Sacramento River Temperature Task Group Meeting

May 22, 2014
1:00 pm

Conference Line: 877-718-6527
Pass code: 1954134

Agenda

1. Introductions

2. Fishery update

3. Hydrology & Operations update
    a. Daily CVP Water Supply Report ***
    b. 90% forecasts ***
    c. Sacramento Temperature Summary Table ***

4. Discussion of recent temperature model runs
    a. Temperature studies packet ***

5. Next meeting

***handouts

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

DAILY CVP WATER SUPPLY REPORT

MAY 20, 2014

RUN DATE: May 21, 2014

RESERVOIR RELEASES IN CUBIC FEET/SECOND

RESERVOIR	DAM	WY 2013	WY 2014	15 YR MEDIAN
TRINITY	LEWISTON	2,128	1,538	2,450
SACRAMENTO	KESWICK	11,568	7,009	10,007
FEATHER	OROVILLE (SWP)	3,000	1,700	2,000
AMERICAN	NIMBUS	1,020	1,745	2,704
STANISLAUS	GOODWIN	307	607	1,090
SAN JOAQUIN	FRIANT	453	1,103	298

STORAGE IN MAJOR RESERVOIRS IN THOUSANDS OF ACRE-FEET

RESERVOIR	CAPACITY	15 YR AVG	WY 2013	WY 2014	% OF 15 YR AVG
TRINITY	2,448	1,982	2,066	1,236	62
SHASTA	4,552	3,905	3,515	2,281	58
OROVILLE (SWP)	3,538	2,804	2,898	1,786	64
FOLSOM	977	788	719	565	72
NEW MELONES	2,420	1,612	1,358	825	51
FED. SAN LUIS	966	687	566	542	79
MILLERTON	520	408	388	293	72
TOT. N. CVP	11,360	8,973	8,224	5,449	61

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

RESERVOIR	CURRENT WY 2014	DRIEST WY 1977	WETTEST WY 1983	15 YR AVG	% OF 15 YR AVG
TRINITY	337	147	1,705	953	35
SHASTA	2,051	1,735	8,834	4,141	50
FOLSOM	688	255	4,665	1,723	40
NEW MELONES	241	0	1,485	613	39
MILLERTON	227	125	2,171	795	29

ACCUMULATED PRECIPITATION FOR WATER YEAR TO DATE IN INCHES

RESERVOIR	CURRENT WY 2014	DRIEST WY 1977	WETTEST WY 1983	AVG (N YRS)	% OF AVG	LAST 24 HRS
TRINITY AT FISH HATCHERY	16.41	12.30	54.59	30.13 (52)	54	0.00
SACRAMENTO AT SHASTA DAM	30.06	15.35	112.07	58.57 (57)	51	0.00
AMERICAN AT BLUE CANYON	43.07	15.64	103.28	62.46 (39)	69	0.45
STANISLAUS AT NEW MELONES	15.40	0.00	45.33	25.90 (36)	59	0.02
SAN JOAQUIN AT HUNTINGTON LK	16.01	15.70	80.80	39.90 (39)	40	0.00

May 90%

Storages

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

		May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Trinity	**1281**	**1178**	**1044**	**858**	**700**	**636**	**574**	**538**	**523**	**516**	**511**	**522**	**429**
	Elev.	2274	2260	2238	2217	2208	2198	2191	2189	2188	2187	2189	2171
Whiskeytown	**238**	**238**	**238**	**238**	**238**	**230**	**230**	**225**	**206**	**182**	**182**	**186**	**238**
	Elev.	1209	1209	1209	1209	1207	1207	1205	1199	1190	1190	1192	1209
Shasta	**2409**	**2100**	**1751**	**1385**	**1104**	**940**	**854**	**843**	**850**	**888**	**971**	**1097**	**1089**
	Elev.	963	942	917	895	880	871	870	871	875	883	894	893
Folsom	**547**	**527**	**451**	**391**	**330**	**275**	**235**	**200**	**181**	**172**	**184**	**237**	**291**
	Elev.	420	410	402	392	383	375	367	362	360	363	375	385
New Melones	**917**	**767**	**666**	**553**	**452**	**368**	**339**	**338**	**339**	**339**	**346**	**342**	**298**
	Elev.	907	890	869	847	827	819	819	819	819	821	820	808
San Luis	**569**	**478**	**343**	**183**	**77**	**35**	**38**	**103**	**237**	**372**	**517**	**600**	**565**
	Elev.	439	409	375	342	348	364	394	430	463	483	498	494
Total		5289	4492	3608	2902	2483	2269	2247	2336	2470	2710	2985	2909

