RECLAMATION
Managing Water in the West

U.S. Department of the Interior
Bureau of Reclamation

Sacramento River Temperature Task Group Meeting

July 25, 2019 | 1:00 pm – 3:00 pm

Location: USFWS: Red Bluff Fish and Wildlife Office, 10950 Tyler Rd, Red Bluff, CA

Conference Line: 877-417-6209

Participant code: 1593030

Agenda

- Introductions
- Meeting Purpose and Overview
- Fishery update
- Hydrology & Operations update (information is available on web-pages)
    - Daily Operation
    - Summary
    - 8-Station Index and Snow Water Content
    - Operations Outlook
    - Mean Daily Water Temperatures
    - Redding 10-Day Forecasted Air Temperatures
    - Sac River Gage temp plot and air temp plot
    - Lake Shasta Isothermobath Plot
    - Lake Shasta Isotherm Statistics Plots
    - Lake Shasta Current TCD Configuration
    - Trinity Lake Isothermobath Plot
    - Whiskeytown Lake Isothermobath Plot
- Temperature Studies
    - 90% Runoff Exceedance: 25% and 50% L3MTO Meteorology
    - Cold Water Pool Tracking
- Updates
- Next Meeting: August 22, 2019 – NMFS 650 Capitol Mall, Suite 5-100 Sacramento, CA, Delta Conference Room

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

DAILY CVP WATER SUPPLY REPORT

JULY 23, 2019

RUN DATE: July 24, 2019

RESERVOIR RELEASES IN CUBIC FEET/SECOND

RESERVOIR	DAM	WY 2018	WY 2019	15 YR MEDIAN
TRINITY	LEWISTON	442	732	462
SACRAMENTO	KESWICK	13,135	11,029	12,376
FEATHER	OROVILLE (SWP)	4,500	6,500	5,500
AMERICAN	NIMBUS	5,203	3,375	3,543
STANISLAUS	GOODWIN	301	2,505	355
SAN JOAQUIN	FRIANT	443	343	347

STORAGE IN MAJOR RESERVOIRS IN THOUSANDS OF ACRE-FEET

RESERVOIR	CAPACITY	15 YR AVG	WY 2018	WY 2019	% OF 15 YR AVG
TRINITY	2,448	1,697	1,665	2,236	132
SHASTA	4,552	3,180	3,283	4,111	129
FOLSOM	977	668	685	858	128
NEW MELONES	2,420	1,518	1,879	2,174	143
FED. SAN LUIS	966	351	393	622	177
TOTAL NORTH CVP	11,363	7,414	7,905	10,001	135
MILLERTON	520	390	363	500	128
OROVILLE (SWP)	3,538	2,370	2,028	3,229	136

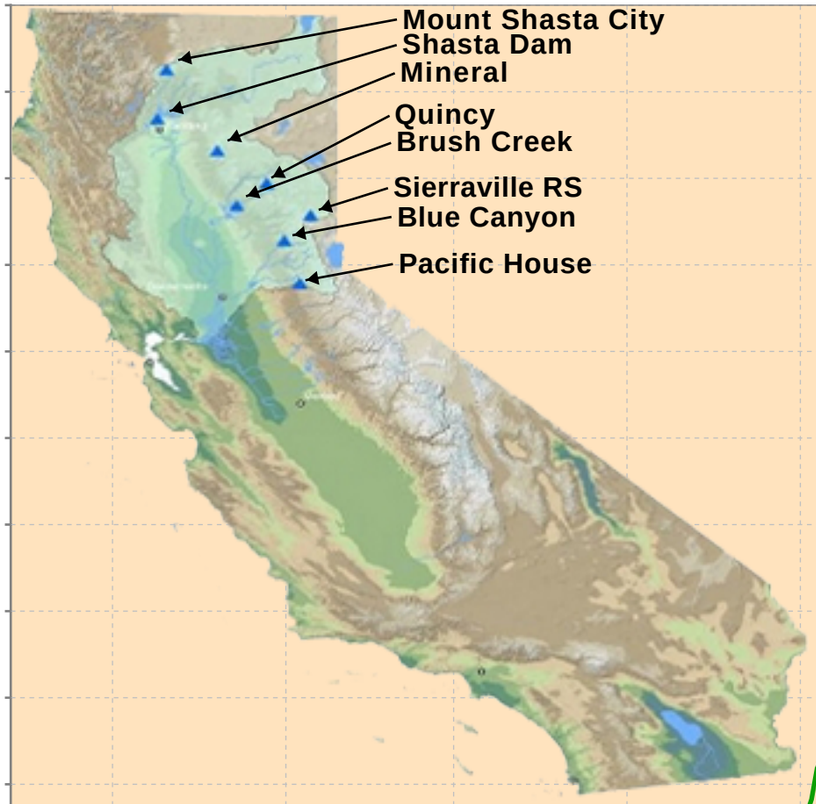
ACCUMULATED INFLOW FOR WATER YEAR TO DATE IN THOUSANDS OF ACRE-FEET

RESERVOIR	CURRENT WY 2019	WY 1977	WY 1983	15 YR AVG	% OF 15 YR AVG
TRINITY	1,605	195	2,742	1,203	133
SHASTA	6,707	2,151	10,130	4,907	137
FOLSOM	3,745	300	6,138	2,610	143
NEW MELONES	1,578	----	2,579	1,028	153
MILLERTON	2,324	252	4,092	1,536	151

ACCUMULATED PRECIPITATION FOR WATER YEAR TO DATE IN INCHES

RESERVOIR	CURRENT WY 2019	WY 1977	WY 1983	AVG (N YRS)	% OF AVG	LAST 24 HRS
TRINITY AT FISH HATCHERY	36.87	13.70	55.19	31.51 (57)	117	0.00
SACRAMENTO AT SHASTA DAM	87.96	17.28	112.58	61.46 (62)	143	0.00
AMERICAN AT BLUE CANYON	90.61	15.70	103.88	66.44 (44)	136	0.00
STANISLAUS AT NEW MELONES	42.23	----	45.33	27.36 (41)	154	0.00
SAN JOAQUIN AT HUNTINGTON LK	57.32	17.20	81.40	41.55 (44)	138	0.00

Northern Sierra Precipitation: 8-Station Index, July 24, 2019



Percent of Average for this Date: 135%

2016-2017 Daily Precip (wettest) 94.7

1982-1983 (2nd wettest) 88.5

1997-1998 82.4

68.4

Average (1966-2015) 51.8

2017-2018 Daily Precip 41.0

2014-2015 Daily Precip 37.2

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

Cumulative Daily/Monthly Precipitation (inches)

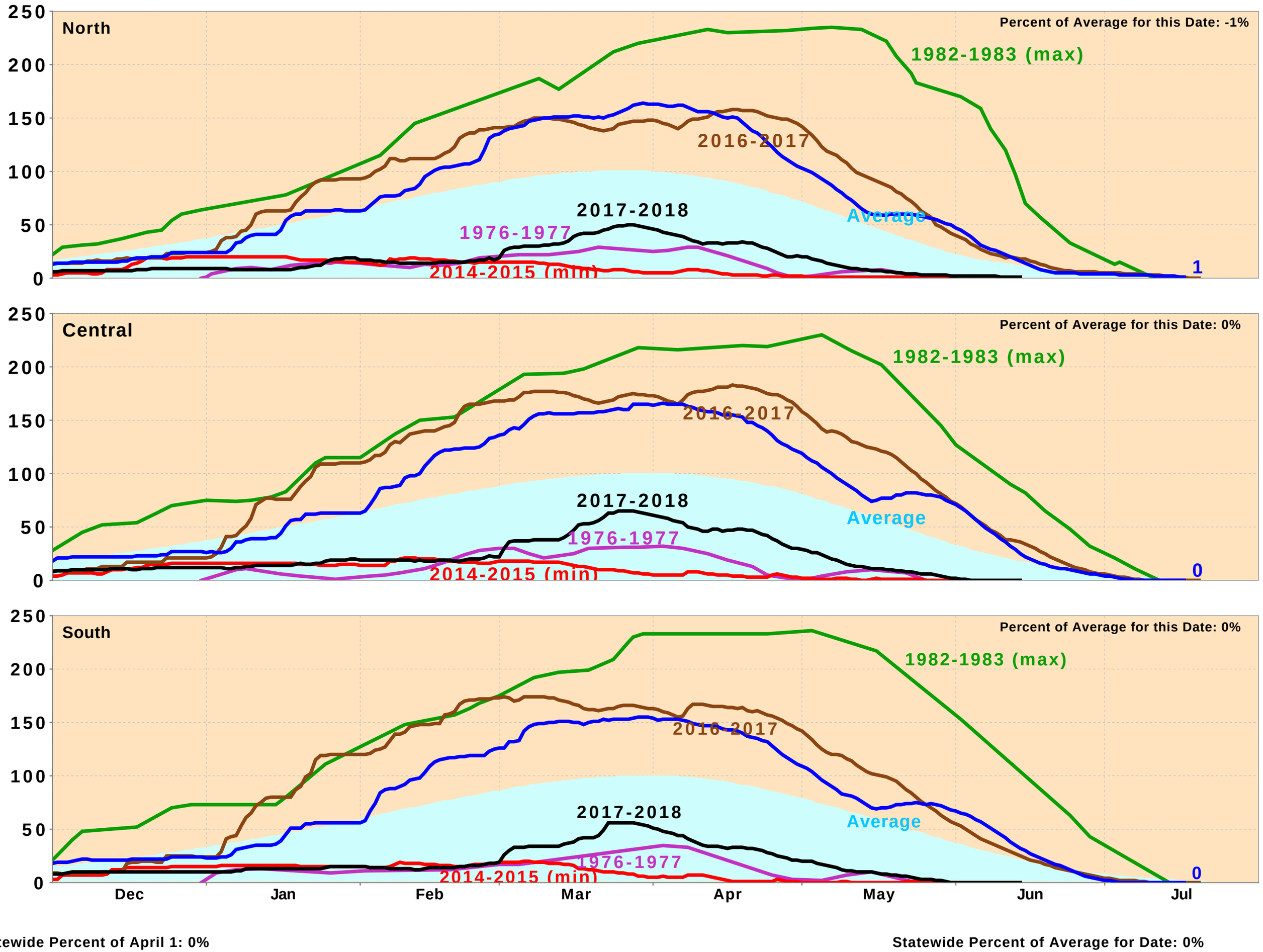
Total Water Year Precipitation

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)

California Snow Water Content, July 17, 2019, Percent of April 1 Average



Statewide Percent of April 1: 0%

Statewide Percent of Average for Date: 0%

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

Storage/Release Management Conditions:

- Reservoir Inflow Uncertainty: Meteorological projections: Shorter term forecasts (8-14 day) suggest normal chances of precipitation
- Longer term forecasts (one-month outlook) suggest equal chances of above normal or below normal precipitation
- Current release from Keswick Dam: 11,000 cfs
- Keswick Dam release is expected to increase in August

Temperature Management:

- Temperature management: Active management in June
- Selective withdrawal: Releases – 1 Upper and 4 Middle TCD gates
- Meteorological Uncertainty: Shorter term forecasts (8-14 day) suggest warming to above normal temperatures
- Longer term forecasts (one-month outlook) suggest above normal chances of warmer temperatures

Resources:

- Excellent link for short term precipitation forecasts, overlay with burn areas, debris flow potential, etc: https://www.cnrfc.noaa.gov/
- Comprehensive Upper Sacramento fishery information: https://www.calfish.org/ProgramsData/ConservationandManagement/CentralValleyMonitoring/CDFWUpperSacRiverBasinSalmonidMonitoring.aspx

CVP Northern System Operation Outlooks

DRAFT July 2019

90% Runoff Exceedance Outlook:

Inflow based on DWR B120 90%; Historical Inflows Oct and future months

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

		Jul	Aug	Sep	Oct	Nov	Dec	Jan
Shasta	4355	3934	3364	3025	2836	2805	2859	3009
Elev.		1045	1023	1009	1000	999	1001	1008

Monthly River Releases (cfs)

	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Sacramento	11000	13000	9500	8000	5000	4500	4000
Clear Creek	150	150	150	200	200	200	200

Trinity Diversions (TAF)

	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Carr Power Plant	101	61	55	68	26	12	3
Spring Creek PP	90	50	45	90	20	12	10

50% Runoff Exceedance Outlook:

Inflow based on DWR B120 50%; Historical Inflows Oct and future months

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

		Jul	Aug	Sep	Oct	Nov	Dec	Jan
Shasta	4355	3972	3435	3128	2959	2919	3001	3239
Elev.		1047	1026	1013	1006	1004	1008	1018

Monthly River Releases (cfs)

	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Sacramento	11000	13000	9500	8000	6000	5000	6000
Clear Creek	150	150	150	200	200	200	240

Trinity Diversions (TAF)

	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Carr Power Plant	100	60	54	68	25	9	0
Spring Creek PP	90	50.3	45	90	20	12	20

Please note:

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)

		Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Trinity	**2314**	**2166**	**2062**	**1957**	**1874**	**1850**	**1860**	**1891**	**1976**	**2053**	**2163**	**2154**	**2050**
	Elev.	2352	2345	2338	2332	2330	2331	2333	2339	2345	2352	2351	2344
Whiskeytown	**237**	**238**	**238**	**238**	**206**	**206**	**206**	**206**	**206**	**206**	**238**	**238**	**238**
	Elev.	1209	1209	1209	1199	1199	1199	1199	1199	1199	1209	1209	1209
Shasta	**4355**	**3934**	**3364**	**3025**	**2836**	**2805**	**2859**	**3009**	**3356**	**3831**	**3999**	**3964**	**3803**
	Elev.	1045	1023	1009	1000	999	1001	1008	1023	1041	1048	1046	1040
Folsom	**920**	**821**	**680**	**582**	**463**	**383**	**322**	**323**	**385**	**533**	**726**	**874**	**881**
	Elev.	452	437	426	412	401	391	391	401	421	442	457	457
New Melones	**2223**	**2099**	**1989**	**1920**	**1871**	**1876**	**1884**	**1888**	**1895**	**1829**	**1812**	**1751**	**1667**
	Elev.	1061	1051	1045	1040	1041	1042	1042	1043	1036	1035	1029	1020
San Luis	**713**	**432**	**263**	**279**	**169**	**206**	**369**	**514**	**561**	**678**	**513**	**250**	**158**
	Elev.	473	463	476	450	459	481	502	509	526	493	446	432
Total		9689	8597	8000	7418	7327	7499	7831	8378	9130	9451	9231	8797

Monthly River Releases (TAF/cfs)

