

Sacramento River Temperature Task Group Meeting

April 26, 2018

Conference Line: 877-718-6527

Participant code: 1954134

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 April 2018
 - 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
- Temperature Studies
 - April 90% Runoff Exceedance and 10% Historical Meteorology
 - April 90% Runoff Exceedance and 50% Historical Meteorology
 - April 50% Runoff Exceedance and 10% Historical Meteorology
 - April 50% Runoff Exceedance and 50% Historical Meteorology
- Updates
- Next Meeting : May 24, 2018 1:00 pm – 3:00 pm, Location TBD

DAILY CVP WATER SUPPLY REPORT

APRIL 24, 2018

RUN DATE: April 25, 2018

RESERVOIR RELEASES IN CUBIC FEET/SECOND

RESERVOIR	DAM	WY 2017	WY 2018	15 YR MEDIAN
TRINITY	LEWISTON	2,988	483	505
SACRAMENTO	KESWICK	28,046	4,930	6,407
FEATHER	OROVILLE (SWP)	35,000	1,100	1,800
AMERICAN	NIMBUS	15,467	2,353	2,353
STANISLAUS	GOODWIN	2,854	1,509	1,405
SAN JOAQUIN	FRIANT	5,136	380	274

STORAGE IN MAJOR RESERVOIRS IN THOUSANDS OF ACRE-FEET

RESERVOIR	CAPACITY	15 YR AVG	WY 2017	WY 2018	% OF 15 YR AVG
TRINITY	2,448	1,855	2,364	1,931	104
SHASTA	4,552	3,771	4,282	4,199	111
FOLSOM	977	714	750	825	115
NEW MELONES	2,420	1,522	1,988	2,057	135
FED. SAN LUIS	966	737	962	894	121
TOTAL NORTH CVP	11,363	8,599	10,346	9,906	115
MILLERTON	520	333	271	454	136
OROVILLE (SWP)	3,538	2,637	2,842	2,371	90

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

RESERVOIR	CURRENT WY 2018	DRIEST WY 1977	WETTEST WY 1983	15 YR AVG	% OF 15 YR AVG
TRINITY	414	107	1,435	768	54
SHASTA	2,517	1,553	7,901	3,760	67
FOLSOM	1,763	222	4,012	1,727	102
NEW MELONES	507	0	1,269	575	88
MILLERTON	657	117	1,870	636	103

ACCUMULATED PRECIPITATION FOR WATER YEAR TO DATE IN INCHES

RESERVOIR	CURRENT WY 2018	DRIEST WY 1977	WETTEST WY 1983	AVG (N YRS)	% OF AVG	LAST 24 HRS
TRINITY AT FISH HATCHERY	18.99	9.27	52.49	29.00 (56)	65	0.00
SACRAMENTO AT SHASTA DAM	36.16	11.04	106.16	56.68 (61)	64	0.00
AMERICAN AT BLUE CANYON	62.35	15.64	97.39	60.94 (43)	102	0.00
STANISLAUS AT NEW MELONES	20.67	0.00	42.90	25.26 (40)	82	0.00
SAN JOAQUIN AT HUNTINGTON LK	32.76	11.50	76.50	37.89 (43)	86	0.00

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

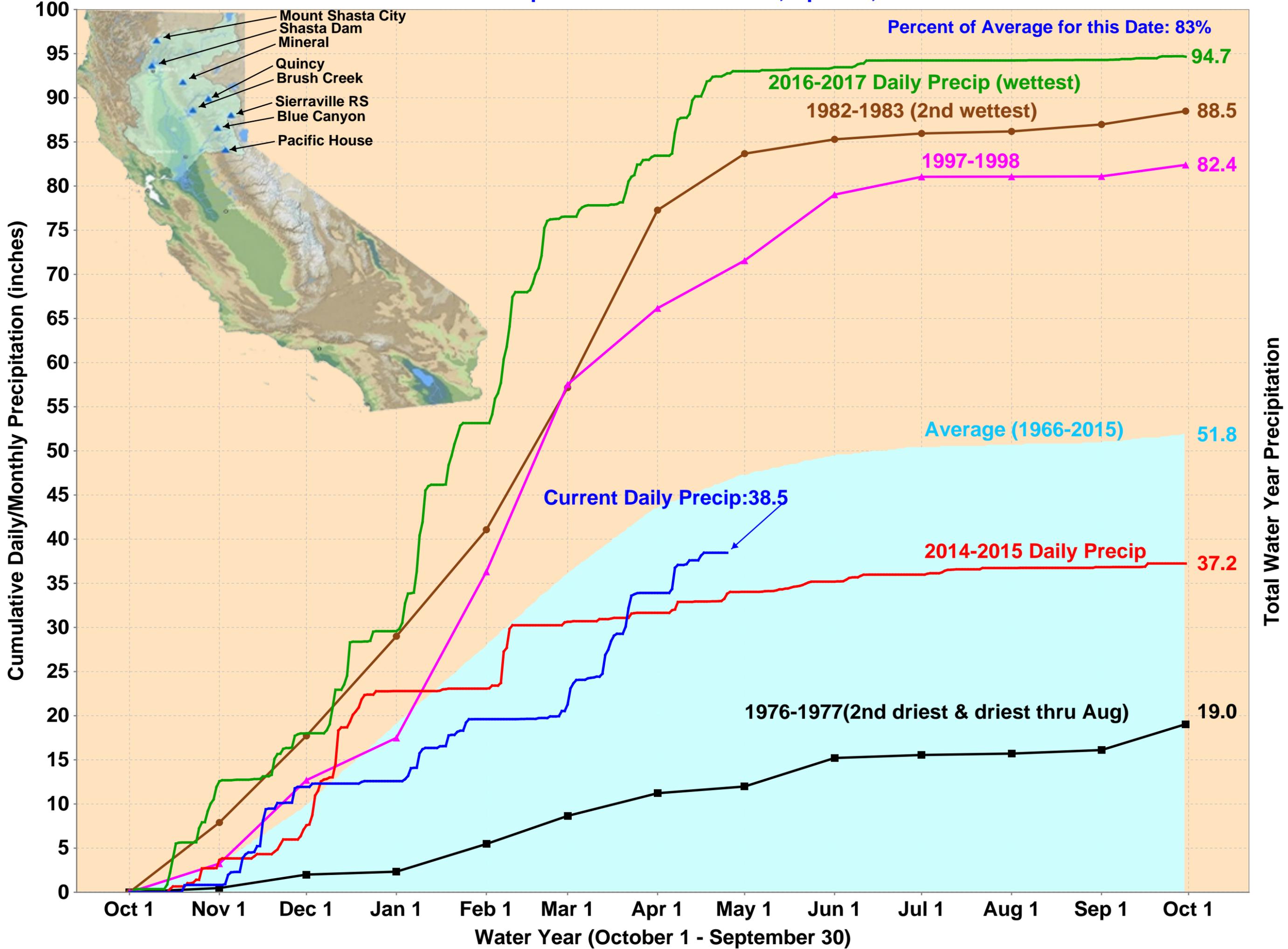
Storage/Release Management Conditions:

- Flood control management: no required flood space at this time
- Meteorological Uncertainty: Shorter term forecasts (8-14 day) are normal chances of precipitation, longer term forecasts (three-month outlook: May - Jul) suggest below normal chances for precipitation
- Inflow potential: The six day projection indicates Shasta Lake watershed to receive 0.35 inches of precipitation in the most favorable locations (Mar 21- Mar 27)
- Releases scheduled for 6,500 cfs this week for downstream demand and temperature management
- Actual runoff in April is slightly wetter than the April 1 forecasted estimates

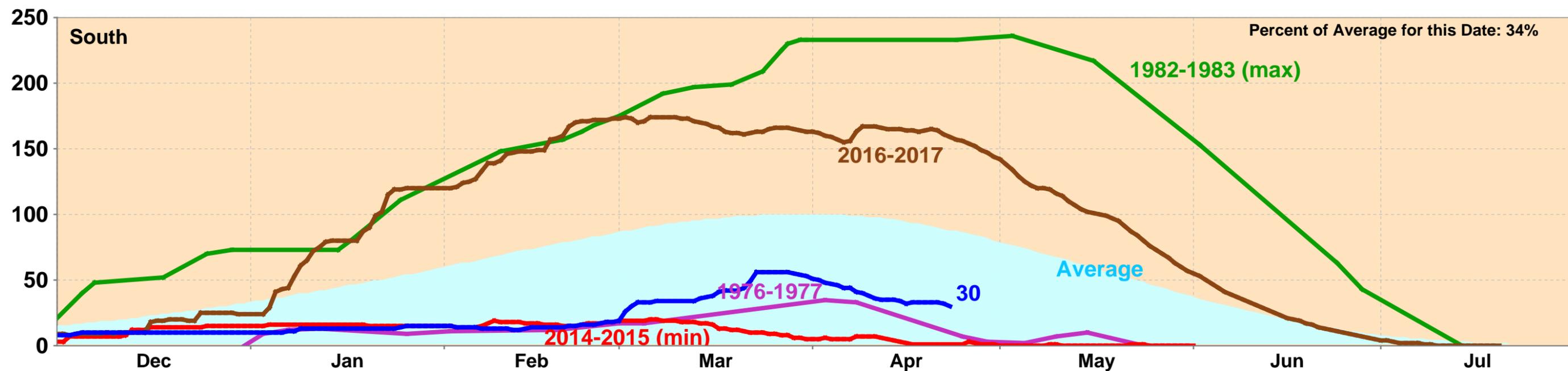
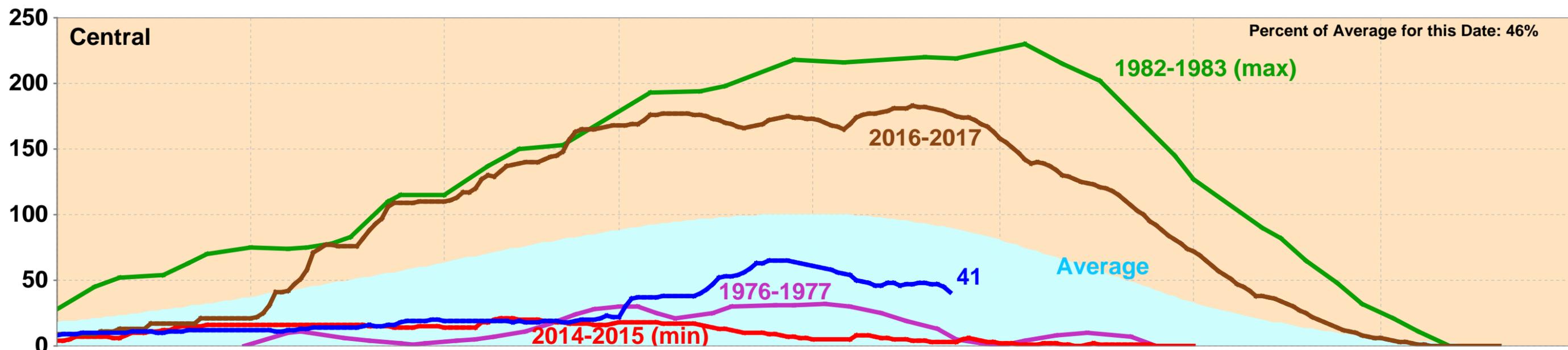
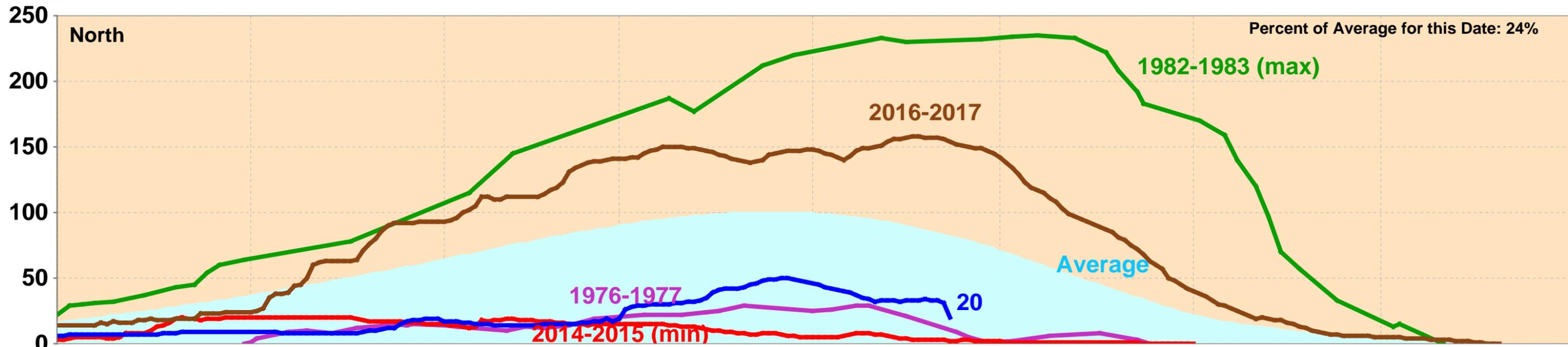
Temperature Management:

- Active temperature management: TCD change 4/22 – One Middle Gate Open to manage Balls Ferry temperatures
- Releases made from Upper and Middle Gates to conserve cold water pool
- Meteorological Uncertainty: Shorter term forecasts (8-14 day) are above normal temperatures; longer term forecasts (three-month outlook May - Jul) suggest above normal temperatures.

North Sierra Precipitation: 8-Station Index, April 25, 2018



California Snow Water Content, April 23, 2018, Percent of April 1 Average



Statewide Percent of April 1: 32%

Statewide Percent of Average for Date: 37%

CVP Northern System Operation Outlooks

DRAFT April 2018

90% Runoff Exceedance Outlook:

Inflow based on the DWR 2018 B120, 70% Historical Inflows Oct and future months

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

		Apr	May	Jun	Jul	Aug	Sep	Oct
Shasta	3880	4132	4011	3656	3077	2630	2351	2226
	Elev.	1052	1048	1035	1011	991	977	970

Monthly River Releases (cfs)

Sacramento	5000	8000	10500	13000	10500	8000	6000
Clear Creek	218	216	288	150	150	150	200

Trinity Diversions (TAF)

		Apr	May	Jun	Jul	Aug	Sep	Oct
Carr Power Plant		39	67	85	80	71	62	16
Spring Creek PP		10	60	70	70	60	60	30

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.

