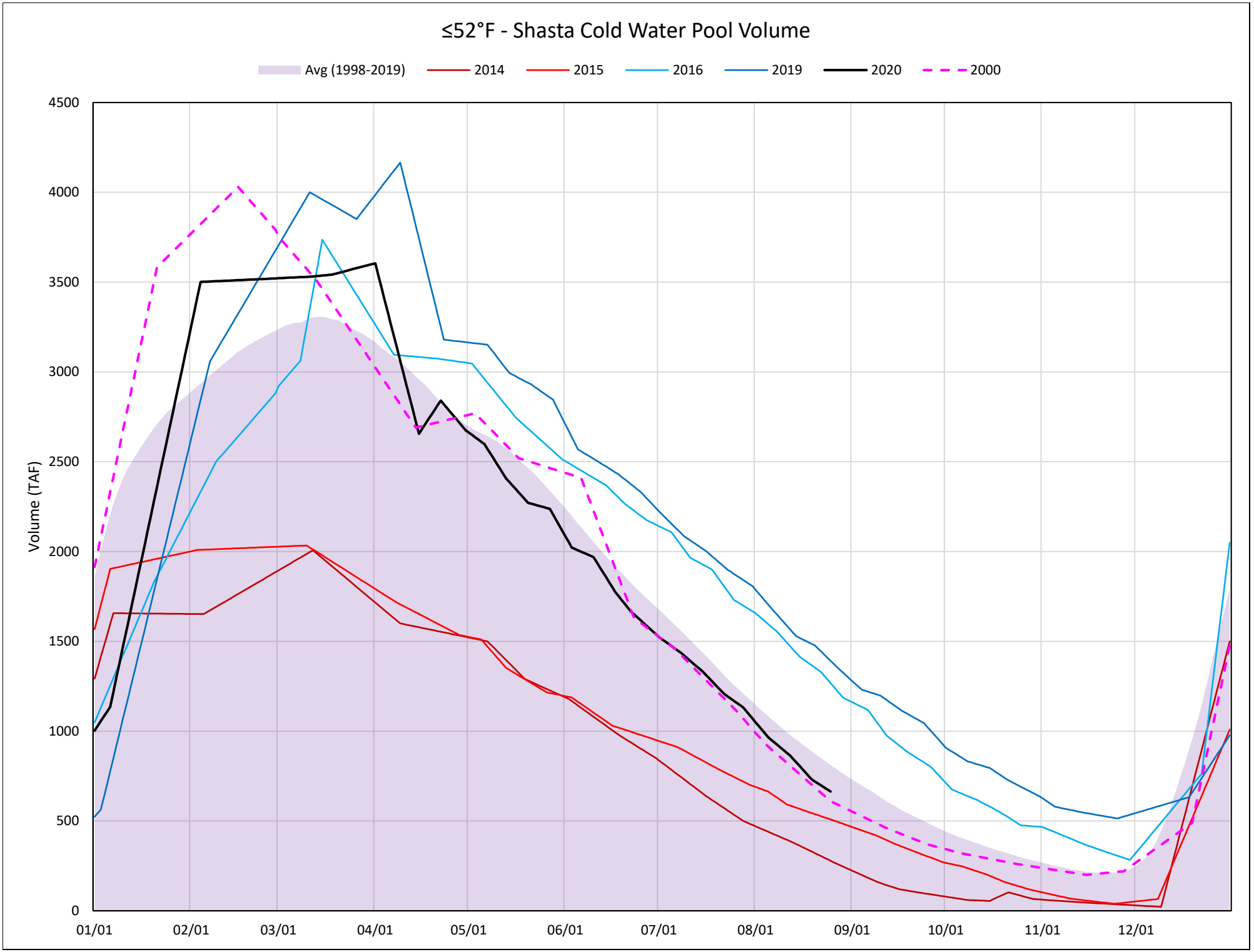
Starting Date: 8/13/2020

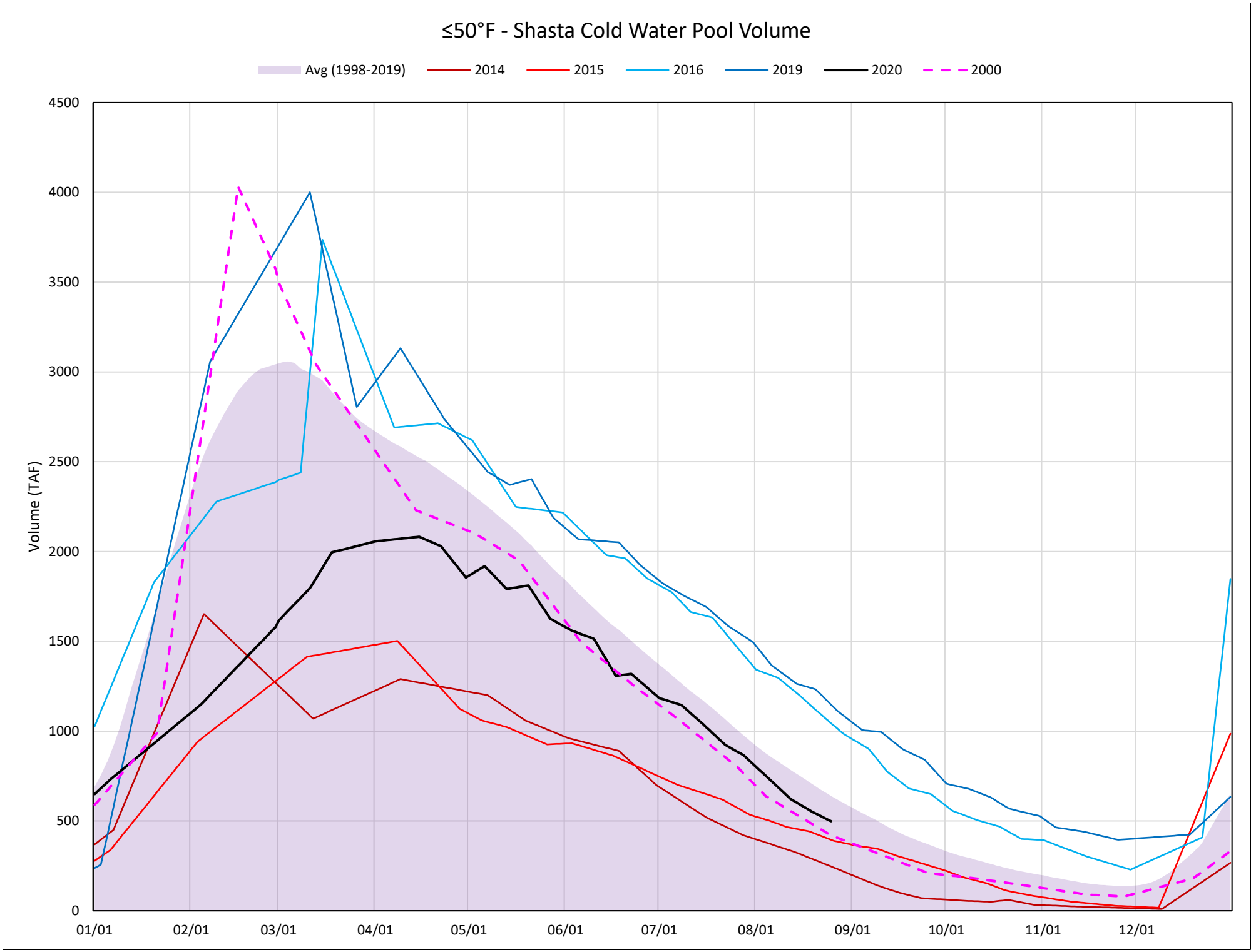
Ending Date: Current

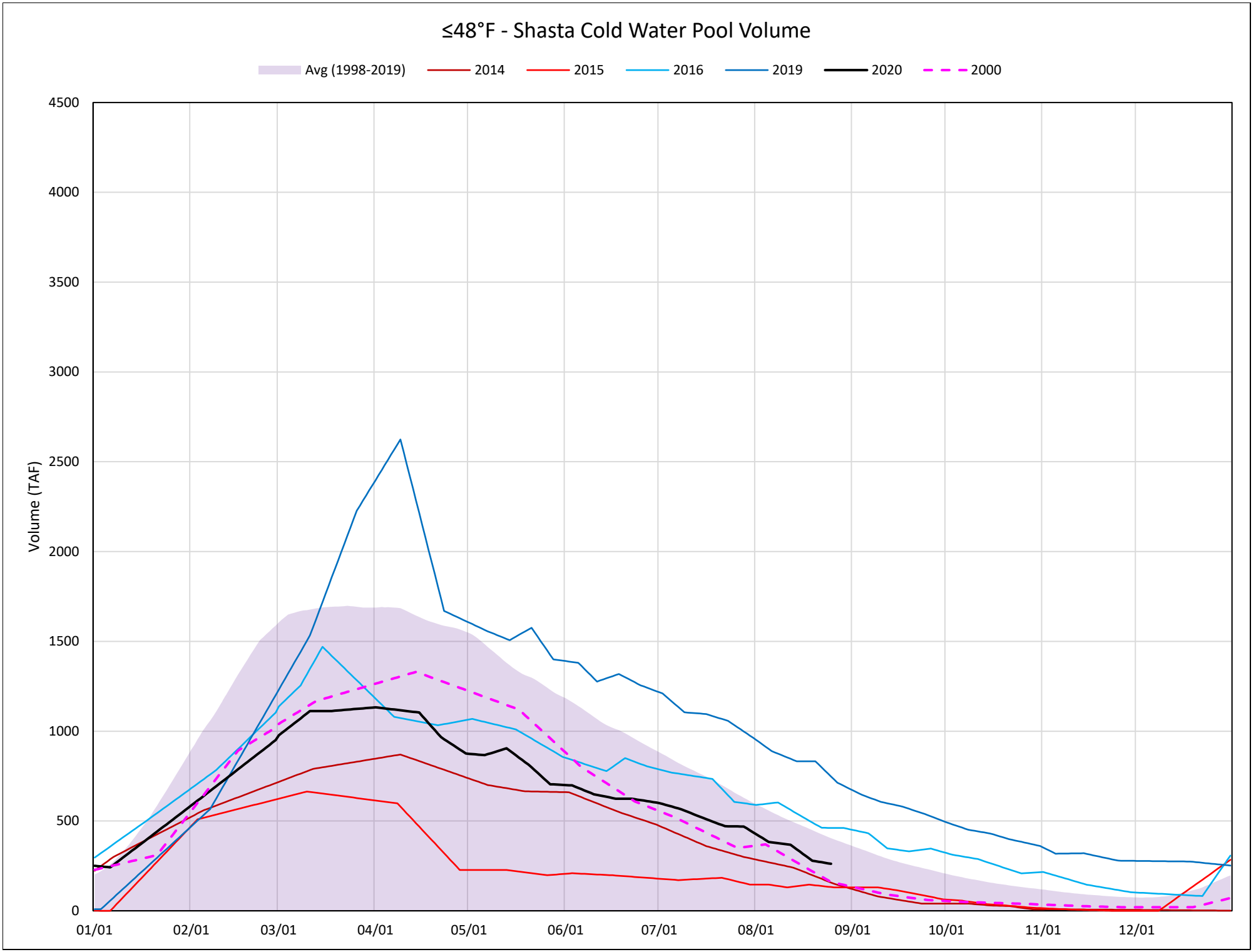
Profile data collected 08/26/2020

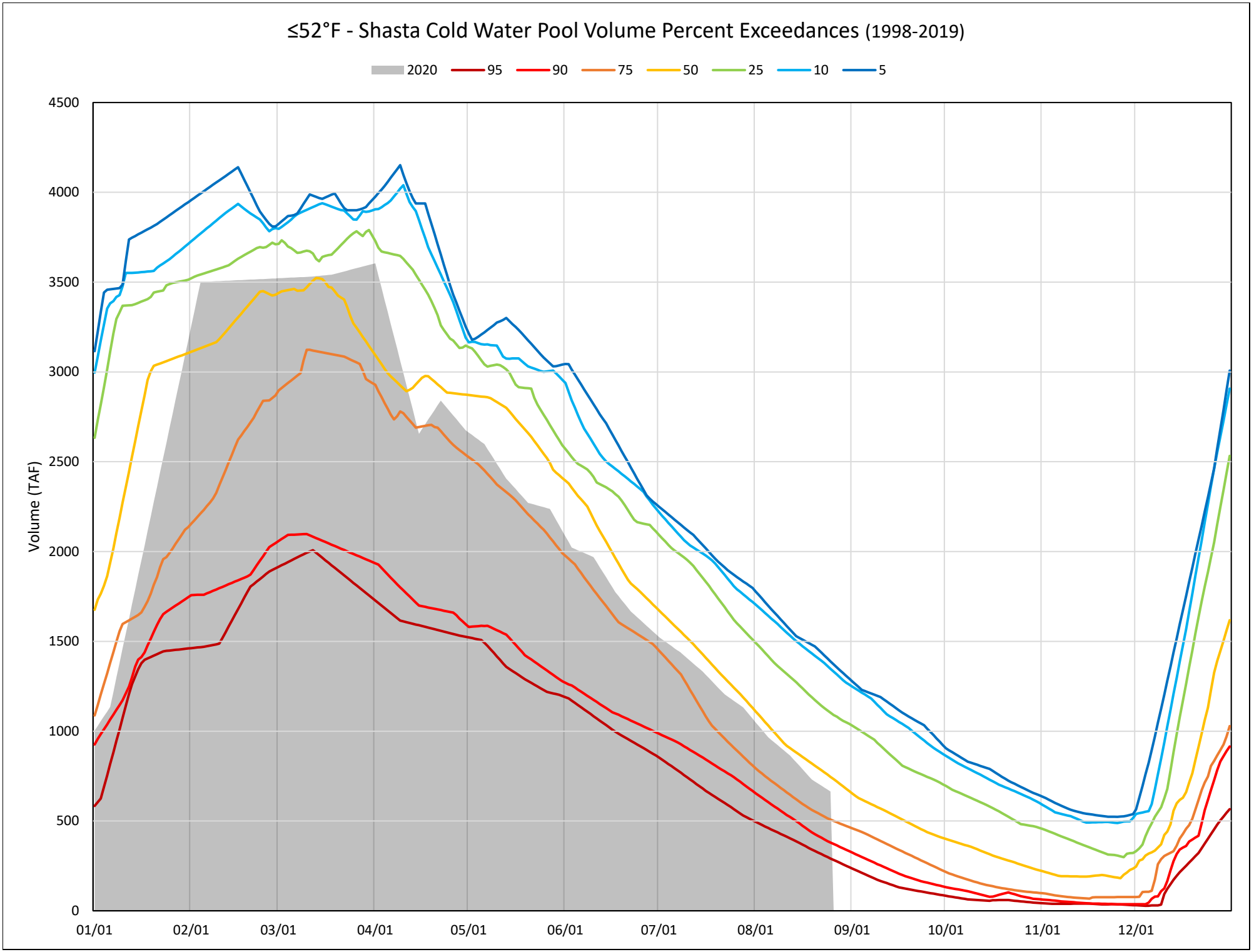


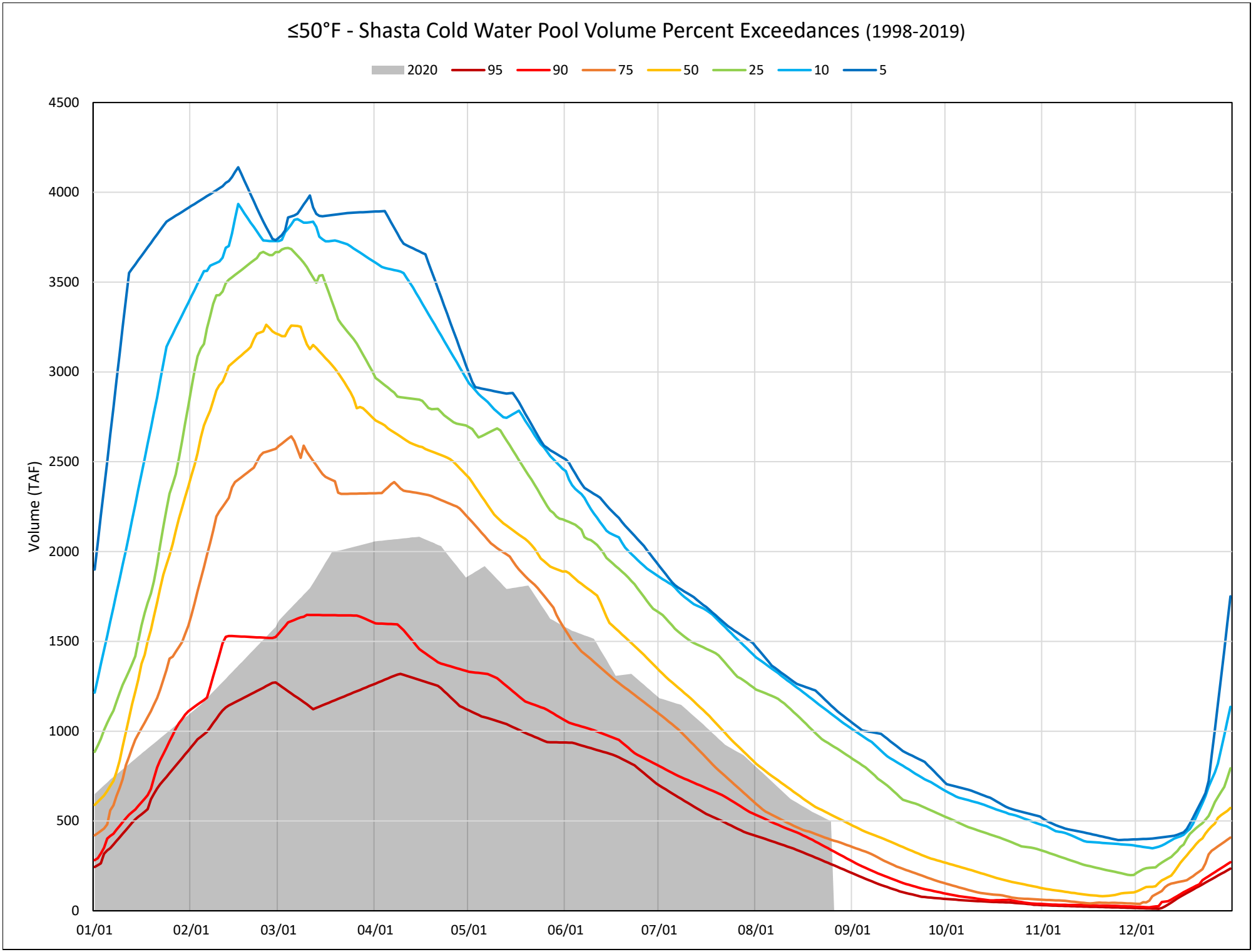
Arrows indicate open Gate or Outlet (i.e. Water flowing from this location)

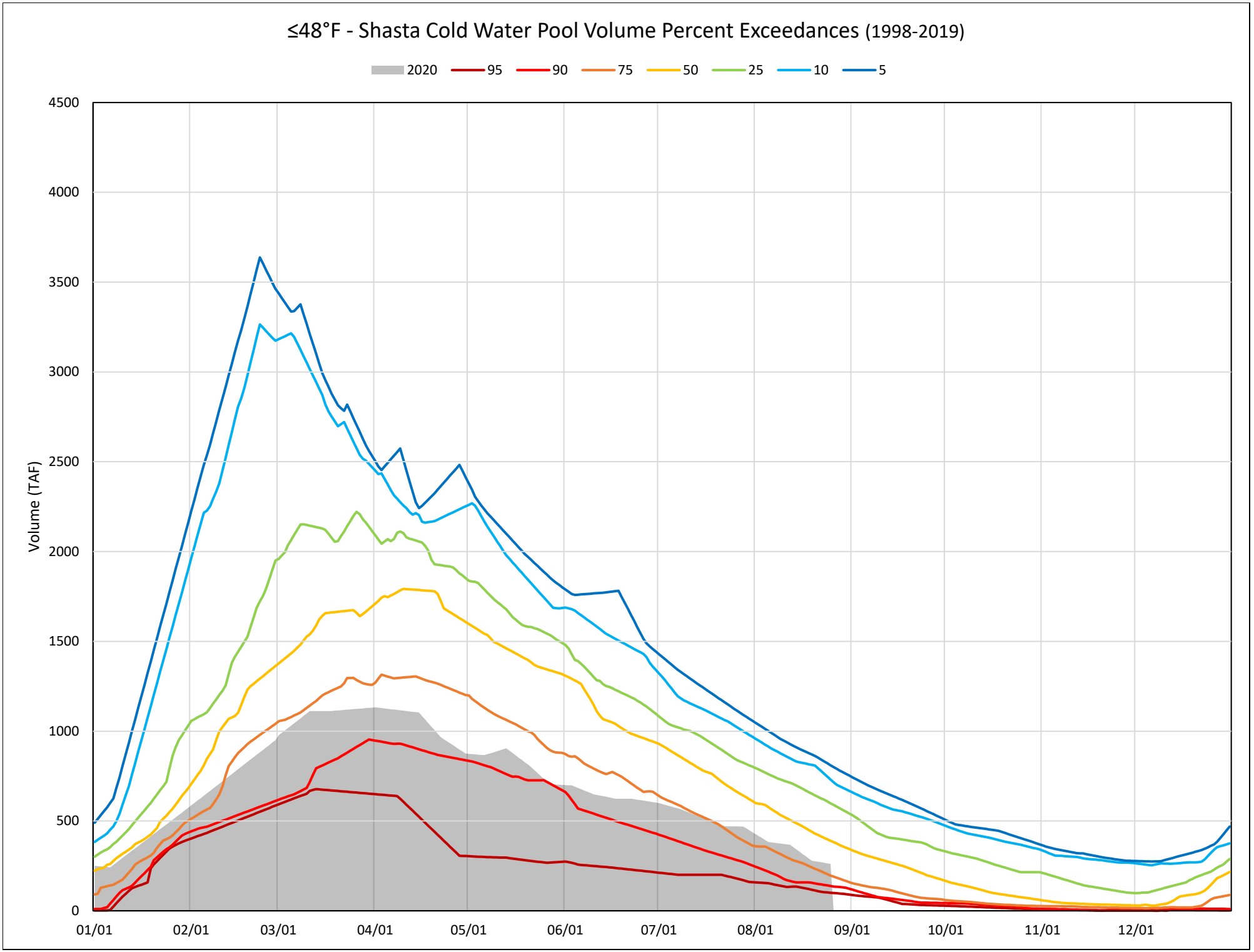

≤52°F - Shasta Cold Water Pool Volume
Avg (1998-2019)
2014
2015
2016
2019
2020
2000
Volume (TAF)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01


≤50°F - Shasta Cold Water Pool Volume
Avg (1998-2019)
2014
2015
2016
2019
2020
2000
Volume (TAF)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01


≤48°F - Shasta Cold Water Pool Volume
Avg (1998-2019)
2014
2015
2016
2019
2020
2000
Volume (TAF)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01


≤52°F - Shasta Cold Water Pool Volume Percent Exceedances (1998-2019)
2020
95
90
75
50
25
10
5
Volume (TAF)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01


≤50°F - Shasta Cold Water Pool Volume Percent Exceedances (1998-2019)
2020
95
90
75
50
25
10
5
Volume (TAF)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01


≤48°F - Shasta Cold Water Pool Volume Percent Exceedances (1998-2019)
2020
95
90
75
50
25
10
5
Volume (TAF)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01