State End of the Month Reservoir Storage (TAF)

Oroville	**1876**	**1702**	**1496**	**1278**	**1104**	**1048**	**953**	**964**	**984**	**1023**	**1128**	**1277**	**1372**
	Elev.	753	730	703	680	671	657	659	662	668	683	703	715
San Luis	**387**	**384**	**253**	**155**	**71**	**141**	**227**	**370**	**544**	**736**	**795**	**884**	**870**
Total San Luis (TAF)	**956**	**862**	**596**	**338**	**148**	**176**	**265**	**473**	**781**	**1108**	**1312**	**1484**	**1435**

Monthly River Releases (TAF/cfs)

Trinity	TAF	92	47	28	28	27	23	18	18	18	17	18	36
	cfs	**1,498**	**783**	**450**	**450**	**450**	**373**	**300**	**300**	**300**	**300**	**300**	**600**
Clear Creek	TAF	12	9	7	7	9	12	12	12	12	11	12	11
	cfs	**190**	**150**	**120**	**120**	**150**	**200**	**200**	**200**	**200**	**200**	**200**	**190**
Sacramento	TAF	489	543	619	501	298	283	208	200	200	180	200	303
	cfs	**7955**	**9129**	**10071**	**8143**	**5007**	**4600**	**3500**	**3250**	**3250**	**3250**	**3250**	**5087**
American	TAF	96	121	99	100	85	49	47	43	43	42	51	48
	cfs	**1567**	**2028**	**1605**	**1630**	**1430**	**792**	**794**	**700**	**700**	**759**	**824**	**800**
Stanislaus	TAF	76	31	30	16	14	35	12	12	13	12	16	21
	cfs	**1235**	**516**	**480**	**267**	**240**	**577**	**200**	**200**	**213**	**214**	**268**	**350**
Feather	TAF	74	98	108	89	74	58	48	49	49	44	49	48
	cfs	**1200**	**1650**	**1750**	**1450**	**1250**	**950**	**800**	**800**	**800**	**800**	**800**	**800**

Trinity Diversions (TAF)

	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Carr PP	41	96	160	129	36	42	24	7	3	8	9	121
Spring Crk. PP	**35**	**89**	**152**	**120**	**34**	**30**	**19**	**17**	**20**	**5**	**8**	**69**

Delta Summary (TAF)

		May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Tracy		61	10	45	45	45	110	91	160	160	158	154	45
USBR Banks		0	35	0	0	0	0	0	0	0	0	0	0
Contra Costa		6.4	6.4	4.9	5.6	6.4	7	8.4	9.2	9.2	7	7	6.4
Total USBR		68	51	50	51	51	117	99	169	169	165	161	51
State Export		12	37	15	20	117	135	179	216	220	102	126	45
Total Export		80	88	65	71	168	252	278	385	389	267	287	96
COA Balance		-196	-205	-224	-235	-136	-93	0	0	0	0	0	0
Old/Middle River Std.													
Old/Middle R. calc.		-892	-1,411	-1,099	-1,281	-2,563	-2,967	-3,634	-4,864	-4,908	-3,629	-3,772	-1,277
Computed DOI		4002	4034	3091	2993	3009	2993	3496	4555	6051	7096	7109	10960
Excess Outflow		0	0	0	0	0	0	0	1057	1545	0	0	5076
% Export/Inflow		18%	16%	12%	14%	33%	47%	52%	57%	54%	42%	39%	11%
% Export/Inflow std.		35%	35%	65%	65%	65%	65%	65%	65%	65%	45%	35%	35%

Hydrology

		Trinity		Shasta		Folsom		New Melones	
Water Year Inflow (TAF)		372		2,514		935		299	
Year to Date + Forecasted	% of mean	31%		45%		34%		28%	

Draft 5/21/2014

Temperature and Release Summary for Shasta and Trinity - May 2104

(Updated twice a week November through April)