50% Runoff Exceedance Outlook:

Inflow based on the DWR 2018 B120, 50% Historical Inflows Oct and future months

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

		Apr	May	Jun	Jul	Aug	Sep	Oct
Shasta	3880	4167	4117	3801	3266	2874	2647	2552
	Elev.	1054	1052	1040	1019	1002	991	987

Monthly River Releases (cfs)

Sacramento	4500	7500	10500	13000	10500	8000	6000
Clear Creek	218	216	288	150	150	150	200

Trinity Diversions (TAF)

		Apr	May	Jun	Jul	Aug	Sep	Oct
Carr Power Plant		35	24	71	84	85	76	26
Spring Creek PP		15	25	60	75	75	75	40

Estimated CVP Operations Mar 90% Exceedance

Storages

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

		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	
Trinity		1844	1964	1893	1782	1679	1555	1439	1409	1390	1400	1432	1518	1615
	Elev.	2338	2338	2333	2325	2318	2308	2298	2295	2294	2295	2297	2305	2313
Whiskeytown		207	238	238	238	238	238	230	206	206	206	206	206	206
	Elev.	1209	1209	1209	1209	1209	1209	1207	1199	1199	1199	1199	1199	1199
Shasta		3880	4132	4011	3656	3077	2630	2351	2226	2221	2351	2548	2895	3351
	Elev.	1052	1048	1035	1011	991	977	970	970	970	977	987	1003	1023
Folsom		817	793	904	825	591	449	402	345	296	256	306	412	576
	Elev.	449	459	452	427	410	403	395	386	379	379	388	405	426
New Melones		2019	1977	1946	1922	1848	1784	1740	1709	1721	1735	1747	1770	1789
	Elev.	1050	1047	1045	1038	1032	1028	1025	1026	1027	1028	1028	1031	1033
San Luis		876	773	574	266	88	8	72	198	382	526	666	699	762
	Elev.	510	485	445	421	399	414	431	451	476	491	493	505	
Total		9877	9567	8689	7521	6665	6234	6093	6215	6474	6905	7500	8298	

End of the Month Reservoir Storage (TAF)

Total San Luis (TAF)		1774	1622	1335	919	697	518	638	791	986	1245	1411	1422	1565

Monthly River Releases (TAF/cfs)

Trinity	TAF	36	92	47	28	53	52	23	18	18	18	17	18
	cfs	600	1,498	783	450	857	870	373	300	300	300	300	300
Clear Creek	TAF	13	13	17	9	9	9	12	12	12	12	11	12
	cfs	218	216	288	150	150	150	200	200	200	200	200	200
Sacramento	TAF	297	492	625	799	645	476	369	268	200	200	180	200
	cfs	5000	8000	10500	13000	10500	8000	6000	4500	3250	3250	3250	3250
American	TAF	506	77	167	293	204	107	92	89	92	61	56	77
	cfs	8500	1250	2811	4768	3311	1798	1500	1500	1500	1000	1005	1250
Stanislaus	TAF	83	96	56	18	18	18	49	12	12	14	13	12
	cfs	1400	1555	940	300	300	300	797	200	200	232	236	200

Trinity Diversions (TAF)

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Carr PP	39	67	85	80	71	62	16	21	12	3	2	15
Spring Crk. PP	10	60	70	70	60	60	30	15	12	10	20	30

Delta Summary (TAF)

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Tracy	93	61	53	225	260	262	265	250	190	190	120	200
USBR Banks	0	0	0	18	18	18	0	0	0	0	0	0
Contra Costa	12.7	12.7	9.8	11.1	12.7	14.0	16.8	18.4	18.3	14.0	14.0	12.7
Total USBR	106	74	63	254	291	294	282	268	208	204	134	213
Total Export	182	105	110	375	355	444	433	374	394	394	261	413
COA Balance	25	25	0	0	0	87	87	87	87	87	46	46
Old/Middle River Std.												
Old/Middle R. calc.	-164	146	-1,354	-4,912	-4,693	-5,945	-5,221	-4,877	-4,978	-4,960	-3,536	-5,040
Computed DOI	30476	9516	7900	6507	4002	3009	4067	4572	6767	9728	11400	12379
Excess Outflow	19079	1610	0	0	0	0	65	67	2261	3725	0	976
% Export/Inflow	8%	11%	13%	35%	40%	54%	54%	52%	47%	41%	29%	34%
% Export/Inflow std.	35%	35%	35%	65%	65%	65%	65%	65%	65%	65%	45%	35%

Hydrology

	Trinity	Shasta	Folsom	New Melones
Water Year Inflow (TAF)	627	3,621	2,352	972
Year to Date + Forecasted % of mean	52%	65%	86%	92%

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Estimated CVP Operations Mar 50% Exceedance

Storages

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

		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Trinity	1844	1878	1860	1773	1659	1514	1381	1343	1330	1360	1425	1535	1629
	Elev.	2332	2331	2325	2316	2304	2293	2290	2288	2291	2297	2306	2314
Whiskeytown	207	238	238	238	238	238	230	206	206	206	206	206	206
	Elev.	1209	1209	1209	1209	1209	1207	1199	1199	1199	1199	1199	1199
Shasta	3880	4167	4117	3801	3266	2874	2647	2552	2601	2792	3198	3682	4240
	Elev.	1054	1052	1040	1019	1002	991	987	989	998	1016	1036	1056
Folsom	817	823	946	831	660	598	538	489	460	449	477	530	595
	Elev.	452	463	452	435	428	421	415	411	410	414	420	428
New Melones	2019	1999	2017	2021	1961	1898	1857	1815	1832	1855	1887	1941	1918
	Elev.	1052	1054	1054	1049	1043	1039	1035	1037	1039	1042	1047	1045
San Luis	876	782	560	367	178	75	128	246	427	634	779	896	968
	Elev.	510	479	452	426	412	434	460	491	522	522	534	543
Total		9887	9738	9030	7962	7197	6780	6651	6856	7296	7972	8791	9556

End of the Month Reservoir Storage (TAF)

Total San Luis (TAF)	1774	1626	1275	994	741	620	814	1075	1402	1765	1764	1918	2031
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Monthly River Releases (TAF/cfs)

Trinity	TAF	36	92	47	28	53	52	23	18	18	18	17	18
	cfs	600	1,498	783	450	857	870	373	300	300	300	300	300
Clear Creek	TAF	13	13	17	9	9	9	12	12	12	15	11	12
	cfs	218	216	288	150	150	150	200	200	200	240	200	200
Sacramento	TAF	268	461	625	799	645	476	369	268	200	200	278	307
	cfs	4500	7500	10500	13000	10500	8000	6000	4500	3250	3250	5000	5000
American	TAF	476	154	252	250	136	132	123	119	123	123	208	246
	cfs	8000	2500	4229	4067	2217	2226	2007	2000	2000	2000	3750	4000
Stanislaus	TAF	83	96	56	18	18	18	49	12	12	14	13	93
	cfs	1400	1555	940	300	300	300	797	200	200	232	236	1521

Trinity Diversions (TAF)

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Carr PP	35	24	71	84	85	76	26	25	9	0	2	35
Spring Crk. PP	15	25	60	75	75	75	40	20	12	20	35	60

Delta Summary (TAF)

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Tracy	129	74	219	273	273	261	265	254	260	205	215	221
USBR Banks	0	0	0	24	24	24	0	0	0	0	0	0
Contra Costa	12.7	12.7	9.8	11.1	12.7	14.0	16.8	18.4	18.3	14.0	14.0	12.7
Total USBR	142	86	229	308	310	299	282	272	278	219	229	234
Total Export	247	105	335	449	493	560	580	547	538	269	444	421
COA Balance	25	25	0	0	16	153	230	224	224	224	224	224
Old/Middle River Std.												
Old/Middle R. calc.	-483	281	-3,941	-5,605	-6,217	-7,257	-6,923	-6,927	-6,577	-3,086	-4,826	-3,440
Computed DOI	33838	13388	7900	6507	4002	3009	4002	4505	8329	17569	23954	25849
Excess Outflow	22441	4441	0	0	0	0	0	0	3823	11566	12553	14445
% Export/Inflow	10%	9%	33%	40%	50%	62%	62%	62%	50%	20%	25%	20%
% Export/Inflow std.	35%	35%	35%	65%	65%	65%	65%	65%	65%	65%	45%	35%

Hydrology

	Trinity	Shasta	Folsom	New Melones
Water Year Inflow (TAF)	539	3,864	2,536	1080
Year to Date + Forecasted % of mean	45%	70%	93%	102%

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Northern CVP Water Temperature Report

April - 2018

Page	Description
1	- Mean Daily Water Temperature, Release Flow Rates and Air Temperatures with Monthly Averages
2	- Redding 10-Day Forecasted Air Temperatures
3	- Sacramento River Mean Daily Water Temperature, Air Temperature and 10-Day Forecasted Air Temperature Plot - Water Temperature Measuring Station Details - Temperature Control Point Details
4	- Daily Maximum and 7DADM
5	- Shasta Lake Isothermobaths Plot
6	- Trinity Lake Isothermobaths Plot
7	- Whiskeytown Lake Isothermobaths Plot
x	- TCD Configuration (External Link)



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	----- ³	Shasta Generation	Spring Creek P.P.	Keswick Total	RDD	BSF	RDB	LWS
Mar	49.7	48.9	47.9	49.4	49.6	50.2	50.7	51.1	51.3	51.7	47.6	46.8	-	2702	152	3087	52.5	51.1	52.5	43.8
04/01	50.2	49.5	48.6	51.3	51.9	53.0	55.2	56.3	56.7	57.6	50.1	50.0	-	2046	679	3044	62.5	62.0	64.3	54.0
04/02	51.1	50.6	49.0	51.6	52.2	53.4	55.8	56.9	57.4	58.3	50.4	50.4	-	2533	50	3045	62.5	61.8	64.0	54.4
04/03	51.2	50.1	48.9	51.4	52.0	53.0	54.8	55.8	56.3	57.8	49.4	50.1	-	3027	17	3045	61.5	56.6	61.1	51.0
04/04	51.1	49.7	48.2	51.5	51.8	52.8	55.1	56.2	56.7	57.7	50.0	50.9	-	2960	131	3043	65.5	63.0	65.3	57.3
04/05	51.0	50.2	48.8	51.5	51.7	52.3	54.0	55.2	55.7	56.9	49.5	50.6	-	3131	36	3046	56.5	57.1	57.5	50.6
04/06	51.0	50.0	48.8	51.5	51.8	52.1	53.5	53.8	54.3	55.0	50.1	50.1	-	2766	16	3044	53.5	53.4	55.2	49.0
04/07	50.6	50.0	48.4	51.4	53.8	54.0	56.6	56.5	56.3	57.0	52.8	50.9	-	1892	490	3045	59.5	61.0	61.4	51.7
04/08	50.5	49.6	48.9	51.3	52.3	53.3	54.7	55.2	55.4	56.7	50.5	51.3	-	1612	1306	3043	58.0	56.1	57.0	50.5
04/09	51.4	? 51.0	48.6	51.3	52.2	53.2	55.0	55.7	55.8	56.5	51.0	51.2	-	2231	337	3045	64.0	59.9	62.0	54.7
04/10	50.6	49.4	48.8	51.5	52.1	53.1	55.6	56.6	56.7	57.3	51.2	51.6	-	2594	48	2963	63.0	61.0	61.7	54.8
04/11	50.6	49.7	48.8	51.7	51.6	52.2	53.9	54.8	55.2	56.2	49.7	49.9	-	2542	14	3043	49.5	53.3	52.7	43.5
04/12	50.6	49.5	48.8	51.5	51.8	52.1	51.9	52.4	? 52.5	53.5	48.7	49.8	-	3066	14	3044	48.5	48.6	50.5	42.7
04/13	51.3	50.5	48.9	51.1	51.8	52.7	52.9	53.3	53.3	53.9	49.6	50.6	-	2905	18	3050	55.0	53.0	54.5	46.8
04/14	51.0	49.9	49.0	51.1	51.9	53.2	55.0	55.8	55.9	56.1	50.9	51.5	-	3061	15	3094	59.5	58.5	60.1	53.3
04/15	50.9	50.2	49.0	51.3	51.2	51.9	54.4	55.9	56.4	57.1	49.6	50.7	-	2606	14	3096	52.0	56.5	57.8	44.8
04/16	50.9	50.3	48.6	51.4	51.6	51.9	52.3	52.9	53.0	54.2	48.8	51.0	-	2637	92	3097	50.5	49.9	49.6	42.6
04/17	51.2	50.6	49.1	51.2	51.8	52.5	52.7	53.3	53.5	54.2	49.5	50.8	-	2890	14	3140	49.0	48.3	49.8	43.6
04/18	51.6	50.2	49.1	51.1	51.4	52.3	53.4	53.8	53.9	54.5	49.4	49.7	-	2611	14	3173	53.0	51.3	51.8	46.3
04/19	52.0	51.1	49.2	51.6	52.0	52.9	53.5	54.2	54.4	54.9	50.5	49.3	-	3096	14	3175	↓ 56.5	54.4	56.3	48.5
04/20	52.2	51.1	49.3	51.9	52.7	53.8	55.6	56.4	56.6	57.1	51.2	49.4	-	3419	14	3522	64.0	61.9	63.0	54.7
04/21	51.7	50.7	49.4	52.4	53.2	54.3	56.6	58.0	58.3	59.2	52.0	50.1	-	3558	14	3732	66.0	64.2	65.9	58.5
04/22	51.1	50.6	49.4	52.9	53.6	54.7	57.3	58.8	59.2	60.3	51.9	50.5	-	3079	14	3727	68.0	64.4	65.5	57.1
04/23	50.5	49.4	49.5	53.2	53.9	55.0	57.6	59.1	59.5	60.7	51.9	50.8	-	3628	14	4278	↑ 71.5	66.7	68.6	58.6
04/24	50.9	50.2	49.5	52.5	53.3	54.4	57.2	58.9	59.4	60.9	51.8	50.6	-	4180	62	4930	68.0	65.3	67.2	60.1
04/25																				
04/26																				
04/27																				
04/28																				
04/29																				
04/30																				
-																				
Apr	51.1	50.2	49.0	51.6	52.2	53.1	54.8	55.7	55.9	56.8	50.4	50.5	-	2836	143	3269	59.1	57.8	59.3	51.2

Total CFS	68070	3437	78464
Total AF	135014	6817	155630

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

D A T E	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	
04/01	48	79	63.5	49	78	63.5	48	74	61.0	43	77	60.0	48	76	62.0	50	68	59.0	52	68	60.0	50	69	59.5	45	73	59.0	46	80	63.0	45	75	60.0	49	75	62.0	
04/02	45	80	62.5	53	73	63.0	42	76	59.0	49	74	61.5	49	68	58.5	51	65	58.0	52	69	60.5	46	70	58.0	46	70	58.0	49	65	57.0	44	69	56.5	48	72	60.0	
04/03	51	74	62.5	47	76	61.5	49	76	62.5	51	68	59.5	51	63	57.0	53	66	59.5	45	68	56.5	45	72	58.5	50	69	59.5	47	76	61.5	47	71	59.0	50	74	62.0	
04/04	47	76	61.5	55	76	65.5	51	65	58.0	51	63	57.0	52	65	58.5	45	68	56.5	45	74	59.5	48	68	58.0	43	65	54.0	47	66	56.5	46	71	58.5	49	75	62.0	
04/05	54	77	65.5	53	64	58.5	50	62	56.0	52	66	59.0	44	70	57.0	43	75	59.0	48	64	56.0	44	66	55.0	43	64	53.5	43	65	54.0	46	73	59.5	48	71	59.5	
04/06	51	62	56.5	51	60	55.5	52	65	58.5	44	72	58.0	46	82	64.0	50	68	59.0	46	65	55.5	41	63	52.0	43	69	56.0	48	73	60.5	46	72	59.0	47	72	59.5	
04/07	51	56	53.5	56	65	60.5	45	68	56.5	46	83	64.5	52	71	61.5	48	65	56.5	41	60	50.5	40	71	55.5	44	68	56.0	46	70	58.0	47	70	58.5	47	76	61.5	
04/08	50	69	59.5	49	70	59.5	46	81	63.5	51	70	60.5	48	64	56.0	40	61	50.5	39	70	54.5	44	70	57.0	49	74	61.5	46	69	57.5	46	73	59.5	48	72	60.0	
04/09	48	68	58.0	50	82	66.0	55	66	60.5	48	61	54.5	39	58	48.5	39	72	55.5	46	74	60.0	48	72	60.0	44	72	58.0	46	79	62.5	48	82	65.0	53	79	66.0	
04/10	48	80	64.0	57	66	61.5	47	59	53.0	39	59	49.0	38	72	55.0	45	74	59.5	48	68	58.0	43	64	53.5	41	65	53.0	46	67	56.5	46	78	62.0	51	76	63.5	
04/11	57	69	63.0	52	59	55.5	37	60	48.5	38	72	55.0	46	74	60.0	47	61	54.0	41	60	50.5	38	62	50.0	43	70	56.5	47	74	60.5	49	79	64.0	53	77	65.0	
04/12	40	59	49.5	37	60	48.5	38	72	55.0	46	74	60.0	48	65	56.5	42	56	49.0	38	60	49.0	42	62	52.0	47	73	60.0	48	77	62.5	51	79	65.0	50	77	63.5	
04/13	36	61	48.5	39	72	55.5	47	74	60.5	48	63	55.5	40	56	48.0	37	61	49.0	42	62	52.0	43	68	55.5	48	77	62.5	50	83	66.5	52	82	67.0	52	81	66.5	
04/14	37	73	55.0	45	75	60.0	49	60	54.5	40	57	48.5	36	62	49.0	41	65	53.0	42	70	56.0	44	75	59.5	49	76	62.5	48	75	61.5	49	77	63.0	51	78	64.5	
04/15	45	74	59.5	41	59	50.0	40	57	48.5	34	63	48.5	41	65	53.0	41	72	56.5	45	78	61.5	48	79	63.5	52	80	66.0	50	82	66.0	52	82	67.0	53	82	67.5	
04/16	41	63	52.0	44	57	50.5	35	63	49.0	42	64	53.0	40	73	56.5	46	80	63.0	49	82	65.5	51	82	66.5	55	84	69.5	52	83	67.5	51	80	65.5	52	78	65.0	
04/17	43	58	50.5	36	64	50.0	43	64	53.5	41	73	57.0	46	81	63.5	51	83	67.0	50	83	66.5	53	82	67.5	54	81	67.5	51	82	66.5	52	87	69.5	56	85	70.5	
04/18	35	63	49.0	45	63	54.0	41	74	57.5	49	81	65.0	51	85	68.0	53	84	68.5	53	85	69.0	53	81	67.0	55	87	71.0	55	85	70.0	56	83	69.5	52	76	64.0	
04/19	43	63	53.0	40	74	57.0	48	82	65.0	51	87	69.0	53	83	68.0	54	86	70.0	54	82	68.0	54	83	68.5	54	82	68.0	50	79	64.5	48	82	65.0	53	80	66.5	
04/20	39	74	56.5	48	82	65.0	50	85	67.5	54	84	69.0	54	86	70.0	54	84	69.0	53	85	69.0	54	82	68.0	52	75	63.5	48	81	64.5	51	83	67.0	54	80	67.0	
04/21	46	82	64.0	46	85	65.5	51	83	67.0	52	87	69.5	55	89	72.0	56	89	72.5	55	87	71.0	54	79	66.5	51	77	64.0	49	81	65.0	52	84	68.0	55	81	68.0	
04/22	46	86	66.0	50	84	67.0	54	87	70.5	56	89	72.5	57	87	72.0	54	84	69.0	51	76	63.5	49	72	60.5	49	73	61.0	50	80	65.0	54	82	68.0	55	80	67.5	
04/23	50	86	68.0	65	89	77.0	55	88	71.5	56	89	72.5	54	85	69.5	50	72	61.0	47	71	59.0	47	74	60.5	48	75	61.5	50	83	66.5	53	84	68.5	52	82	67.0	
04/24	55	88	71.5	50	87	68.5	55	88	71.5	54	83	68.5	49	71	60.0	48	68	58.0	48	68	58.0	47	72	59.5	51	80	65.5	53	85	69.0	55	86	70.5	56	84	70.0	
04/25	50	86	68.0	52	88	70.0	54	84	69.0	50	70	60.0	47	68	57.5	47	69	58.0	48	76	62.0	49	85	67.0	55	86	70.5	56	86	71.0	57	86	71.5	57	85	71.0	
04/26																																					
04/27																																					
04/28																																					
04/29																																					
04/30																																					
-																																					