Trinity	TAF	66	53	52	23	18	18	18	17	18	32	180	47
	cfs	**1,073**	**857**	**870**	**373**	**300**	**300**	**300**	**300**	**300**	**540**	**2,924**	**783**
Clear Creek	TAF	9	9	9	12	12	12	12	11	12	13	13	17
	cfs	**150**	**150**	**150**	**200**	**200**	**200**	**200**	**200**	**200**	**218**	**216**	**288**
Sacramento	TAF	676	799	565	492	297	277	246	180	200	332	430	535
	cfs	**11000**	**13000**	**9500**	**8000**	**5000**	**4500**	**4000**	**3250**	**3250**	**5586**	**7000**	**9000**
American	TAF	231	240	192	154	119	123	111	100	92	89	92	89
	cfs	**3751**	**3906**	**3220**	**2500**	**2005**	**2000**	**1800**	**1800**	**1500**	**1500**	**1500**	**1500**
Stanislaus	TAF	98	61	48	52	18	18	22	20	101	42	96	56
	cfs	**1600**	**1000**	**800**	**842**	**300**	**300**	**358**	**364**	**1648**	**700**	**1555**	**940**

Trinity Diversions (TAF)

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Carr PP	101	61	55	68	26	12	3	2	35	32	12	132
Spring Crk. PP	**90**	**50**	**45**	**90**	**20**	**12**	**10**	**20**	**50**	**10**	**10**	**120**

Delta Summary (TAF)

		Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Tracy		263	267	260	50	122	226	220	162	258	48	55	225
USBR Banks		0	0	0	0	0	0	0	0	0	0	0	0
Contra Costa		11.1	12.7	14.0	16.8	18.4	18.3	14.0	14.0	12.7	12.7	12.7	9.8
COA Balance		29	25	-9	-9	21	21	21	21	21	21	21	21
Vernalis	TAF	189	153	137	99	66	81	85	90	181	101	176	141
Vernalis	cfs	3080	2497	2296	1606	1107	1325	1383	1625	2950	1700	2856	2369
Old/Middle River Std.													
Old/Middle R. calc.		-7,585	-8,494	-8,514	-1,931	-4,744	-6,060	-4,903	-4,560	-5,033	-1,144	-619	-7,093
Computed DOI		8004	11794	13280	12298	5850	4522	11891	11418	13193	11162	8378	9329
Excess Outflow		0	0	0	16	0	16	5889	18	1789	1664	1269	1866
% Export/Inflow		47%	42%	42%	15%	46%	62%	36%	35%	36%	11%	13%	44%
% Export/Inflow std.		65%	65%	65%	65%	65%	65%	65%	45%	35%	35%	35%	35%

Hydrology

	Trinity		Shasta		Folsom		New Melones	
Water Year Inflow (TAF)	1636		7,097		4,001		1665	
Year to Date + Forecasted % of mean	135%		128%		147%		158%	

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Estimated CVP Operations 50% Exceedance

Storages

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

		Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Trinity	**2314**	**2177**	**2069**	**1964**	**1883**	**1869**	**1899**	**1963**	**2073**	**2157**	**2302**	**2248**	**2085**
	Elev.	2353	2346	2338	2333	2332	2334	2338	2346	2352	2361	2357	2347
Whiskeytown	**237**	**238**	**238**	**238**	**206**	**206**	**206**	**206**	**206**	**206**	**238**	**238**	**238**
	Elev.	1209	1209	1209	1199	1199	1199	1199	1199	1199	1209	1209	1209
Shasta	**4355**	**3972**	**3435**	**3128**	**2959**	**2919**	**3001**	**3239**	**3556**	**3939**	**4202**	**4270**	**4078**
	Elev.	1047	1026	1013	1006	1004	1008	1018	1031	1045	1055	1057	1051
Folsom	**920**	**816**	**617**	**514**	**436**	**377**	**366**	**394**	**489**	**616**	**770**	**861**	**779**
	Elev.	451	430	418	408	400	398	402	415	430	446	455	447
New Melones	**2223**	**2119**	**2025**	**1965**	**1921**	**1931**	**1949**	**1973**	**2019**	**1996**	**1987**	**2032**	**2006**
	Elev.	1063	1055	1049	1045	1046	1048	1050	1054	1052	1051	1055	1053
San Luis	**713**	**433**	**262**	**278**	**170**	**344**	**547**	**711**	**839**	**966**	**813**	**557**	**509**
	Elev.	475	465	478	460	485	509	522	533	543	512	468	439
Total		9754	8646	8086	7574	7646	7968	8485	9183	9880	10312	10205	9696

Monthly River Releases (TAF/cfs)

Trinity	TAF	66	53	52	23	18	18	18	17	18	28	258	126
	cfs	**1,073**	**857**	**870**	**373**	**300**	**300**	**300**	**300**	**300**	**477**	**4,189**	**2,120**
Clear Creek	TAF	9	9	9	12	12	12	15	11	12	13	13	17
	cfs	**150**	**150**	**150**	**200**	**200**	**200**	**240**	**200**	**200**	**218**	**216**	**288**
Sacramento	TAF	676	799	565	492	357	307	369	444	492	357	408	595
	cfs	**11000**	**13000**	**9500**	**8000**	**6000**	**5000**	**6000**	**8000**	**8000**	**6000**	**6636**	**10000**
American	TAF	246	307	208	154	149	123	123	167	184	268	369	297
	cfs	**4000**	**5000**	**3500**	**2500**	**2500**	**2000**	**2000**	**3000**	**3000**	**4500**	**6000**	**5000**
Stanislaus	TAF	98	61	48	52	18	18	22	20	93	83	96	56
	cfs	**1600**	**1000**	**800**	**842**	**300**	**300**	**358**	**364**	**1521**	**1400**	**1555**	**940**

Trinity Diversions (TAF)

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Carr PP	100	60	54	68	25	9	0	2	45	31	9	131
Spring Crk. PP	**90**	**50.3**	**45**	**90**	**20**	**12**	**20**	**35**	**70**	**10**	**10**	**120**

Delta Summary (TAF)

		Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Tracy		264	265	260	50	256	265	235	240	265	54	55	256
USBR Banks		0	0	0	0	0	0	0	0	0	0	0	0
Contra Costa		11.1	12.7	14.0	16.8	18.4	18.3	14.0	14.0	12.7	12.7	12.7	9.8
COA Balance		35	35	35	35	35	35	35	35	35	35	35	126
Vernalis	TAF	189	153	137	130	105	109	127	244	330	161	219	130
Vernalis	cfs	3080	2497	2296	2111	1762	1780	2066	4399	5376	2701	3556	2184
Old/Middle River Std.													
Old/Middle R. calc.	cfs	-7,785	-8,469	-8,604	-2,669	-6,662	-6,281	-3,593	-3,936	-3,027	-694	-304	-4,808
Computed DOI		8004	11859	13414	12428	7127	10525	19716	27412	29037	17969	14494	7463
Excess Outflow		0	65	134	65	34	6019	13713	16011	17634	8472	7385	0
% Export/Inflow		47%	42%	42%	21%	52%	43%	20%	20%	17%	7%	9%	38%
% Export/Inflow std.		65%	65%	65%	65%	65%	65%	65%	45%	35%	35%	35%	35%

Hydrology

	Trinity		Shasta		Folsom		New Melones	
Water Year Inflow (TAF)	1640		7,200		4,033		1691	
Year to Date + Forecasted % of mean	136%		130%		148%		160%	

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Northern CVP Water Temperature Report

July - 2019

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[4]	LWS	-----[3]		Shasta Generation	Spring Creek P.P.	Keswick Total	RDD	BSF	RDB	LWS
Jun	51.0	50.3	52.5	51.7	52.2	52.8	55.0	57.1	57.8	58.8	58.2	48.6	-		8544	2160	11089	80.2	76.2	77.1	-
07/01	51.2	50.6	# -	51.8	52.3	52.9	**54.6**	56.3	57.0	58.1	58.2	48.7	-		9090	977	10990	75.0	71.8	72.8	-
07/02	51.3	50.7	! -	51.8	52.3	53.0	**54.9**	56.6	57.3	58.1	58.4	49.2	-		9351	1165	10982	77.0	75.4	75.2	-
07/03	51.4	50.8	53.7	52.0	52.5	53.1	**55.0**	56.8	57.5	58.5	! -	49.4	-		9346	1200	10990	77.5	75.0	76.0	-
07/04	51.3	50.7	53.6	52.0	52.5	53.1	**55.1**	56.9	57.7	58.8	# -	49.5	-		9101	1454	10909	82.0	77.7	78.3	-
07/05	51.5	50.9	53.6	52.1	52.6	53.3	**55.3**	57.1	57.9	59.0	# -	49.3	-		9387	1385	9472	81.0	77.5	78.2	-
07/06	51.7	51.1	53.7	52.1	52.6	53.3	**55.4**	57.3	58.1	59.3	# -	? 49.3	-		10203	747	10895	82.5	79.9	78.7	-
07/07	51.5	50.9	53.7	52.2	52.8	53.5	**55.4**	57.2	58.0	59.1	# -	49.4	-		9364	1110	10895	80.0	75.5	75.1	-
07/08	51.3	# -	53.7	52.4	52.9	53.6	**55.6**	57.4	58.2	59.2	# -	49.7	-		8554	1601	10894	76.5	71.8	71.2	-
07/09	51.3	# -	53.9	51.9	52.5	53.1	**55.0**	57.0	57.8	59.0	# -	49.7	-		9647	784	10893	77.0	72.8	71.9	-
07/10	51.0	# -	53.8	51.9	52.5	53.0	**55.0**	56.6	57.3	58.3	# -	50.1	-		8657	1695	10888	78.5	74.7	74.9	-
07/11	51.1	# -	54.0	51.8	52.5	? 53.1	**55.3**	57.2	58.0	59.0	# -	50.1	-		9592	987	10898	82.5	78.4	79.3	-
07/12	51.5	# -	54.0	52.1	52.6	53.1	**55.3**	57.2	58.0	59.2	60.2	49.9	-		9156	1738	10897	85.0	80.8	80.8	-
07/13	51.4	# -	54.1	52.2	52.8	53.3	? **55.7**	57.6	58.4	59.6	59.8	50.4	-		9361	1402	10923	86.0	81.5	81.3	-
07/14	51.3	# -	54.1	52.1	52.8	53.3	**55.7**	57.6	58.4	59.6	59.5	50.7	-		9132	1347	10937	84.0	80.2	79.2	-
07/15	? 51.3	# -	54.1	52.1	52.7	53.2	**55.3**	57.1	58.0	59.2	58.9	50.6	-		8337	1425	10925	82.5	79.8	81.4	-
07/16	51.2	# -	54.2	52.2	52.8	53.3	**55.5**	57.2	58.0	59.0	59.6	50.9	-		9190	1428	10888	83.0	79.5	79.0	-
07/17	51.3	# -	54.3	52.0	52.7	53.3	**55.5**	57.4	58.3	59.5	59.6	51.1	-		8968	1646	10889	85.0	81.1	80.0	-
07/18	51.0	# -	54.2	52.0	52.9	53.5	**55.8**	57.6	58.4	59.8	59.7	51.4	-		9232	1101	11122	84.0	79.3	79.1	-
07/19	51.1	# -	54.3	51.7	52.6	53.2	**55.4**	57.2	58.1	59.6	59.4	51.5	-		9340	1244	10894	82.5	78.4	78.8	-
07/20	51.0	# -	54.4	51.7	52.5	53.1	**55.2**	57.0	57.8	59.2	58.6	51.2	-		9178	1236	10893	80.0	77.2	76.3	-
07/21	51.1	# -	54.5	51.5	52.4	52.9	**55.1**	56.8	57.7	59.0	58.4	50.9	-		9990	758	10890	82.5	78.0	78.0	-
07/22	51.2	# -	54.5	51.7	52.4	52.9	**55.0**	56.7	57.6	58.9	58.7	51.0	-		9479	1160	10922	85.5	80.4	81.2	-
07/23	51.0	# -	54.6	52.0	52.8	53.3	**55.3**	57.1	57.9	59.2	58.8	51.2	-		8380	1647	11029	83.5	79.9	80.0	-
07/24																					
07/25																					
07/26																					
07/27																					
07/28																					
07/29																					
07/30																					
07/31																					
Jul	51.3	50.8	54.0	52.0	52.6	53.2	55.3	57.1	57.9	59.0	59.1	50.2	-		9219	1271	10866	81.4	77.7	77.7	-
														Total CFS	212035	29237	249915				
														Total AF	420563	57990	495696				