Day	Sacramento River Water Temperatures in Degrees F Collected from CDEC (California Data Exchange Center)													Mean Daily Release in CFS			Mean Daily Air Temp Degrees F			
	TCD Wt. Avg.	SHD minus TCD (Diff)	Shd	Spp	Kwk	Control Point 3/1 to 3/27 Bsf	Jlf	Bnd	Rdb	Lws	Control Point 3/28 to Ccr	Igo		Shasta Generation El 815	Spring Crk Powerplant Release	Keswick Total Release	RDD	BSF	RDB	LWS
Apr	50.6		49.8	49.9	51.4	55.0	56.9	57.5	58.5	50.6	53.1	51.3		2,419	524	3,084	60.7	59.7	61.2	54.2
May																				
1	51.1	(0.8)	50.3	51.1	52.0	56.0	58.6	59.5	61.6	50.2	53.8	53.0		4,514	54	4,533	69.5	67.7	70.3	63.3
2	51.2	(0.7)	50.5	51.3	51.9	55.5	58.0	58.8	60.9	50.5	53.7	53.2		5,187	14	5,068	69.5	68.5	71.5	63.2
3	51.1	(0.7)	50.4	51.2	51.9	55.2	57.7	58.5	60.3	50.6	53.5	53.3		5,061	14	5,068	68.0	67.8	67.5	60.0
4	51.1	(0.7)	50.4	51.3	51.9	55.2	57.7	58.4	59.9	51.0	53.3	52.7		5,197	14	5,066	63.5	63.7	63.0	56.4
5	51.4	(0.8)	50.6	51.3	51.6	54.4	56.5	57.1	58.9	51.4	52.9	52.2		5,135	14	5,094	60.5	58.0	59.0	52.8
6	52.0	(0.8)	51.2	51.4	51.5	53.9	56.1	56.6	57.9	51.1	52.9	52.8		5,939	18	5,854	62.5	60.8	63.7	52.5
7	51.8	(0.7)	51.1	51.5	52.1	54.0	56.2	56.8	58.2	50.4	53.1	53.2		6,840	14	6,438	66.0	62.6	64.8	55.3
8	51.4	(0.6)	50.8	51.0	52.1	54.6	55.8	56.5	57.9	50.0	52.9	52.5		6,761	197	6,421	63.0	61.5	62.9	53.1
9	51.6	(0.6)	51.0	51.1	51.6	54.0	55.8	56.2	57.4	49.8	53.0	53.1		7,424	148	6,970	64.0	63.5	64.1	53.8
10	52.1	(0.7)	51.4	51.9	51.8	53.7	55.5	56.1	57.5	49.7	52.8	52.7		7,237	14	6,998	58.5	58.8	61.8	51.8
11	52.8	(0.9)	51.9	51.2	52.0	53.8	55.6	56.1	57.3	50.4	53.1	52.9		6,893	314	6,997	65.0	63.2	64.7	54.0
12	52.6	(0.8)	51.8	51.8	53.1	54.5	56.7	57.1	58.5	50.2	54.2	53.6		6,928	14	7,008	73.5	66.9	70.6	60.5
13	52.6	(0.8)	51.8	51.1	53.2	55.6	57.9	58.4	59.9	50.4	54.7	53.9		6,568	169	6,986	72.5	71.0	74.1	64.1
14	52.6	(0.9)	51.7	51.2	53.1	56.0	58.2	58.9	60.8	50.7	54.6	54.1		7,189	305	6,989	76.0	73.4	74.5	67.1
15	52.7	(0.9)	51.8	51.3	53.0	55.9	58.0	58.6	60.7	50.8	54.3	54.0		7,239	144	6,965	75.5	71.5	73.8	67.0
16	52.8	(0.9)	51.9	51.3	53.0	56.1	57.9	58.5	60.4	50.8	54.5	54.3		7,367	144	6,944	74.0	70.4	72.1	63.8
17	52.9	(0.9)	52.0	51.4	53.2	56.2	58.1	58.7	60.8	50.6	54.5	54.3		8,072	98	6,996	70.5	68.8	71.2	62.2
18	52.8	(1.0)	51.8	52.0	53.3	56.3	57.9	58.5	60.5	51.1	54.6	54.0		7,401	14	7,001	68.5	67.8	69.8	60.0
19	52.9	(0.8)	52.1	51.4	53.1	55.8	57.3	57.8	59.3	51.6	54.2	53.3		6,422	679	6,993	64.0	60.1	62.0	53.3
20	53.2	(0.9)	52.3	51.4	53.1	55.6	57.3	57.8	59.4	51.4	54.4	54.0		6,884	170	7,009	66.5	62.6	61.7	59.8
21		0.0																		
22		0.0																		
23		0.0																		
24		0.0																		
25		0.0																		
26		0.0																		
27		0.0																		
28		0.0																		
29		0.0																		
30		0.0																		
31		0.0																		
Avg	52.1		51.3	51.4	52.4	55.1	57.1	57.7	59.4	50.6	53.8	53.4		6,513	128	6,370	67.6	65.4	67.2	58.7
Tot cfs														130,258	2,552	127,398				
Tot af														258,367	5,062	252,694				