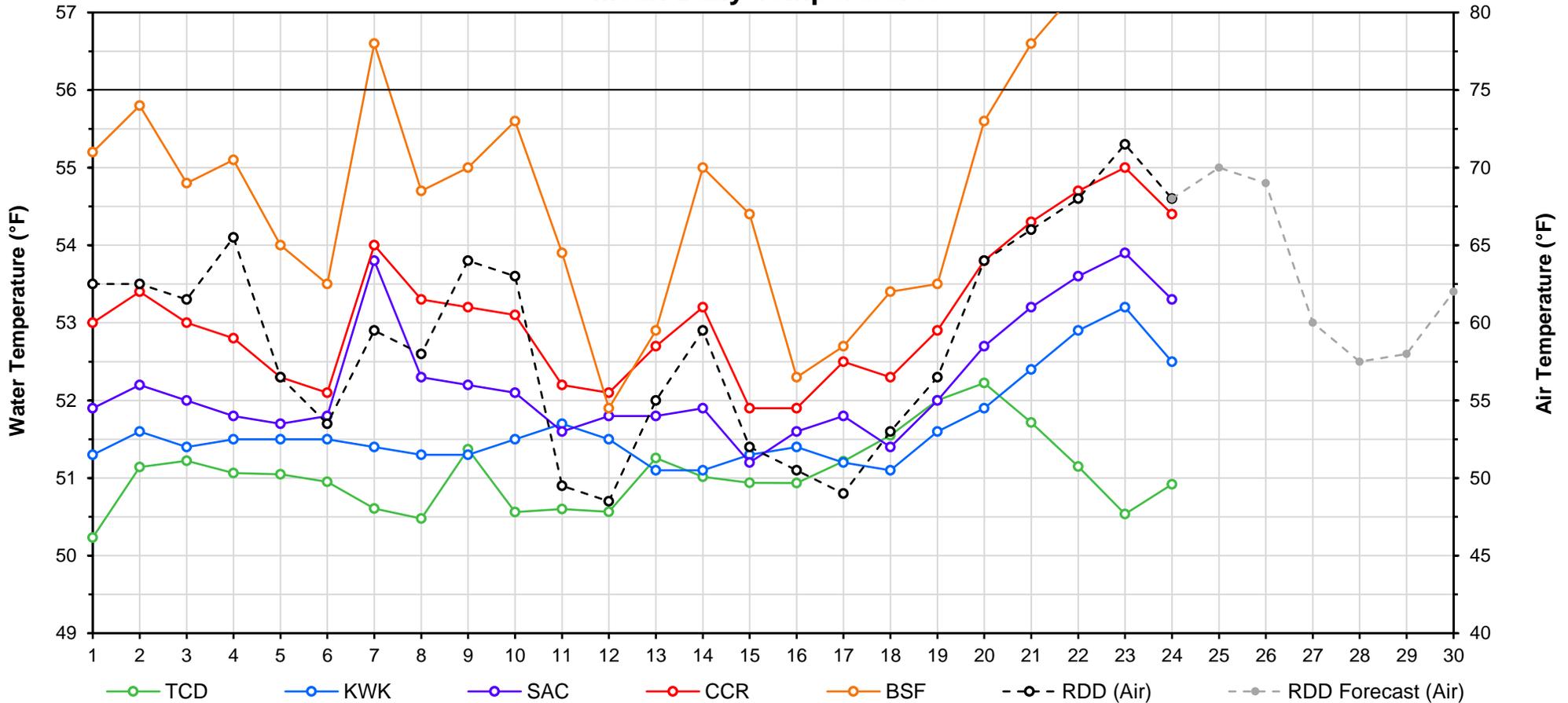
Web Links

- [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

Mean Daily Temperatures



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)	Date Range
BSF	56.0	06/01/17 - Current

Notes

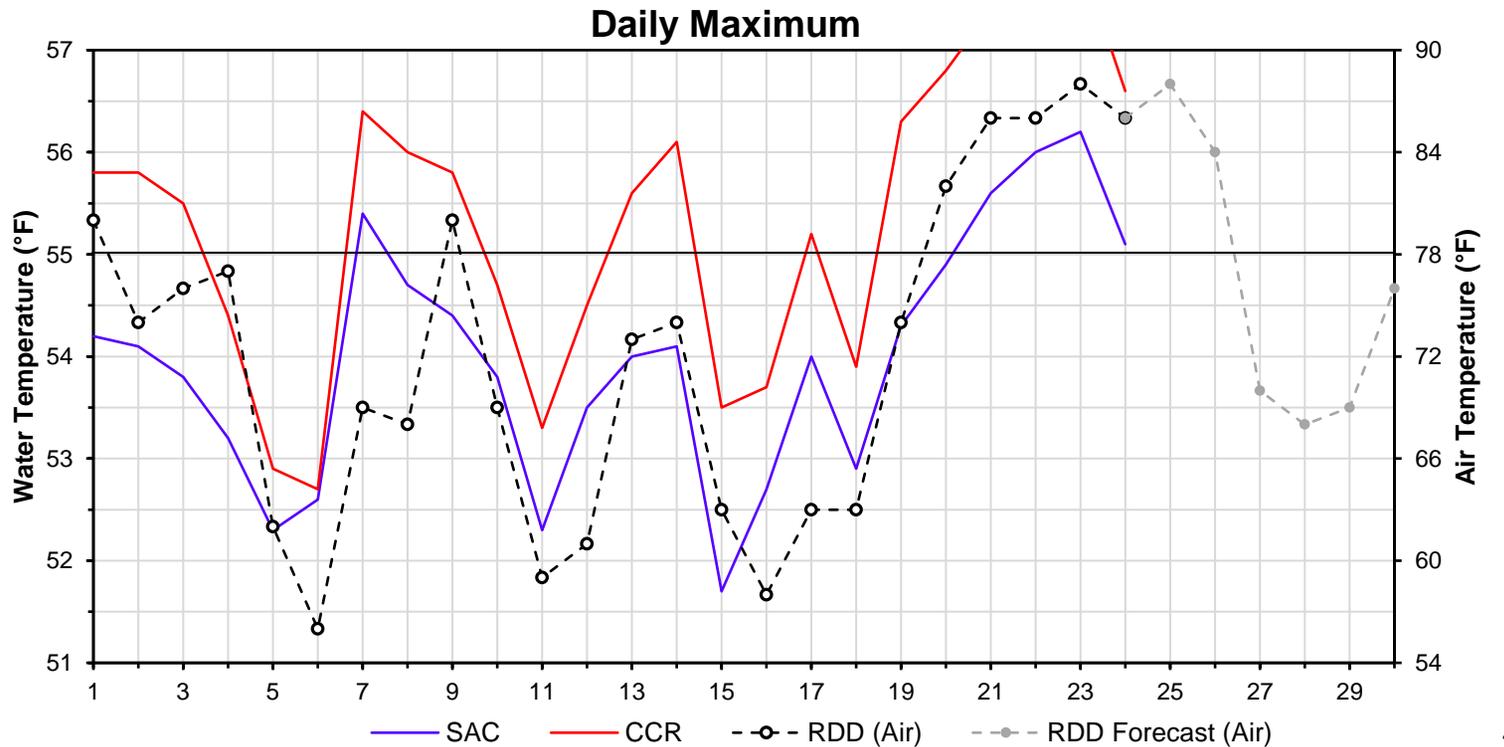
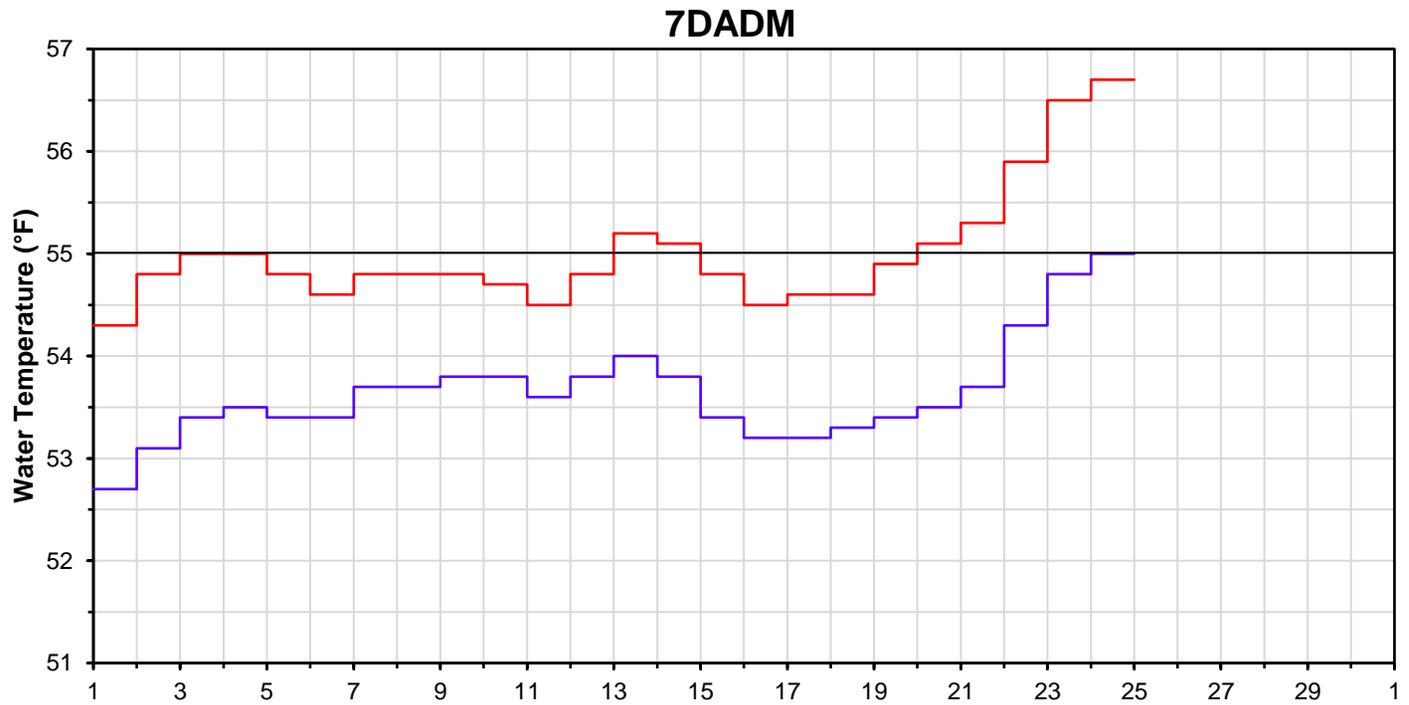
- ¹ Distances are approximate
- ² DGC is only reported in September
- ³ NFH is only reported in October, November and December

DATE	Daily Max		7DADM ¹		DAT ²
	SAC	CCR	SAC	CCR	BSF
04/01	54.2	55.8	52.7	54.3	55.2
04/02	54.1	55.8	53.1	54.8	55.8
04/03	53.8	55.5	53.4	55.0	54.8
04/04	53.2	54.4	53.5	55.0	55.1
04/05	52.3	52.9	53.4	54.8	54.0
04/06	52.6	52.7	53.4	54.6	53.5
04/07	55.4	56.4	53.7	54.8	56.6
04/08	54.7	56.0	53.7	54.8	54.7
04/09	54.4	55.8	53.8	54.8	55.0
04/10	53.8	54.7	53.8	54.7	55.6
04/11	52.3	53.3	53.6	54.5	53.9
04/12	53.5	54.5	53.8	54.8	51.9
04/13	54.0	55.6	54.0	55.2	52.9
04/14	54.1	56.1	53.8	55.1	55.0
04/15	51.7	53.5	53.4	54.8	54.4
04/16	52.7	53.7	53.2	54.5	52.3
04/17	54.0	55.2	53.2	54.6	52.7
04/18	52.9	53.9	53.3	54.6	53.4
04/19	54.3	56.3	53.4	54.9	53.5
04/20	54.9	56.8	53.5	55.1	55.6
04/21	55.6	57.4	53.7	55.3	56.6
04/22	56.0	57.8	54.3	55.9	57.3
04/23	56.2	57.9	54.8	56.5	57.6
04/24	55.1	56.6	55.0	56.7	57.2
04/25					
04/26					
04/27					
04/28					
04/29					
04/30					
-					