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
07/01	60	93	76.5	60	93	76.5	61	93	77.0	62	91	76.5	62	94	78.0	64	102	83.0	67	103	85.0	68	102	85.0	66	95	80.5	67	100	83.5	70	98	84.0	68	100	84.0
07/02	59	91	75.0	62	90	76.0	63	92	77.5	63	94	78.5	65	98	81.5	66	99	82.5	67	96	81.5	66	95	80.5	66	96	81.0	69	100	84.5	69	100	84.5	69	100	84.5
07/03	61	93	77.0	64	93	78.5	63	96	79.5	65	99	82.0	66	99	82.5	66	97	81.5	64	96	80.0	66	101	83.5	66	98	82.0	68	100	84.0	70	99	84.5	68	98	83.0
07/04	62	93	77.5	NR	97	NR	65	99	82.0	66	98	82.0	66	92	79.0	63	92	77.5	65	91	78.0	66	96	81.0	66	95	80.5	66	96	81.0	69	96	82.5	68	99	83.5
07/05	66	98	82.0	NR	99	NR	66	98	82.0	66	93	79.5	62	90	76.0	63	93	78.0	65	96	80.5	66	98	82.0	67	96	81.5	66	96	81.0	69	97	83.0	69	99	84.0
07/06	64	98	81.0	68	100	84.0	66	96	81.0	62	92	77.0	63	95	79.0	65	96	80.5	66	98	82.0	67	99	83.0	68	99	83.5	67	99	83.0	68	97	82.5	67	99	83.0
07/07	67	98	82.5	67	95	81.0	62	92	77.0	63	93	78.0	64	95	79.5	65	96	80.5	67	99	83.0	67	99	83.0	66	97	81.5	68	95	81.5	69	97	83.0	68	99	83.5
07/08	65	95	80.0	65	90	77.5	63	90	76.5	64	93	78.5	65	97	81.0	66	101	83.5	67	100	83.5	65	97	81.0	67	98	82.5	67	100	83.5	70	99	84.5	69	99	84.0
07/09	65	88	76.5	65	89	77.0	64	94	79.0	65	100	82.5	67	104	85.5	68	102	85.0	66	100	83.0	65	100	82.5	67	96	81.5	65	93	79.0	66	92	79.0	66	93	79.5
07/10	65	89	77.0	65	94	79.5	65	99	82.0	66	104	85.0	68	104	86.0	67	100	83.5	65	98	81.5	65	98	81.5	68	97	82.5	67	95	81.0	69	98	83.5	68	99	83.5
07/11	64	93	78.5	66	97	81.5	67	99	83.0	68	99	83.5	67	96	81.5	65	98	81.5	65	98	81.5	65	98	81.5	67	96	81.5	68	95	81.5	67	94	80.5	65	95	80.0
07/12	67	98	82.5	70	102	86.0	68	101	84.5	67	98	82.5	65	96	80.5	65	99	82.0	67	100	83.5	67	100	83.5	70	100	85.0	69	100	84.5	69	98	83.5	67	99	83.0
07/13	69	101	85.0	72	102	87.0	66	99	82.5	65	97	81.0	65	98	81.5	66	98	82.0	65	98	81.5	65	97	81.0	68	96	82.0	67	97	82.0	66	96	81.0	66	98	82.0
07/14	72	100	86.0	70	100	85.0	66	98	82.0	66	99	82.5	66	101	83.5	67	99	83.0	67	97	82.0	65	95	80.0	66	93	79.5	65	95	80.0	67	95	81.0	66	98	82.0
07/15	70	98	84.0	68	98	83.0	67	99	83.0	67	101	84.0	68	100	84.0	66	96	81.0	65	97	81.0	64	97	80.5	69	100	84.5	68	101	84.5	69	100	84.5	68	100	84.0
07/16	67	98	82.5	70	99	84.5	67	101	84.0	68	98	83.0	66	95	80.5	65	98	81.5	66	98	82.0	67	98	82.5	69	103	86.0	68	103	85.5	69	99	84.0	67	100	83.5
07/17	68	98	83.0	70	100	85.0	68	98	83.0	66	95	80.5	66	98	82.0	67	99	83.0	68	99	83.5	67	98	82.5	69	100	84.5	68	102	85.0	69	101	85.0	68	100	84.0
07/18	69	101	85.0	72	100	86.0	66	97	81.5	67	99	83.0	67	99	83.0	68	97	82.5	67	97	82.0	66	96	81.0	64	100	82.0	66	102	84.0	68	99	83.5	67	99	83.0
07/19	71	97	84.0	69	97	83.0	68	99	83.5	67	99	83.0	68	99	83.5	70	98	84.0	67	101	84.0	69	102	85.5	66	104	85.0	67	104	85.5	70	101	85.5	67	99	83.0
07/20	67	98	82.5	66	100	83.0	67	101	84.0	68	102	85.0	67	102	84.5	66	104	85.0	68	104	86.0	69	104	86.5	68	106	87.0	70	105	87.5	70	102	86.0	67	98	82.5
07/21	64	96	80.0	67	100	83.5	68	102	85.0	67	101	84.0	66	104	85.0	68	105	86.5	69	105	87.0	68	106	87.0	68	102	85.0	68	101	84.5	68	99	83.5	66	99	82.5
07/22	67	98	82.5	71	102	86.5	67	101	84.0	66	104	85.0	68	105	86.5	68	102	85.0	68	103	85.5	69	103	86.0	69	103	86.0	66	101	83.5	67	98	82.5	66	99	82.5
07/23	70	101	85.5	67	101	84.0	65	104	84.5	67	104	85.5	70	104	87.0	69	106	87.5	70	107	88.5	69	103	86.0	68	99	83.5	67	99	83.0	67	98	82.5	65	97	81.0
07/24	67	100	83.5	71	104	87.5	67	104	85.5	69	103	86.0	69	109	89.0	72	109	90.5	69	104	86.5	67	101	84.0	67	100	83.5	65	99	82.0	67	97	82.0	66	99	82.5
07/25																																				
07/26																																				
07/27																																				
07/28																																				
07/29																																				
07/30																																				
07/31																																				

Web Links

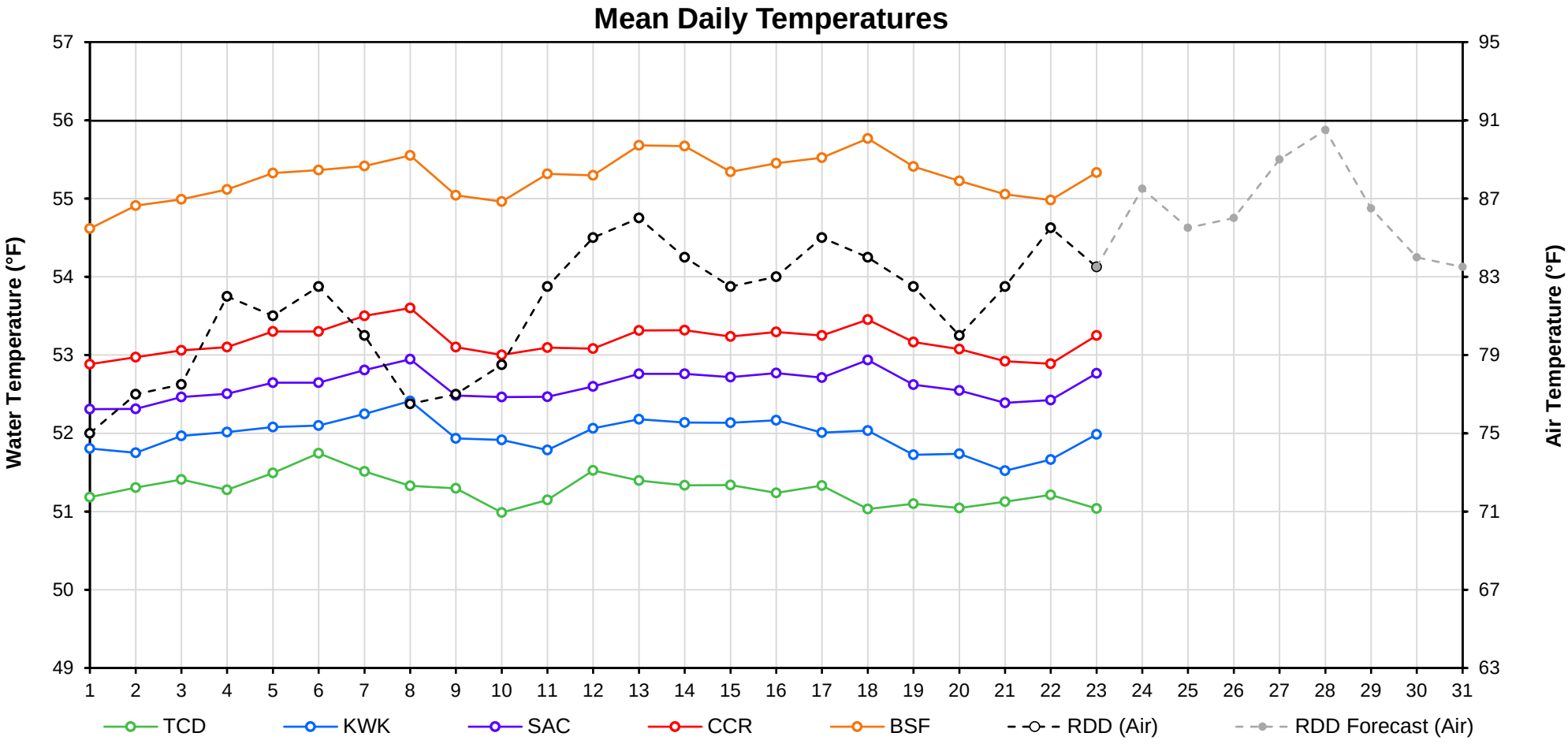
[10-Day Min/Max Forecast]

[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**	**05/25/2018**

Notes

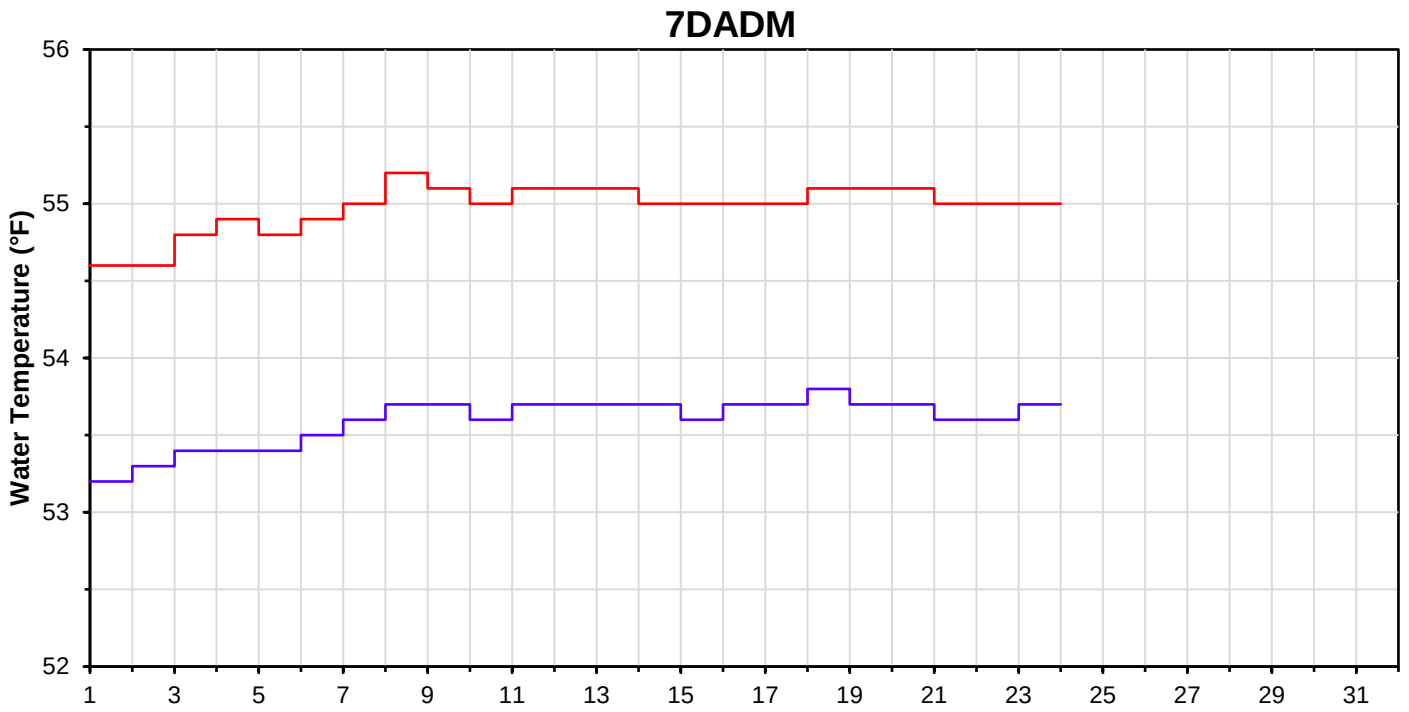
[1] Distances are approximate
[2] DGC is only reported in September
[3] NFH is only reported in October, November and December

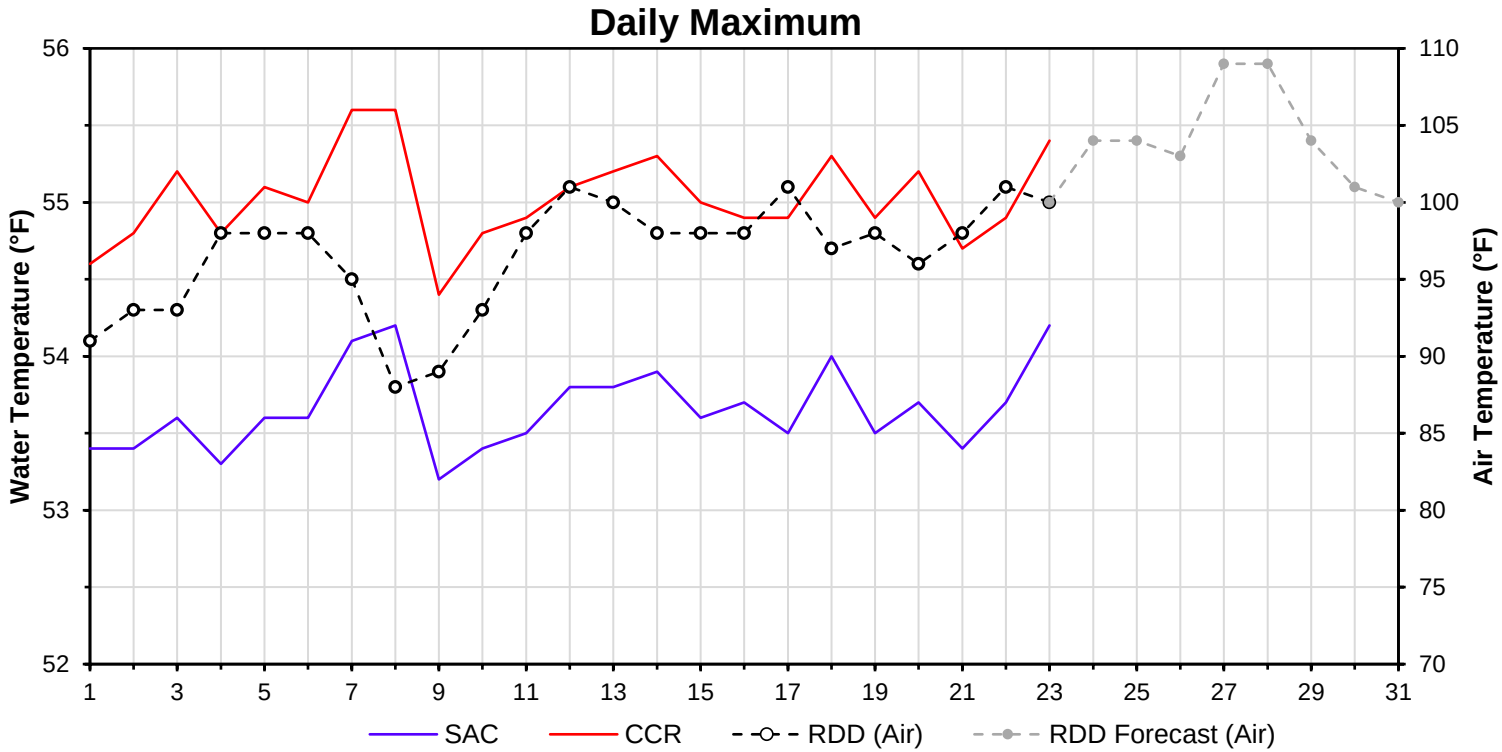
DATE	Daily Max		7DADM[1]		DAT[2]
	SAC	CCR	SAC	CCR	BSF
07/01	53.4	54.6	53.2	54.6	54.6
07/02	53.4	54.8	53.3	54.6	54.9
07/03	53.6	55.2	53.4	54.8	55.0
07/04	53.3	54.8	53.4	54.9	55.1
07/05	53.6	55.1	53.4	54.8	55.3
07/06	53.6	55.0	53.5	54.9	55.4
07/07	54.1	55.6	53.6	55.0	55.4
07/08	54.2	55.6	53.7	55.2	55.6
07/09	53.2	54.4	53.7	55.1	55.0
07/10	53.4	54.8	53.6	55.0	55.0
07/11	53.5	54.9	53.7	55.1	55.3
07/12	53.8	55.1	53.7	55.1	55.3
07/13	53.8	55.2	53.7	55.1	55.7
07/14	53.9	55.3	53.7	55.0	55.7
07/15	53.6	55.0	53.6	55.0	55.3
07/16	53.7	54.9	53.7	55.0	55.5
07/17	53.5	54.9	53.7	55.0	55.5
07/18	54.0	55.3	53.8	55.1	55.8
07/19	53.5	54.9	53.7	55.1	55.4
07/20	53.7	55.2	53.7	55.1	55.2
07/21	53.4	54.7	53.6	55.0	55.1
07/22	53.7	54.9	53.6	55.0	55.0
07/23	54.2	55.4	53.7	55.0	55.3
07/24					
07/25					
07/26					
07/27					
07/28					
07/29					
07/30					
07/31					

