

## Sacramento River Temperature Task Group Meeting

June 26, 2017 - 2:00 pm

Conference Line: 877-718-6527

Participant code: 1954134

### Agenda

1. Introductions
2. Meeting Purpose and Overview
3. Fishery update
4. Hydrology & Operations update (information is available on CVO's web-page)
  - a. Mean Daily Water Temperatures
  - b. Redding 10-Day Forecasted Air Temperatures
  - c. Sac River Gage temp plot and air temp plot
  - d. Lake Shasta Isothermalbaths Plot
  - e. Lake Shasta Current TCD Configuration
5. Temperature Studies
  - a. June 90% Runoff Exceedence and 10% L3TMO Meteorology
  - b. June 90% Runoff Exceedence and 50% L3TMO Meteorology
6. Updates
  - a. Trinity Pulse
  - b. Clear Creek Pulse
7. Next meeting -- July 27, 2017

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

- Sacramento River seasonal warming
- Lower Keswick release (10,500 cfs) than Mean (12,100 cfs) and Median (12,300 cfs)

## Storage/Release Management Conditions:

- Management Challenge: Higher than normal Shasta storage conditions
- Peak storage: High Storage conditions – 4.4 MAF, May 13
- Accumulated Inflow to date: 9.1 MAF (191% of 15 year average)

## Temperature Management:

- Vertical Profile comparison to 2016 – cooler at lower elevations
- Review of 6/18 exceedence at BSF (56.2 °F DAT)
  - Monitoring
  - Forecasted Temperatures and deviation to actual
  - Action 6/14 Unit Priority Adjustment for 6/16
  - Action 6/16 Open Middle Gate – Adjustment for temperature performance
  - Action 6/18 Close Upper Gate – Adjustment for temperature performance
  - Action 6/18 Open Middle Gate - Adjustment for unplanned facility outage
  - Action 6/19 Keswick Release increase to 10,500 cfs – Adjustment for temperature performance
  - Performance at monitoring locations
- Management Challenges:
  - Forecasted Temperature
  - Facility Limits
  - Balance objectives throughout the season
- Due to modeling limitations, manage fall temperatures based on cold-water-pool volumes and conditions at the time
- Modeling results suggest optimistic performance
- Seasonal Temperature Performance:
  - Keswick Dam 52 °F DAT
  - Sacramento River at Clear Creek gage 53 °F DAT
  - Balls Ferry 56 °F DAT
- Continue exercising real-time management capabilities

**DAILY CVP WATER SUPPLY REPORT**

JUNE 22, 2017

RUN DATE: June 23, 2017

**RESERVOIR RELEASES IN CUBIC FEET/SECOND**

RESERVOIR	DAM	WY 2016	WY 2017	15 YR MEDIAN
TRINITY	LEWISTON	2,008	2,361	1,998
SACRAMENTO	KESWICK	8,790	9,503	12,002
FEATHER	OROVILLE (SWP)	5,500	2,500	3,500
AMERICAN	NIMBUS	4,025	4,987	3,824
STANISLAUS	GOODWIN	338	2,511	451
SAN JOAQUIN	FRIANT	293	8,229	307

**STORAGE IN MAJOR RESERVOIRS IN THOUSANDS OF ACRE-FEET**

RESERVOIR	CAPACITY	15 YR AVG	WY 2016	WY 2017	% OF 15 YR AVG
TRINITY	2,448	1,832	1,305	2,207	120
SHASTA	4,552	3,561	3,991	4,264	120
FOLSOM	977	772	757	927	120
NEW MELONES	2,420	1,475	640	2,158	146
FED. SAN LUIS	966	473	187	907	192
TOTAL NORTH CVP	11,363	8,113	6,880	10,463	129
MILLERTON	520	415	449	460	111
OROVILLE (SWP)	3,538	2,707	3,090	2,345	87

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

RESERVOIR	CURRENT WY 2017	DRIEST WY 1977	WETTEST WY 1983	15 YR AVG	% OF 15 YR AVG
TRINITY	2,154	188	2,443	1,211	178
SHASTA	9,058	1,964	9,703	4,751	191
FOLSOM	6,959	294	5,594	2,318	300
NEW MELONES	2,519	0	2,199	874	288
MILLERTON	3,378	175	3,311	1,214	278

**ACCUMULATED PRECIPITATION FOR WATER YEAR TO DATE IN INCHES**

RESERVOIR	CURRENT WY 2017	DRIEST WY 1977	WETTEST WY 1983	AVG (N YRS)	% OF AVG	LAST 24 HRS
TRINITY AT FISH HATCHERY	43.88	13.69	54.65	31.32 ( 55 )	140	0.00
SACRAMENTO AT SHASTA DAM	99.17	17.27	112.33	60.85 ( 60 )	163	0.00
AMERICAN AT BLUE CANYON	134.41	15.64	103.88	65.53 ( 42 )	205	0.00
STANISLAUS AT NEW MELONES	49.97	0.00	45.33	27.04 ( 39 )	185	0.00
SAN JOAQUIN AT HUNTINGTON LK	78.88	17.20	81.40	41.12 ( 42 )	192	0.00

# DRAFT June 2017

## 90% Runoff Exceedance Outlook:

Inflow based on the DWR May 2017 B120, 70% Historical Inflows Oct and future months

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

		Jun	Jul	Aug	Sep	Oct
Shasta	4353	4200	3848	3513	3275	3047
	Elev.	1055	1042	1029	1019	1010

### Monthly River Releases (cfs)

Sacramento	10100	11000	10500	8850	7650
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# Northern CVP Water Temperature Report