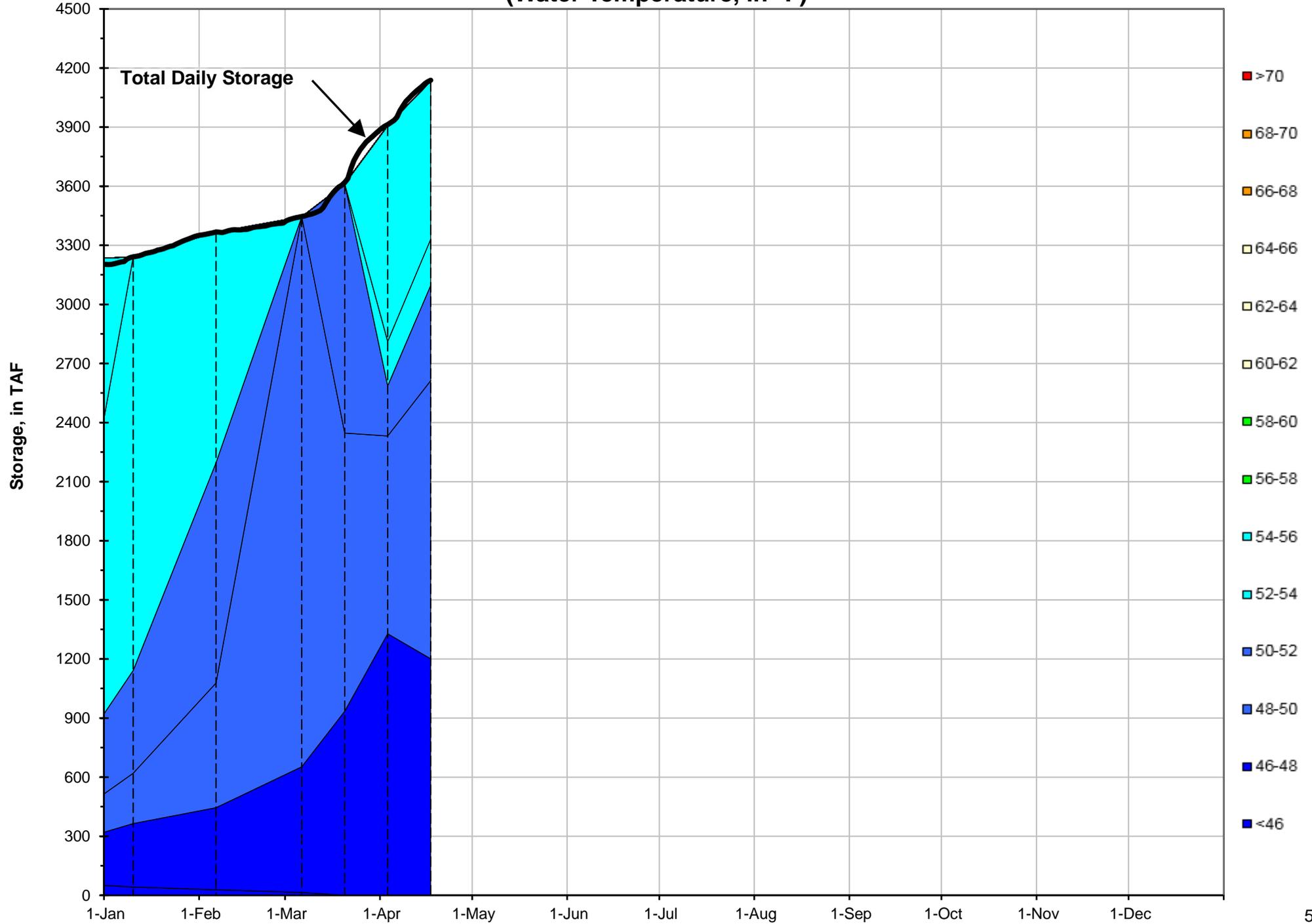
Notes

¹ 7DADM = 7-Day Average Daily Maximum

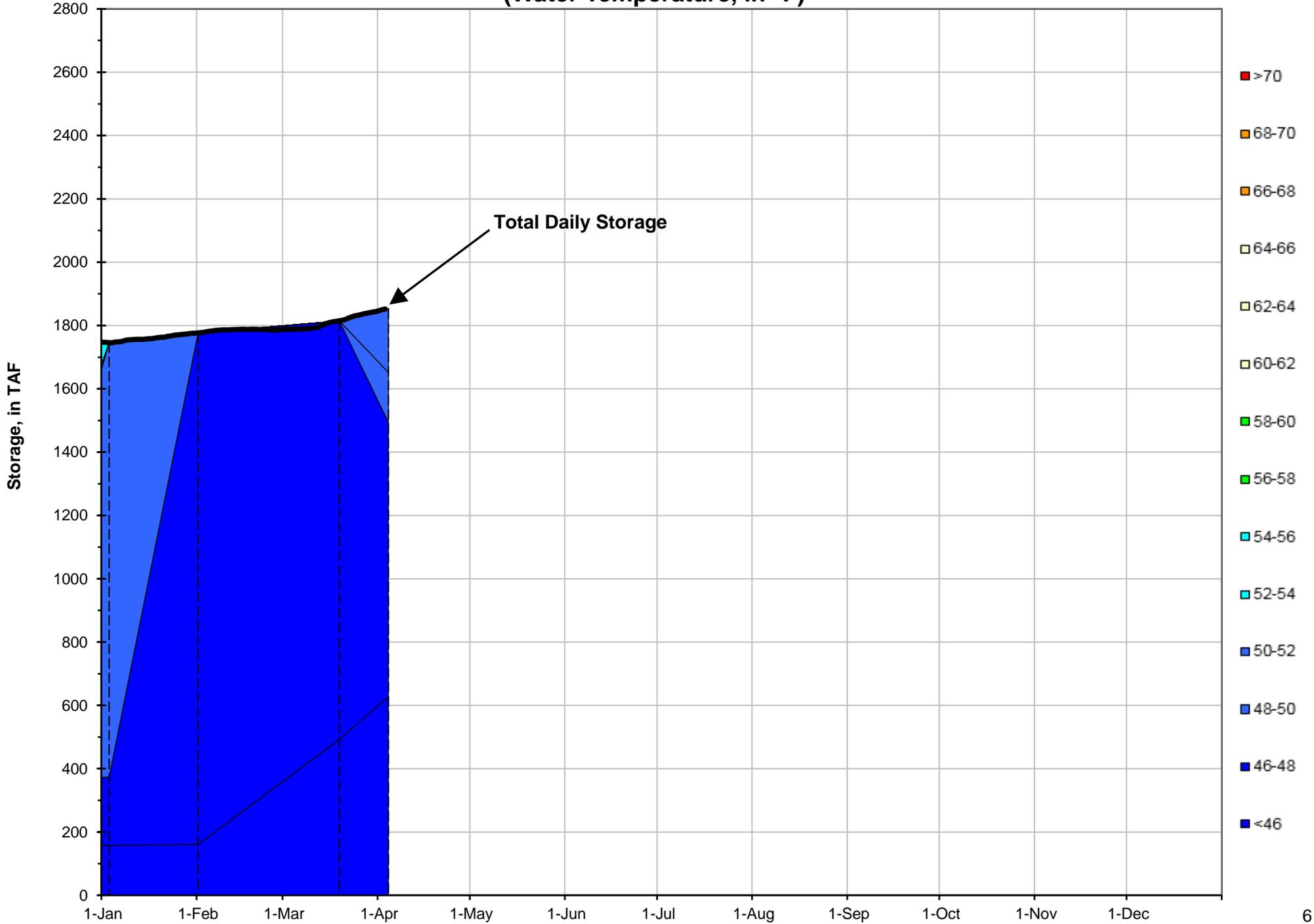
² DAT = Daily Average Temperature



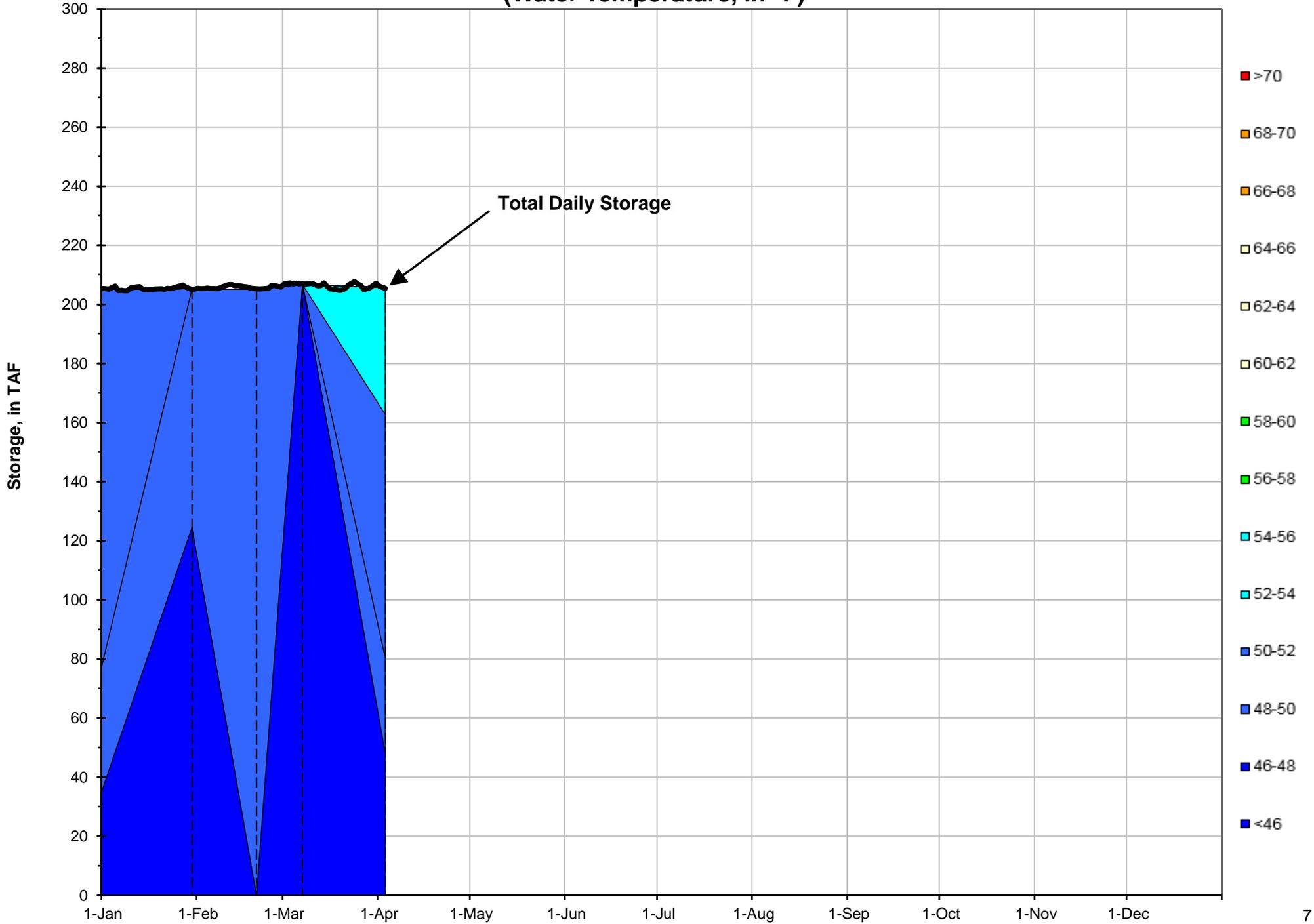
Shasta Lake Isothermobaths - 2018 (Water Temperature, in °F)



Trinity Lake Isothermobaths - 2018 (Water Temperature, in °F)

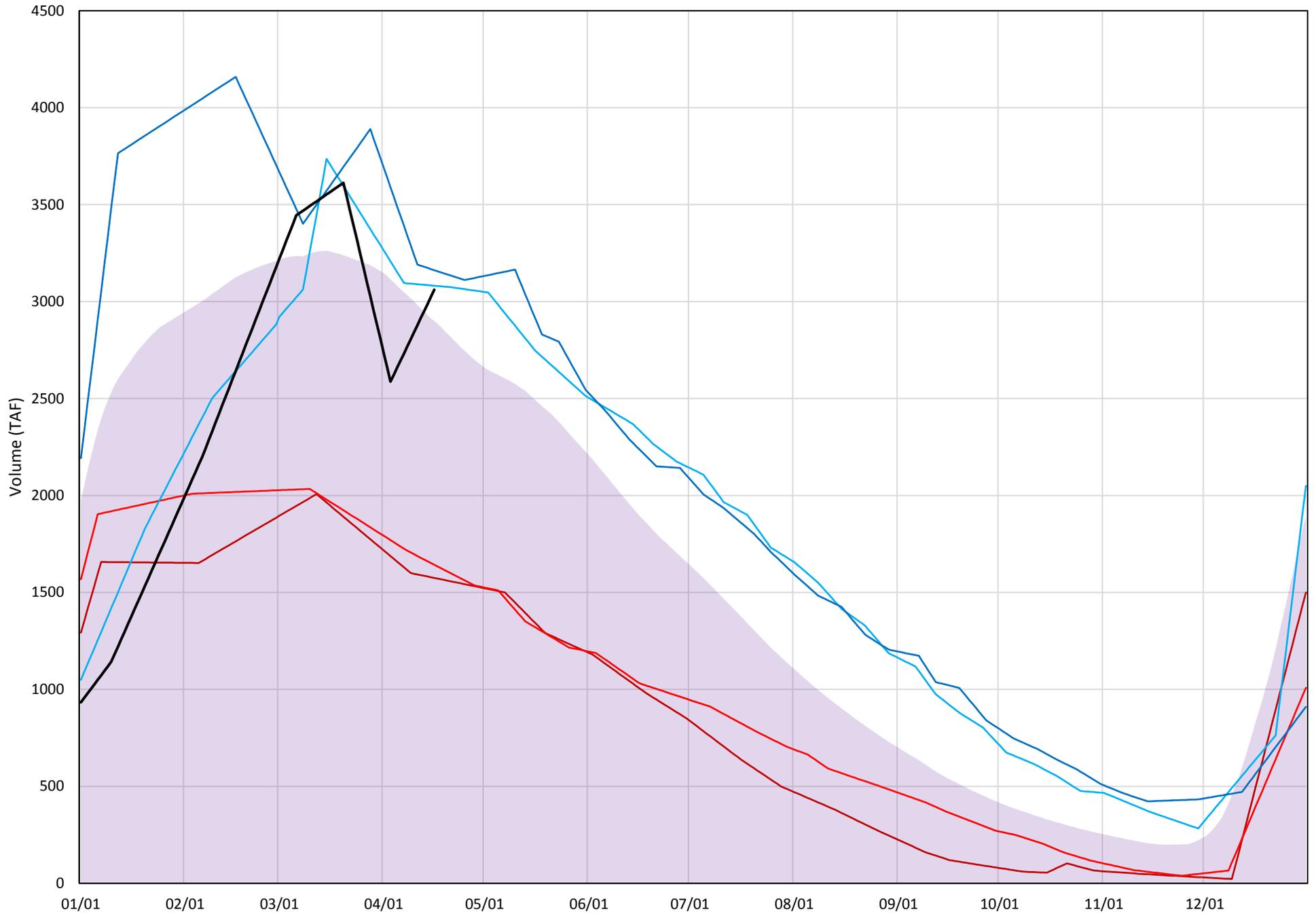


Whiskeytown Lake Isothermobaths - 2018 (Water Temperature, in °F)