\# = Station out of service ^ - estimated (7 hours or less available) ? = Avg. includes estimated data

! = 17 hours or less of readings & = 18 to 23 hours of reading ND = No hourly readings or incorrect

Control Point: Balls Ferry 3/1/2014 to 3/27/2014 56.0; Clear Creek 3/28/2014 to 4/24/2014 58.0; Clear Creek 4/25/2014 to present 56.0.

May 22, 2014

Upper Sacramento River – May 2014 Preliminary Temperature Analysis

Summary of Temperature Target Results by Month

Initial Target Location	JUN	JUL	AUG	SEP	OCT
90%-Exceedance Outlook					
Sac. R. above Clear Creek (CCR)	**CCR**	**CCR**	**CCR**	**CCR**	**CCR~56˚F to 58+˚F**
50%-Exceedance Outlook					
Sac. R. above Clear Creek (CCR)	**CCR**	**CCR**	**CCR**	**CCR**	**CCR~57˚F to 59+˚F**

Temperature Model Inputs, Assumptions, Limitations and Uncertainty:

1. Operation is based on the May 2014 Operation Outlooks (monthly flows, reservoir release, and end-of-month reservoir storage) for the 90% and 50% exceedances.
2. The profiles used for Shasta, Trinity and Whiskeytown were taken on May 19, May 14, and May 5, respectively.
3. Guidance on forecasted flows from the creeks (e.g., Cow, Cottonwood, Battle, etc.) between Keswick Dam and Bend Bridge is not available beyond 5 days. Model input side flows (Cottonwood Cr & Bend Bridge local flow w/o Cottonwood Cr) were selected from the historical record, and are consistent with the forecast exceedance frequency. During spring, the relatively warm creek flows can be a significant percentage of the flows at Bend Bridge.
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.
5. Cottonwood Creek flows, Keswick to Bend Bridge local flows, and diversions are mean daily synthesized flows based on the available historical record for a 1922-2002 study period.
6. Meteorological inputs were derived from a database of 86 years of meteorological data (1920-2005). The NOAA-NWS Local Three-Month Temperature Outlook (L3MTO), as a means of estimating air temperature expectation, was used to select each month's meteorology from the database.
7. Meteorology, as well as 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.

Temperature Analysis Results:

Note that for all exceedances, Lake Shasta storage is too low to utilize the upper gates of the TCD. This TCD limitation, along with the relatively small cold-water pool volume, significantly impacts temperature management.

90%-Exceedance:
A temperature target location above Clear Creek is possible through September (Figure 1). By early September, the TCD intake level will be through the side gates.

Figure 2 shows temperature results for Clear Creek at Igo.

Figure 3 includes results for the Trinity River at Lewiston Dam. The dashed lines are the 2009 mean daily temperatures at selected locations. **NOTE**: 2009 was the last time the auxiliary outlet works (AOW) was used for fall temperature management; however, there are no releases through the auxiliary outlet works (AOW) in this analysis.

50%-Exceedance:
A temperature target location above Clear Creek is possible through late September (Figure 4). By early September, the TCD intake level will be through the side gates.

Figure 5 shows temperature results for Clear Creek at Igo.

Figure 6 includes results for the Trinity River at Lewiston Dam.