## June - 2017

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	- Lake Shasta Isothermalbaths Plot
5	- Daily Maximum and 7DADM
x	- <a href="#">TCD Configuration</a> (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 <sup>1</sup>	SHD	SPP <sup>1</sup>	KWK	SAC	CCR	BSF <sup>2</sup>	JLF	BND	RDB	IGO	LWS	----- <sup>3</sup>	Shasta Generation	Spring Creek P.P.	Keswick Total	RDD	BSF	RDB	LWS
May	51.2	50.2	50.2	51.5	51.9	52.5	54.5	56.1	56.5	57.9	52.8	46.1	-	8478	2284	10616	71.0	68.0	69.2	61.0
06/01	50.8	49.8	50.3	51.4	51.9	52.5	54.9	56.6	57.2	58.7	54.0	46.6	-	8655	1881	10043	75.0	72.3	71.6	64.2
06/02	50.7	49.7	50.4	51.4	51.8	52.4	54.9	56.8	57.4	59.2	54.1	46.7	-	8250	1654	13357	76.5	74.0	74.6	65.2
06/03	51.0	50.0	50.5	51.2	51.6	52.3	54.7	56.5	57.2	58.9	54.3	46.7	-	8864	1650	10569	78.5	73.9	73.9	67.1
06/04	51.0	49.9	50.6	51.3	51.8	52.4	54.6	56.4	57.1	58.8	52.3	47.2	-	8675	1660	10521	76.5	73.0	72.4	63.6
06/05	51.1	50.1	50.7	51.4	51.8	52.4	54.5	56.3	56.9	58.6	51.5	47.0	-	9573	1158	10474	80.5	73.2	74.3	64.1
06/06	51.1	49.9	50.8	51.4	51.9	52.5	54.7	56.4	56.9	58.6	52.0	46.8	-	8769	1568	10517	78.0	74.0	74.9	67.8
06/07	51.2	50.1	50.9	51.4	51.8	52.3	54.4	56.1	56.7	58.4	52.4	46.9	-	8682	1341	10531	74.0	70.8	70.7	63.6
06/08	51.4	49.8	51.1	51.2	51.3	51.7	53.1	54.6	55.2	56.5	52.2	46.5	-	7706	2265	9736	64.0	57.8	58.4	55.4
06/09	51.3	50.1	51.1	51.2	51.6	52.2	53.8	55.1	55.2	56.1	53.6	46.5	-	7754	1648	9581	67.0	61.9	65.2	57.2
06/10	51.3	49.8	51.2	51.3	51.6	52.1	53.9	55.4	55.6	56.9	53.0	46.5	-	7360	1731	9587	↓ 61.5	59.7	61.8	51.8
06/11	51.6	50.1	51.2	51.4	51.7	52.2	53.7	55.0	55.3	56.4	53.1	46.0	-	8007	1876	9515	62.0	60.2	60.3	47.3
06/12	51.0	49.9	51.3	51.4	51.6	52.1	53.8	55.2	55.5	56.7	53.5	45.7	-	7800	1696	9578	↓ 61.5	60.5	60.0	54.3
06/13	51.2	49.9	51.2	51.6	52.1	52.8	54.8	56.3	56.6	57.7	54.8	46.5	-	6926	2358	9533	71.0	68.2	68.8	58.4
06/14	51.1 ?	49.9	51.3	51.9	52.2	52.8	54.9	56.7	57.1	58.7	55.1	46.9	-	7311	1967	9529	74.5	71.7	73.3	62.5
06/15	50.7	49.8	51.3	52.3	52.9	53.5	55.6	57.5	57.8	59.4	55.4	47.1	-	7596	2207	9544	77.0	74.7	78.3	65.4
06/16	50.4	49.5	51.4	51.8	52.5	53.3	55.9	58.1	58.6	60.5	56.3	47.4	-	6783	2289	9536	82.5	79.1	83.3	70.7
06/17	50.4	49.3	51.3	51.8	52.4	53.2	56.0	58.2	58.7	60.7	56.2	47.9	-	6731	2543	9459	87.5	81.9	86.1	71.5
06/18	50.1	49.2	51.4	51.4	52.1	53.1	56.2	58.6	59.3	61.4	53.7	47.8	-	8413	1277	9191	↑ 96.5	90.5	92.0	75.3
06/19	49.9	48.9	51.4	51.3	52.0	52.8	55.4	57.9	58.6	61.0	52.5	47.7	-	7878	1858	9330	↑ 94.5	89.2	88.3	78.1
06/20	50.0	49.0	51.5	50.9	51.6	52.4	55.3	57.8	58.3	60.4	52.8	47.7	-	8356	1175	9541	↑ 95.0	89.7	89.7	76.9
06/21	49.9	49.1	51.5	51.0	51.7	52.6	55.5	58.1	58.6	60.9	53.3	47.8	-	8973	1175	9540	↑ 97.5	90.9	92.5	76.8
06/22	49.8	48.9	51.6	51.0	51.6	52.5	55.4	57.9 ?	58.5	60.9	54.0	48.0	-	8529	1572	9503	↑ 97.0	92.4	95.0	75.7
06/23																				
06/24																				
06/25																				
06/26																				
06/27																				
06/28																				
06/29																				
06/30																				
-																				
Jun	50.8	49.7	51.1	51.4	51.9	52.6	54.8	56.7	57.2	58.9	53.6	47.0	-	8072	1752	9942	78.5	74.5	75.7	65.1