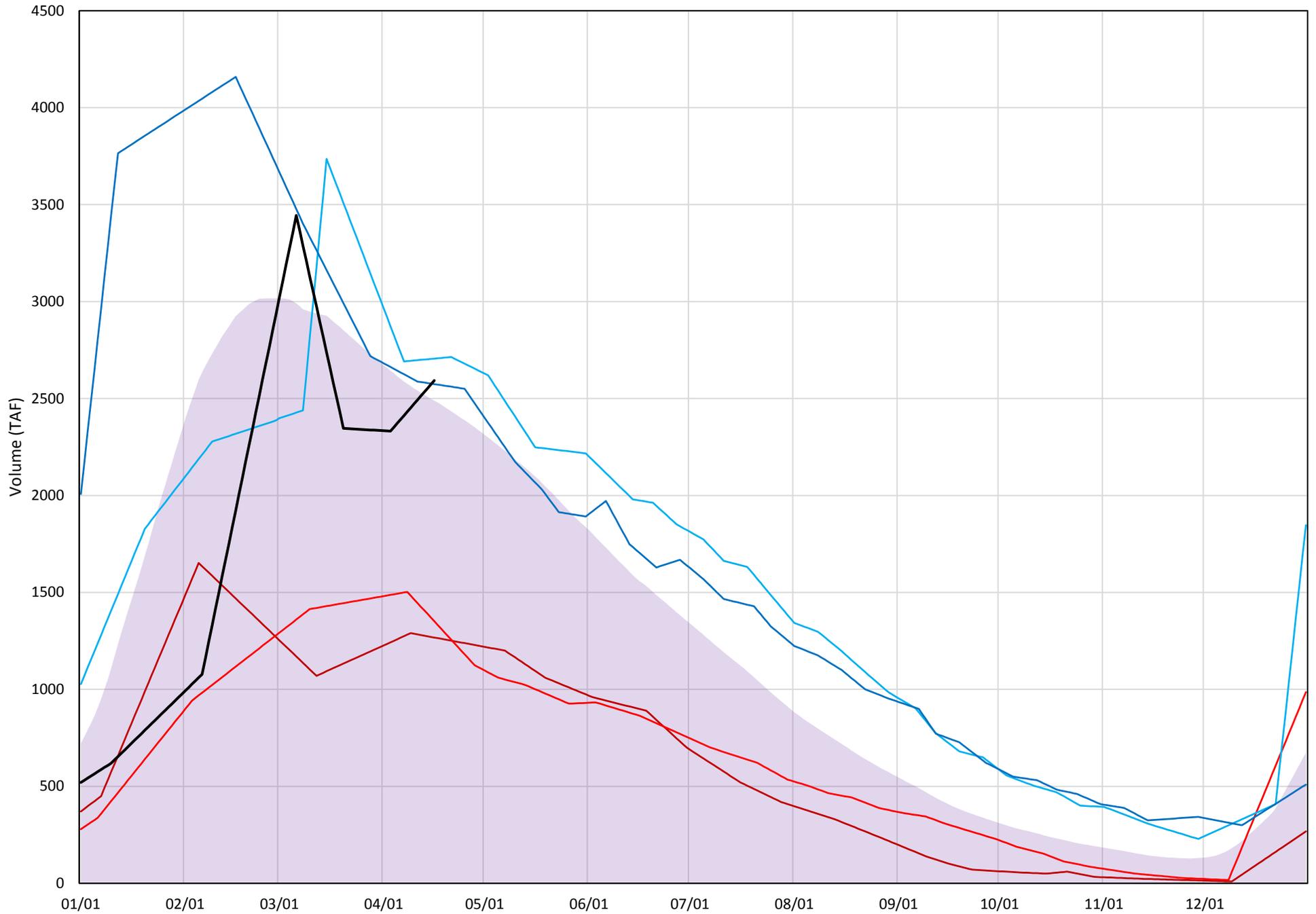
<52°F - Shasta Cold Water Pool Volume

Avg (1998-2017) 2014 2015 2016 2017 2018



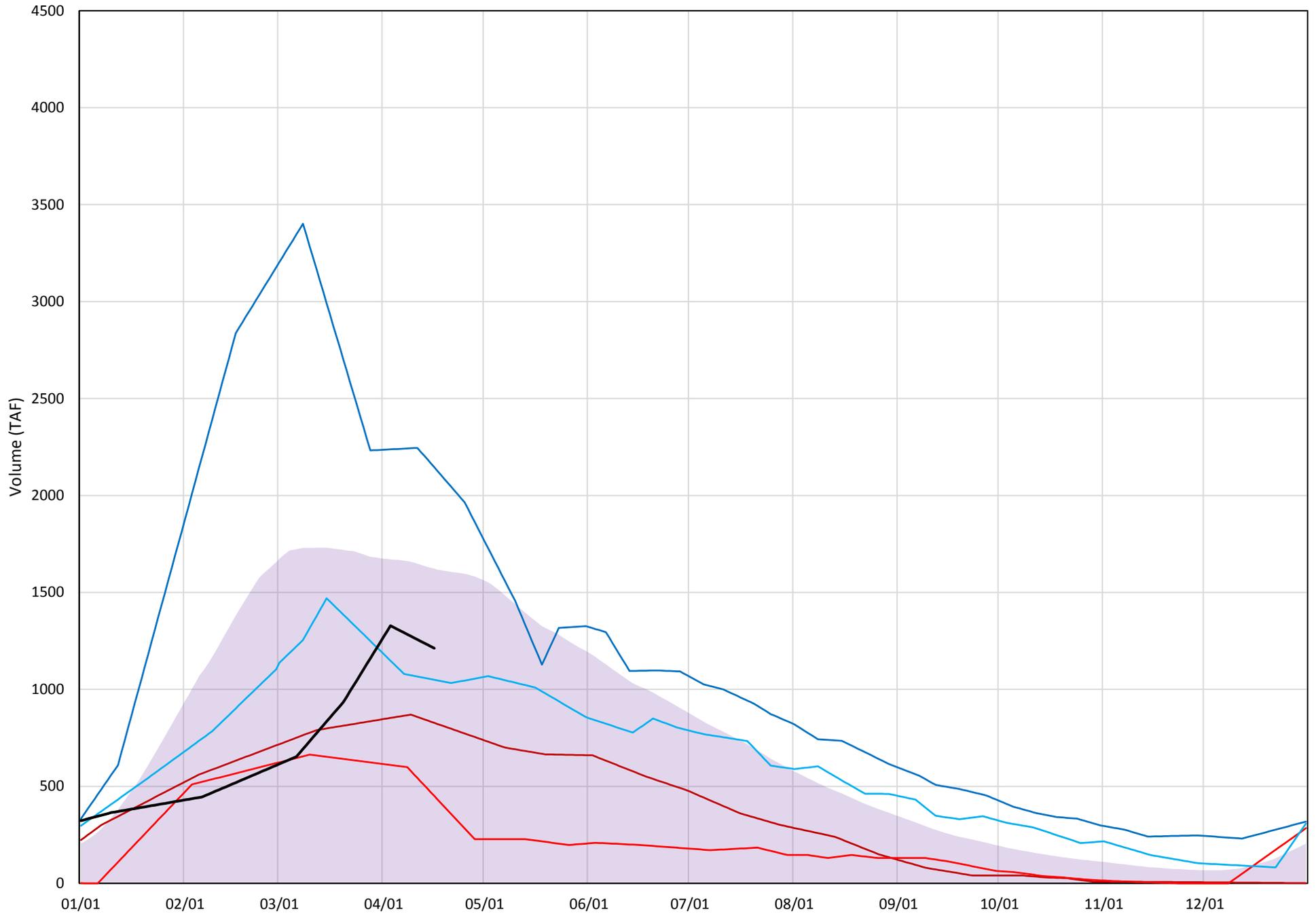
<50°F - Shasta Cold Water Pool Volume

Avg (1998-2017) 2014 2015 2016 2017 2018



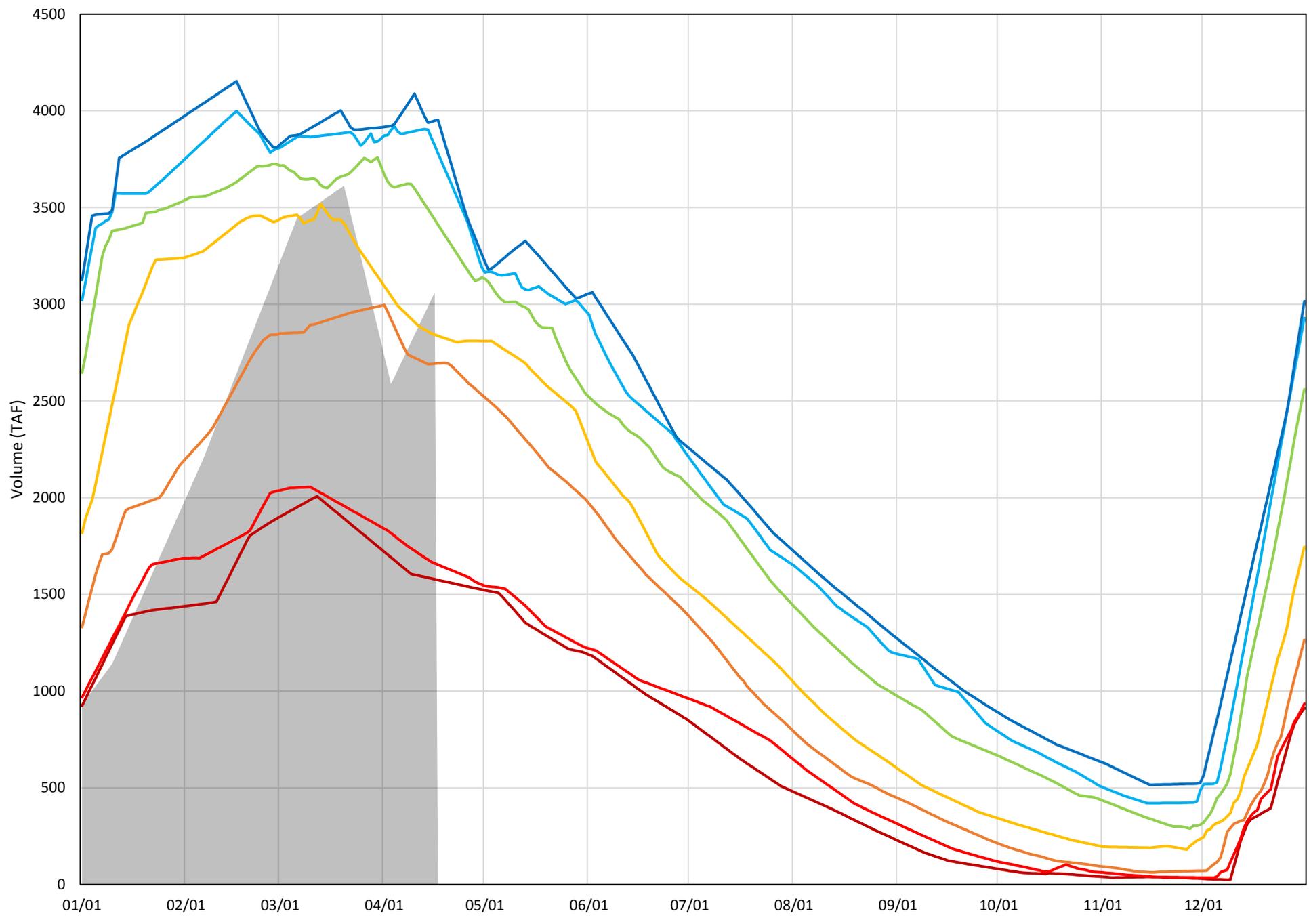
<48°F - Shasta Cold Water Pool Volume

Avg (1998-2017) 2014 2015 2016 2017 2018



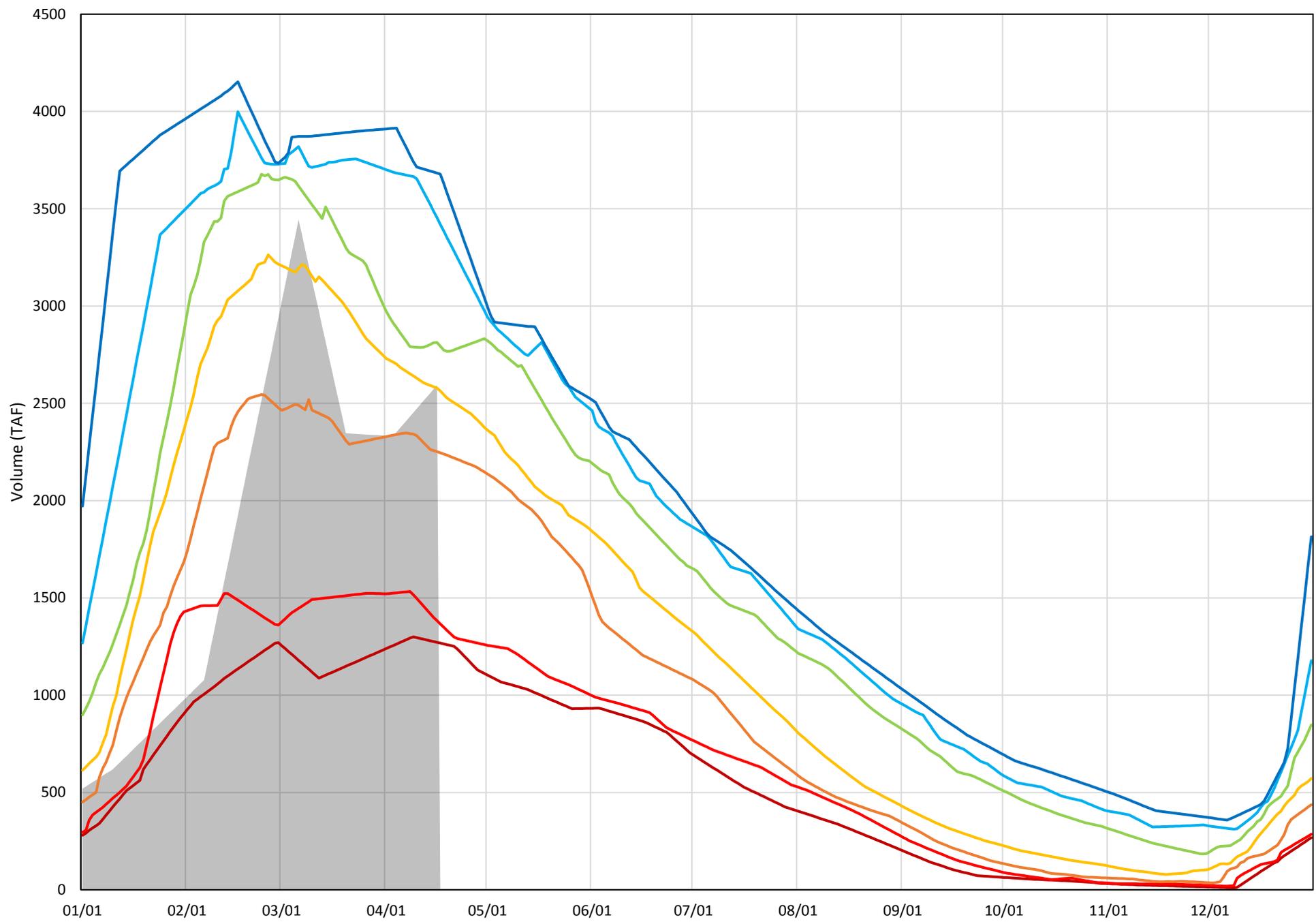
<52°F - Shasta Cold Water Pool Volume Percent Exceedances (1998-2017)

2018 95 90 75 50 25 10 5



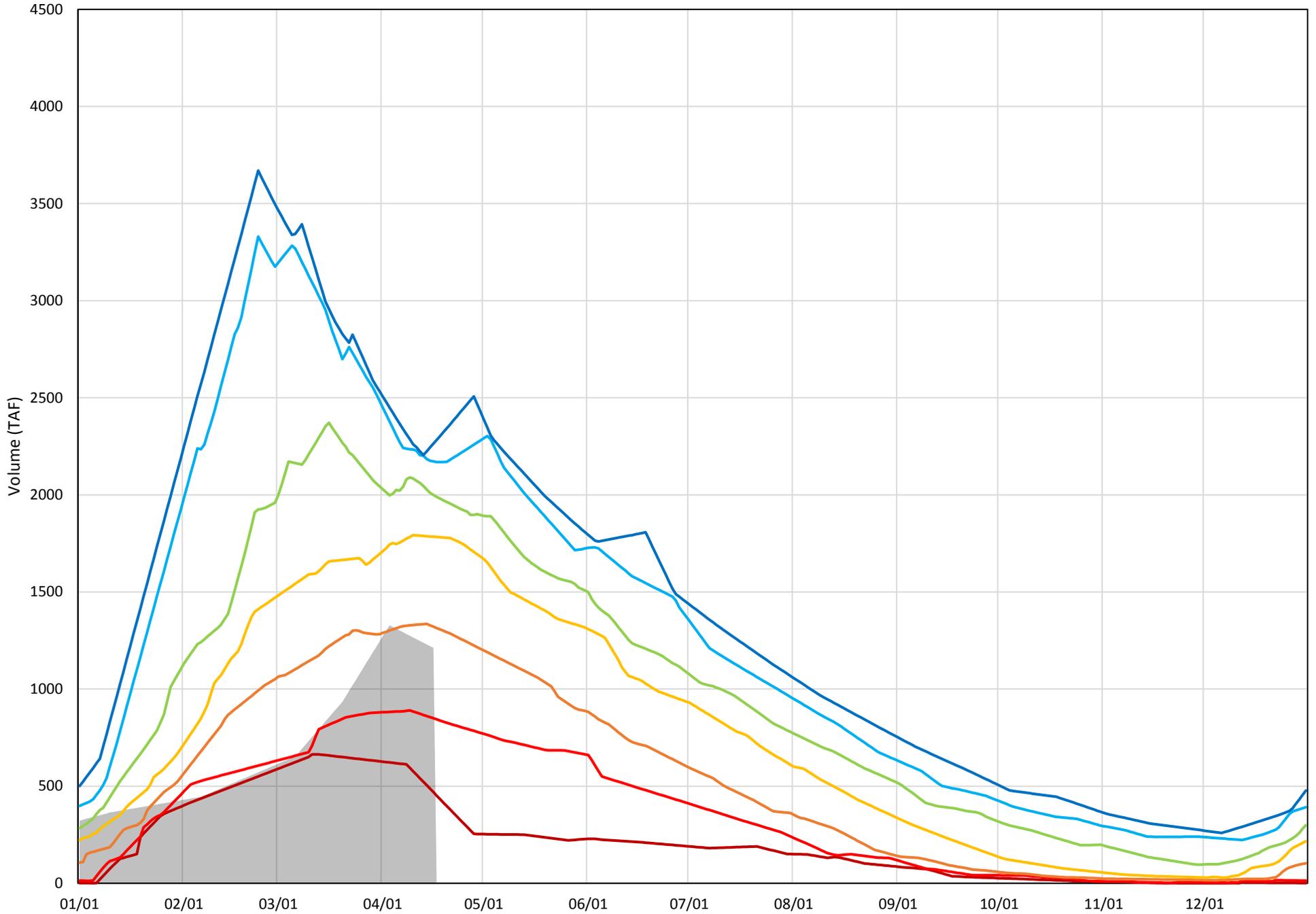
<50°F - Shasta Cold Water Pool Volume Percent Exceedances (1998-2017)

2018 95 90 75 50 25 10 5



<48°F - Shasta Cold Water Pool Volume Percent Exceedances (1998-2017)

2018 95 90 75 50 25 10 5



April 24, 2018

Upper Sacramento River – April 2018 Preliminary Temperature Analysis
Summary of Temperature Results by Month (Monthly Average Temperature °F)

Initial Compliance Location (°F DAT)	ARR	MAY	JUN	JUL	AUG	SEP	OCT	Late Sep-Oct Uncertainty Estimation
April 90%-Exceedance Outlook – 10% Historical Meteorology								
Keswick Dam KWK	52.6	52.0	52.4	53.0	53.1	53.3	52.2	53 - 56
Sac. R. abv Clear Creek CCR	53.1	52.9	53.1	53.5	53.6	53.7	52.3	54 - 58
Balls Ferry BSF	55.9	57.2	56.1	55.5	55.5	55.5	53.6	55 - 58
April 90%-Exceedance Outlook – 50% Historical Meteorology								
Keswick Dam KWK	52.5	51.9	52.0	53.0	53.0	53.1	52.0	53 - 56
Sac. R. abv Clear Creek CCR	52.9	52.7	52.6	53.4	53.5	53.5	52.1	54 - 58
Balls Ferry BSF	55.5	56.6	55.5	55.3	55.3	55.2	53.2	55 - 58
April 50%-Exceedance Outlook – 10% Historical Meteorology								
Keswick Dam KWK	52.3	51.3	52.0	52.8	53.1	53.3	52.0	53 - 56
Sac. R. abv Clear Creek CCR	52.9	52.1	52.5	53.2	53.4	53.5	52.1	54 - 58
Balls Ferry BSF	55.8	56.7	55.4	55.1	55.2	55.2	53.3	55 - 58
April 50%-Exceedance Outlook – 50% Historical Meteorology								
Keswick Dam KWK	52.2	50.9	52.2	52.8	53.2	53.1	51.8	53 - 56
Sac. R. abv Clear Creek CCR	52.7	51.5	52.6	53.1	53.4	53.3	51.9	53 - 57
Balls Ferry BSF	55.3	55.8	55.3	54.9	55.1	54.9	53.0	54 - 58

* The HEC5Q model output is displayed above for the months April through October. 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, an uncertainty estimate is provided based on the Fall Temperature Index (graphics below). This is based on a historical relationship between end-of-

September Lake Shasta Volume less than 56°F and likely downstream temperature performances for the early fall months. The range represents the 90% confidence interval based on that data. Refinement of the concepts for those estimates is underway.