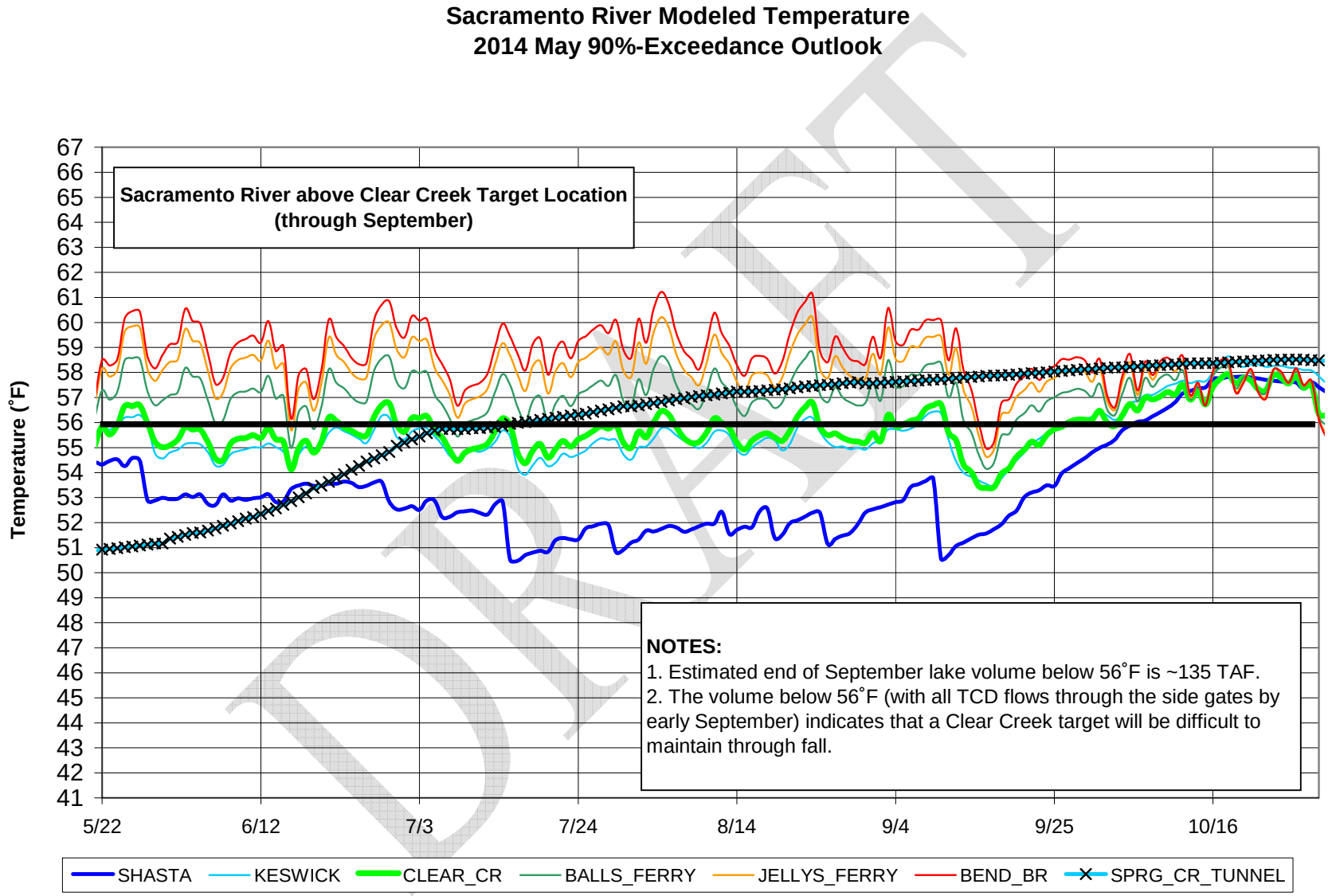

Sacramento River Modeled Temperature
2014 May 90%-Exceedance Outlook
Sacramento River above Clear Creek Target Location
(through September)
Temperature (˚F)
67
66
65
64
63
62
61
60
59
58
57
56
55
54
53
52
51
50
49
48
47
46
45
44
43
42
41
5/22
6/12
7/3
7/24
8/14
9/4
9/25
10/16
NOTES:
1. Estimated end of September lake volume below 56˚F is ~135 TAF.
2. The volume below 56˚F (with all TCD flows through the side gates by early September) indicates that a Clear Creek target will be difficult to maintain through fall.
SHASTA
KESWICK
CLEAR_CR
BALLS_FERRY
JELLYS_FERRY
BEND_BR
SPRG_CR_TUNNEL