Shasta Lake - Cold Water Pool Comparison by Year for Specified Date

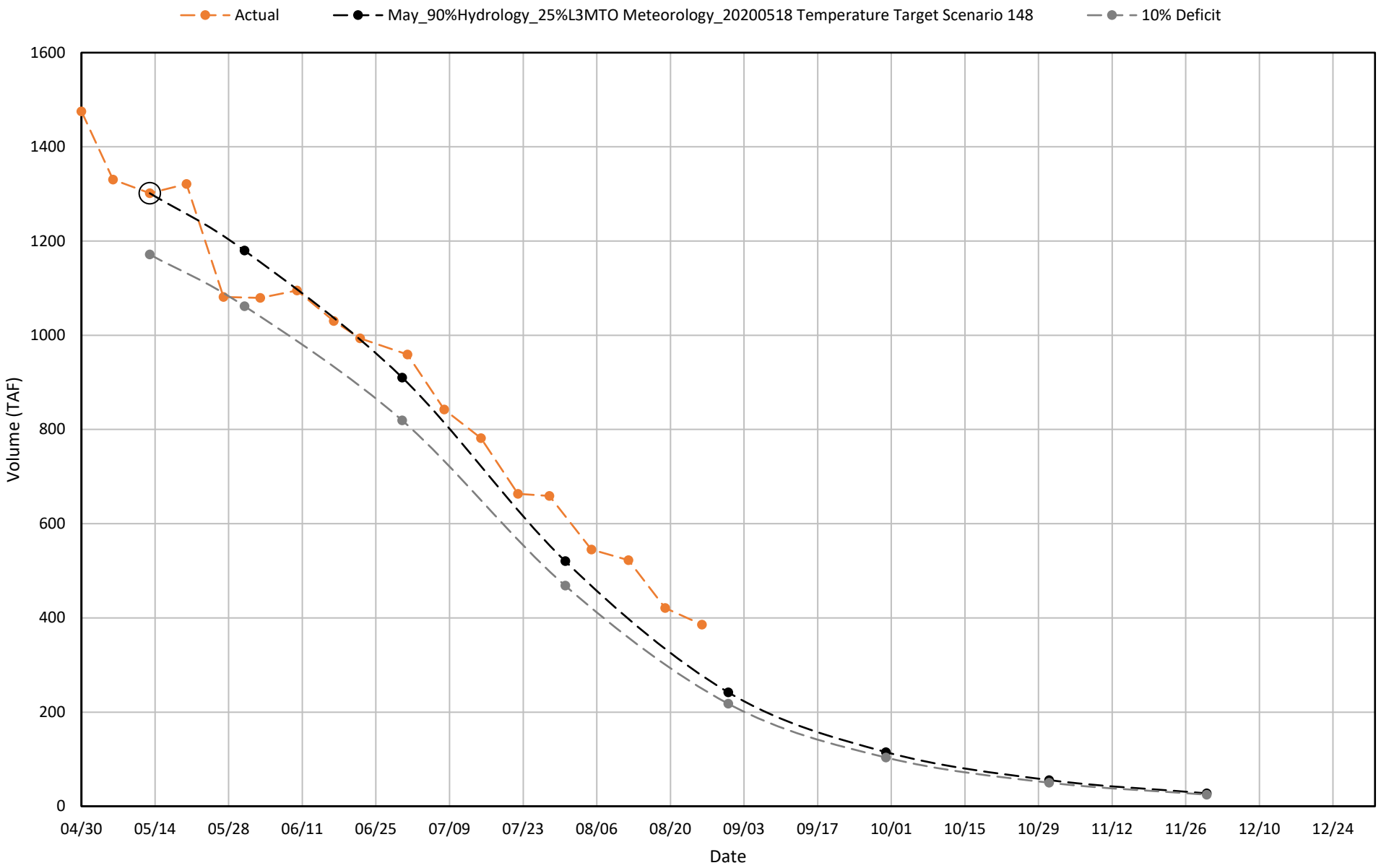
Aug-26 2020	Δ TAF				% Δ			
	≤52°	≤50°	≤48°	Abs. Avg.	≤52°	≤50°	≤48°	Abs. Avg.
1998	50	-88	-109	82	8	-18	-42	22
1999	390	406	431	409	59	81	165	102
2000	-54	-79	-101	78	-8	-16	-39	21
2001	-101	-27	113	81	-15	-5	43	21
2002	208	217	257	227	31	44	98	58
2003	113	-104	-166	128	17	-21	-64	34
2004	-242	-148	-38	143	-36	-30	-15	27
2005	-160	-133	-53	115	-24	-27	-20	24
2006	258	191	195	215	39	38	74	51
2007	-79	13	144	79	-12	3	55	23
2008	-302	-165	33	167	-45	-33	12	30
2009	-170	-81	71	107	-26	-16	27	23
2010	627	496	375	499	94	99	143	112
2011	707	621	560	629	106	125	214	148
2012	369	394	325	363	56	79	124	86
2013	-15	59	166	80	-2	12	63	26
2014	-386	-252	-105	247	-58	-50	-40	50
2015	-155	-103	-129	129	-23	-21	-49	31
2016	604	546	200	450	91	109	77	92
2017	585	481	389	485	88	96	149	111
2018	272	210	106	196	41	42	41	41
2019	728	649	486	621	110	130	186	142
2020	0	0	0	0	0	0	0	0