Temperature Model Inputs, Assumptions, Limitations and Uncertainty:

1. The latest available profiles for Shasta, Trinity, and Whiskeytown were taken on April 17, April 4, and April 3 respectively. Model results are sensitive to initial reservoir temperature conditions and the model performs best under highly stratified conditions. The April 2018 temperature profile does not yet exhibit conditions for ideal model computations (still nearly isothermal conditions although warming will initiate stratification). The model performs well after the reservoir stratifies, typically in late spring. 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.
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 low creek flows cause significant additional warming in the upper Sacramento River during spring.
3. Operation is based on the April 2018 Operation Outlooks and DWR Bulletin 120 inflow projections (monthly flows, reservoir release, and end-of-month reservoir storage) for the 90%- and 50%-exceedances. Trinity Lake inflows are updated with the CNRFC 90% runoff exceedance for the 90% 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. Inflows 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 exceedance at 10% and 50% patterned after like months on a 6-hour time-step. Assumed inflow temperature remain static inputs and do not vary with the assumed meteorology.
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.
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. Model re-calibrations efforts are underway.

Model Run Date April 22, 2018

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. The fall uncertainty estimation relationship between end-of-September lake volume below 56°F and a Balls Ferry compliance through fall is based on the Figures 5-7.

Model Run	End of September Cold Water Pool <56°F (TAF)	First Side Gate	Full Side Gates
90% Hydro, 10% Historical Met	682	9/1	10/8
90% Hydro, 50% Historical Met	682	9/1	10/10
50% Hydro, 10% Historical Met	690	9/1	10/9
50% Hydro, 50% Historical Met	725	9/3	10/12

Sacramento River Modeled Temperature 2018 April 90%-Exceedance Water Outlook - 10% Historical Meteorology

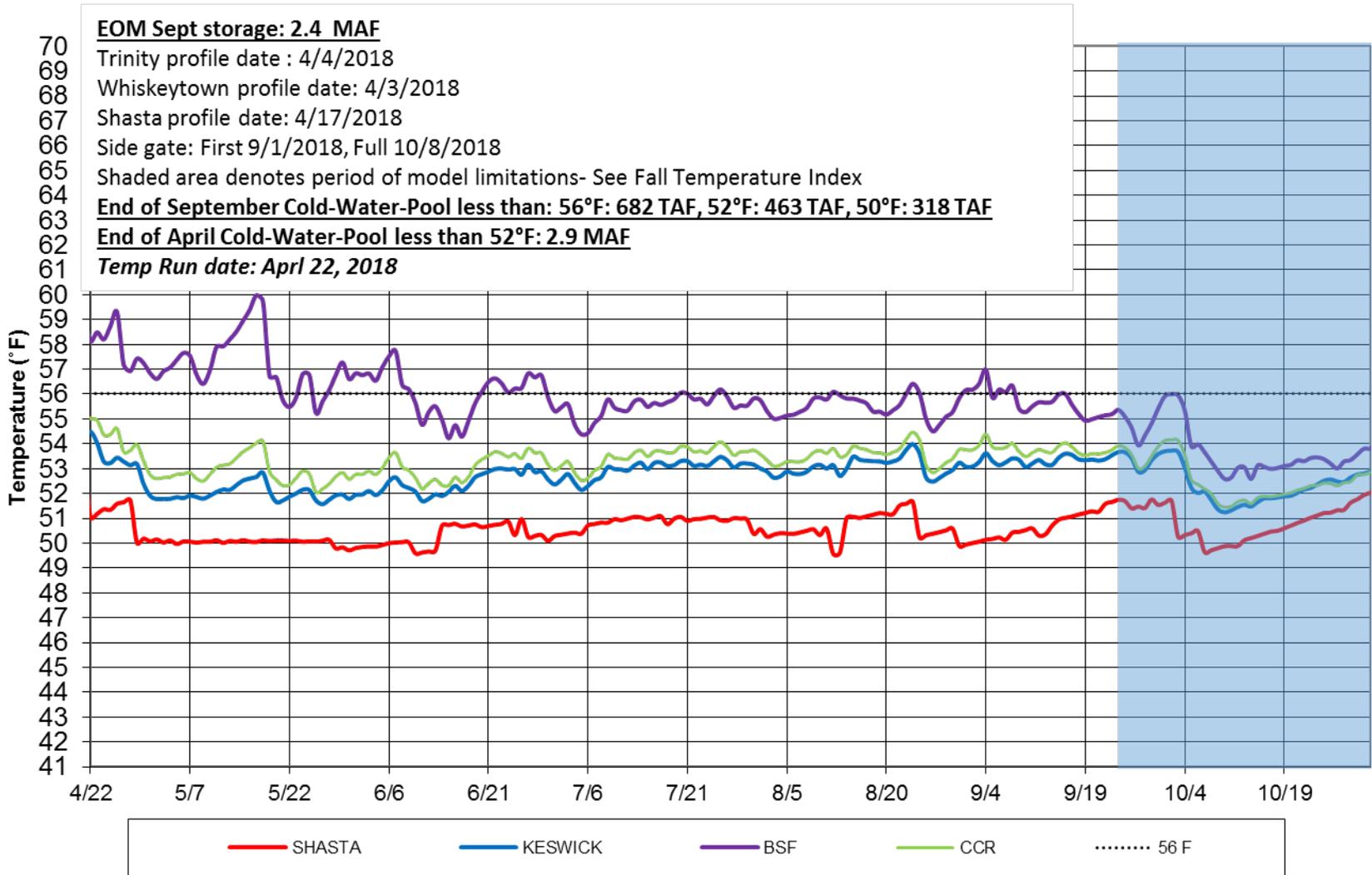


Figure 1

Sacramento River Modeled Temperature 2018 April 90%-Exceedance Water Outlook - 50% Historical Meteorology

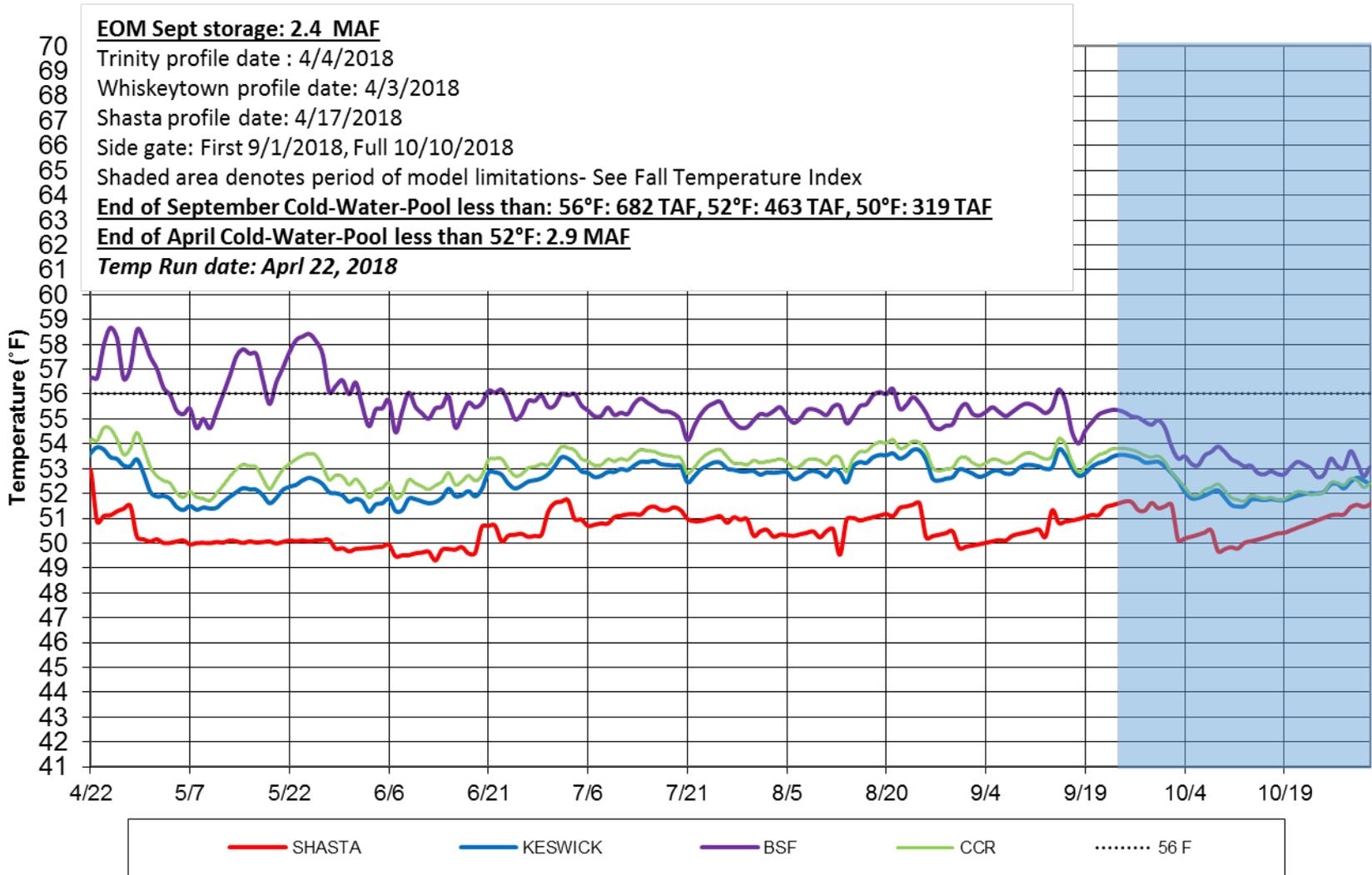


Figure 2

Sacramento River Modeled Temperature 2018 April 50%-Exceedance Water Outlook - 10% Historical Meteorology

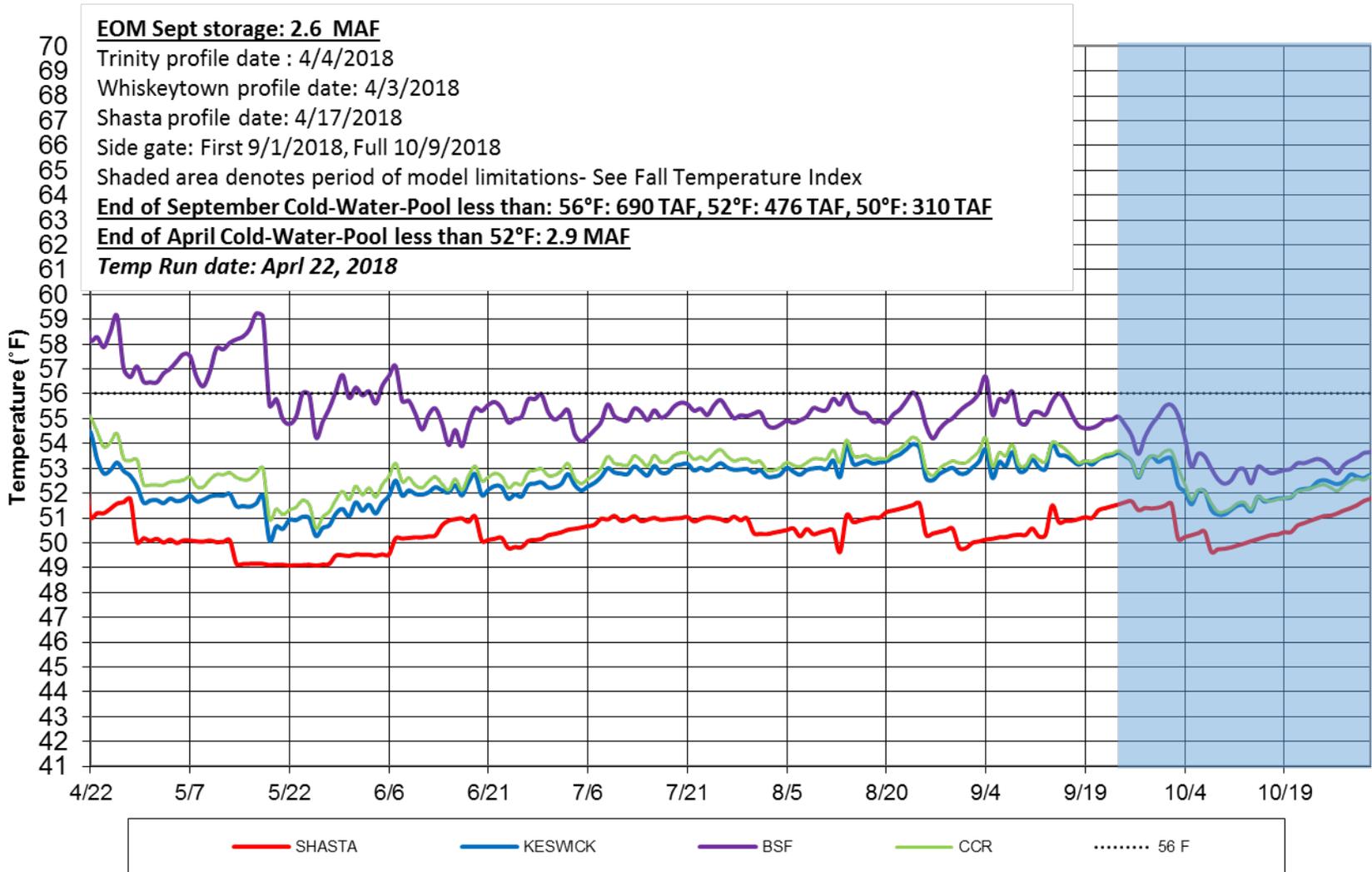


Figure 3

Sacramento River Modeled Temperature 2018 April 50%-Exceedance Water Outlook - 50% Historical Meteorology