Notes

[1] 7DADM = 7-Day Average Daily Maximum

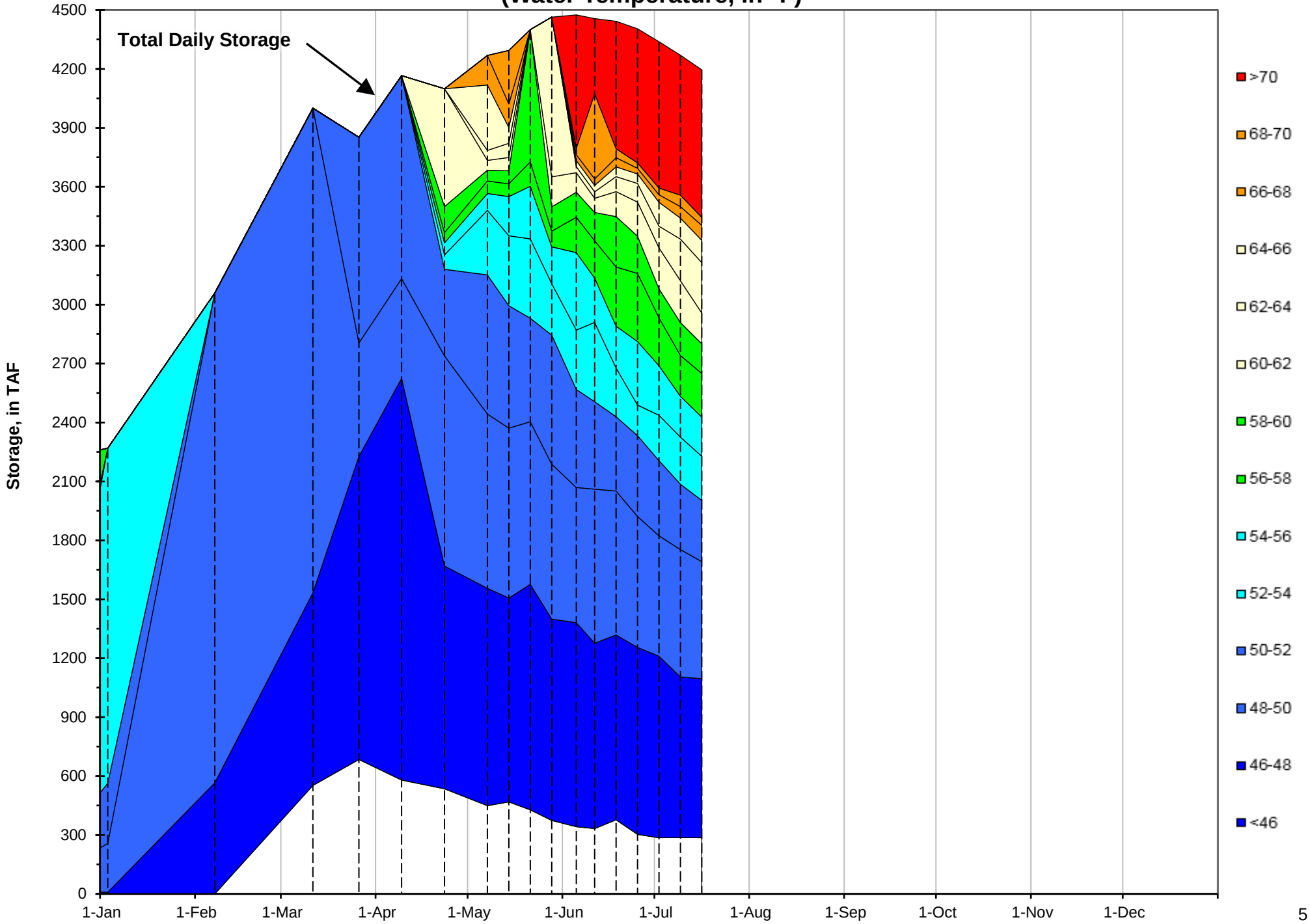
[2] DAT = Daily Average Temperature





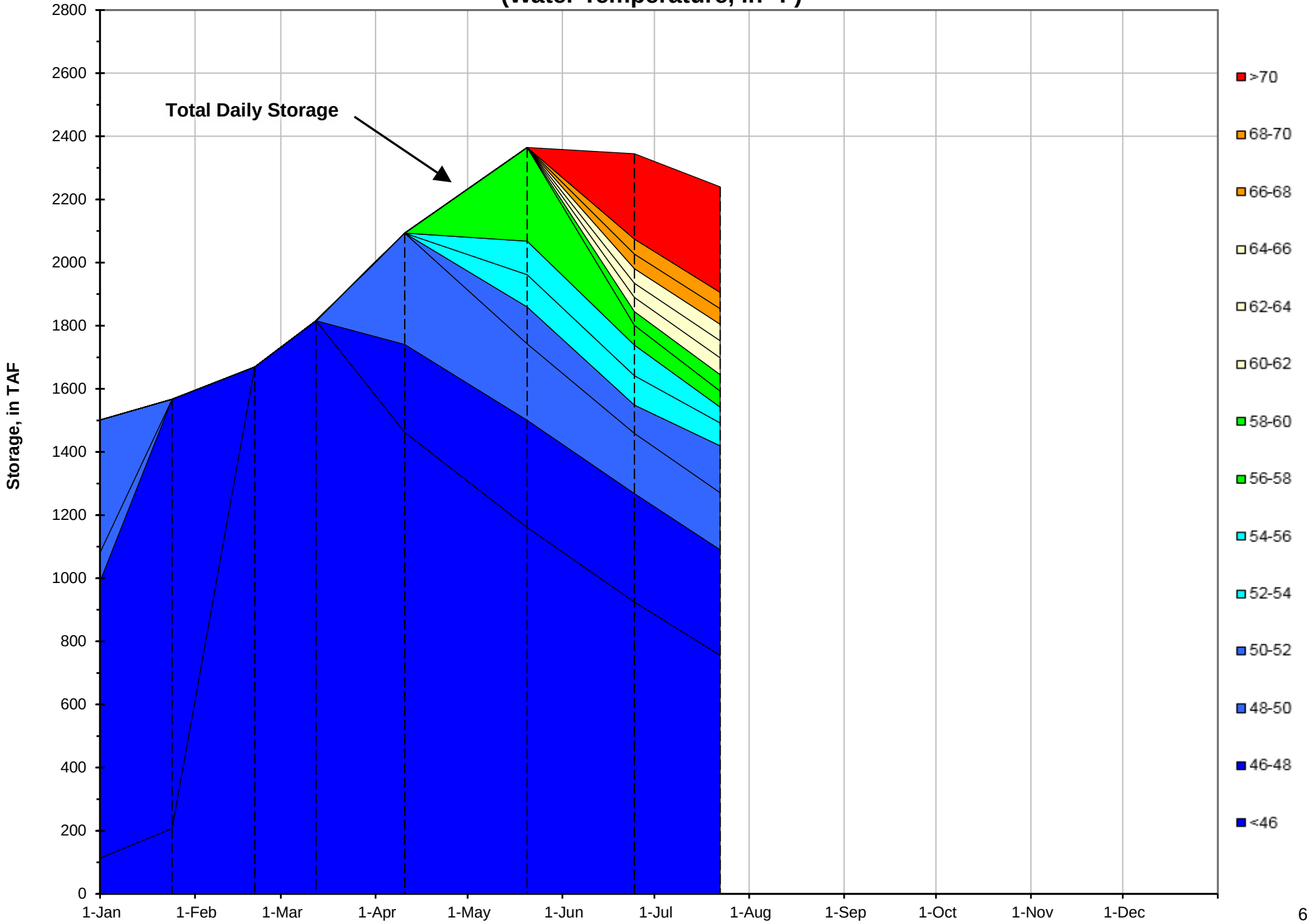
Latest Profile Date: 07/16/2019

Shasta Lake Isothermobaths - 2019
(Water Temperature, in °F)



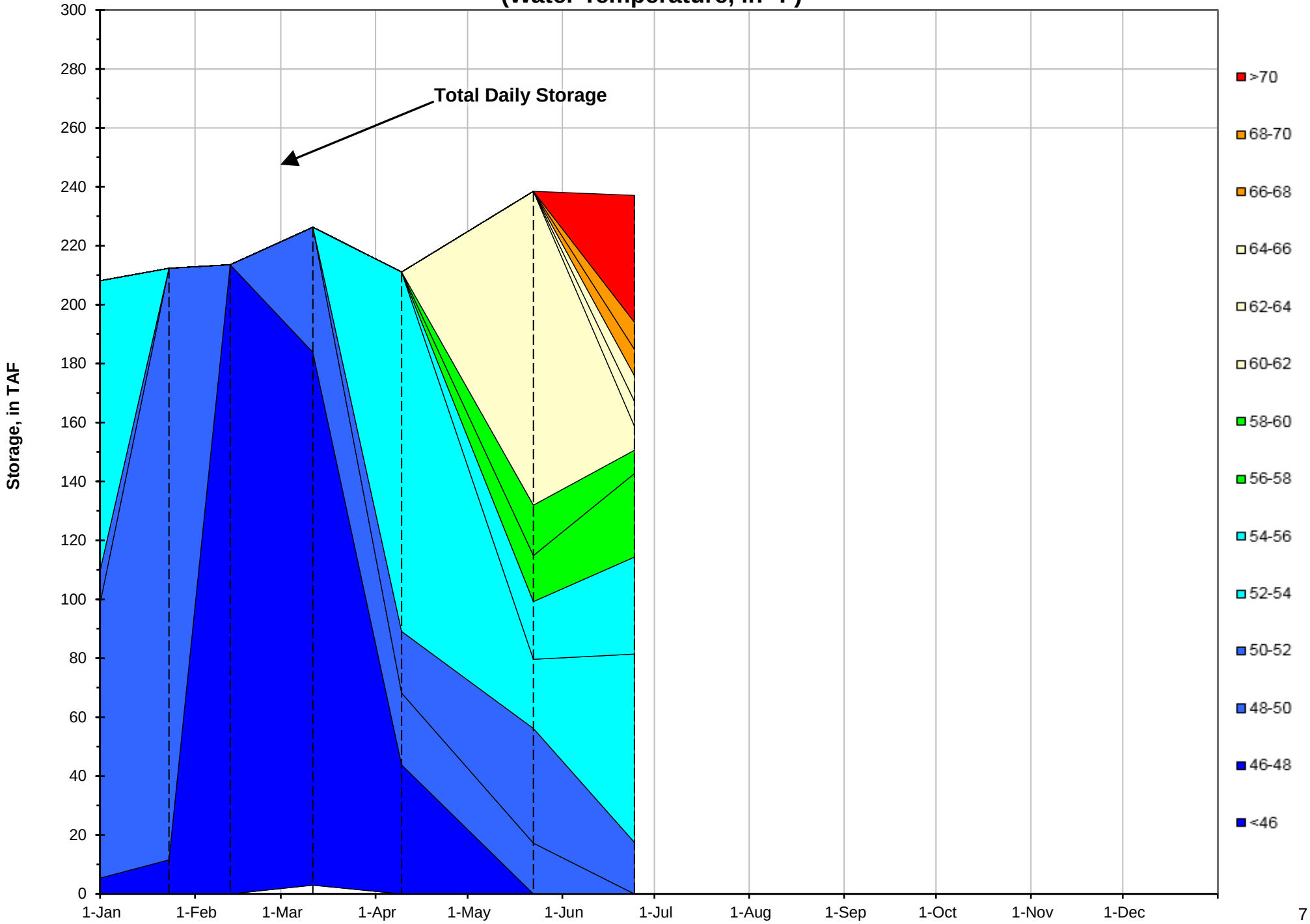
Latest Profile Date: 07/22/2019

Trinity Lake Isothermobaths - 2019
(Water Temperature, in °F)



Latest Profile Date: 06/24/2019

Whiskeytown Lake Isothermobaths - 2019
(Water Temperature, in °F)