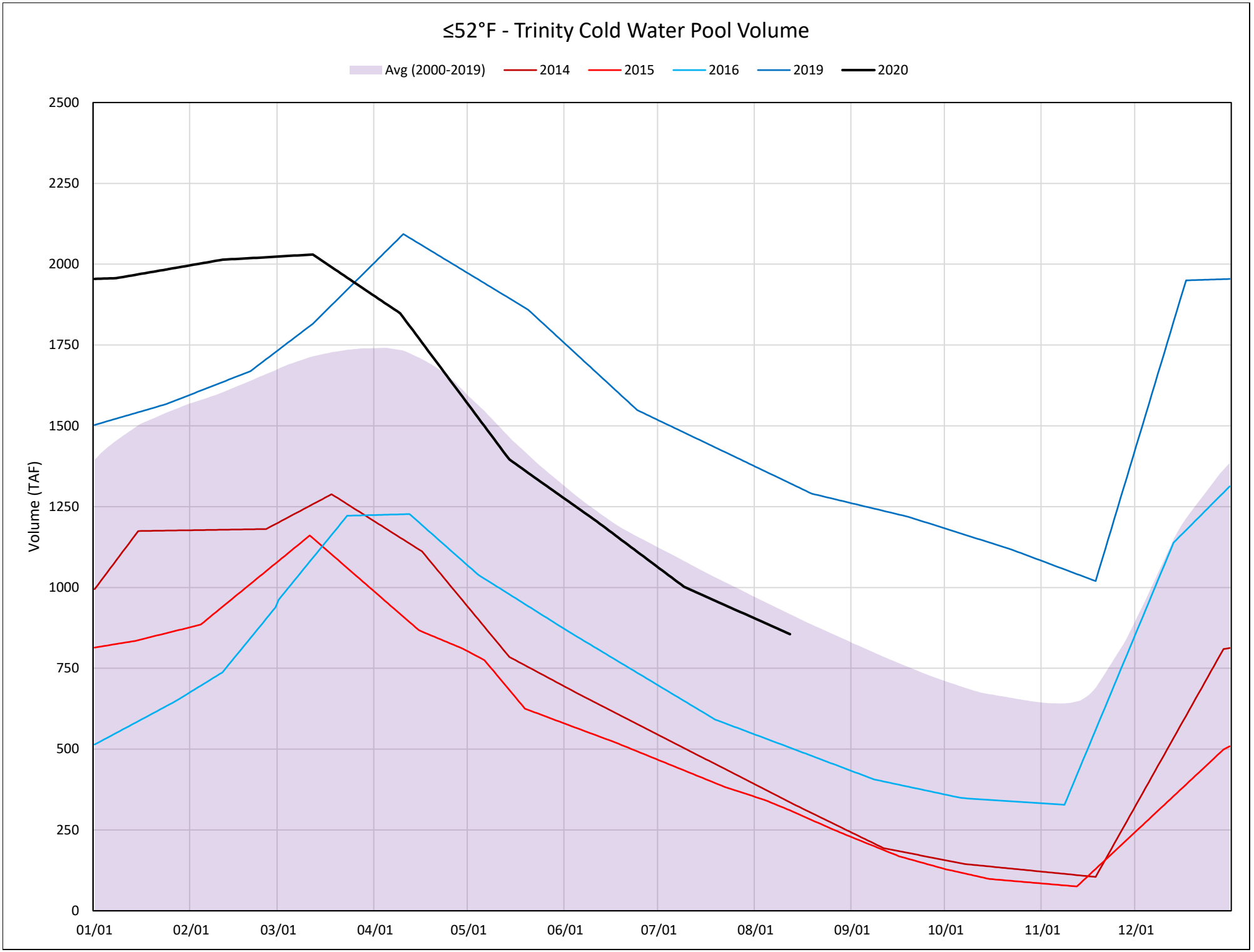
Historic - Current

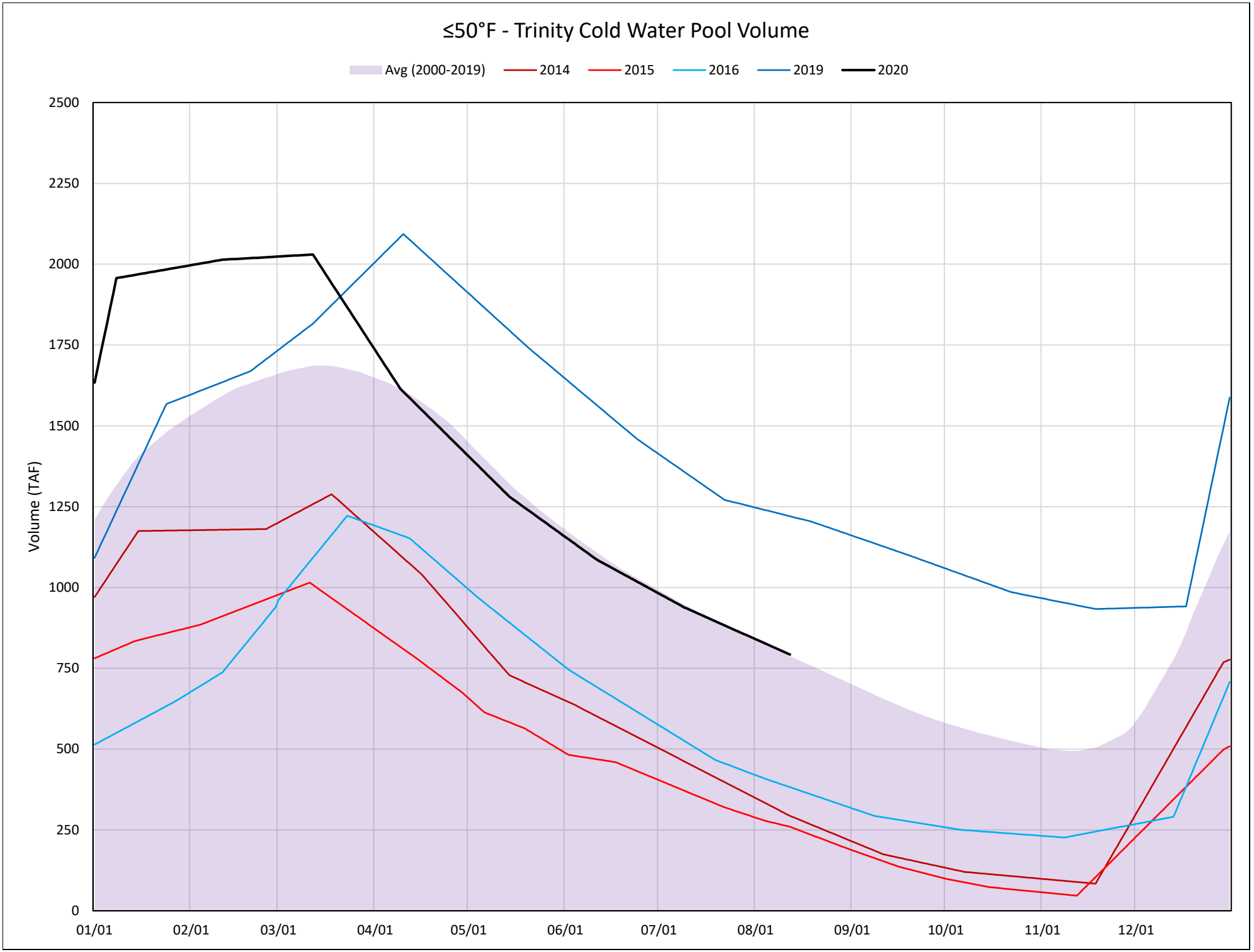
(Historic - Current) / Current

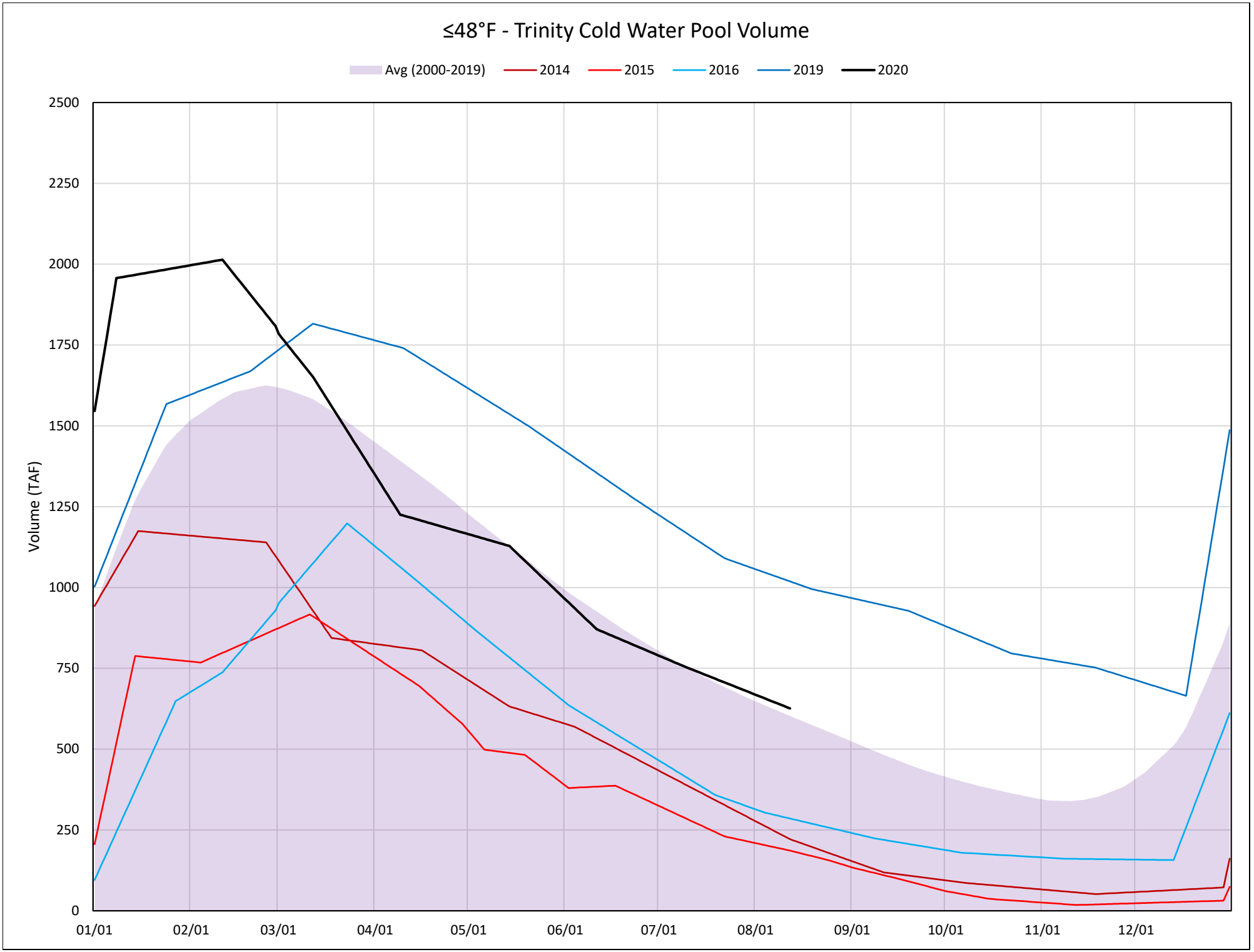
Printed: 2020.08.26

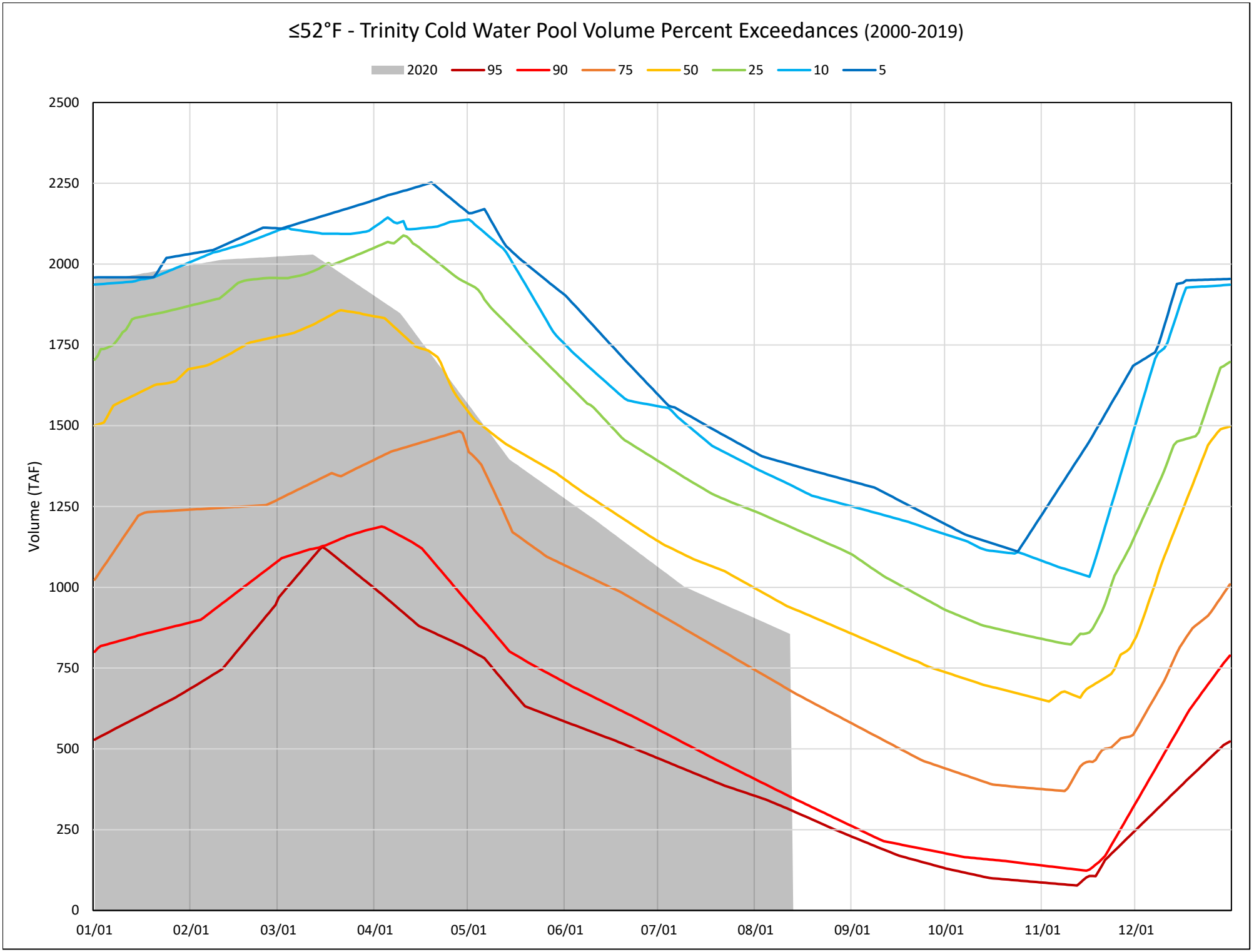
2020 Shasta Cold Water Pool Volume ≤49°F

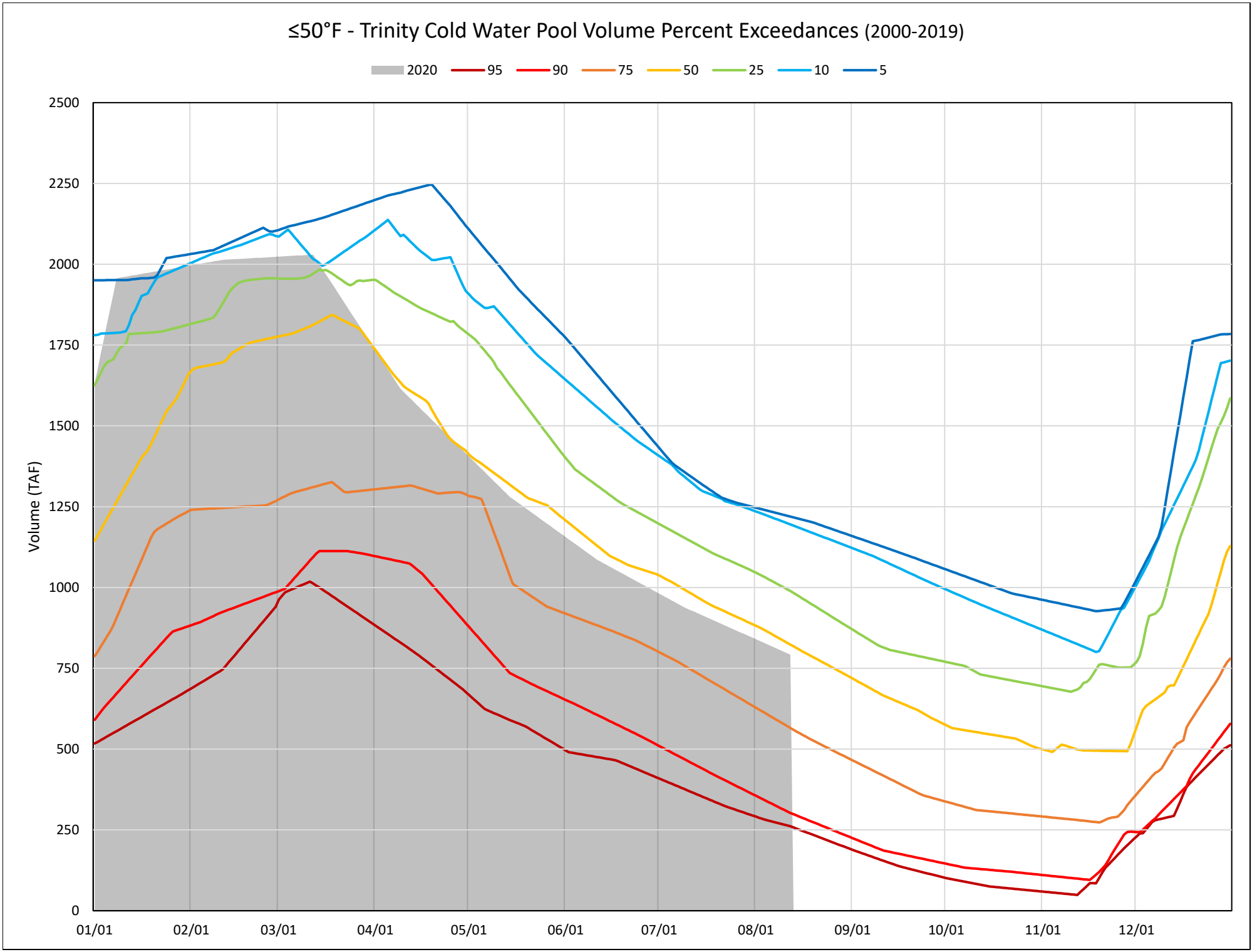


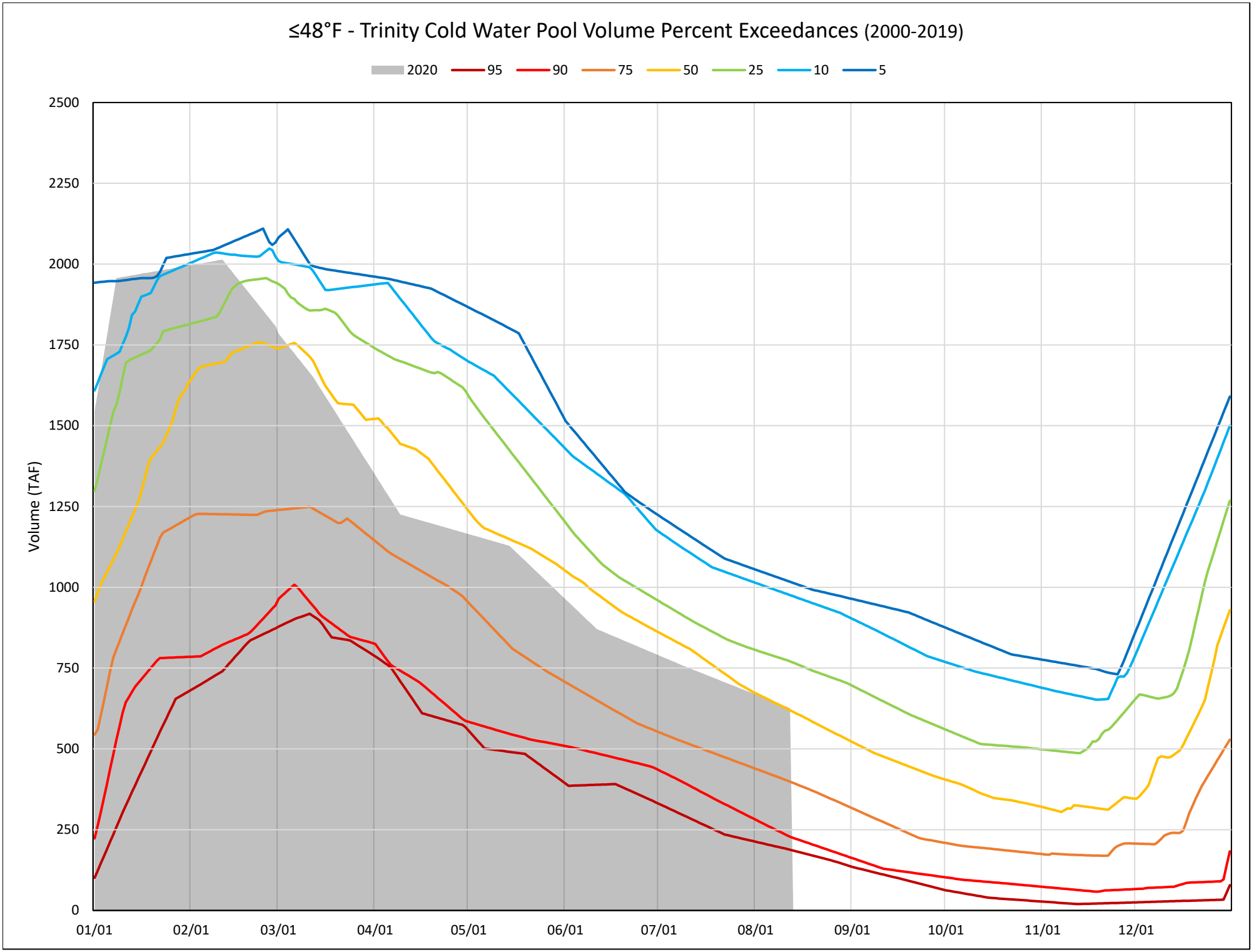

≤52°F - Trinity Cold Water Pool Volume
Avg (2000-2019)
2014
2015
2016
2019
2020
Volume (TAF)
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01