Figure 1

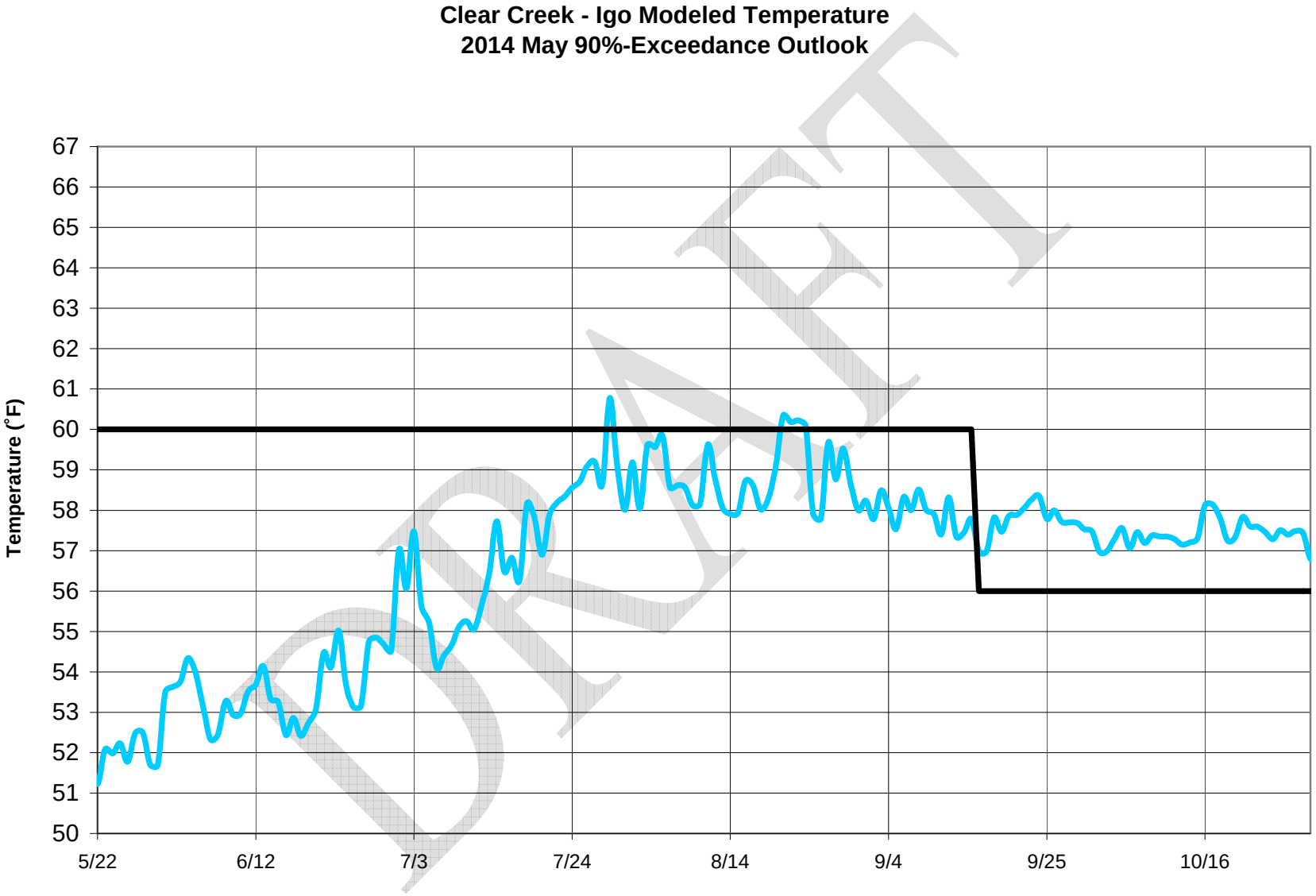

Clear Creek - Igo Modeled Temperature
2014 May 90%-Exceedance Outlook
Temperature (°F)
67
66
65
64
63
62
61
60
59
58
57
56
55
54
53
52
51
50
5/22
6/12
7/3
7/24
8/14
9/4
9/25
10/16
DRAFT