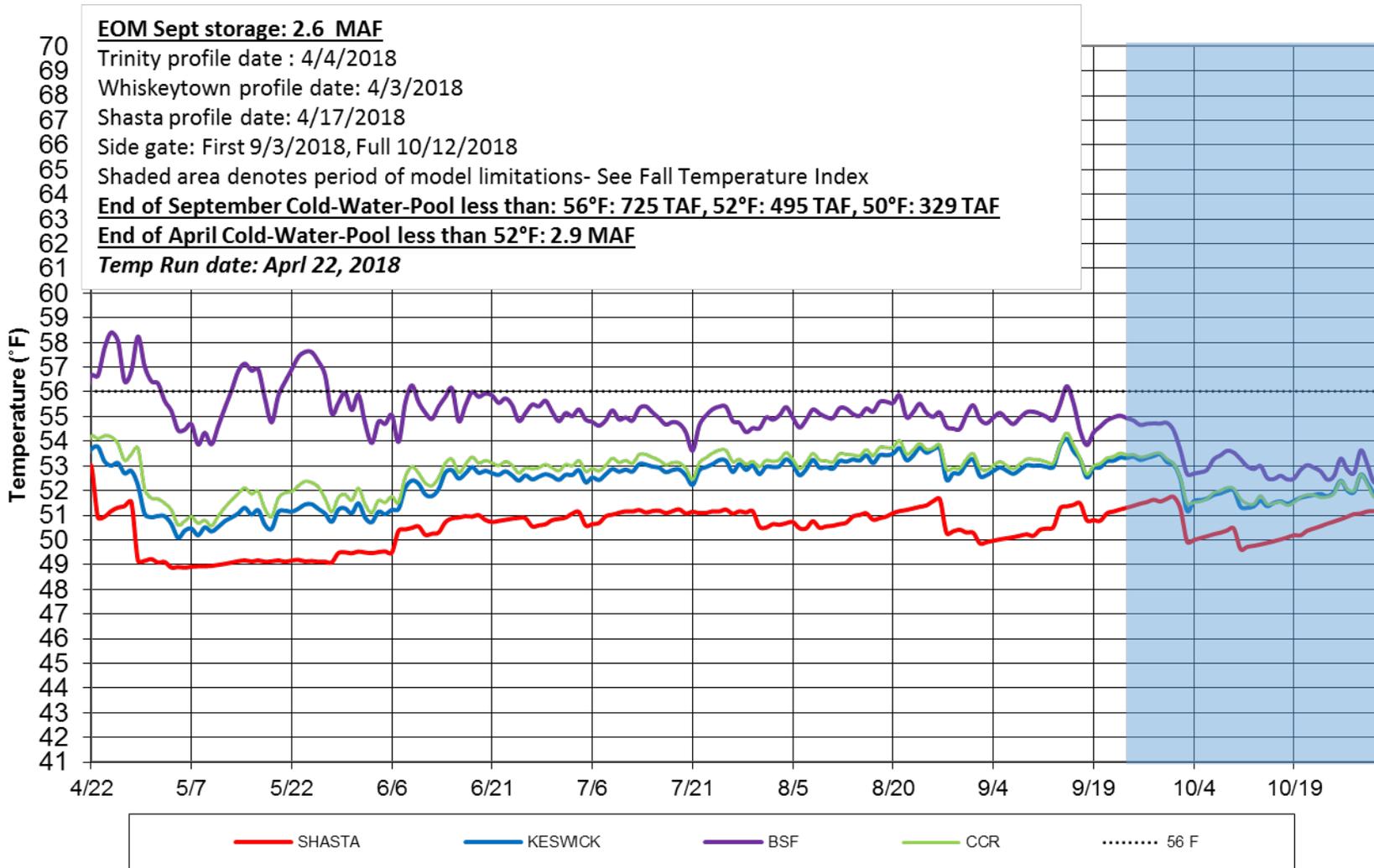


Figure 4

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 can be used as an indicator of fall water temperature in the river reach to Balls Ferry.
3. Based on these records and estimates, the index below illustrates a range of uncertainty in the ability to meet for river temperatures not to exceed 56 °F downstream based on the end-of-September lake volume less than 56°F; see charts below.
4. Refinement of these estimates and concepts is currently underway.

Sacramento River - Lake Shasta Early Fall Water Temperature - Keswick (KWK)

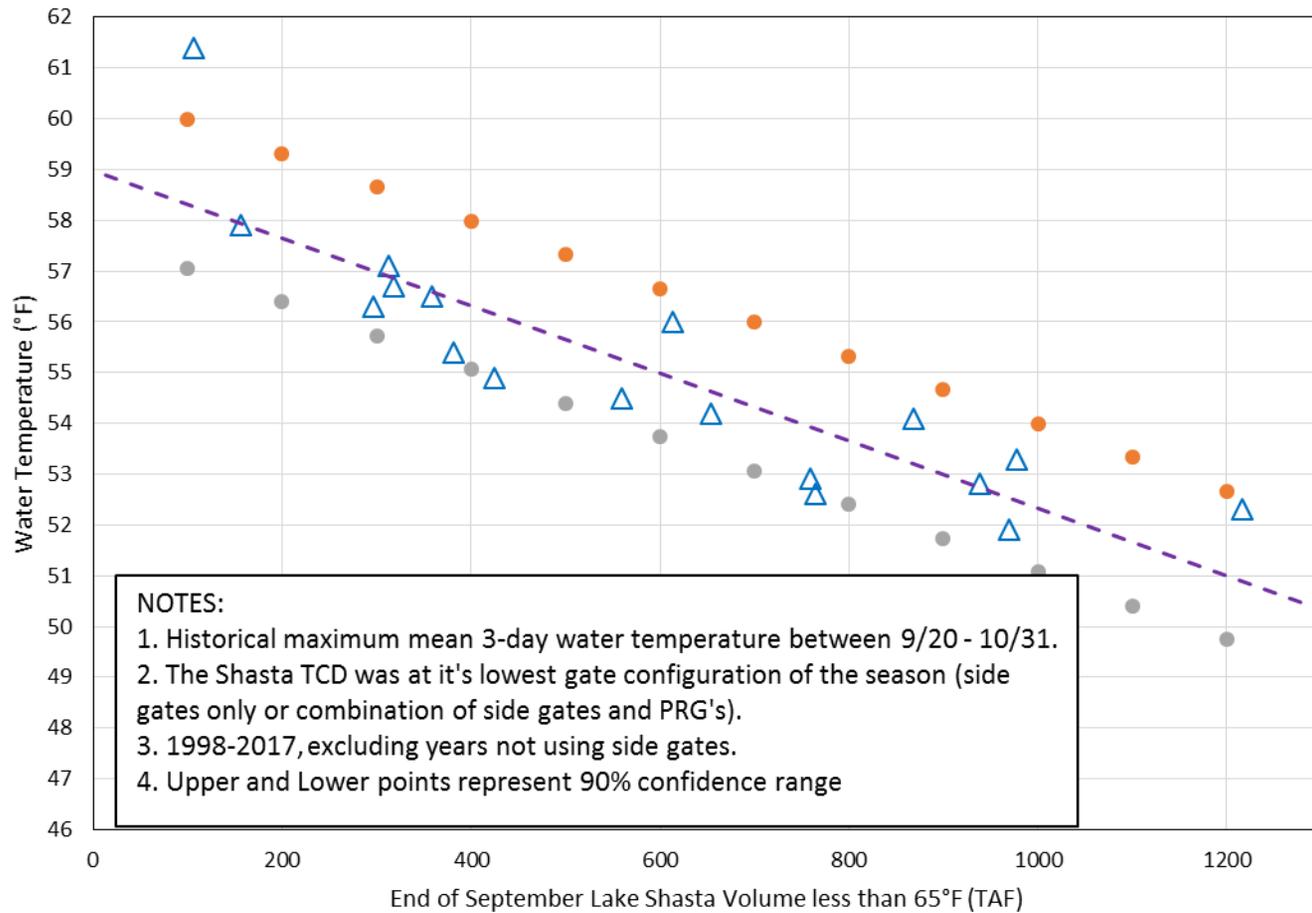


Figure 5

Sacramento River - Lake Shasta Early Fall Water Temperature - Sac River above Clear Creek (CCR)

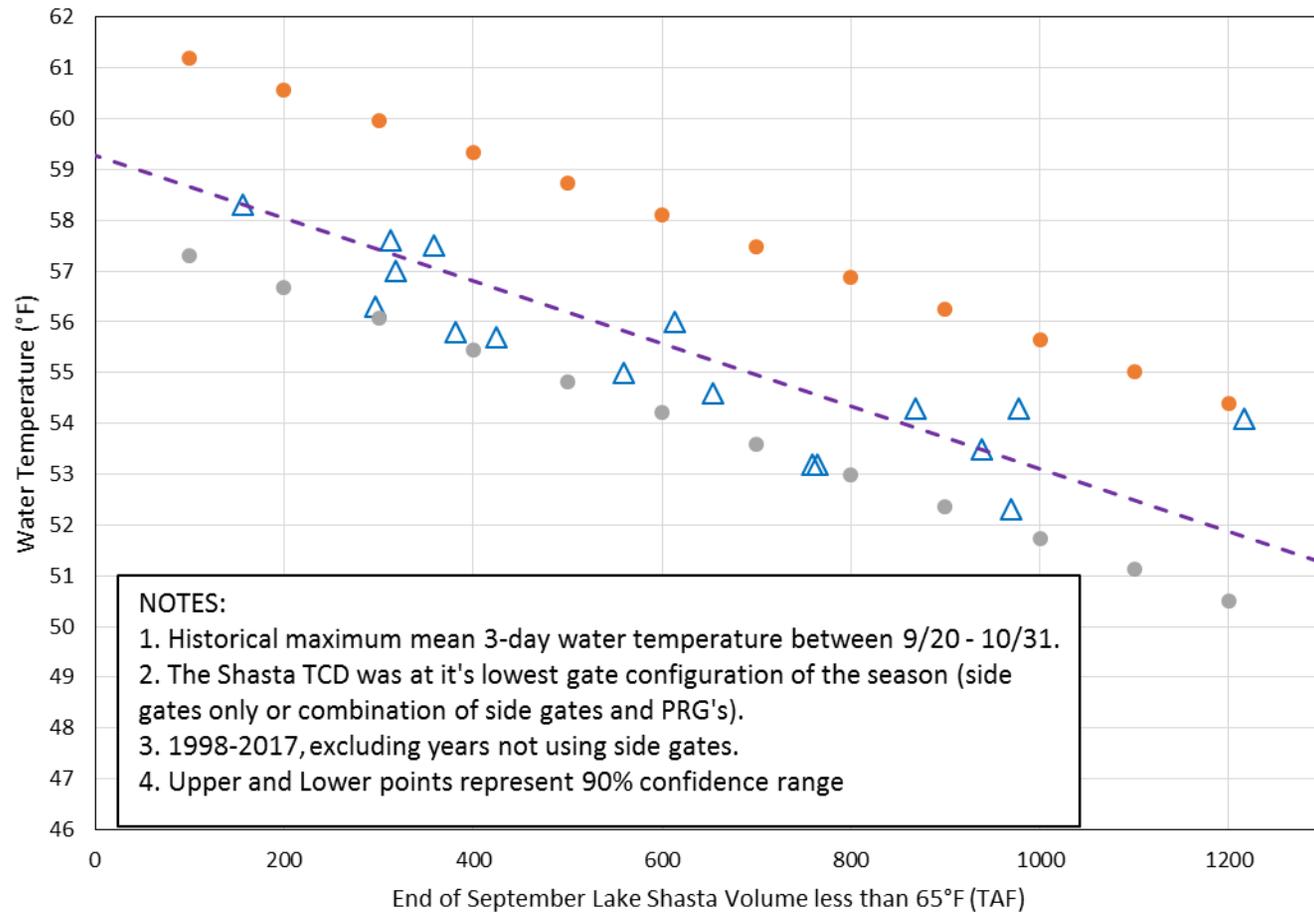


Figure 6

Sacramento River - Lake Shasta Early Fall Water Temperature - Balls Ferry (BSF)

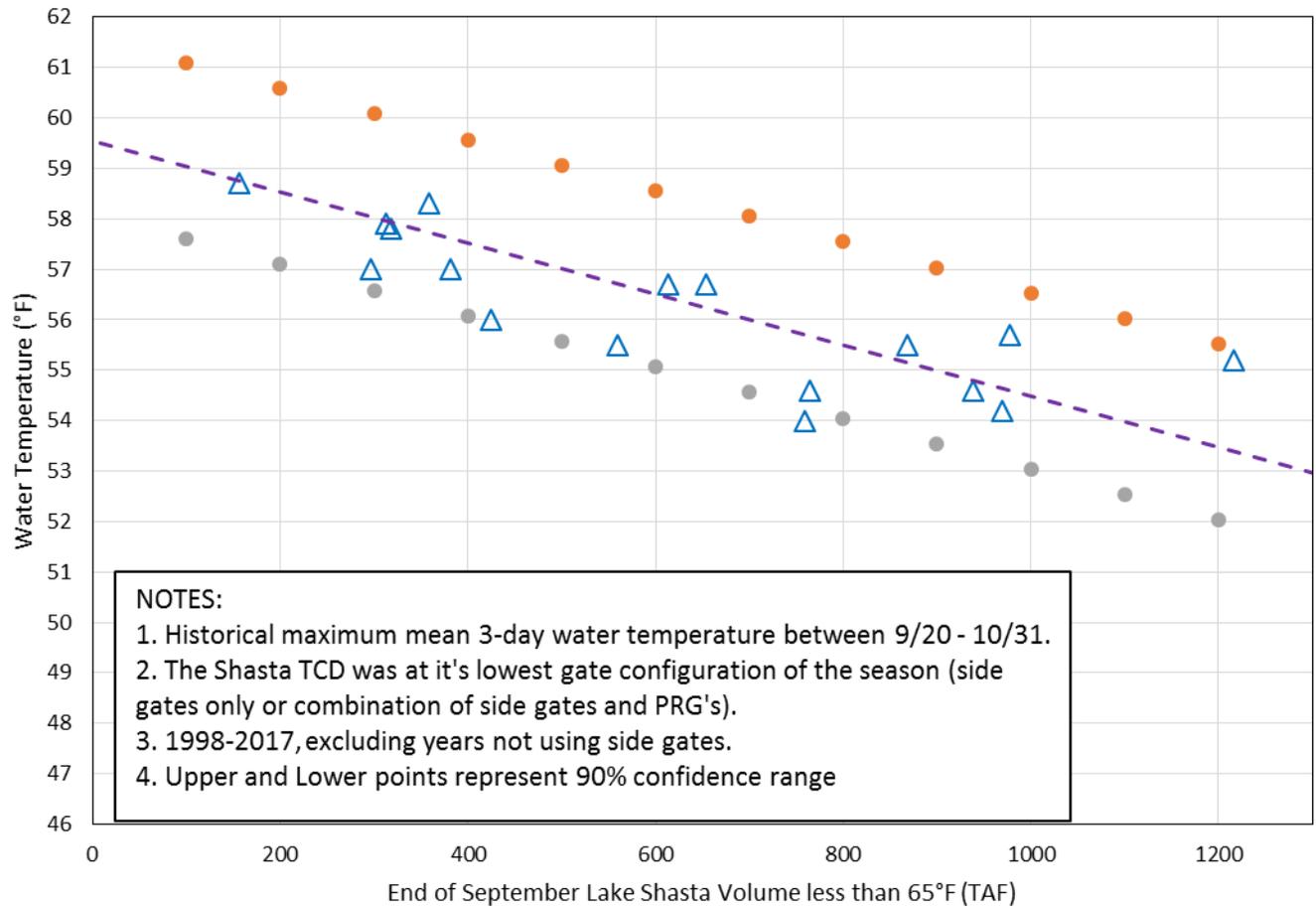


Figure 7

April 24, 2018

Upper Sacramento River – April 2018 Preliminary Temperature Analysis
Summary of Temperature Results by Month (Monthly Average Temperature °F)

Initial Compliance Location (°F DAT)	ARR	MAY	JUN	JUL	AUG	SEP	OCT	Late Sep-Oct Uncertainty Estimation
April 90%-Exceedance Outlook – 10% Historical Meteorology								
Keswick Dam KWK	52.6	52.0	52.4	52.5	52.4	52.6	53.1	54 - 56
Sac. R. abv Clear Creek CCR	53.1	52.9	53.0	53.0	52.9	53.0	53.2	54 - 58
Balls Ferry BSF	55.9	57.2	56.0	55.1	54.9	54.9	54.3	55 - 58

* The HEC5Q model output is displayed above for the months April through October. 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, an uncertainty estimate is provided based on the Fall Temperature Index (graphics below). This is based on a historical relationship between end-of-September Lake Shasta Volume less than 56°F and likely downstream temperature performances for the early fall months. The range represents the 90% confidence interval based on that data. Refinement of the concepts for those estimates is underway.

Temperature Model Inputs, Assumptions, Limitations and Uncertainty:

1. The latest available profiles for Shasta, Trinity, and Whiskeytown were taken on April 17, April 4, and April 3 respectively. Model results are sensitive to initial reservoir temperature conditions and the model performs best under highly stratified conditions. The April 2018 temperature profile does not yet exhibit conditions for ideal model computations (still nearly isothermal conditions although warming will initiate stratification). The model performs well after the reservoir stratifies, typically in late spring. 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.
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 low creek flows cause significant additional warming in the upper Sacramento River during spring.
3. Operation is based on the April 2018 Operation Outlooks and DWR Bulletin 120 inflow projections (monthly flows, reservoir

release, and end-of-month reservoir storage) for the 90%- and 50%-exceedances. Trinity Lake inflows are updated with the CNRFC 90% runoff exceedance for the 90% 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. Inflows 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 exceedance at 10% and 50% patterned after like months on a 6-hour time-step. Assumed inflow temperature remain static inputs and do not vary with the assumed meteorology.