≤50°F - Trinity Cold Water Pool Volume
Avg (2000-2019)
2014
2015
2016
2019
2020
Volume (TAF)
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01


≤48°F - Trinity Cold Water Pool Volume
Avg (2000-2019)
2014
2015
2016
2019
2020
Volume (TAF)
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01


≤52°F - Trinity Cold Water Pool Volume Percent Exceedances (2000-2019)
2020
95
90
75
50
25
10
5
Volume (TAF)
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01


≤50°F - Trinity Cold Water Pool Volume Percent Exceedances (2000-2019)
2020
95
90
75
50
25
10
5
Volume (TAF)
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01


≤48°F - Trinity Cold Water Pool Volume Percent Exceedances (2000-2019)
2020
95
90
75
50
25
10
5
Volume (TAF)
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01

Trinity Lake - Cold Water Pool Comparison by Year for Specified Date

Aug-13 2020	Δ TAF				% Δ			
	≤52°	≤50°	≤48°	Abs. Avg.	≤52°	≤50°	≤48°	Abs. Avg.
2000	171	47	-9	76	20	6	-1	9
2001	34	-18	-4	19	4	-2	-1	2
2002	44	14	52	37	5	2	8	5
2003	418	218	126	254	49	28	20	32
2004	74	-29	-92	65	9	-4	-15	9
2005	261	134	-53	149	30	17	-8	19
2006	404	295	190	296	47	37	30	38
2007	91	66	108	88	11	8	17	12
2008	-197	-259	-250	235	-23	-33	-40	32
2009	-285	-317	-301	301	-33	-40	-48	40
2010	63	-47	-161	90	7	-6	-26	13
2011	528	409	298	412	62	52	48	54
2012	355	341	355	351	42	43	57	47
2013	-107	-131	-113	117	-13	-17	-18	16
2014	-520	-499	-405	475	-61	-63	-65	63
2015	-545	-533	-440	506	-64	-67	-70	67
2016	-351	-410	-341	367	-41	-52	-54	49
2017	195	73	28	99	23	9	4	12
2018	142	117	151	137	17	15	24	19
2019	467	428	393	429	55	54	63	57
2020	0	0	0	0	0	0	0	0

Historic - Current

(Historic - Current) / Current

August 26, 2020

Upper Sacramento River – August 2020 Preliminary Temperature Analysis

Summary of Temperature Results by Month (Monthly Average Temperature °F)

Model Run	Location	Aug	Sep*	Oct*
90% Hydro. - 25% L3MTO Met. Scenario 148	Keswick Dam KWK	52.9	See Fig. 5	See Fig. 5
	Sac. R. abv Clear Creek CCR	53.2	See Fig. 6	See Fig. 6
	Airport Road	53.8	n/a	n/a
	Balls Ferry BSF	54.7	See Fig. 7	See Fig. 7
90% Hydro. - 25% L3MTO Met. Scenario 148 – Extend 54°F in September	Keswick Dam KWK	52.9	See Fig. 5	See Fig. 5
	Sac. R. abv Clear Creek CCR	53.2	See Fig. 6	See Fig. 6
	Airport Road	53.8	n/a	n/a
	Balls Ferry BSF	54.7	See Fig. 7	See Fig. 7

Summary of Shasta Lake Cold Water Pool and TCD Operation

Model Run	End of September Cold Water Pool <56°F (TAF)	First Side Gate Use (Date)	Full Side Gate Use (Date)
90% Hydro. - 25% L3MTO Met. Scenario 148	482	8/19	10/30
90% Hydro. - 25% L3MTO Met. Scenario 148 – Extend 54°F in September	467	8/19	9/21

Model Run Date August 25, 2020

* The HEC5Q model output is displayed for the months April through August. Based on past analysis, the temperature model does not perform well in late September and October. One factor is that the modeled release temperatures are cooler than has historically been achieved when all release is through the side gates (lowest gates), especially when there's a large temperature gradient between the pressure relief gates (PRG) and the side gates.

For the months of September and October, ranges in possible outcomes are illustrated with the Fall Temperature Index (graphics above Figures 5-7). This relationship is an end of September Lake Shasta Volume less than 56°F and likely downstream temperature performance for the early fall months. Estimated temperatures for September and October may fall into a range indicated within the Fall Temperature Index (graphical chart), illustrating historical performance. However, this range should be viewed as an element of uncertainty based on past performance, not a simulation or projection of temperature management operations or results.

Temperature Analysis Results:

Modeling runs explore Sacramento River compliance performance above Clear Creek confluence and Balls Ferry locations by varying Shasta tailbay temperature targets. The temperature results for the Sacramento River between Keswick Dam and Balls Ferry and the Trinity River are shown in Figures 1-4. The relationship between end-of-September lake volume below 56°F and a downstream Sacramento River compliance location through fall is based on the Figures 5-7.

Temperature Model Inputs, Assumptions, Limitations and Uncertainty:

1. The latest available profiles for Shasta, Trinity, and Whiskeytown were taken on August 19, August 13, and August 18, respectively. Initial temperature profiles are adjusted and noted at Whiskeytown and Trinity using simulated results if the length of time between monitoring is large. Model results are sensitive to initial reservoir temperature conditions and the model performs best

under highly stratified conditions. The temperature profiles prior to May do not yet exhibit conditions for ideal model computations (still nearly isothermal conditions). The model performs well after the reservoir stratifies, typically in late spring (i.e. end of April). The concern this year is assuming over or under estimations with variable hydrologic and meteorological conditions and not capturing the stratification with sufficient detail to project into the future with confidence.

2. Guidance on forecasted flows from the creeks (e.g., Cow, Cottonwood, Battle, etc.) between Keswick Dam and Bend Bridge are not available beyond 5 days. Creek flows developed from the historical record that most closely reflects current conditions were used for all model runs. The resulting creek flows can cause significant additional warming in the upper Sacramento River during spring.

3. Operation is based on the August 2020 Operation Outlooks (monthly flows, reservoir release, and end-of-month reservoir storage) for the 90%- and 50%-exceedances (when available), with minor modifications to accommodate for within month real-time operations (e.g. flood operations, underestimated system demands/requirements, etc.). After September, historical information is used for inflow. Trinity Lake inflows are updated with the CNRFC 90% runoff exceedance for the 90% and DWR Bulletin 120 for the 50% runoff exceedance studies. The Operation Outlook assumes a representation of the State and Federal regulatory environment under NMFS and FWS 2019 Biological Opinions.

4. Although mean daily flows and releases are temperature model inputs, they are based on the mean monthly values from the operation outlooks. Mean daily flow patterns are user defined and are generalized representations. It is important to note that these outlooks do not suggest a certain actual future outcome, but rather the statistical likelihood of an event occurring, including, but not limited to, projected storage and releases. Thus, the outlooks do not provide exact end of month storages or flow rates but general projections that will likely fall within the range of uncertainty based on the different hydrologic runoff conditions between the 90% and 50% runoff exceedance hydrology.

5. Cottonwood Creek flows, Keswick to Bend Bridge local flows, and ACID diversions are mean daily synthesized flows based on the available historical record for a 1922-2002 study period. Side-flows were adjusted to a 95% historical exceedance for both the 90% and 50% runoff exceedance studies.

6. Meteorological inputs represent historical (1985 – 2017) monthly mean equilibrium temperature non-exceedance at 25% and 50% (when available) patterned after like months on a 6-hour time-step (for months prior to April). Assumed inflows temperature remain static inputs and do not vary with the assumed meteorology. Tools to use local three-month-temperature outlooks (L3MTO), driven by the NOAA NWS Climate Prediction Center (CPC) are used beginning in April.

7. Meteorology, as well as the flow volume and pattern, significantly influences reservoir inflow temperatures and downstream tributary temperatures; and consequently, the development of the cold-water pool during winter and early spring, which is still uncertain prior to the end of April.

8. Modified model coefficients more closely represent actual Keswick Dam temperatures. As a result, temperature predictions downstream of Keswick Dam are likely to be warmer than actual.

9. The model is specifically being applied to generate the most accurate results at the Sacramento River above Clear Creek confluence location (CCR).

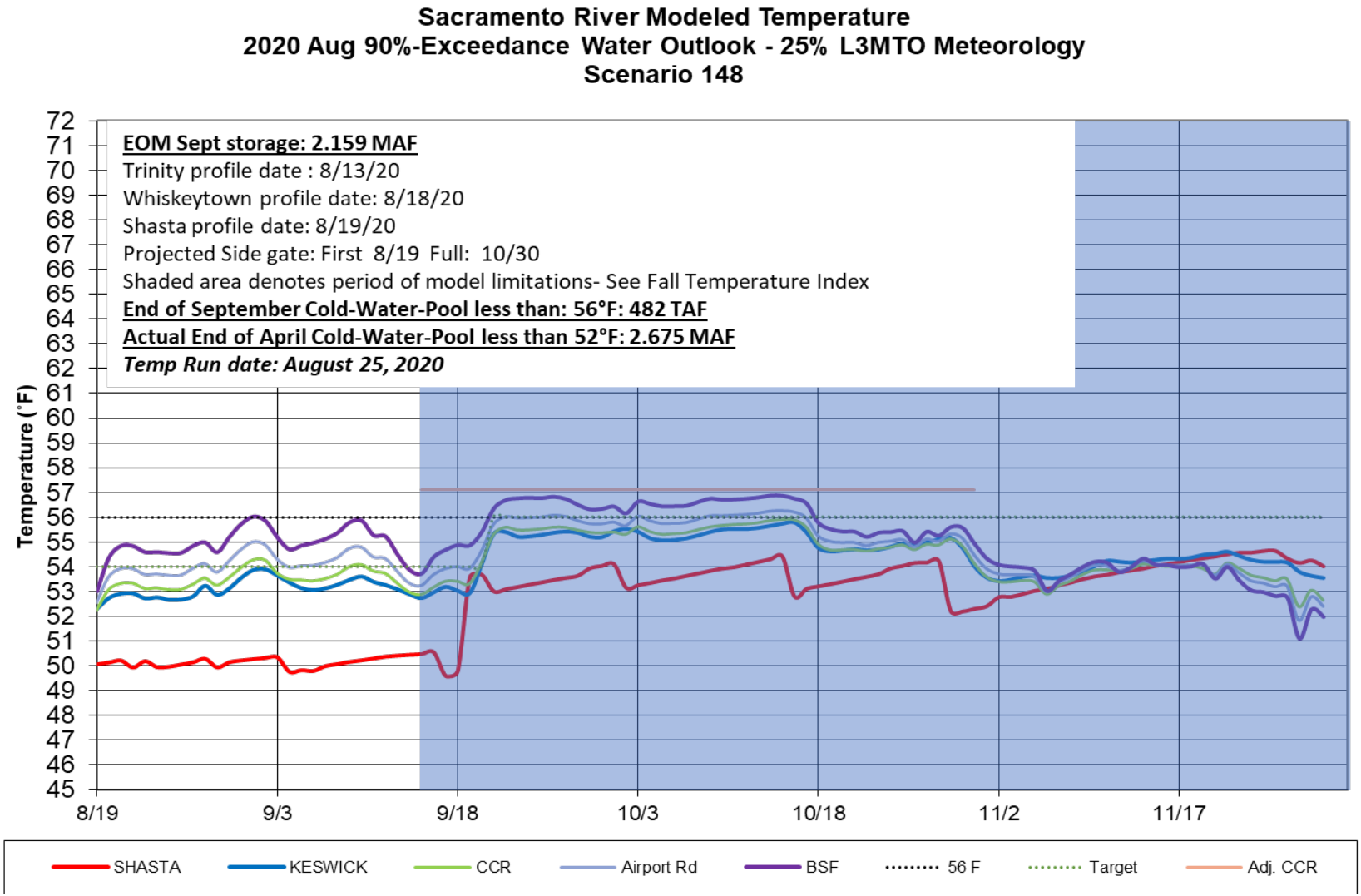


Figure 1. August 2020 simulated Sacramento River temperatures 90% runoff exceedance hydrology and 25% L3MTO meteorology with Scenario 148.