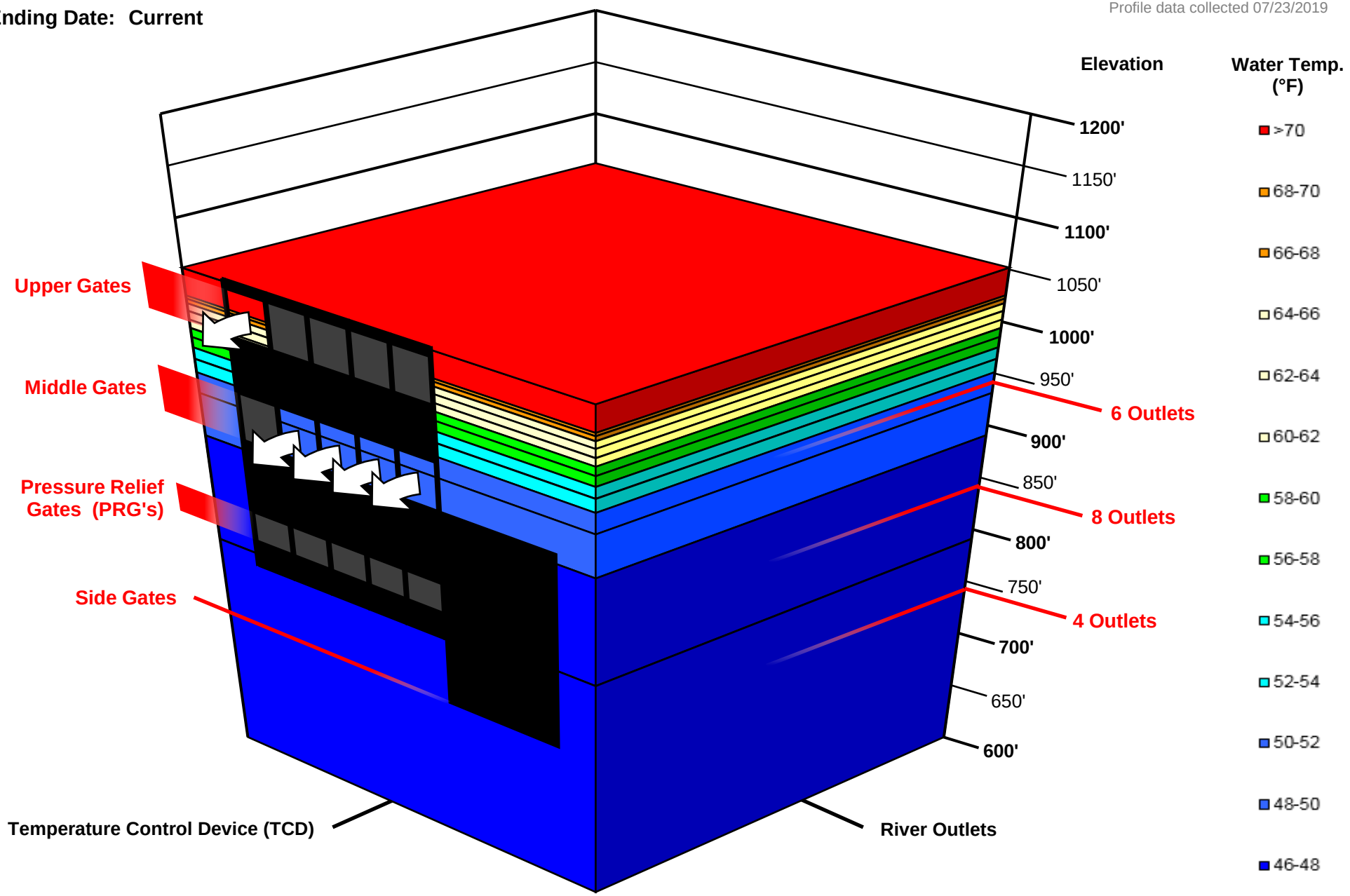


Shasta TCD Configuration

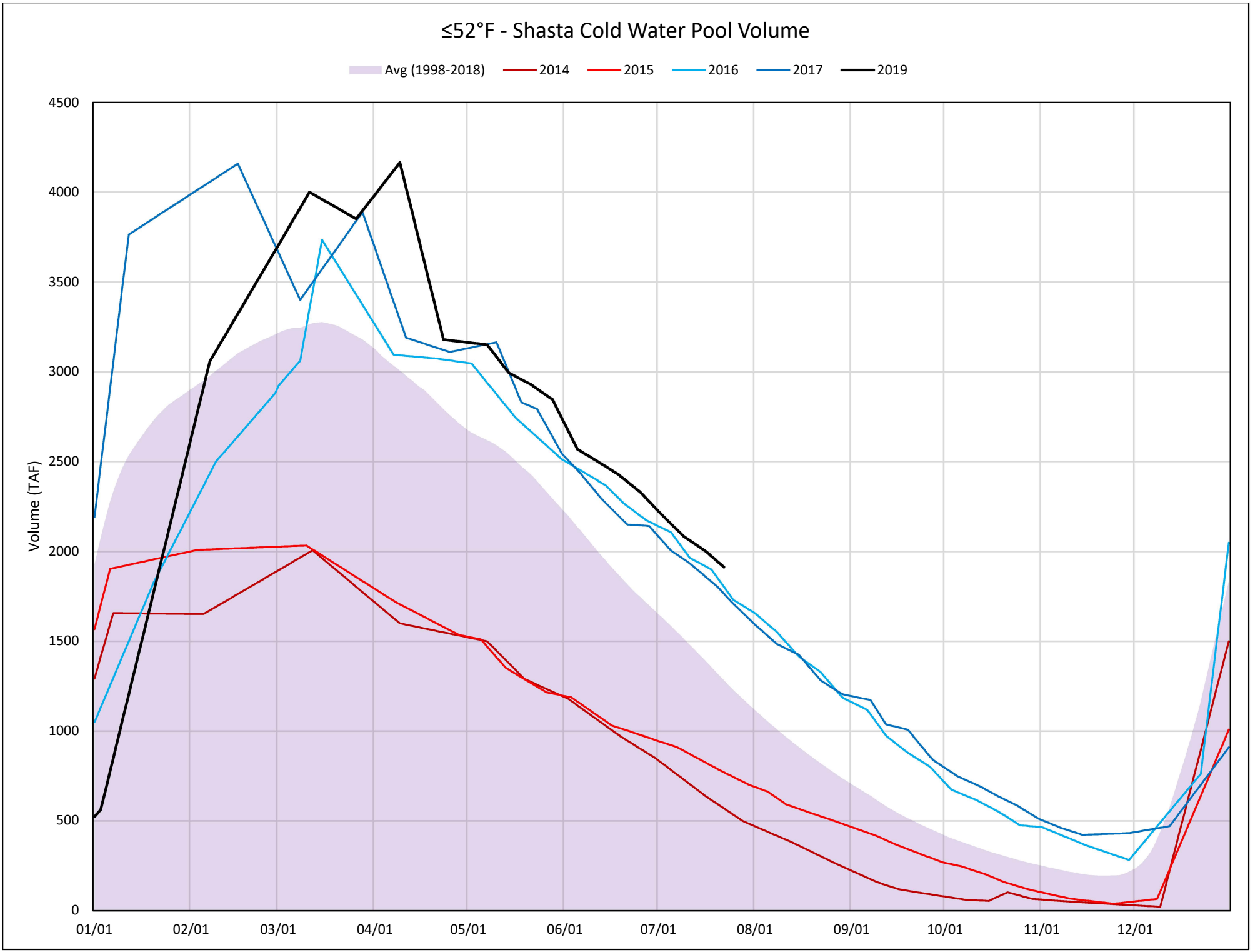
Starting Date: 07/24/2019

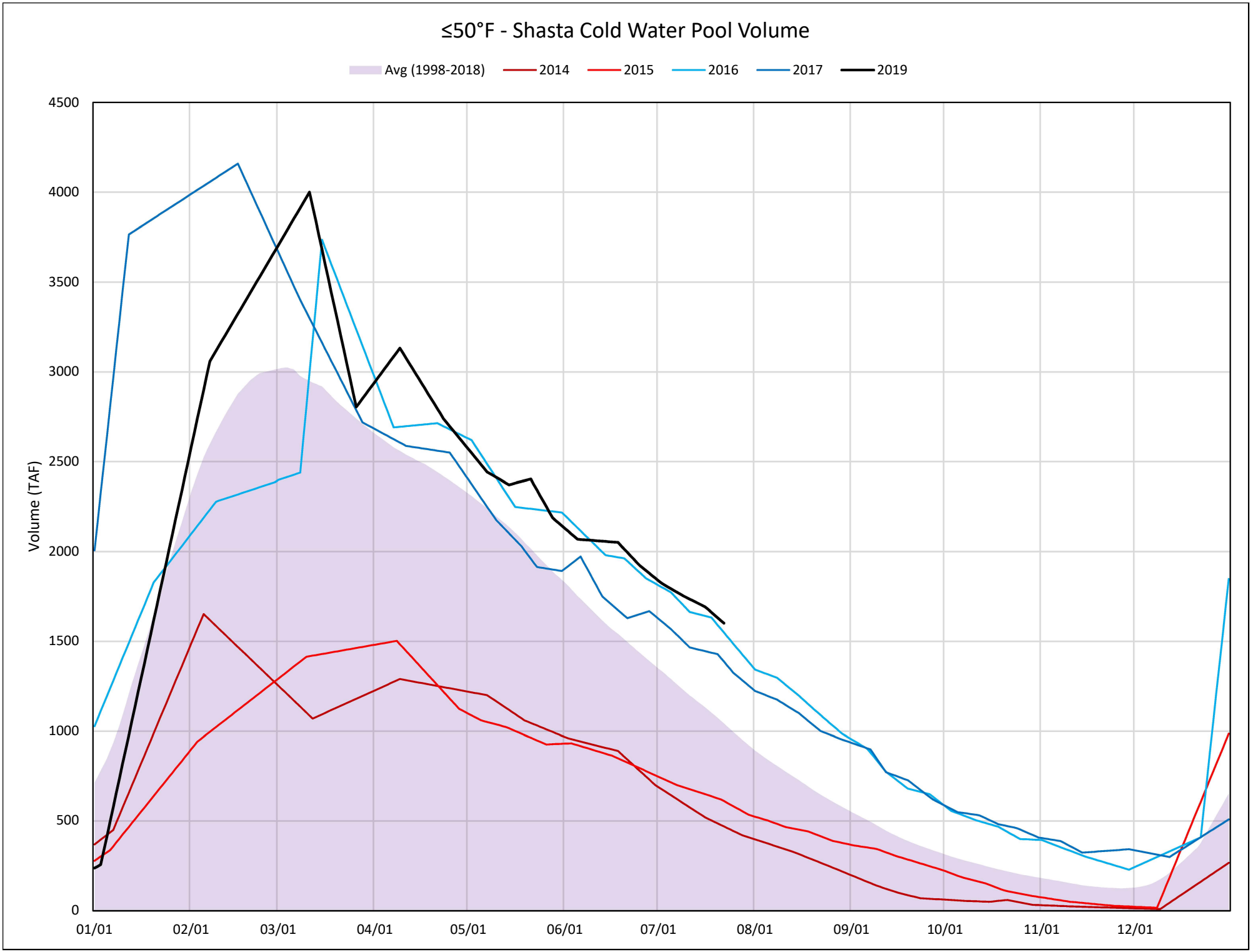
Ending Date: Current

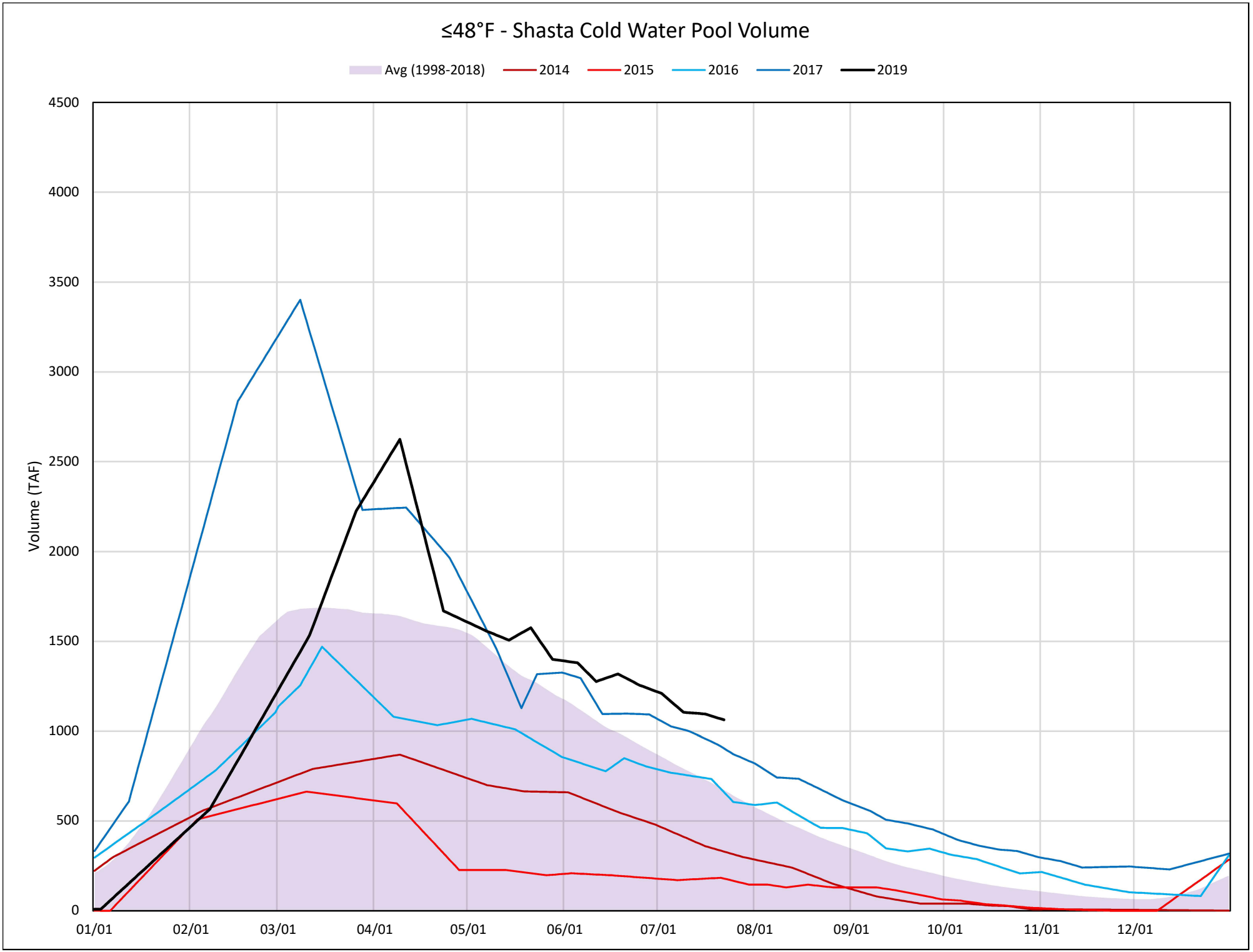
Profile data collected 07/23/2019

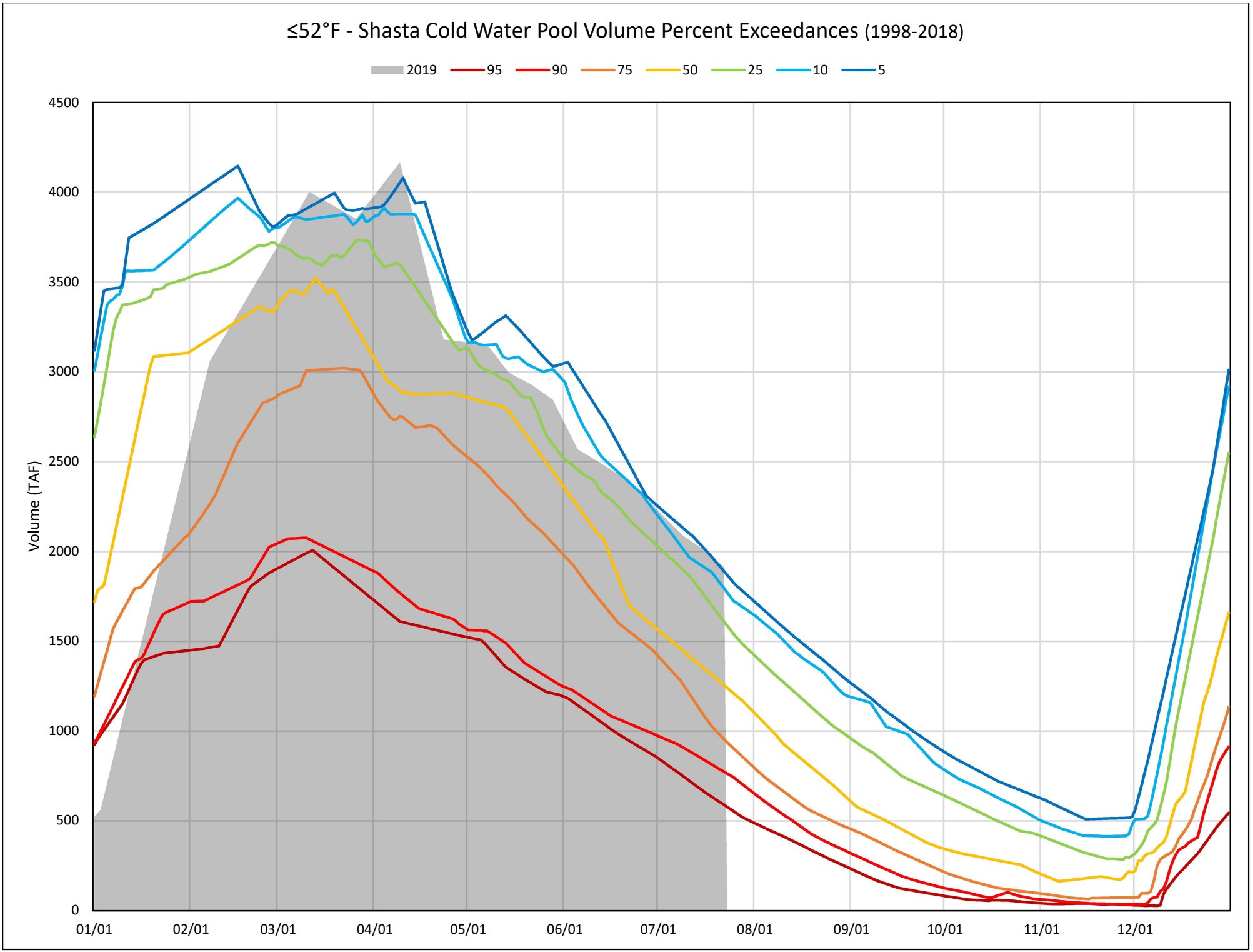


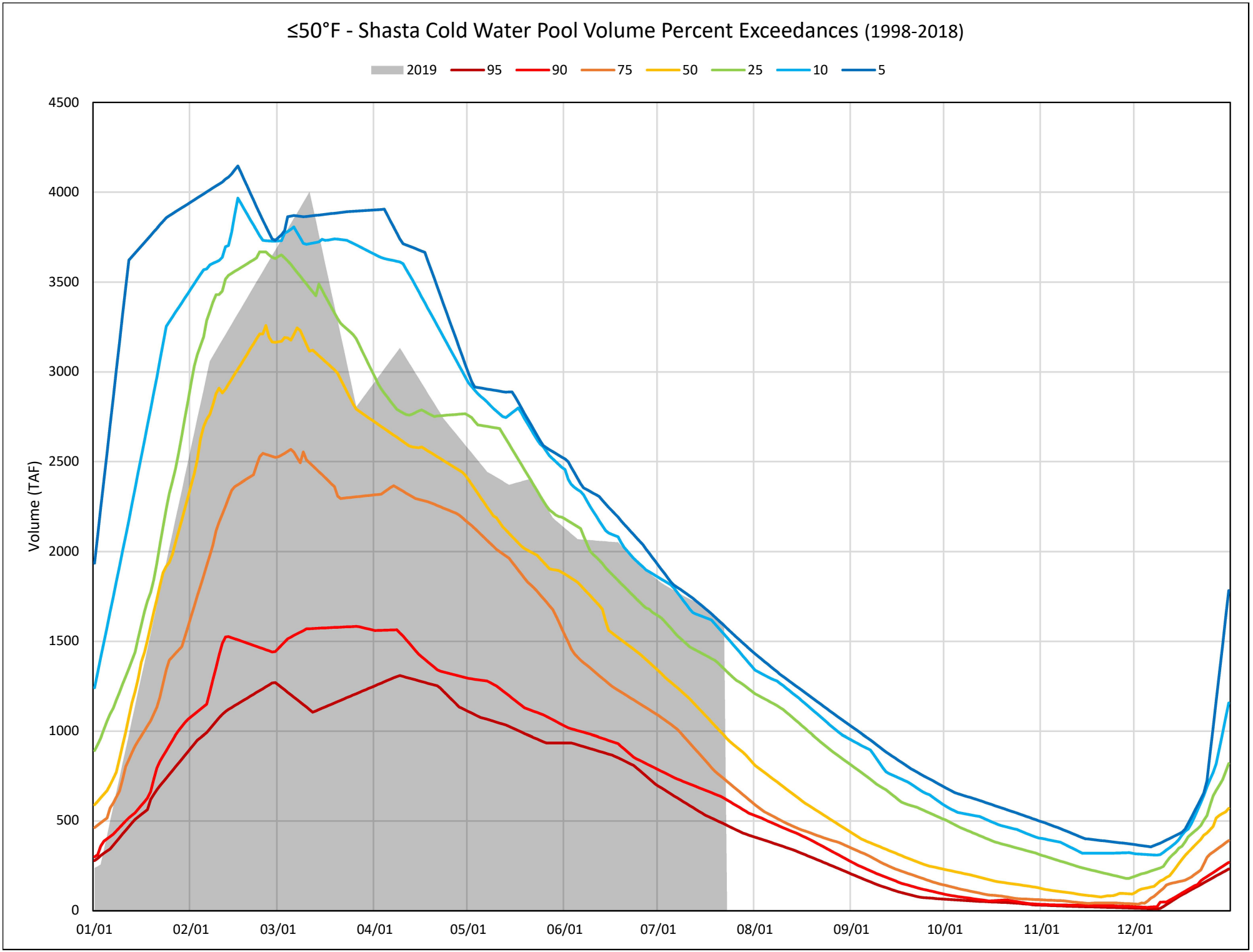
Arrows indicate open Gate or Outlet (i.e. Water flowing from this location)

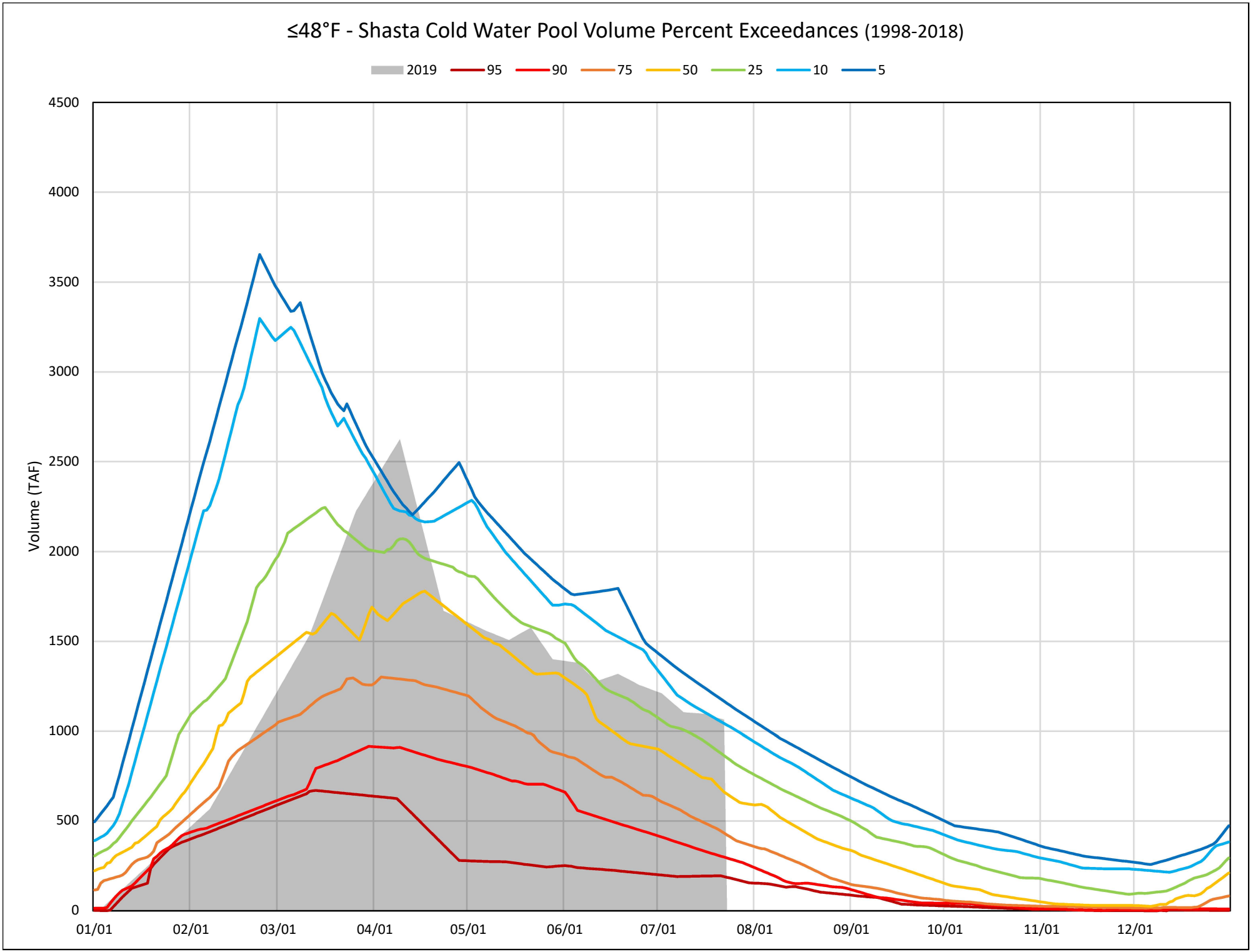

≤52°F - Shasta Cold Water Pool Volume
Avg (1998-2018)
2014
2015
2016
2017
2019
Volume (TAF)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01


≤50°F - Shasta Cold Water Pool Volume
Avg (1998-2018)
2014
2015
2016
2017
2019
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 (1998-2018)
2014
2015
2016
2017
2019