Total CFS	177591	38549	218715
Total AF	352245	76460	433812

Legend

Notes

- ? = 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

- <sup>1</sup> 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
- <sup>2</sup> Current control point (see page 3 for more details)
- <sup>3</sup> 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	
06/01	60	79	69.5	64	87	75.5	57	92	74.5	58	92	75.0	58	87	72.5	56	92	74.0	59	97	78.0	61	97	79.0	64	94	79.0	63	94	78.5	63	92	77.5	59	89	74.0	
06/02	64	86	75.0	60	93	76.5	59	92	75.5	59	86	72.5	55	93	74.0	59	97	78.0	60	94	77.0	61	89	75.0	56	84	70.0	56	84	70.0	60	87	73.5	61	92	76.5	
06/03	60	93	76.5	66	92	79.0	59	88	73.5	56	94	75.0	58	96	77.0	59	93	76.0	60	84	72.0	57	82	69.5	56	80	68.0	57	82	69.5	58	85	71.5	59	90	74.5	
06/04	64	93	78.5	63	88	75.5	56	94	75.0	58	95	76.5	59	93	76.0	60	79	69.5	57	78	67.5	52	80	66.0	55	81	68.0	59	88	73.5	61	94	77.5	62	93	77.5	
06/05	62	91	76.5	69	94	81.5	59	95	77.0	58	90	74.0	57	71	64.0	55	73	64.0	47	74	60.5	50	79	64.5	59	91	75.0	61	94	77.5	62	93	77.5	63	93	78.0	
06/06	65	96	80.5	62	95	78.5	58	89	73.5	56	71	63.5	55	72	63.5	51	73	62.0	51	82	66.5	53	88	70.5	59	90	74.5	61	91	76.0	62	94	78.0	64	97	80.5	
06/07	61	95	78.0	61	88	74.5	57	71	64.0	54	75	64.5	51	72	61.5	51	73	62.0	50	82	66.0	55	88	71.5	60	89	74.5	61	85	73.0	61	84	72.5	62	87	74.5	
06/08	60	88	74.0	56	72	64.0	53	76	64.5	51	71	61.0	50	72	61.0	51	82	66.5	54	87	70.5	58	90	74.0	62	96	79.0	66	101	83.5	66	98	82.0	66	95	80.5	
06/09	56	72	64.0	57	76	66.5	51	71	61.0	50	66	58.0	51	77	64.0	52	86	69.0	57	89	73.0	57	94	75.5	63	96	79.5	69	99	84.0	69	98	83.5	67	98	82.5	
06/10	57	77	67.0	51	71	51.0	50	70	60.0	50	76	63.0	52	86	69.0	56	89	72.5	57	91	74.0	63	98	80.5	72	102	87.0	71	101	86.0	70	100	85.0	68	99	83.5	
06/11	50	73	61.5	54	68	61.0	50	74	62.0	52	84	68.0	54	89	71.5	58	91	74.5	65	99	82.0	68	101	84.5	71	104	87.5	71	105	88.0	69	102	85.5	70	101	85.5	
06/12	53	71	62.0	50	74	62.0	50	84	67.0	54	90	72.0	59	92	75.5	65	98	81.5	68	100	84.0	69	104	86.5	75	105	90.0	72	104	88.0	70	102	86.0	69	101	85.0	
06/13	49	74	61.5	58	84	71.0	54	89	71.5	58	91	74.5	64	98	81.0	68	102	85.0	69	105	87.0	70	105	87.5	71	103	87.0	70	105	87.5	70	101	85.5	68	100	84.0	
06/14	57	85	71.0	57	90	73.5	57	92	74.5	63	98	80.5	65	101	83.0	71	106	88.5	71	105	88.0	70	105	87.5	75	106	90.5	71	104	87.5	68	100	84.0	66	97	81.5	
06/15	56	93	74.5	62	93	77.5	64	97	80.5	67	101	84.0	72	107	89.5	72	107	89.5	72	107	89.5	72	105	88.5	73	103	88.0	68	100	84.0	66	97	81.5	64	94	79.0	
06/16	60	94	77.0	66	98	82.0	70	102	86.0	76	109	92.5	74	109	91.5	73	109	91.0	72	107	89.5	70	103	86.5	71	102	86.5	65	99	82.0	67	96	81.5	66	96	81.0	
06/17	66	99	82.5	72	102	87.0	75	109	92.0	74	110	92.0	74	110	92.0	72	106	89.0	71	104	87.5	67	101	84.0	66	98	82.0	66	99	82.5	66	98	82.0	65	96	80.5	
06/18	72	103	87.5	83	109	96.0	78	110	94.0	74	109	91.5	73	109	91.0	73	107	90.0	69	104	86.5	65	102	83.5	68	100	84.0	67	99	83.0	65	96	80.5	64	96	80.0	
06/19	83	110	96.5	76	109	92.5	74	110	92.0	75	111	93.0	75	110	92.5	71	106	88.5	69	105	87.0	68	100	84.0	69	97	83.0	66	97	81.5	66	93	79.5	64	95	79.5	
06/20	76	113	94.5	79	111	95.0	73	111	92.0	75	111	93.0	71	107	89.0	70	108	89.0	68	101	84.5	66	97	81.5	68	96	82.0	64	94	79.0	64	93	78.5	64	94	79.0	
06/21	79	111	95.0	86	110	98.0	75	111	93.0	72	108	90.0	71	108	89.5	70	102	86.0	67	97	82.0	63	92	77.5	66	96	81.0	65	95	80.0	66	95	80.5	65	95	80.0	
06/22	85	110	97.5	85	112	98.5	72	110	91.0	71	110	90.5	72	104	88.0	68	99	83.5	64	95	79.5	63	97	80.0	66	99	82.5	66	102	84.0	67	100	83.5	67	98	82.5	
06/23	85	109	97.0	87	109	98.0	74	109	91.5	73	104	88.5	68	99	83.5	65	97	81.0	65	98	81.5	66	97	81.5	66	98	82.0	64	99	81.5	66	94	80.0	65	96	80.5	
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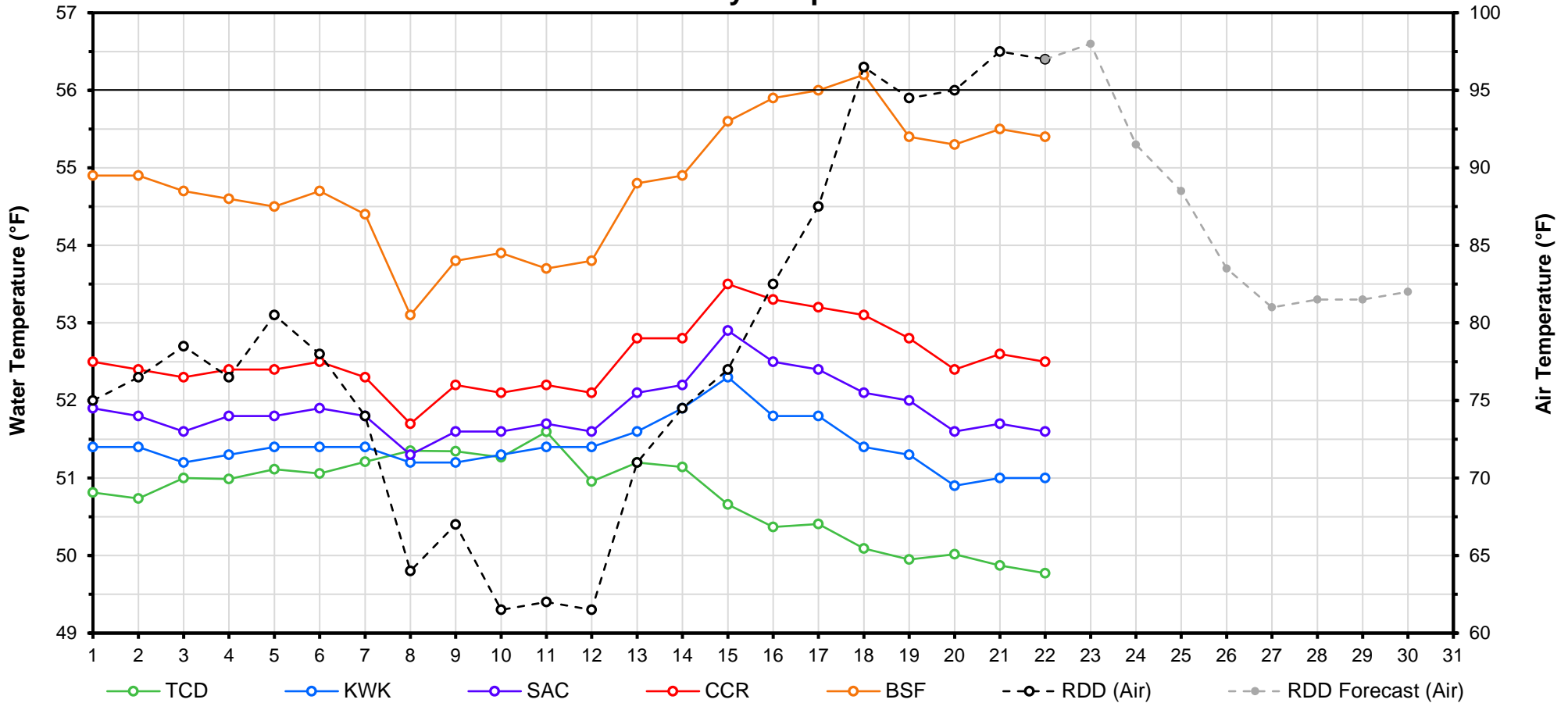
[Web Links](#)

[Legend](#)

[10-Day Min/Max Forecast](#)  
[Previous Days Min/Max Actuals](#)

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 <sup>1</sup>	CDEC Link
TCD	N/A	Shasta Power Plant	N/A
SHD	Sacramento River	0.3 miles downstream of Shasta Power Plant	<a href="#">Click Here</a>
SPP	N/A	Spring Creek Power Plant	N/A
KWK	Sacramento River	0.8 miles downstream of Keswick Dam	<a href="#">Click Here</a>
SAC	Sacramento River	4.8 miles downstream of Keswick Dam	<a href="#">Click Here</a>
CCR	Sacramento River	9.7 miles downstream of Keswick Dam	<a href="#">Click Here</a>
BSF	Sacramento River	25 miles downstream of Keswick Dam	<a href="#">Click Here</a>
JLF	Sacramento River	34 miles downstream of Keswick Dam	<a href="#">Click Here</a>
BND	Sacramento River	41 miles downstream of Keswick Dam	<a href="#">Click Here</a>
RDB	Sacramento River	58 miles downstream of Keswick Dam	<a href="#">Click Here</a>
IGO	Clear Creek	7.3 miles downstream of Whiskeytown Dam	<a href="#">Click Here</a>
LWS	Trinity River	1.1 miles downstream of Lewiston Dam	<a href="#">Click Here</a>
DGC <sup>2</sup>	Trinity River	19 miles downstream of Lewiston Dam	<a href="#">Click Here</a>
NFH <sup>3</sup>	Trinity River	38 miles downstream of Lewiston Dam	<a href="#">Click Here</a>

Temperature Control Point		
Point	Temp. (°F)	Date Range
<b>BSF</b>	<b>56.0</b>	<b>06/01/17 - Current</b>