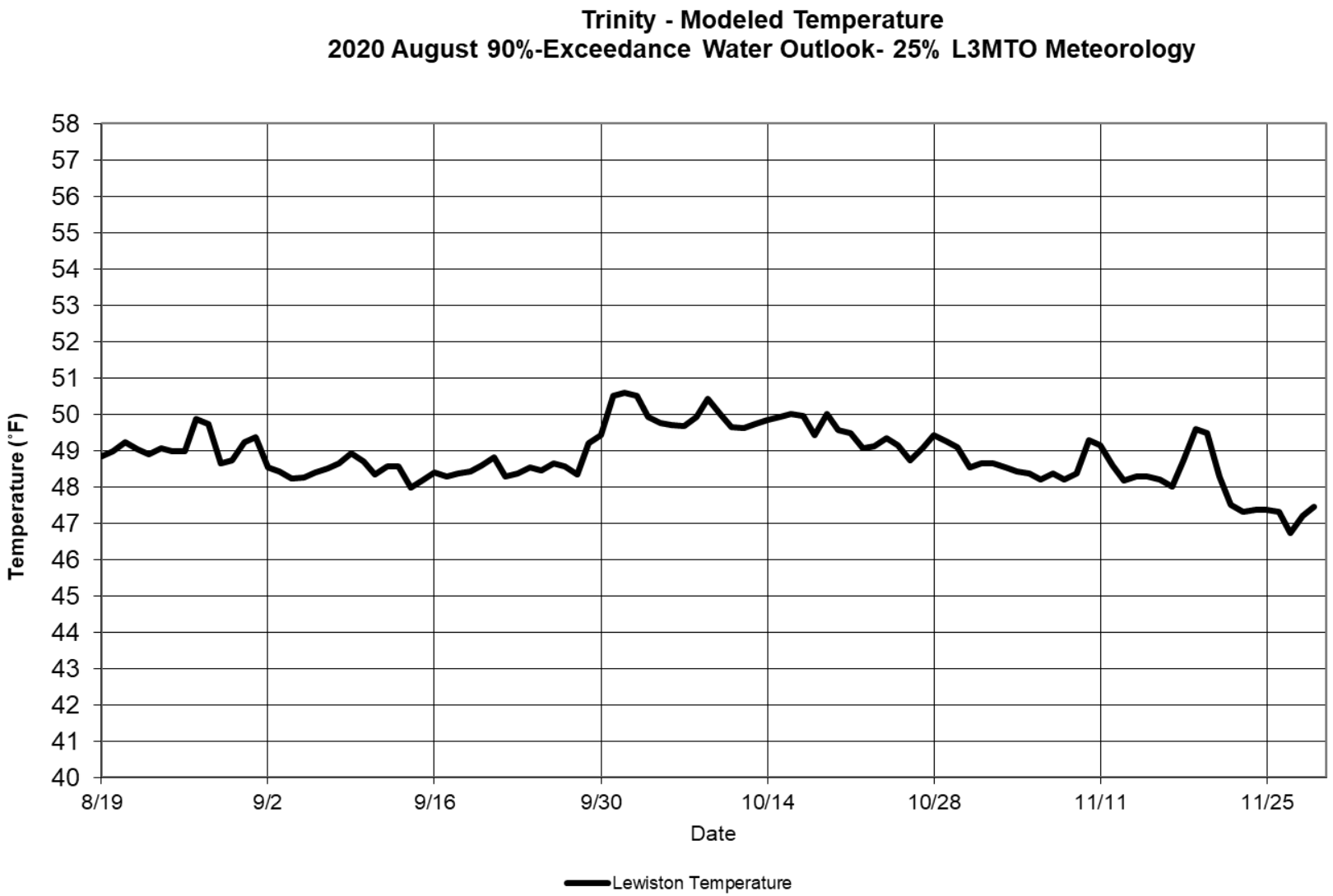


Figure 2. August 2020 simulated Trinity River temperatures 90% runoff exceedance hydrology and 25% L3MTO meteorology with Scenario 148.

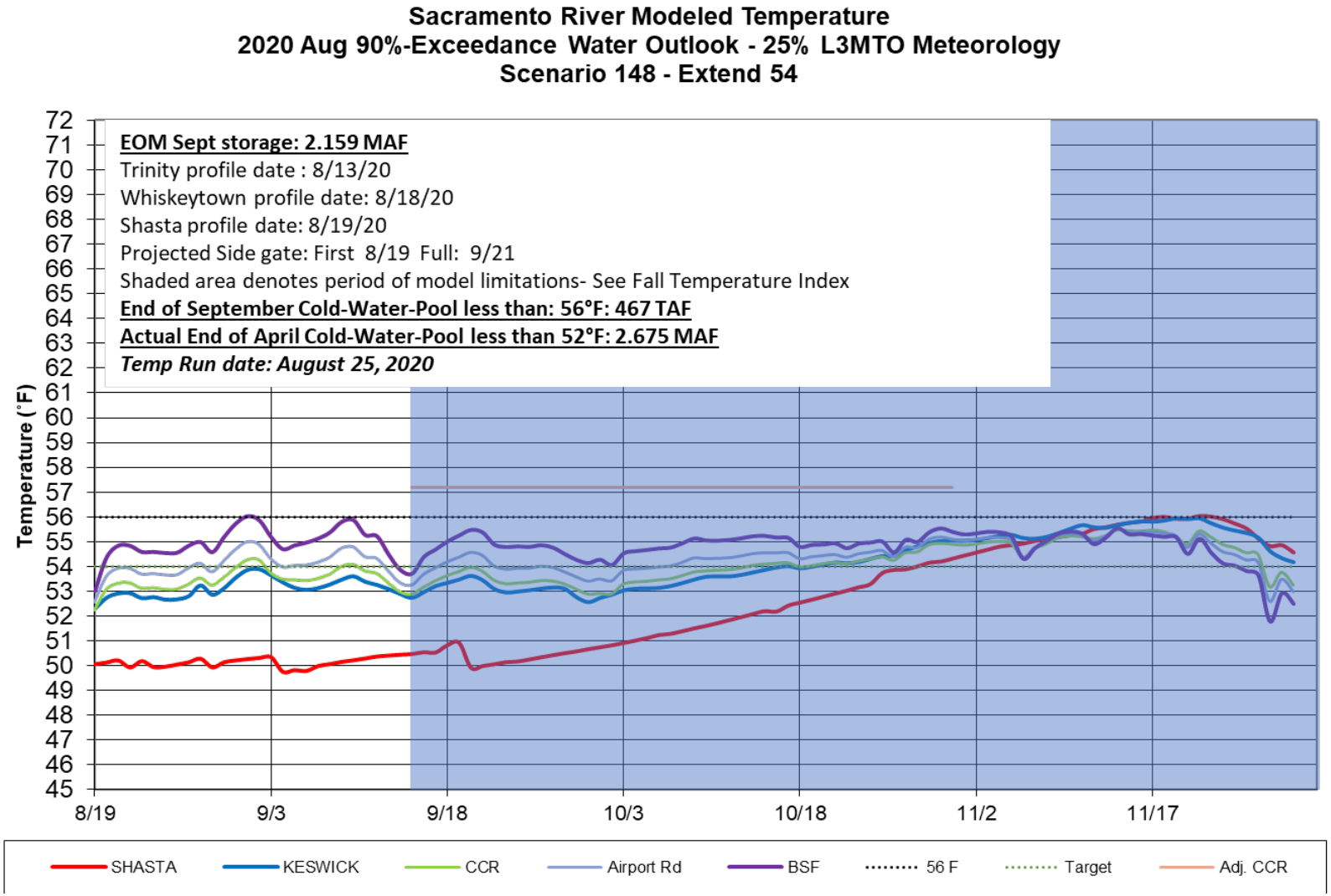


Figure 3. August 2020 simulated Sacramento River temperatures 90% runoff exceedance hydrology and 25% L3MTO meteorology Extending 54 in September.

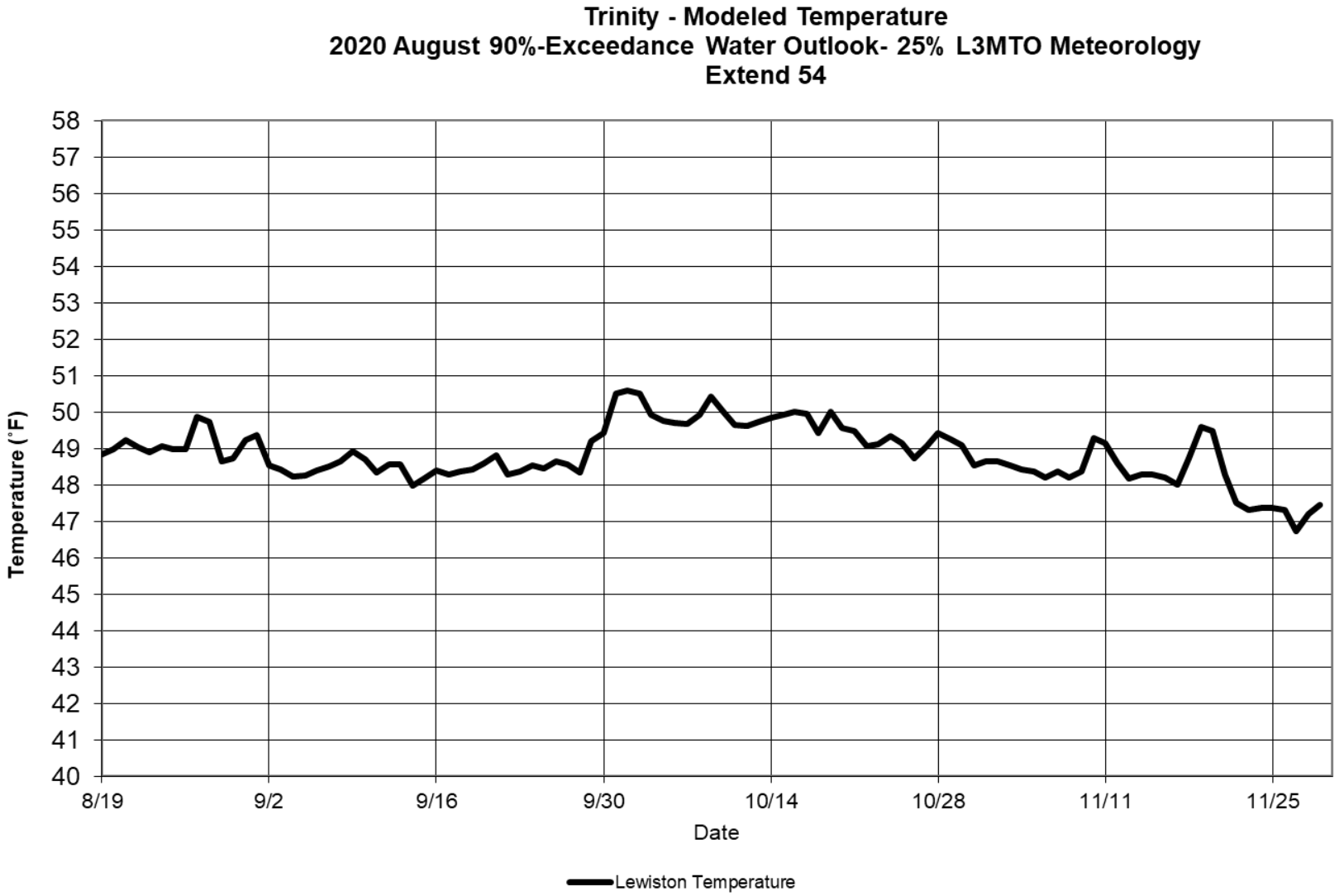


Figure 4. August 2020 simulated Trinity River temperatures 90% runoff exceedance hydrology and 25% L3MTO meteorology Extending 54.

Figures 5-7 Model Performance and Fall Temperature Index:

1. Based on past analyses, the temperature model does not perform well in late September and October. One factor is that the modeled release temperatures are cooler than has historically been achieved when all release is through the side gates (lowest gates), especially when there's a large temperature gradient between the pressure relief gates (PRG) and the side gates.
2. Based on historical records, the end-of-September Lake Shasta volume below 56˚F is a good indicator of fall water temperature in the river reaches.
3. Based on these records and estimates, the charts below illustrate a range of uncertainty in the expected river temperatures based on the end-of-September lake volume less than 56˚F.