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

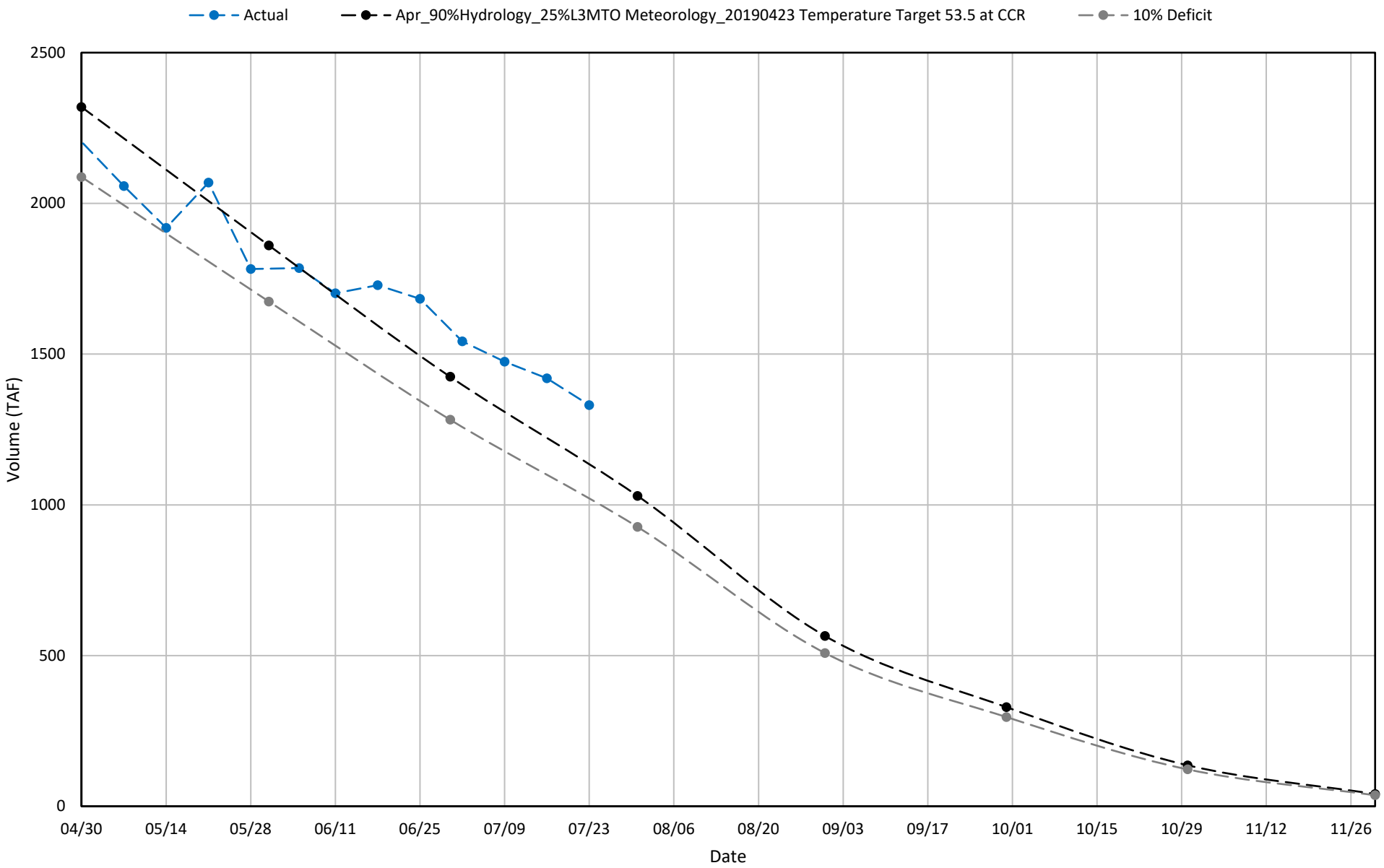

≤52°F - Shasta Cold Water Pool Volume Percent Exceedances (1998-2018)
2019
95
90
75
50
25
10
5
Volume (TAF)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01


≤50°F - Shasta Cold Water Pool Volume Percent Exceedances (1998-2018)
2019
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 (1998-2018)
2019
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

Printed: 2019.07.24

2019 Shasta Cold Water Pool Volume ≤49°F



July 24, 2019

Upper Sacramento River – July 2019 Preliminary Temperature Analysis

July Model Run: Only the most conservative hydrology set (90% Runoff Exceedance) is used in July as the hydrology information has converged and water year 2019 runoff volumes are nearly identical.