## Notes

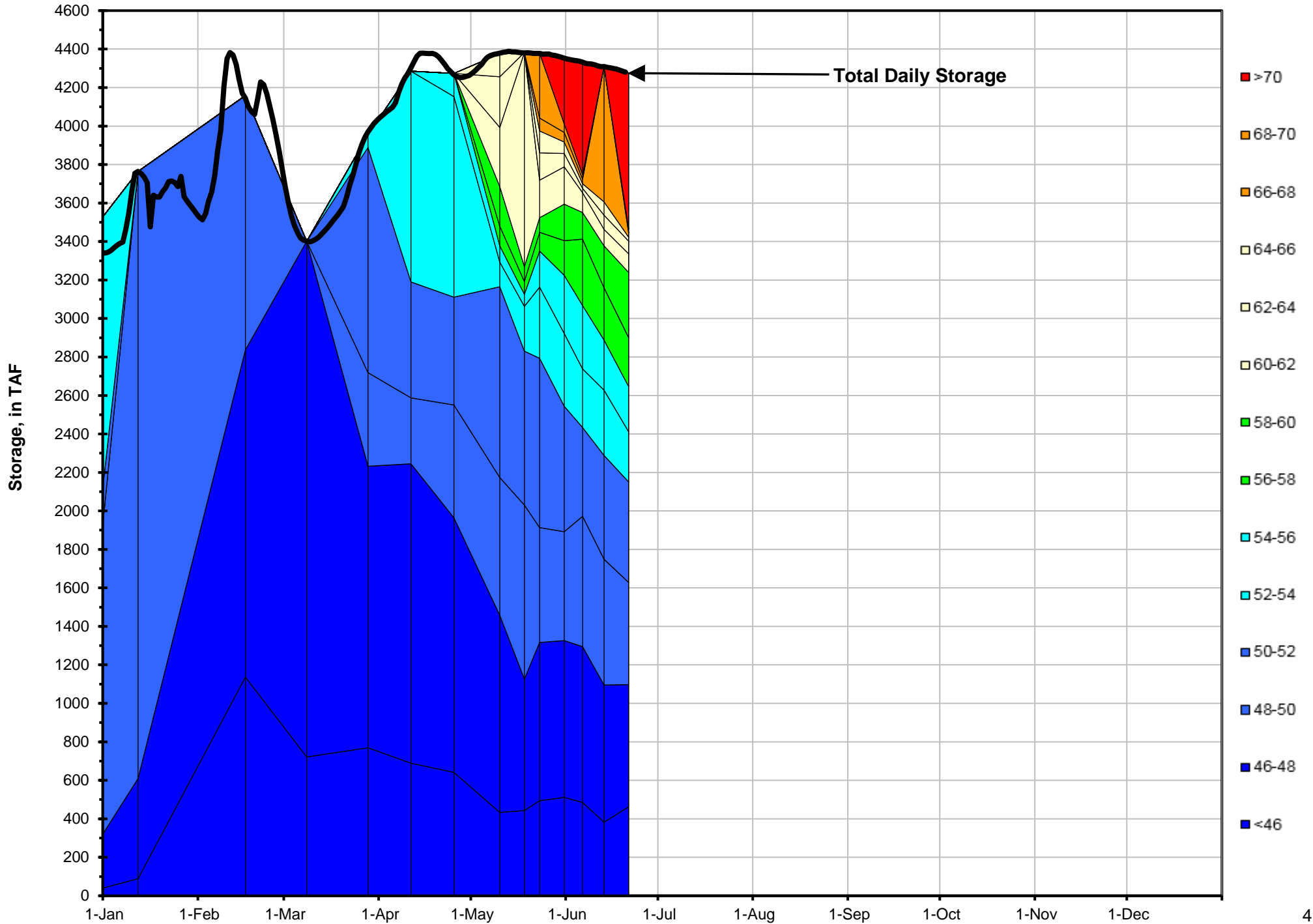
<sup>1</sup> Distances are approximate

<sup>2</sup> DGC is only reported in September

<sup>3</sup> NFH is only reported in October, November and December



# Lake Shasta Isothermalbaths - 2017 (Water Temperature, in °F)

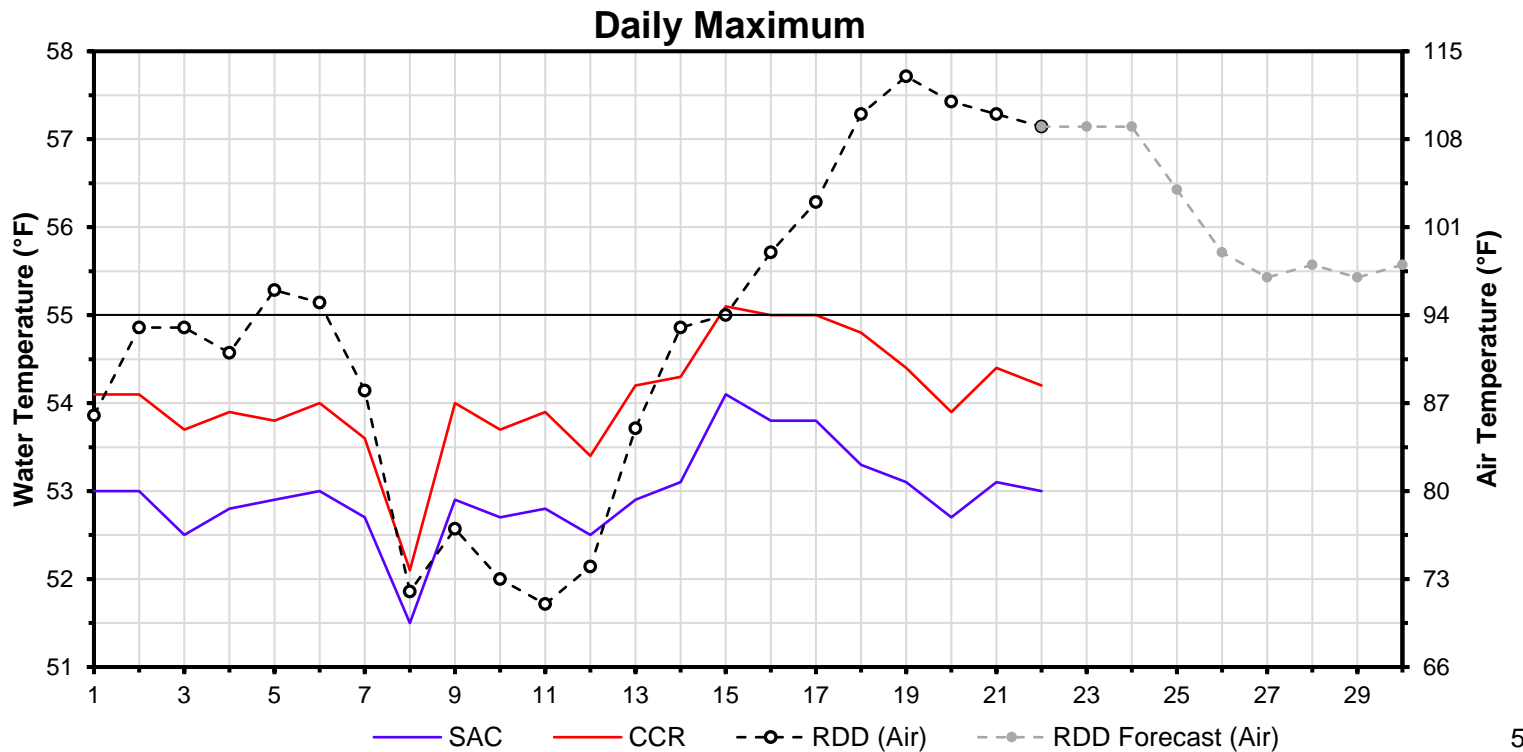
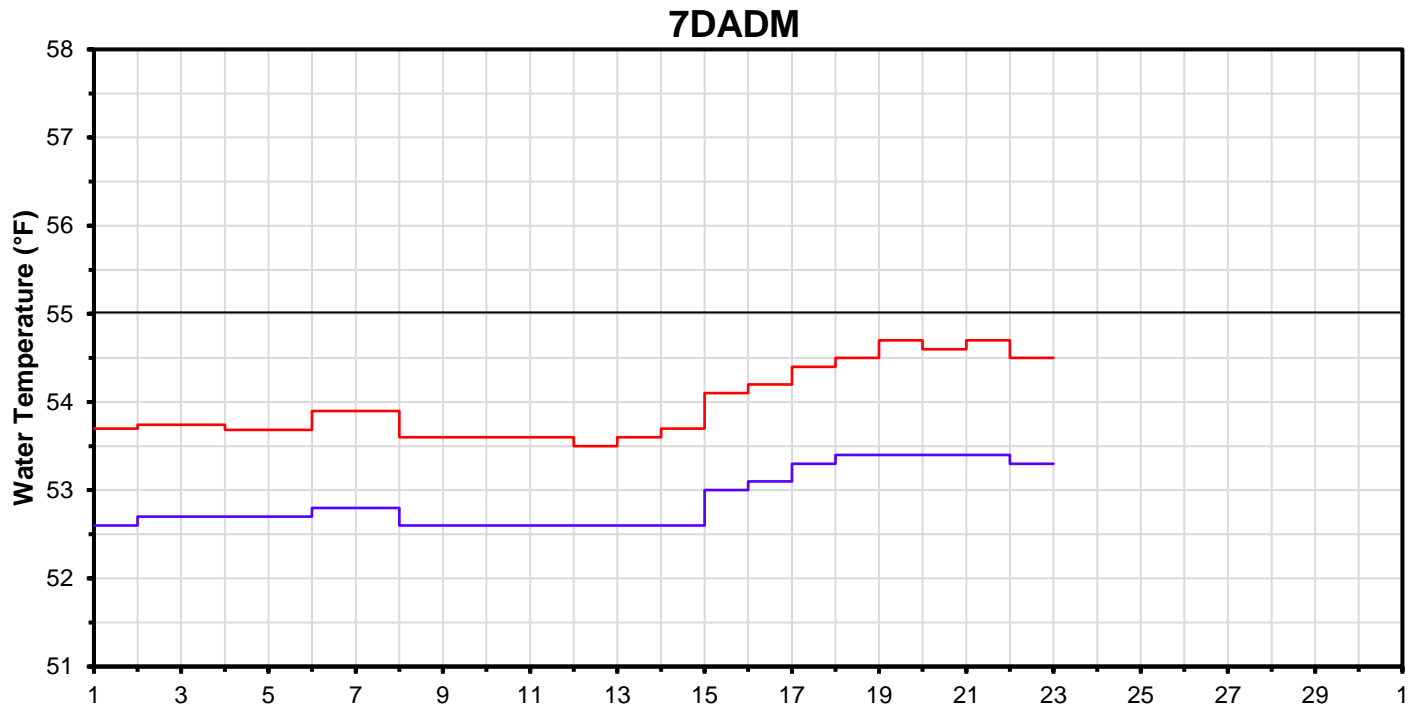