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.

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. Model re-calibrations efforts are underway.

Model Run Date April 22, 2018

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. The fall uncertainty estimation relationship between end-of-September lake volume below 56°F and a Balls Ferry compliance through fall is based on the Figures 2-4.

Model Run	End of September Cold Water Pool <56°F (TAF)	First Side Gate	Full Side Gates
90% Hydro, 10% Historical Met	625	8/21	9/22

Sacramento River Modeled Temperature 2018 April 90%-Exceedance Water Outlook - 10% Historical Meteorology

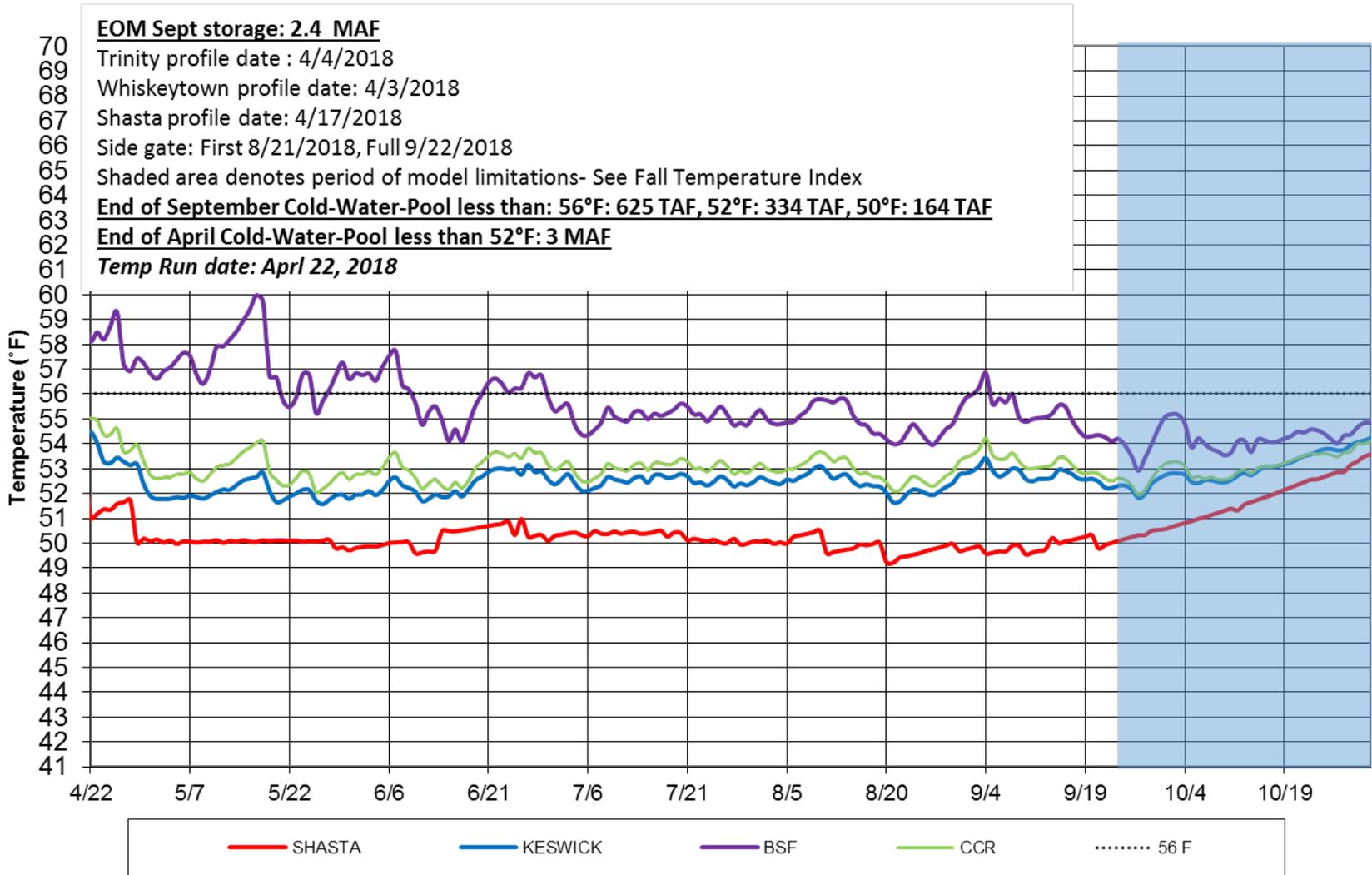


Figure 1

Figures 2-4 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 can be used as an indicator of fall water temperature in the river reach to Balls Ferry.
3. Based on these records and estimates, the index below illustrates a range of uncertainty in the ability to meet for river temperatures not to exceed 56 °F downstream based on the end-of-September lake volume less than 56°F; see charts below.
4. Refinement of these estimates and concepts is currently underway.

Sacramento River - Lake Shasta Early Fall Water Temperature - Keswick (KWK)

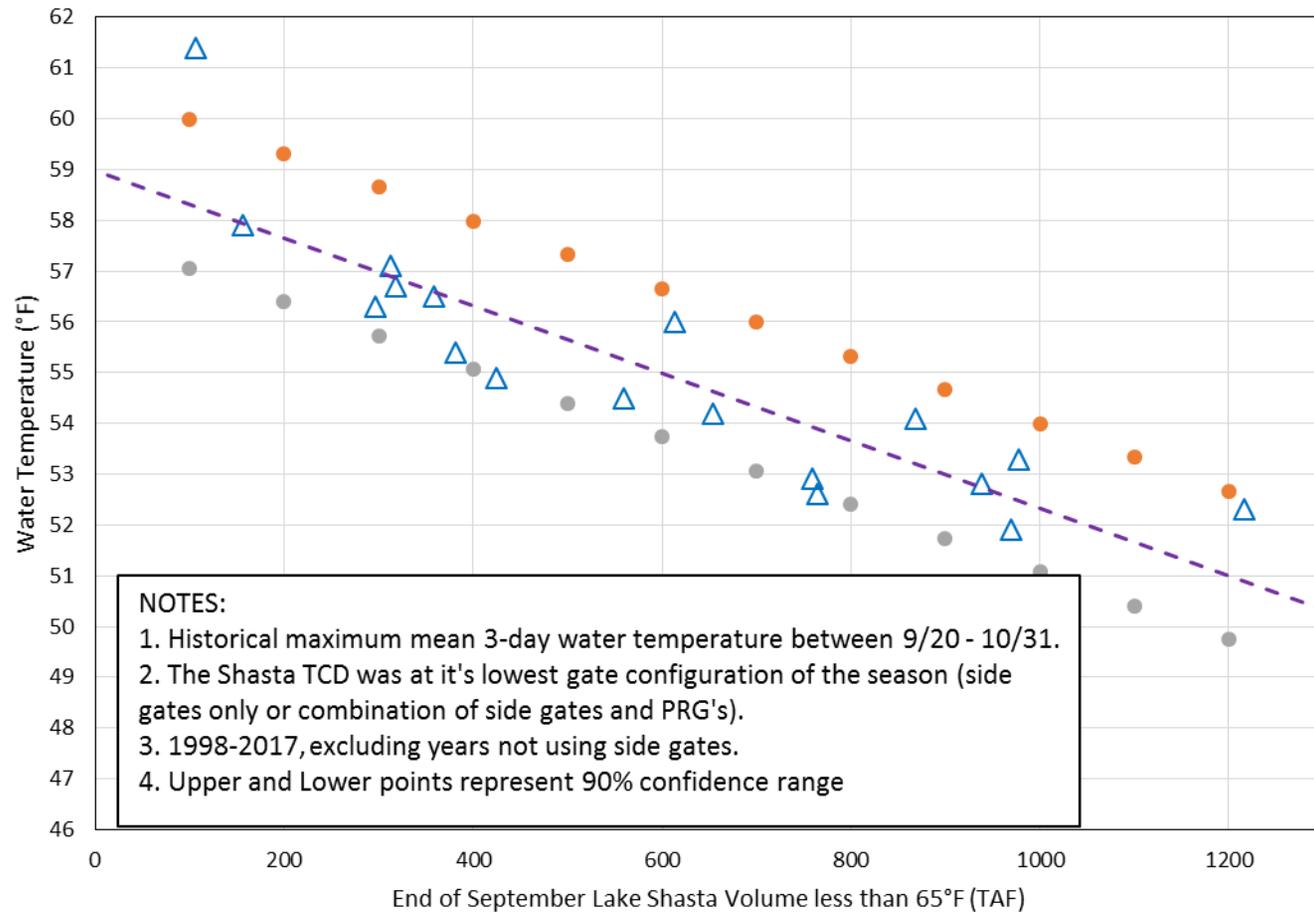


Figure 2

Sacramento River - Lake Shasta Early Fall Water Temperature - Sac River above Clear Creek (CCR)

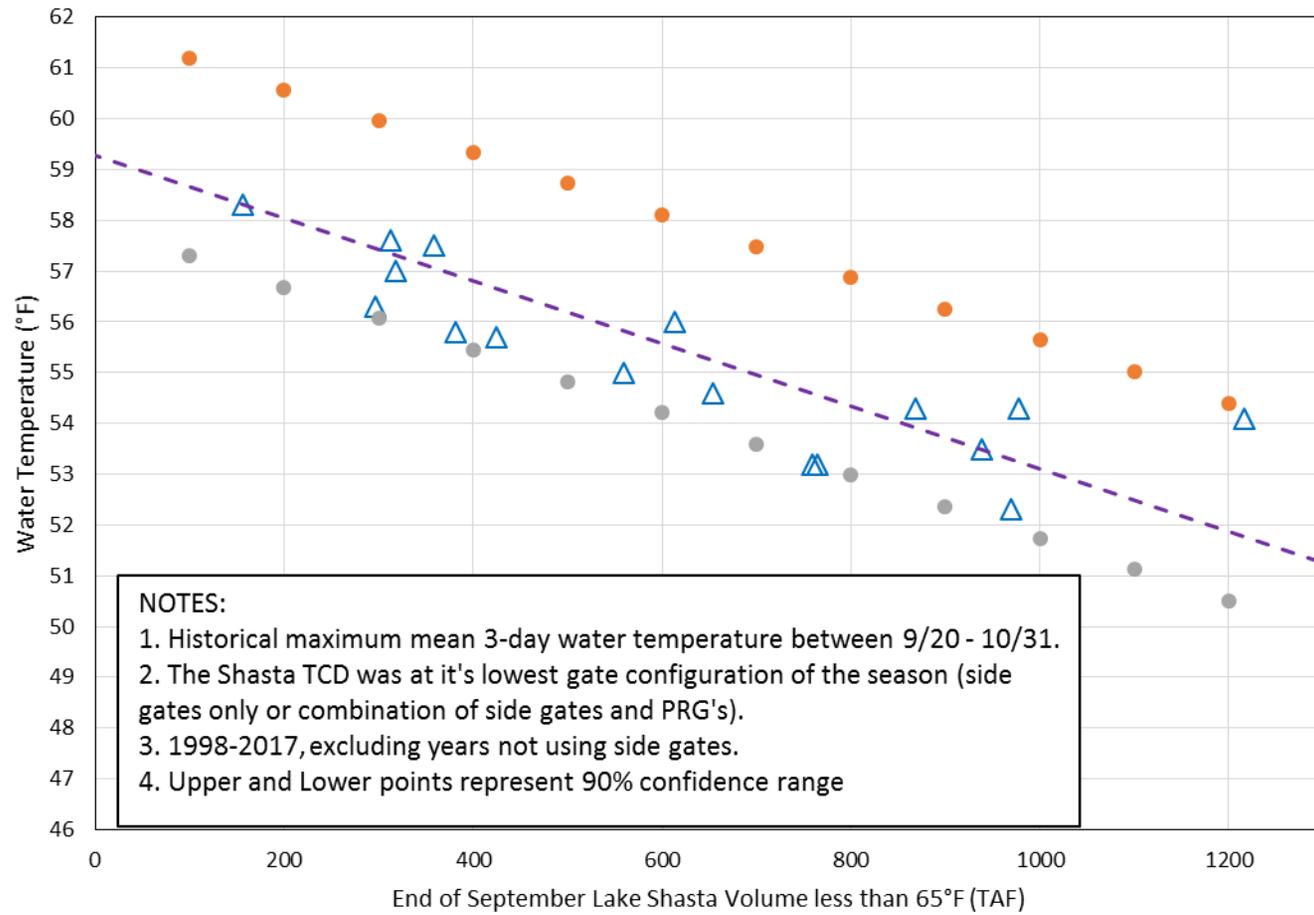


Figure 3

Sacramento River - Lake Shasta Early Fall Water Temperature - Balls Ferry (BSF)

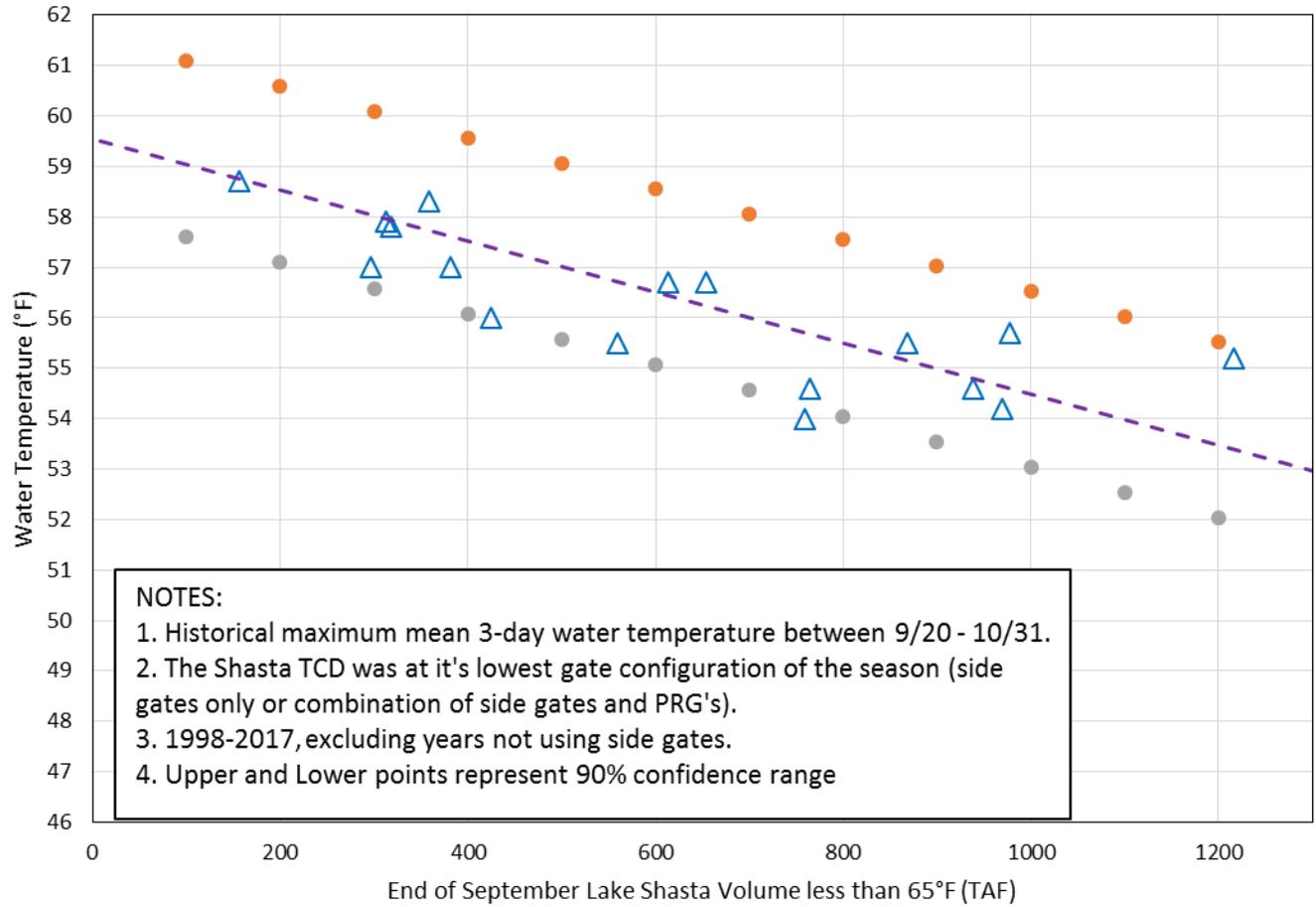


Figure 4