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

Location (°F DAT)	JUL	AUG	SEP*	OCT*
May 90%-Exceedance Outlook – 25% L3MTO Meteorology				
Keswick Dam KWK	53.0	52.7	See Figures 1 and 3	See Figures 1 and 3
Sac. R. abv Clear Creek CCR	53.4	53.0	See Figures 1 and 4	See Figures 1 and 4
Balls Ferry BSF	55.2	54.5	See Figures 1 and 5	See Figures 1 and 5
May 90%-Exceedance Outlook – 50% L3MTO Meteorology				
Keswick Dam KWK	52.2	52.7	See Figures 2 and 3	See Figures 2 and 3
Sac. R. abv Clear Creek CCR	52.3	53.0	See Figures 2 and 4	See Figures 2 and 4
Balls Ferry BSF	53.4	54.5	See Figures 2 and 5	See Figures 2 and 5

Model Run	End of September Cold Water Pool <56°F (TAF)	First Side Gate	Full Side Gates
90% Hydro, 25% Met	1063	10/25	NA
90% Hydro, 50% Met	1108	10/25	NA

Model Run Date July 24, 2019

* 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 3-5). 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 hydrology and meteorology. The temperature results for the Sacramento River between Keswick Dam and Balls Ferry are shown in Figures 1 through 2. 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 3-5.

Temperature Model Inputs, Assumptions, Limitations and Uncertainty:

1. The latest available profiles for Shasta, Trinity, and Whiskeytown were taken on July 23, July 22, and July 23, respectively. 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 cause significant additional warming in the upper Sacramento River during spring.
3. Operation is based on the June 2019 Operation Outlooks (monthly flows, reservoir release, and end-of-month reservoir storage) for the 90%- and 50%-exceedances, with minor modifications to accommodate for flood management. Trinity Lake inflows are updated with the CNRFC 90% runoff exceedance for the 90% and DWR Bulletin 120 for the 50% runoff exceedance studies.
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 25% historical exceedance for both the 90% and 50% runoff exceedance studies.
6. Meteorological inputs represent historical (1985 – 2017) monthly mean equilibrium temperature exceedance at 25% and 50% 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, 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.

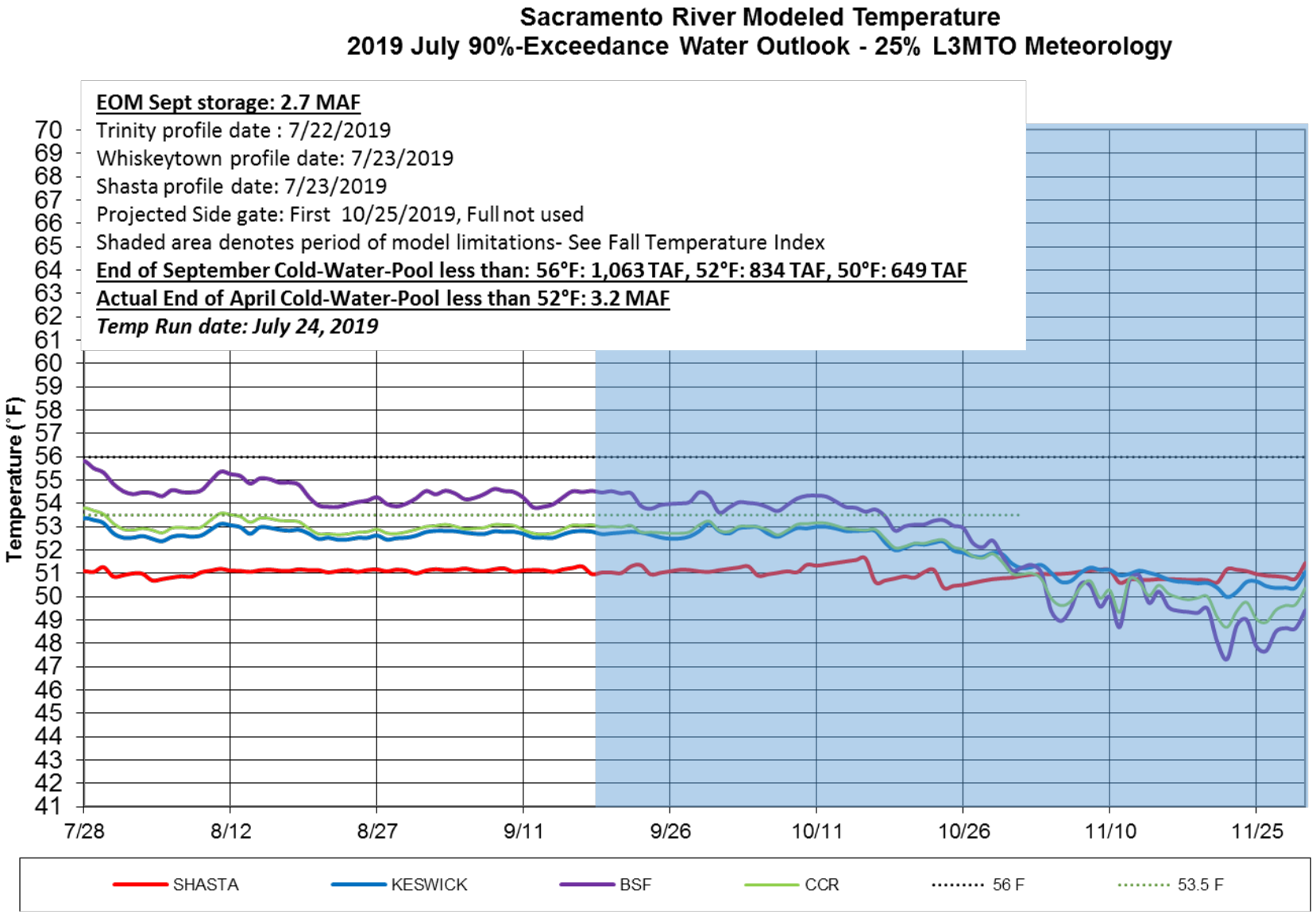


Figure 1. July 2019 simulated Sacramento River temperatures 90% runoff exceedance hydrology and 25% L3MTO meteorology.

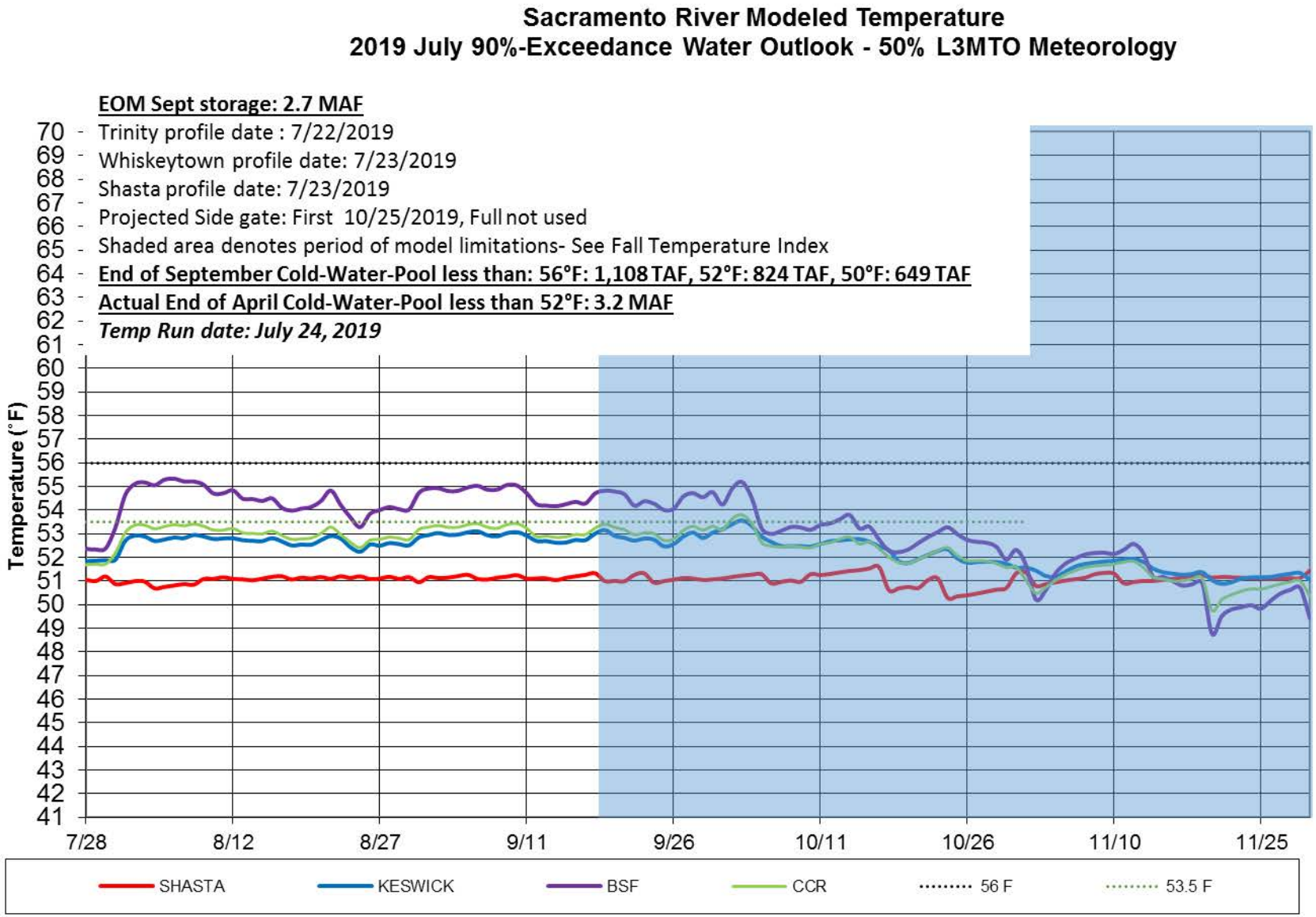


Figure 2. July 2019 simulated Sacramento River temperatures 90% runoff exceedance hydrology and 50% L3MTO meteorology.

Figures 3-5 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 reach to Balls Ferry.
3. Based on these records and estimates, the charts below illustrates a range of uncertainty in the expected river temperatures based on the end-of-September lake volume less than 56˚F.

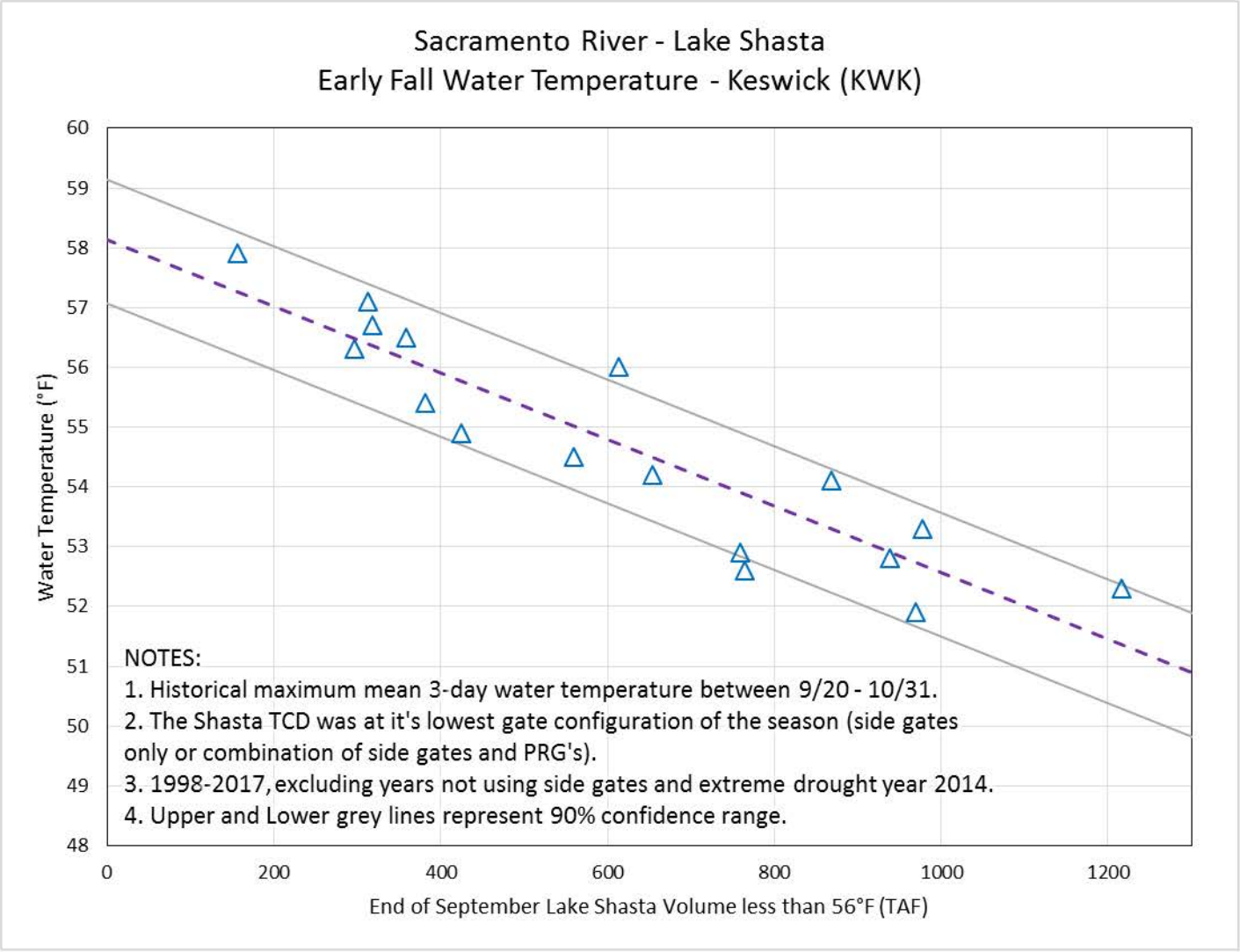


Figure 3. Historical relationship between Lake Shasta cold-water-pool characteristics and early fall Keswick water temperature.