DATE	Daily Max		7DADM <sup>1</sup>		DAT <sup>2</sup>
	SAC	CCR	SAC	CCR	BSF
06/01	53.0	54.1	52.6	53.7	54.9
06/02	53.0	54.1	52.7	53.7	54.9
06/03	52.5	53.7	52.7	53.7	54.7
06/04	52.8	53.9	52.7	53.7	54.6
06/05	52.9	53.8	52.7	53.7	54.5
06/06	53.0	54.0	52.8	53.9	54.7
06/07	52.7	53.6	52.8	53.9	54.4
06/08	51.5	52.1	52.6	53.6	53.1
06/09	52.9	54.0	52.6	53.6	53.8
06/10	52.7	53.7	52.6	53.6	53.9
06/11	52.8	53.9	52.6	53.6	53.7
06/12	52.5	53.4	52.6	53.5	53.8
06/13	52.9	54.2	52.6	53.6	54.8
06/14	53.1	54.3	52.6	53.7	54.9
06/15	54.1	55.1	53.0	54.1	55.6
06/16	53.8	55.0	53.1	54.2	55.9
06/17	53.8	55.0	53.3	54.4	56.0
06/18	53.3	54.8	53.4	54.5	56.2
06/19	53.1	54.4	53.4	54.7	55.4
06/20	52.7	53.9	53.4	54.6	55.3
06/21	53.1	54.4	53.4	54.7	55.5
06/22	53.0	54.2	53.3	54.5	55.4
06/23					
06/24					
06/25					
06/26					
06/27					
06/28					
06/29					
06/30					
-					