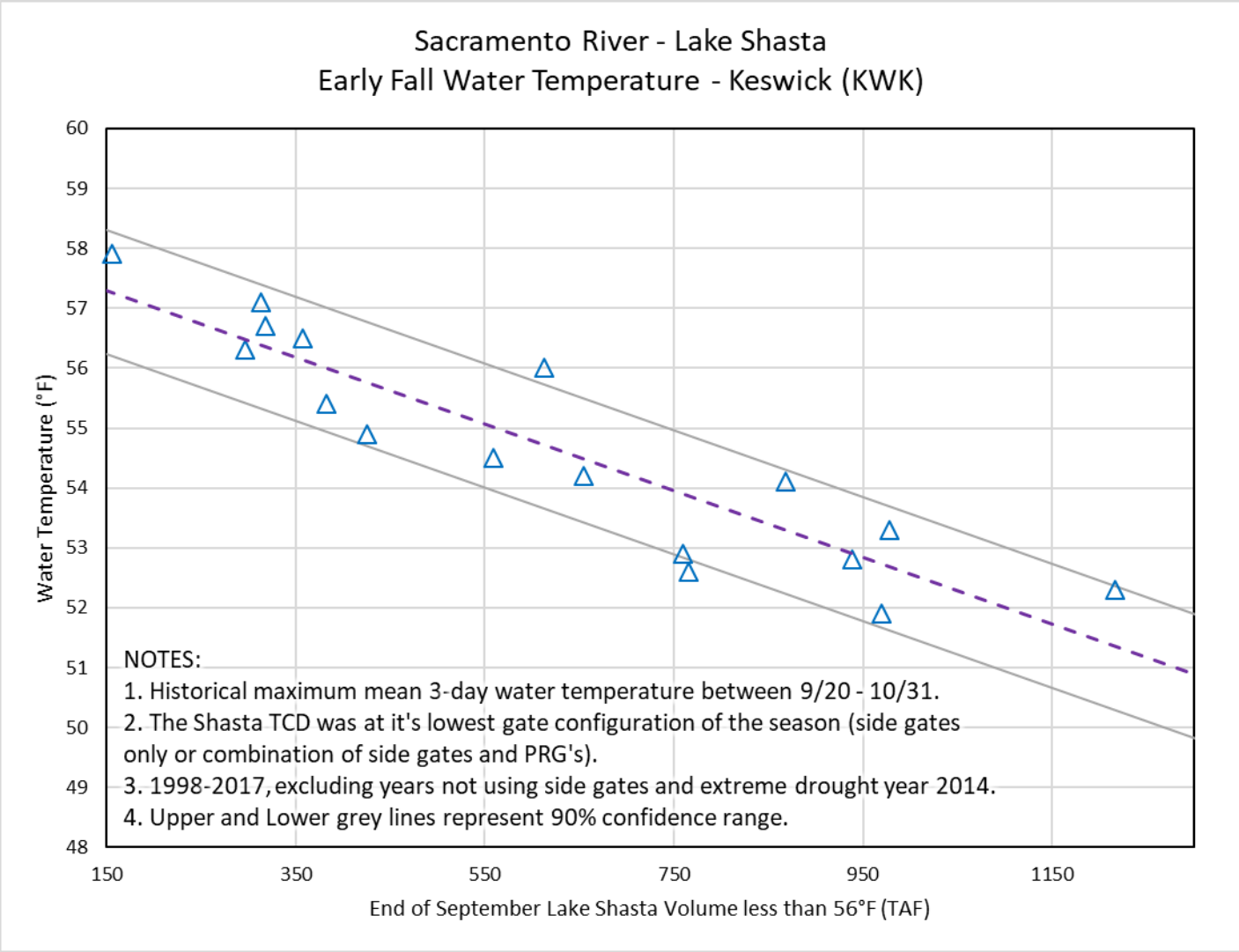


Figure 5. Historical relationship between Lake Shasta cold-water-pool characteristics and early fall Keswick water temperature.

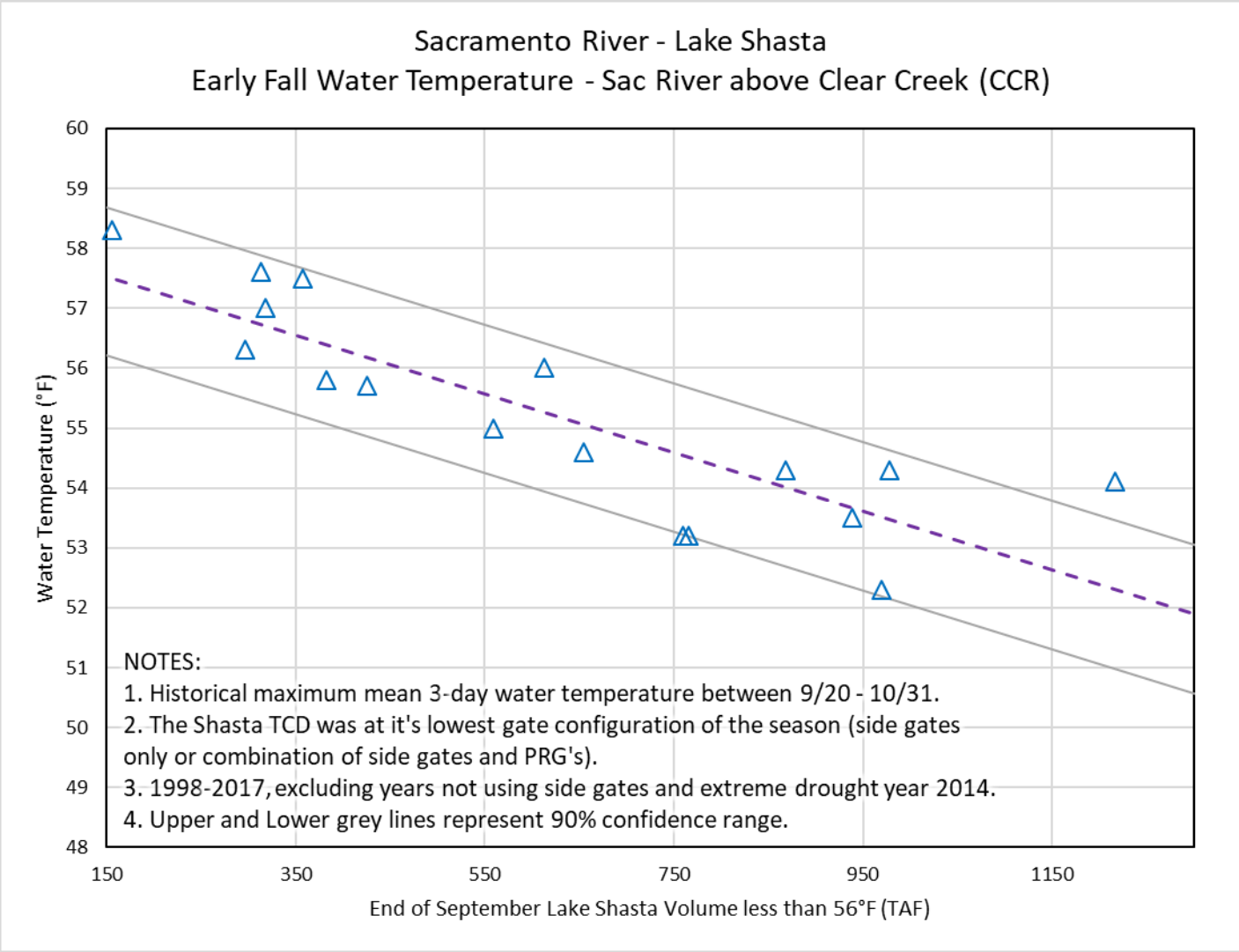


Figure 6. Historical relationship between Lake Shasta cold-water-pool characteristics and early fall Sacramento River above Clear Creek confluence water temperature.

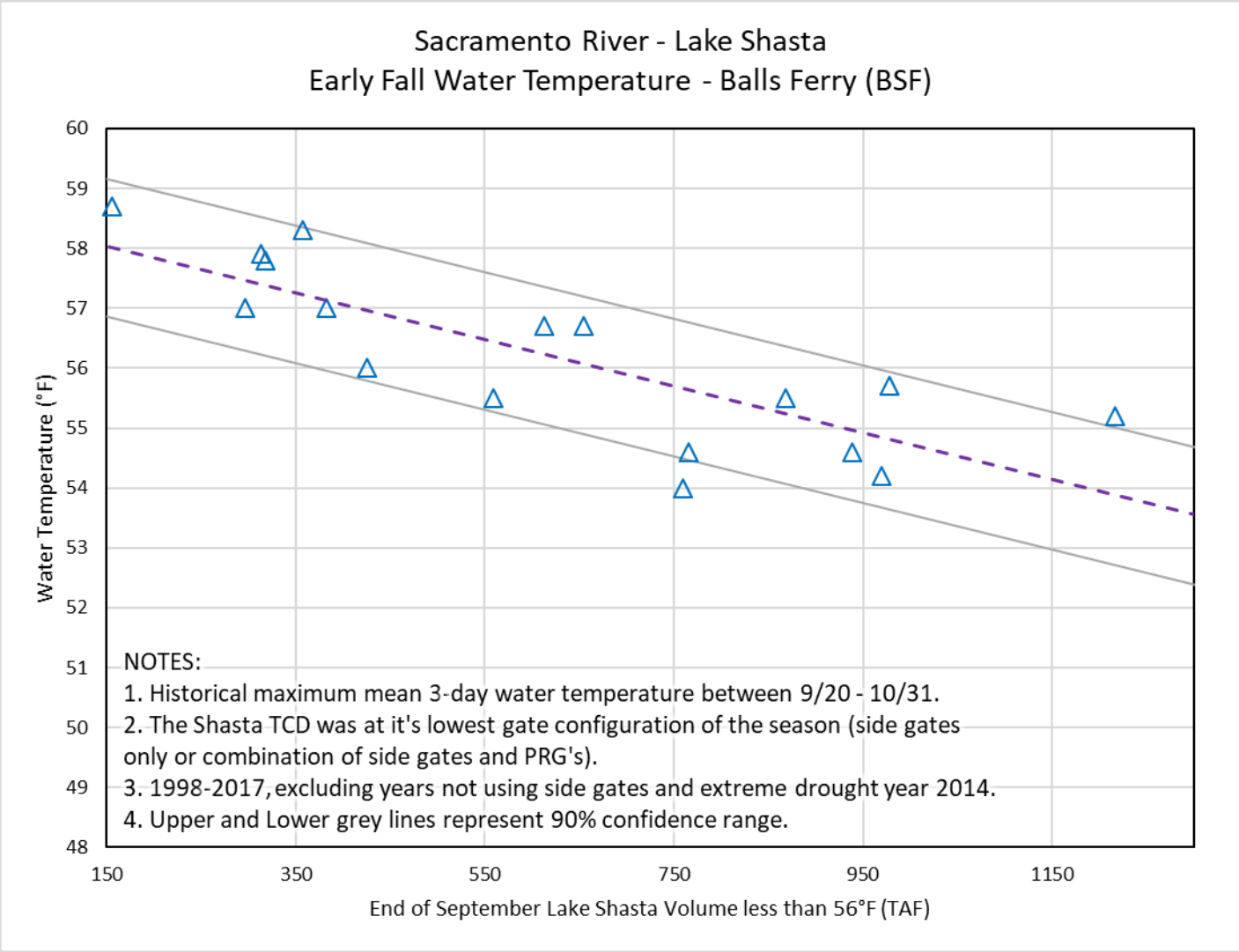
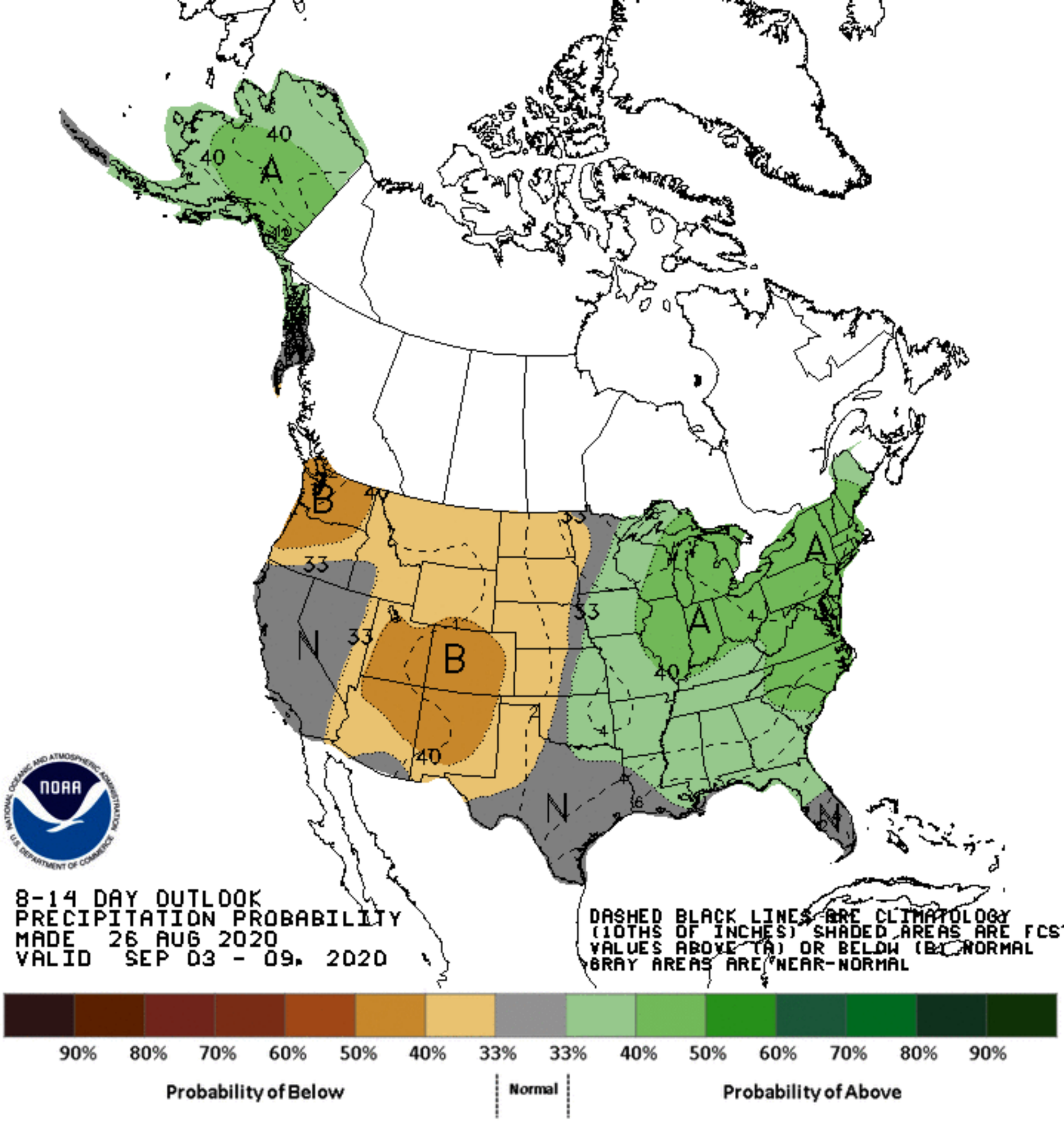
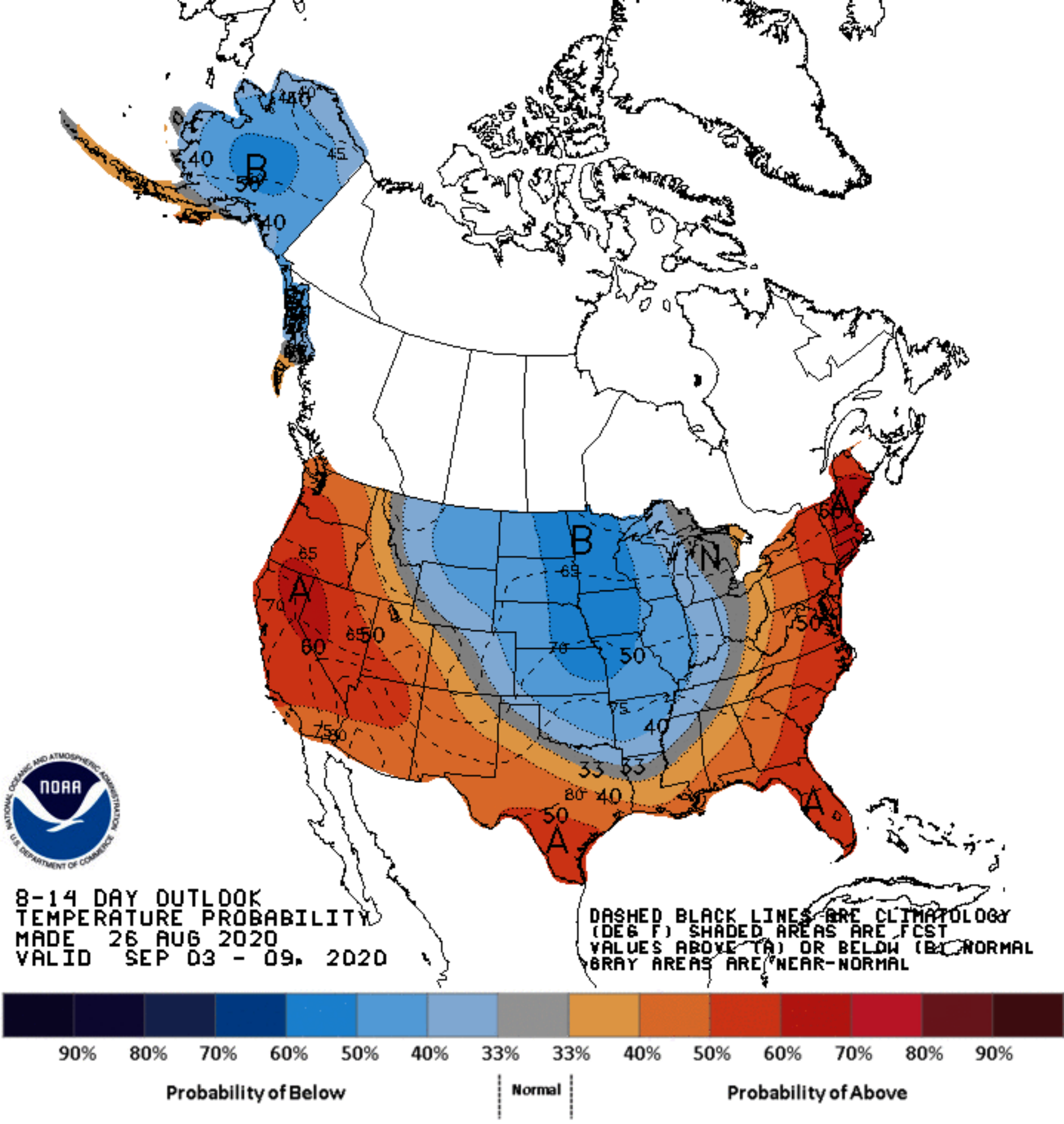