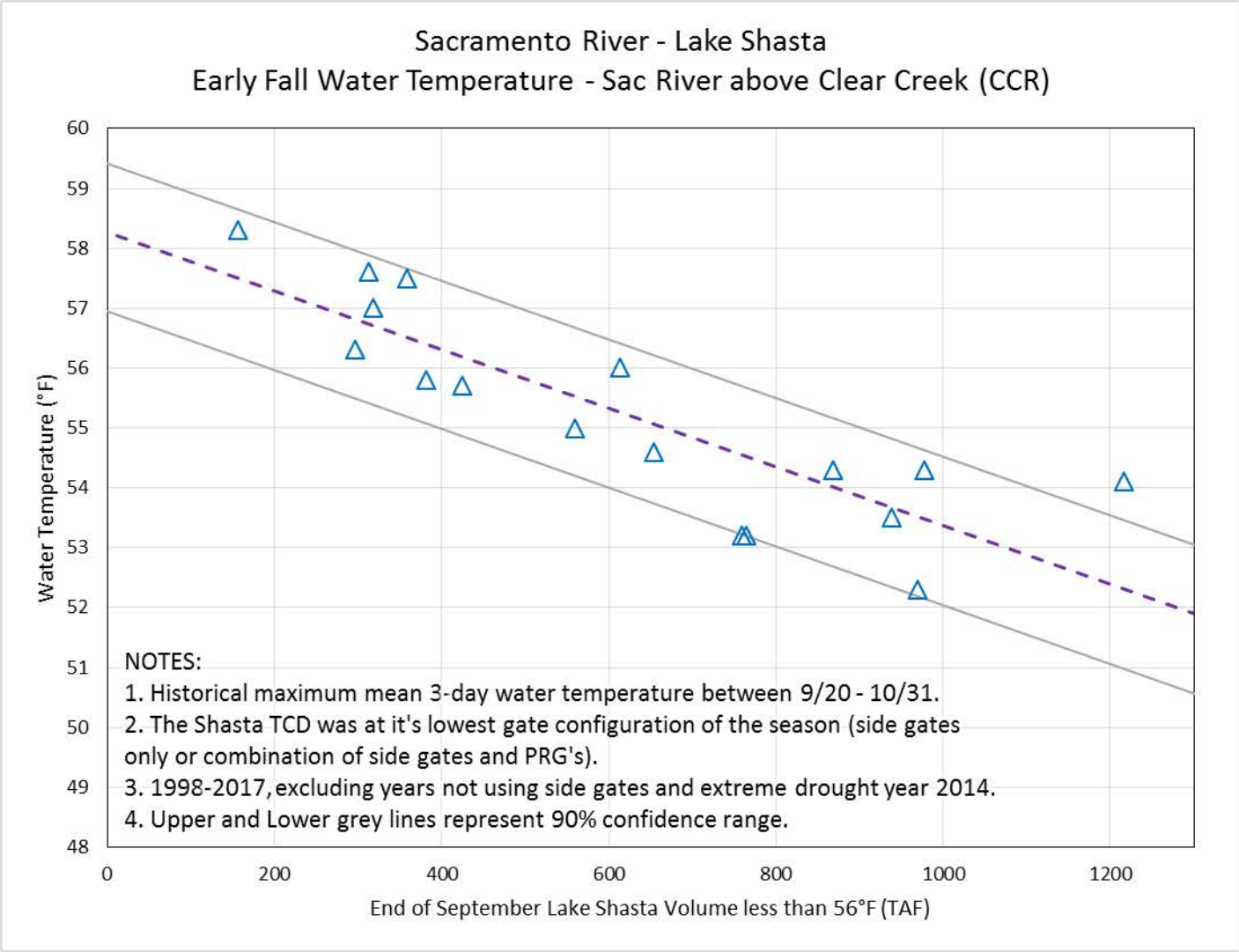


Figure 4. Historical relationship between Lake Shasta cold-water-pool characteristics and early fall Sacramento River above Clear Creek confluence water temperature.

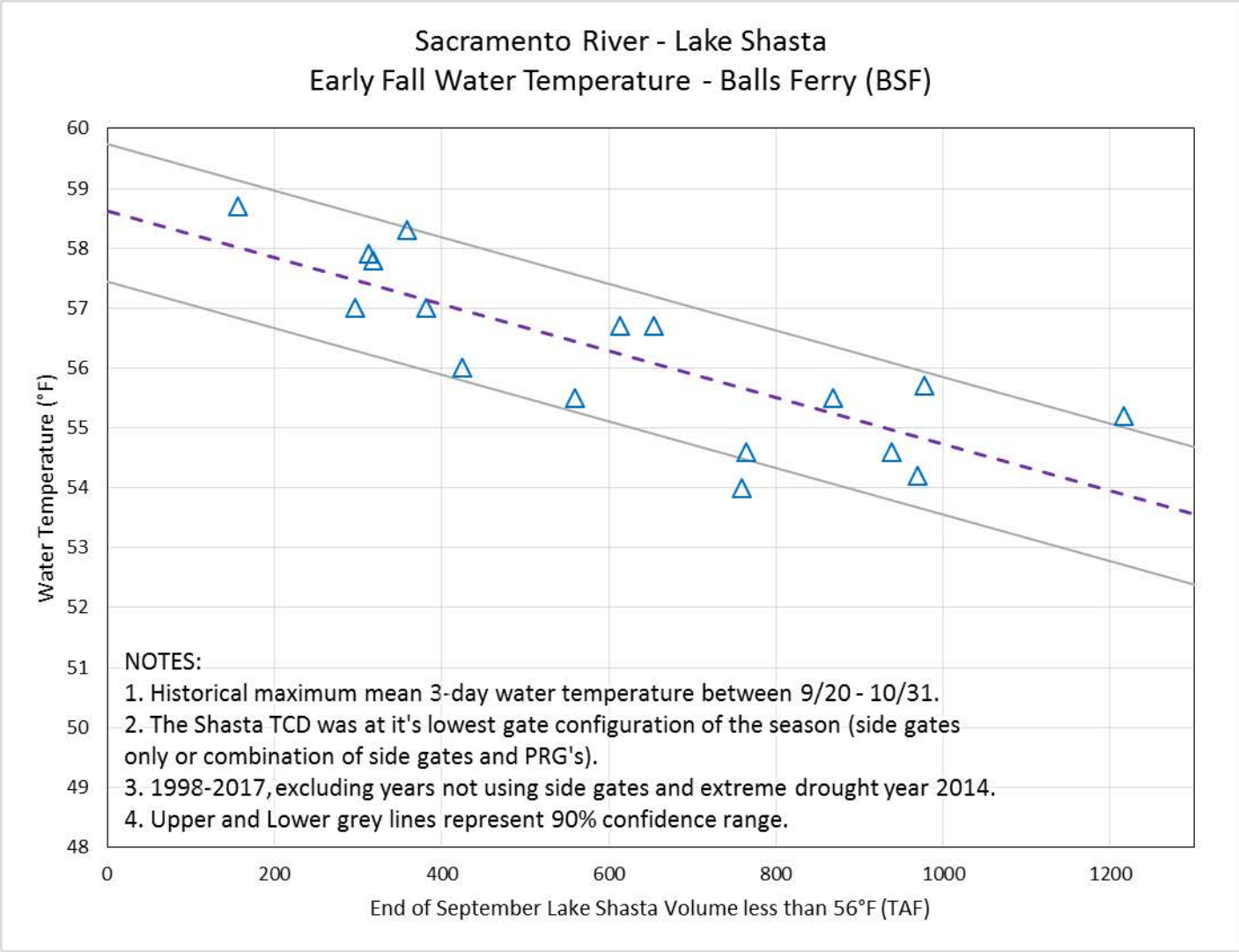
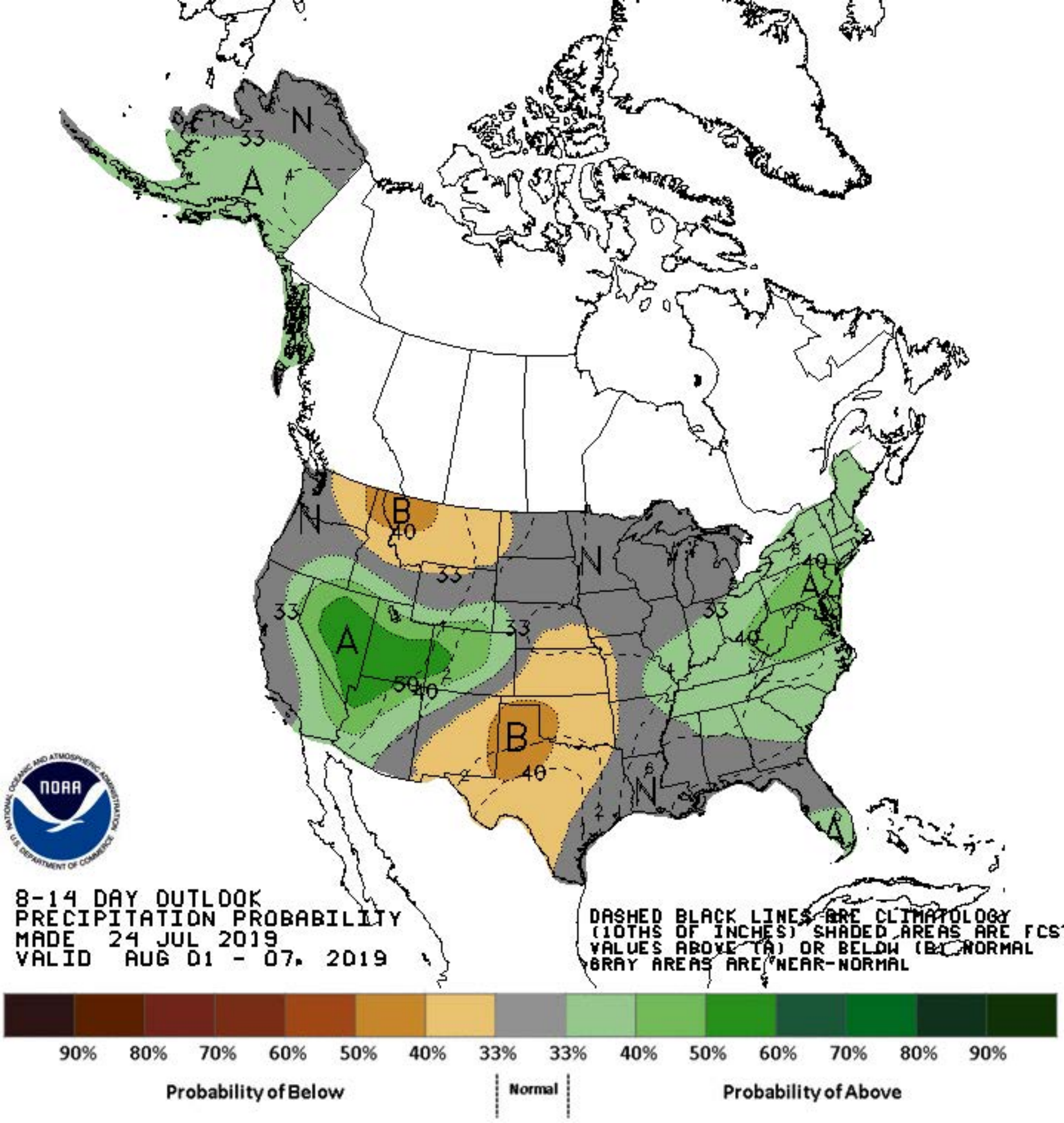


Figure 5. Historical relationship between Lake Shasta cold-water-pool characteristics and early fall Balls Ferry water temperature.


N
33
A
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B
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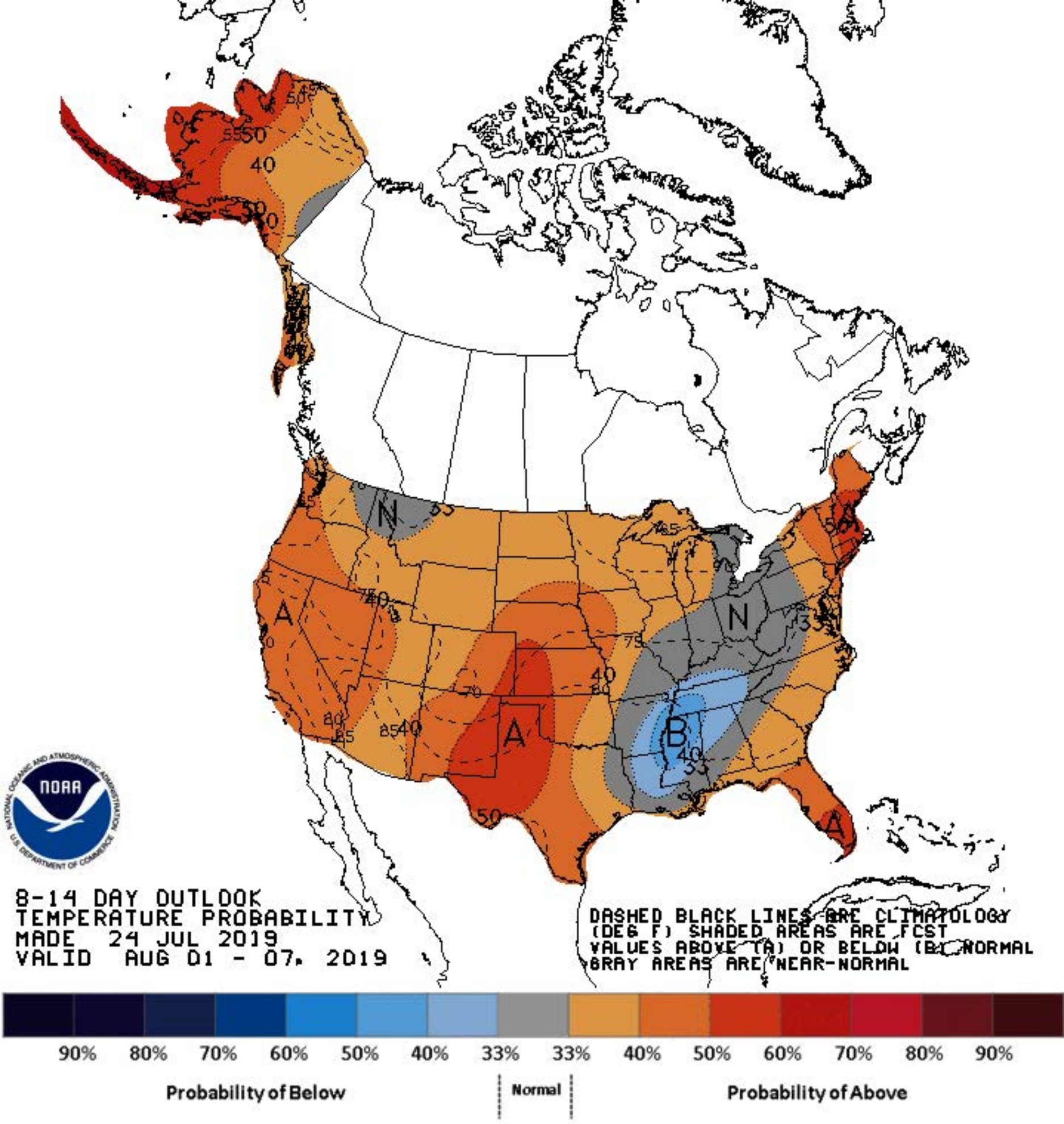
B
40
N
8-14 DAY OUTLOOK
PRECIPITATION PROBABILITY
MADE 24 JUL 2019
VALID AUG 01 - 07, 2019
DASHED BLACK LINES ARE CLIMATOLOGY
(10THS OF INCHES) SHADED AREAS ARE FCS
VALUES ABOVE (A) OR BELOW (B) NORMAL
GRAY AREAS ARE NEAR-NORMAL
90% 80% 70% 60% 50% 40% 33% 33% 40% 50% 60% 70% 80% 90%
Probability of Below
Normal
Probability of Above


8-14 DAY OUTLOOK
TEMPERATURE PROBABILITY
MADE 24 JUL 2019
VALID AUG 01 - 07, 2019
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