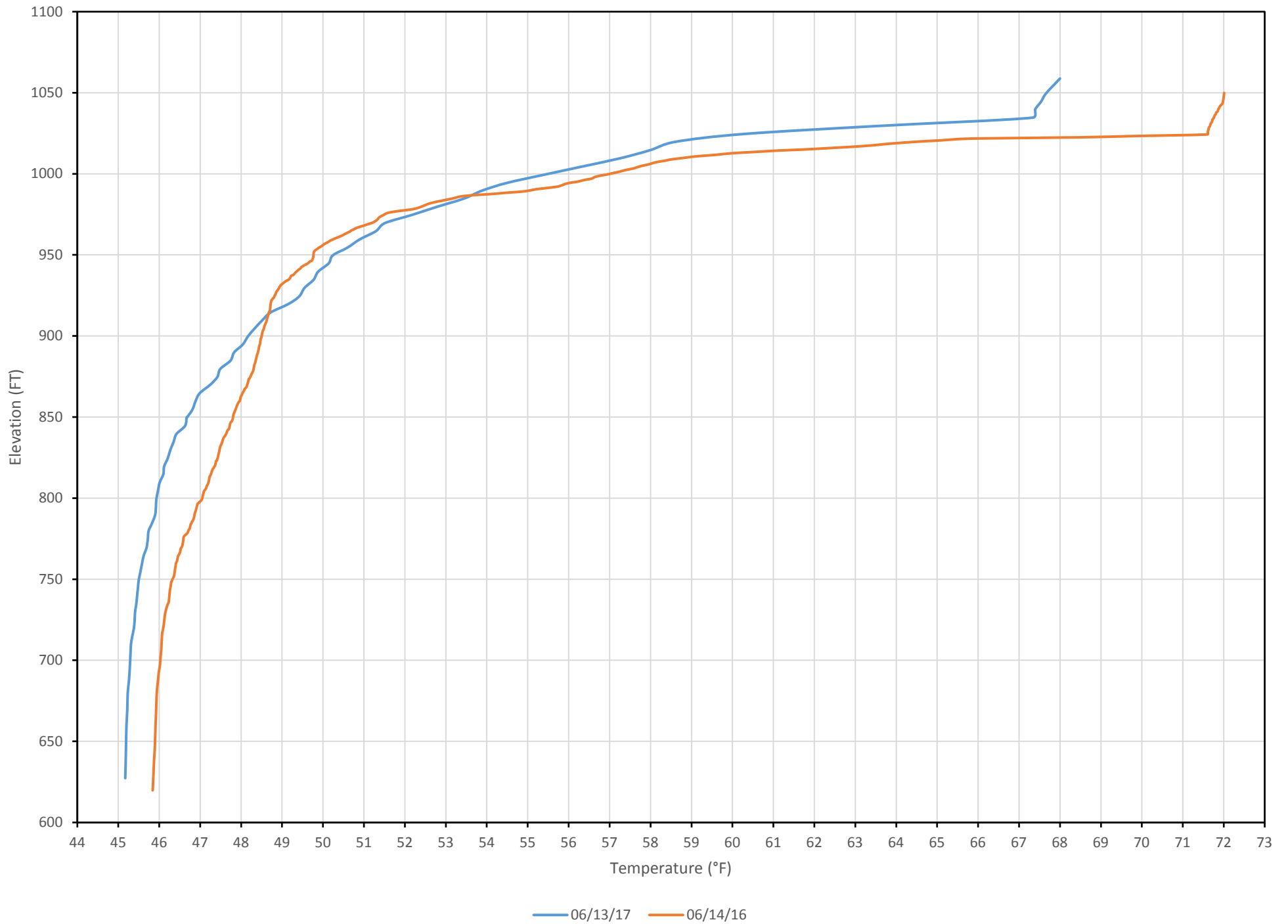
**Notes**

<sup>1</sup> 7DADM = 7-Day Average Daily Maximum

<sup>2</sup> DAT = Daily Average Temperature



# Shasta Reservoir Vertical Temperature Profile 2016 vs 2017

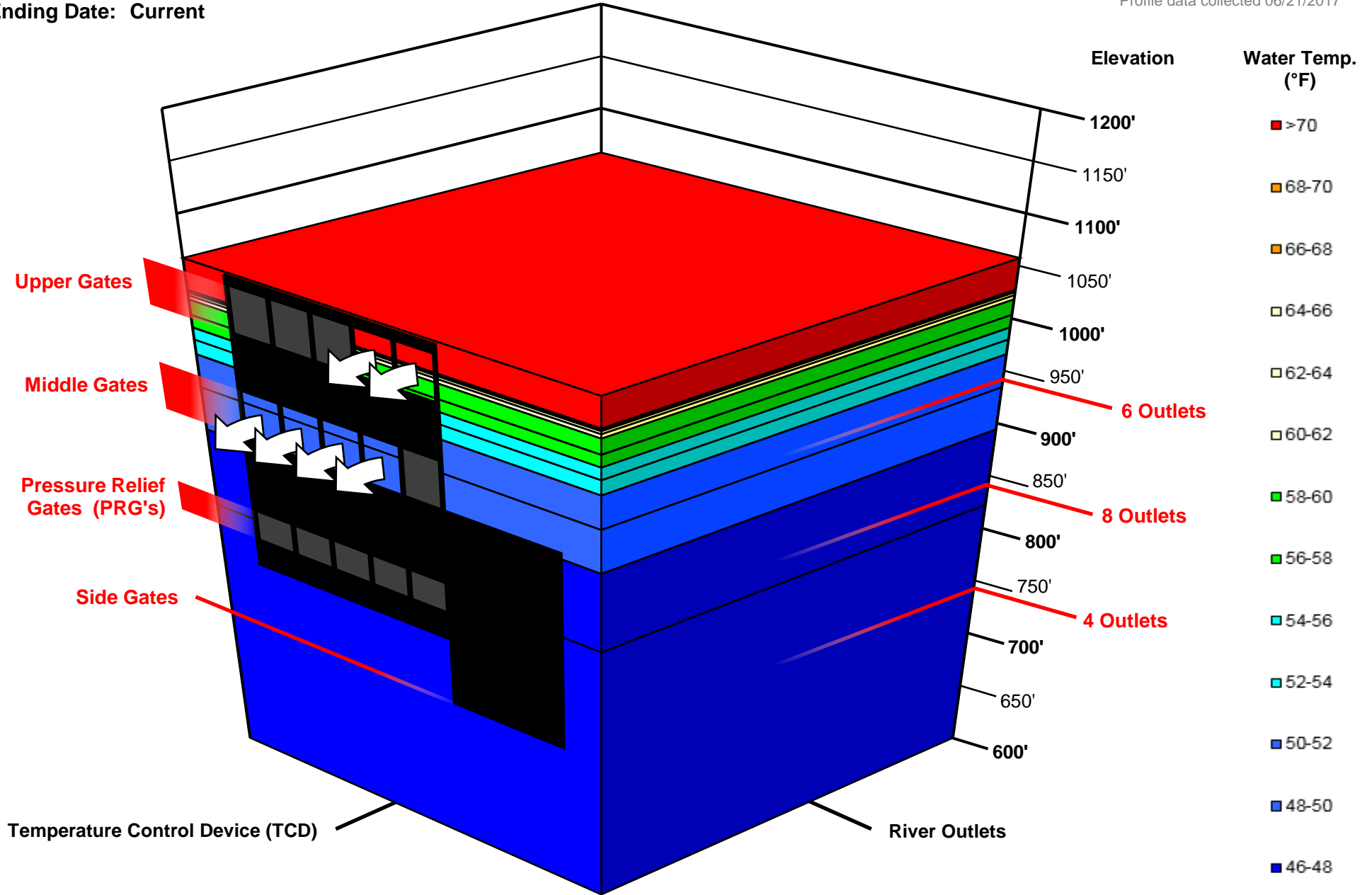


# Shasta TCD Configuration

Starting Date: 06/18/2017

Ending Date: Current

Profile data collected 06/21/2017



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

## Upper Sacramento River – June 2017 Preliminary Temperature Analysis

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

Initial Compliance Location (°F DAT)	JUN	JUL	AUG	SEP	OCT
<b>June 90%-Exceedance Outlook – 10% L3MTO Meteorology</b>					
<b>Keswick Dam KWK (52)</b>	51.5	51.8	51.9	51.5	52.0
<b>Sac. R. abv Clear Creek CCR (53)</b>	52.0	52.6	52.4	51.8	51.8
<b>Balls Ferry BSF (56)</b>	54.5	55.1	54.4	53.4	52.5
<b>June 90%-Exceedance Outlook – 50% L3MTO Meteorology</b>					
<b>Keswick Dam KWK (52)</b>	51.5	51.8	51.7	51.6	52.0
<b>Sac. R. abv Clear Creek CCR (53)</b>	52.0	52.4	52.2	52.1	51.9
<b>Balls Ferry BSF (56)</b>	54.3	54.7	54.1	53.8	52.5

### **Temperature Model Inputs, Assumptions, Limitations and Uncertainty:**

1. The latest available profiles for Shasta, Trinity, and Whiskeytown were taken on June 13, June 20, and June 7, respectively.
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 greater than normal creek flows cause additional warming in the upper Sacramento River during spring. Consistent with prior wet year temperature operations, early spring temperatures are not adjusted due to this additional warming.
3. Operation is based on the June 2017 Operation Outlooks (monthly flows, reservoir release, and end-of-month reservoir storage) for the 90%- and 50%-exceedances and adjusted further for the month of June. Trinity Lake inflows are updated with the CNRFC 90% runoff exceedance for both the 90% and 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.
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 25% historical exceedance for both the 90% and 50% runoff exceedance studies.

6. Meteorological inputs represent the 10% Local Three-Month Temperature Outlook (L3MTO) and the 50% L3MTO derived from NOAA NWS climate prediction products.
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.
9. Trinity Auxiliary Outlet works are assumed available the end of April through mid-June.

DRAFT

Model Run Date 6/21/2017

**Discussion of Results:**

**Modeling runs explore Sacramento River compliance performance at Clear Creek and Balls Ferry locations by varying meteorology.**