Figure 7. Historical relationship between Lake Shasta cold-water-pool characteristics and early fall Balls Ferry water temperature.


40
40
A
B
40
33
33
N
33
B
40
33
A
A
4
40
4
N
6
N
8-14 DAY OUTLOOK
PRECIPITATION PROBABILITY
MADE 26 AUG 2020
VALID SEP 03 - 09, 2020
DASHED BLACK LINES ARE CLIMATOLOGY
(10THS OF INCHES) SHADED AREAS ARE FCS
VALUES ABOVE (A) OR BELOW (B) NORMAL
GRAY AREAS ARE NEAR-NORMAL
90% 80% 70% 60% 50% 40% 33% 33% 40% 50% 60% 70% 80% 90%
Probability of Below
Normal
Probability of Above


8-14 DAY OUTLOOK
TEMPERATURE PROBABILITY
MADE 26 AUG 2020
VALID SEP 03 - 09, 2020
DASHED BLACK LINES ARE CLIMATOLOGY (DEG F) SHADED AREAS ARE FCST VALUES ABOVE (A) OR BELOW (B) NORMAL
GRAY AREAS ARE NEAR-NORMAL
90% 80% 70% 60% 50% 40% 33% 33% 40% 50% 60% 70% 80% 90%
Probability of Below
Normal
Probability of Above

Summary Document for temperature-dependent egg mortality

Prepared by U.S. Bureau of Reclamation, Bay-Delta Office on August 26, 2020

Below are biological results from the temperature management scenarios run August 25, 2020 based on an August 19, 2020 Shasta temperature profile. These estimates are from the same planning model used in the Temperature Tier Selection Protocol this spring and summer and used in the May 20 Temperature Management Plan.

Spatially-explicit daily average Sacramento River water temperatures forecasts from the HEC-5Q model results are used as inputs to generate temperature-dependent egg mortality estimates between August 19 and September 14. Through August 18, historical temperature data is used to capture actual observed temperature during the early temperature management period. For this period, historical temperatures on the Sacramento River at Shasta Dam, Keswick Dam, above Clear Creek, Balls Ferry, Jelly's Ferry, and Bend Bridge are interpolated to estimate temperatures at river miles where simulated redds were located. Between September 15 and October 31, daily temperatures at the simulated redds' river miles are estimated based on a relationship between cold water pool volume less than 56 degrees F at the end of September in Shasta Lake and water temperatures above Clear Creek derived by Central Valley Operations. Reclamation thinks this relationship is more reliable in that time period than outputs from the HEC-5Q model. The 90% confidence interval value from this analysis was used as a conservative estimate. The average difference between the simulated temperatures above Clear Creek and the simulated temperatures at the redds' river miles during this period are used to adjust above Clear Creek estimated temperatures for each river mile. Temperature-dependent egg mortality estimates are calculated by modeling a redd's lifetime based on the days required to cross a known cumulative degree-day threshold and estimating mortality as an increasing function of temperature past a temperature threshold. Two models were used: 1. Martin et al (2017)[1] for stage independent modeling whereby a single temperature threshold is used from spawning and incubation through emergence; and 2. Anderson et al. (2018)[2] for stage dependent modeling for targeting different temperatures before, during, and after the most sensitive stages during egg incubation. The methods are applied to a set of simulated redds representative of redd construction timing and location from 2007-2014 and the results summarized on a seasonal level for comparison.

Further information about the model's assumptions and methods are described in Reclamation's Final EIS for the Reinitiation of Consultation on the Coordinated LTO of the CVP and SWP: Appendix F- Modeling.

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[1] Martin B.T. et al. (2017). Phenomenological vs. biophysical models of thermal stress in aquatic eggs. Ecology Letters 10:50-59.

[2] Anderson, J. (2018). Using river temperature to optimize fish incubation metabolism and survival: a case for mechanistic models. ResearchGate Preprint. 10.1101/257154.

Table 1: Estimated temperature dependent egg mortality using observed and HEC-5Q interpolated temperature model output and 2007-2014 spatial and temporal redd distribution.

Scenario	Stage Dependent Egg Mortality – Anderson Model (%)	Stage Independent Egg Mortality – Martin Model (%)
Scenario 148	9.8	24.7
Scenario 148 – Extend 54°F in September	9.8	25.0

Summary Document for Shasta/Keswick Operational Scenarios
Prepared by the Southwest Fisheries Science Center on August 26th, 2020

Below are results comparing two USBR scenarios ran August 26th 2020. Scenarios have the same hydrology (Input 90% exceedance) and air temperature (25% exceedance of L3MTO) inputs. Inputs from scenarios are used to generate daily average Sacramento River water temperatures using the RAFT model and associated temperature-dependent egg mortality and survival estimates using the NMFS stage-independent temperature mortality model (Martin et al. 2017) for the 2020 temperature management season.

Further details of modeling methods are at: https://oceanview.pfeg.noaa.gov/CVTEMP/

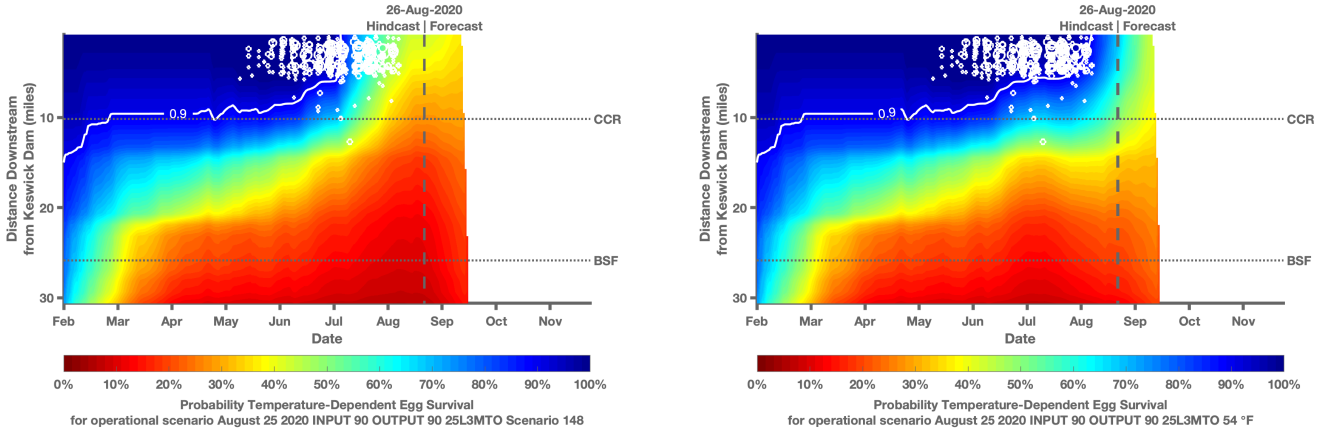

Figure1: Estimated temperature-dependent egg survival produced by the NMFS stage-independent temperature mortality model under the two August 25th 2020 scenarios. 2012-2019 redd distributions are used for all plots.

Table 1: Estimated temperature-dependent egg mortality under different scenarios assuming a 2012-2019 spatial and temporal redd distribution using output from RAFT model.

Scenario	MODEL	Mean (%)	Median (%)	Lower (%)	Upper (%)
AUGUST_25_2020_INPUT_90_OUTPUT_90_25L3MTO **Scenario 148**	RAFT	24.8	21.9	0.2	63.1
AUGUST_25_2020_INPUT_90_OUTPUT_90_25L3MTO **Scenario Extend 54 °F**	RAFT	13.9	6.8	0.1	59.4

Reference: Martin, B. T., Pike, A., John, S. N., Hamda, N., Roberts, J., Lindley, S. T. and Danner, E. M. (2017), Phenomenological vs. biophysical models of thermal stress in aquatic eggs. Ecology Letters 20: 50–59. doi:10.1111/ele.12705