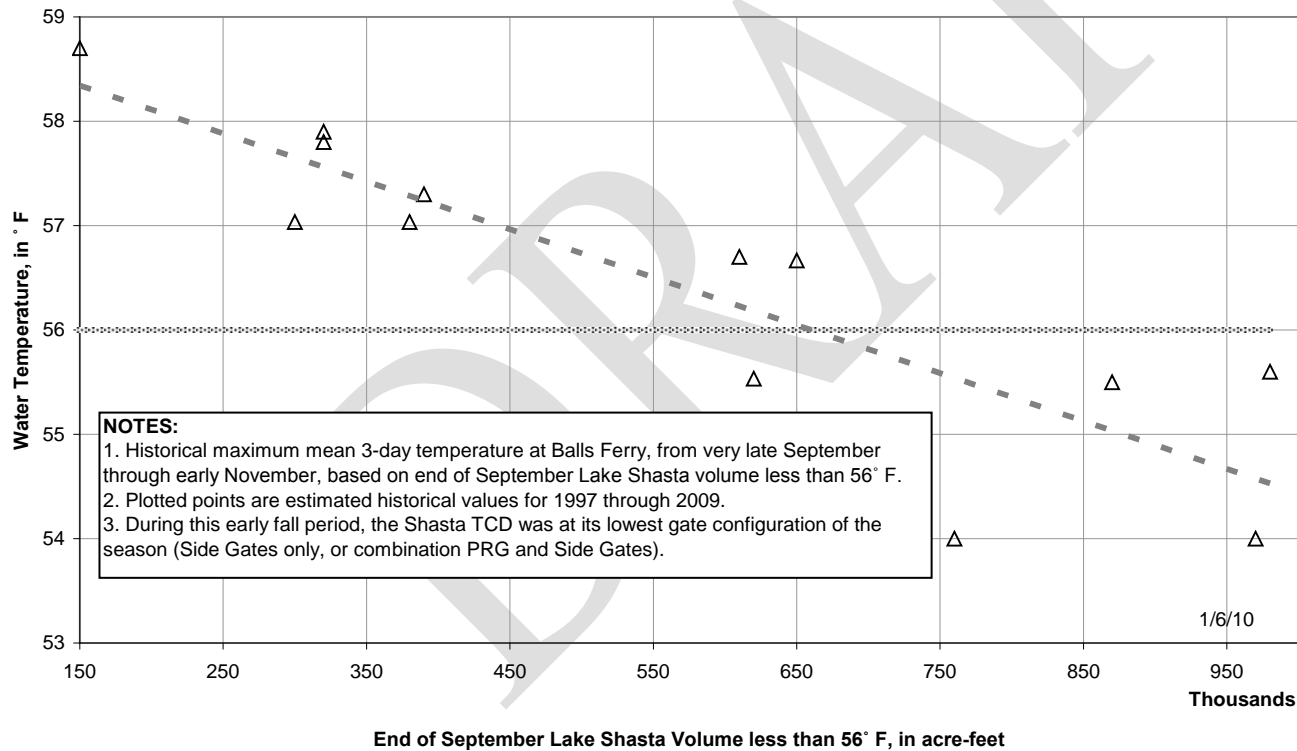
**June 2017 90% Runoff Exceedance – Meteorology 10% and 50% L3MTO (Figures 1-2):**

**Clear Creek and Balls Ferry:** Based on the June 90%-exceedance outlook assuming a 10% and 50% meteorology, a Sacramento River at Clear Creek (CCR) daily average temperature of 53 °F (a surrogate for 55 °F 7DADM at the most downstream winter-run redd) and a Balls Ferry (BSF) compliance point of 56 °F daily average temperature can be achieved from May 15 through October 31 (Figures 1 and 2). The estimated end-of-September lake volume below 56°F is 1063 TAF, for the 10% and 50% meteorology, indicates a high likelihood of achieving compliance performance through fall.

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. For river temperatures not to exceed 56 °F downstream to Balls Ferry, the end-of-September lake volume less than 56°F should be greater than about 600 TAF, see chart below:

**Sacramento River - Lake Shasta  
Early Fall Water Temperature at Balls Ferry**





**Sacramento River Modeled Temperature  
2017 June 90%-Exceedance Water Outlook - L3MTO 10% Meteorology  
Target: Approximately 52 degree at Keswick**

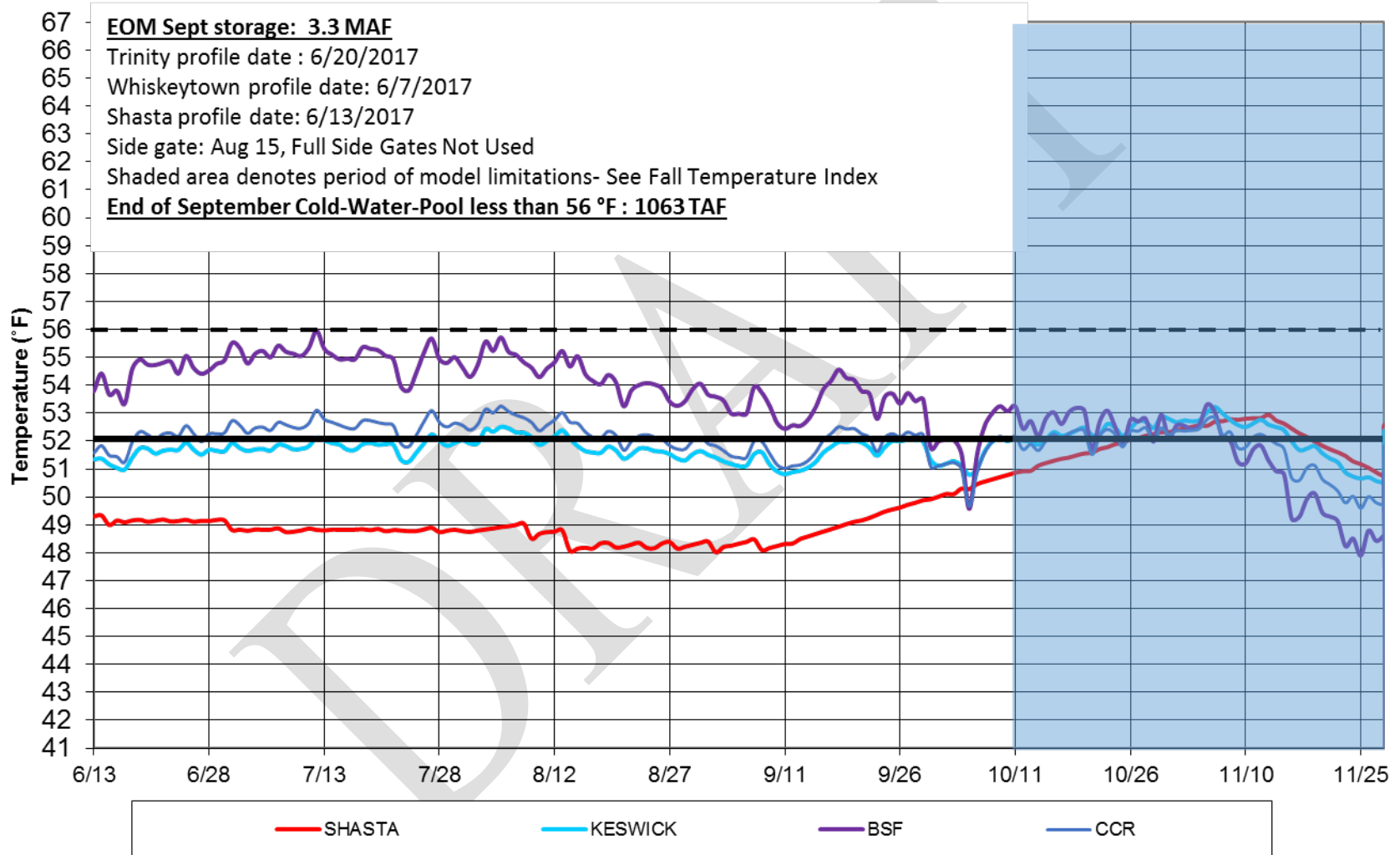


Figure 1

**Sacramento River Modeled Temperature  
2017 June 90%-Exceedance Water Outlook - L3MTO 50% Meteorology  
Target: Approximately 52 degree at Keswick**

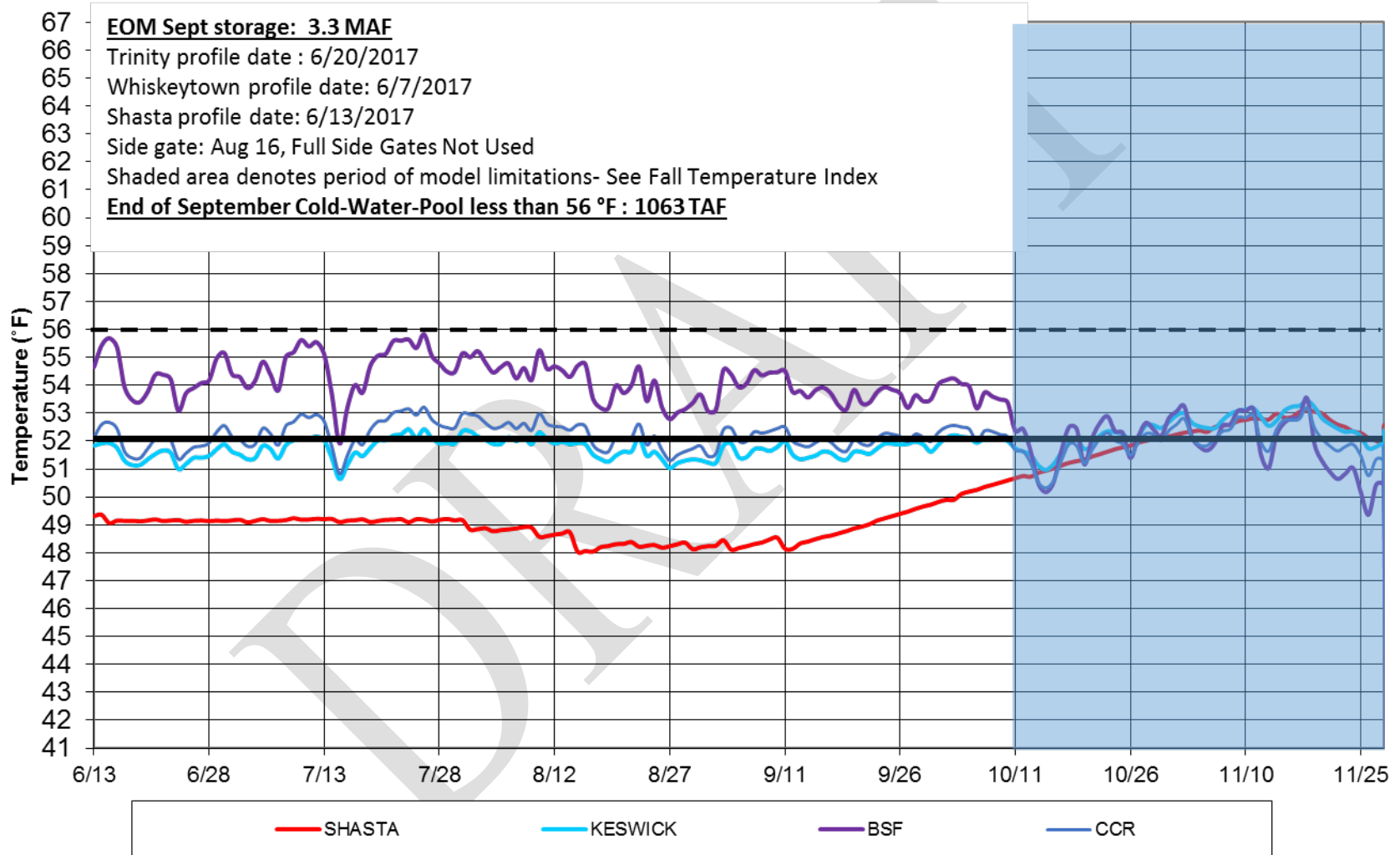
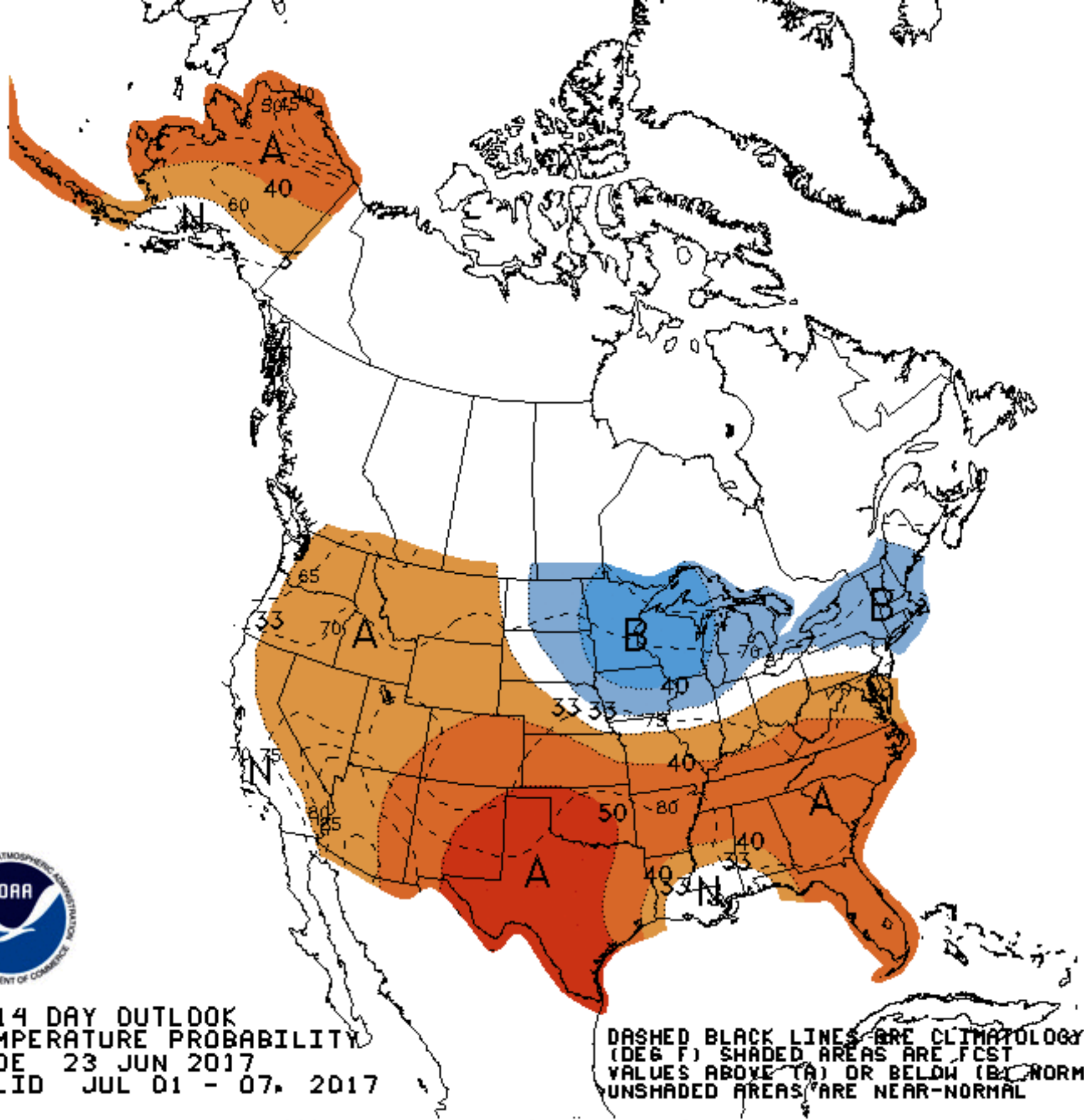


Figure 2



8-14 DAY OUTLOOK  
 TEMPERATURE PROBABILITY  
 MADE 23 JUN 2017  
 VALID JUL 01 - 07, 2017

DASHED BLACK LINES ARE CLIMATOLOGY (DEG F) SHADED AREAS ARE FCST VALUES ABOVE (A) OR BELOW (B) NORMAL UNSHADED AREAS ARE NEAR-NORMAL