Figure 2

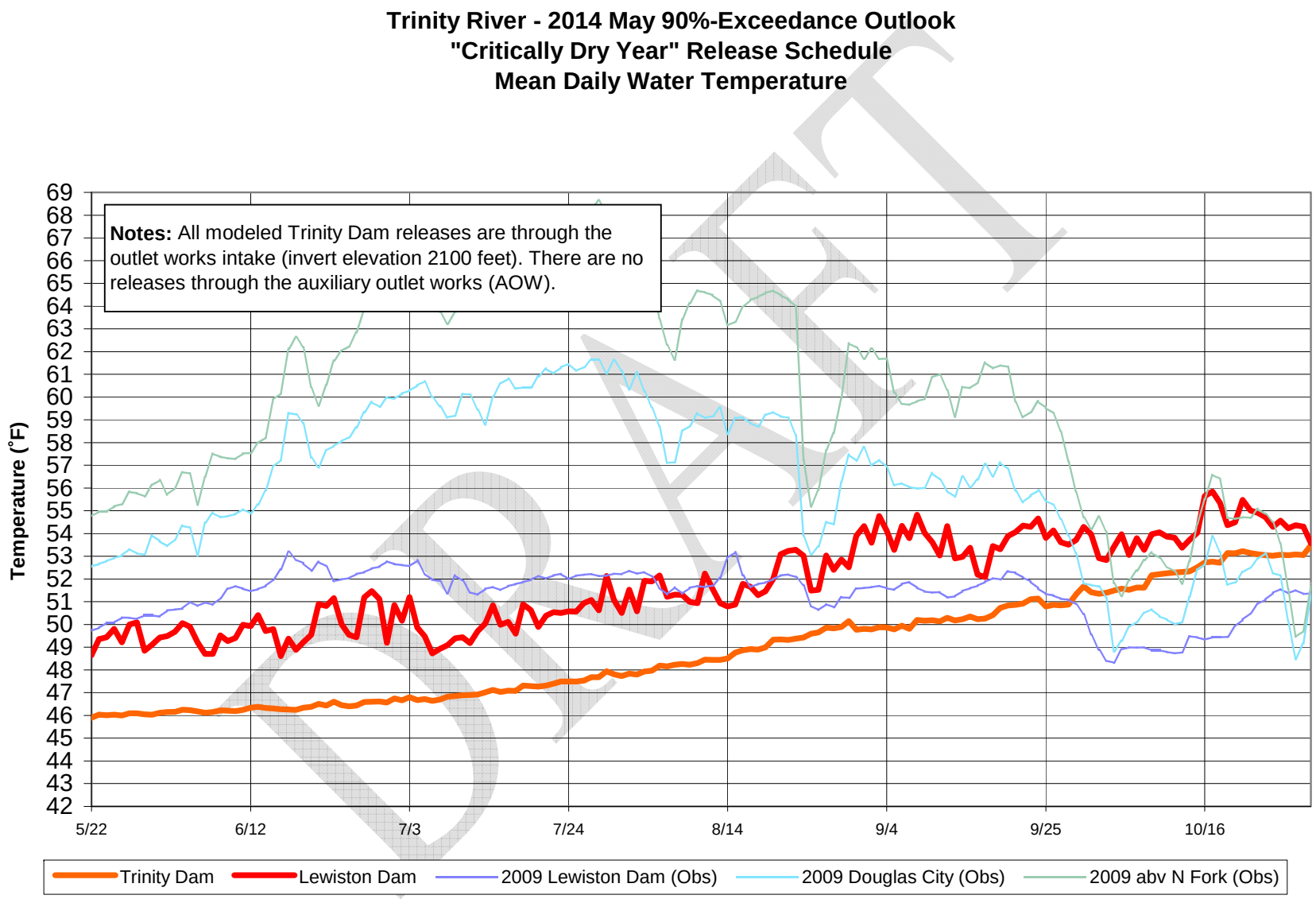

Trinity River - 2014 May 90%-Exceedance Outlook
"Critically Dry Year" Release Schedule
Mean Daily Water Temperature
Notes: All modeled Trinity Dam releases are through the outlet works intake (invert elevation 2100 feet). There are no releases through the auxiliary outlet works (AOW).
Temperature (°F)
69
68
67
66
65
64
63
62
61
60
59
58
57
56
55
54
53
52
51
50
49
48
47
46
45
44
43
42
5/22
6/12
7/3
7/24
8/14
9/4
9/25
10/16
Trinity Dam
Lewiston Dam
2009 Lewiston Dam (Obs)
2009 Douglas City (Obs)
2009 abv N Fork (Obs)

Figure 3

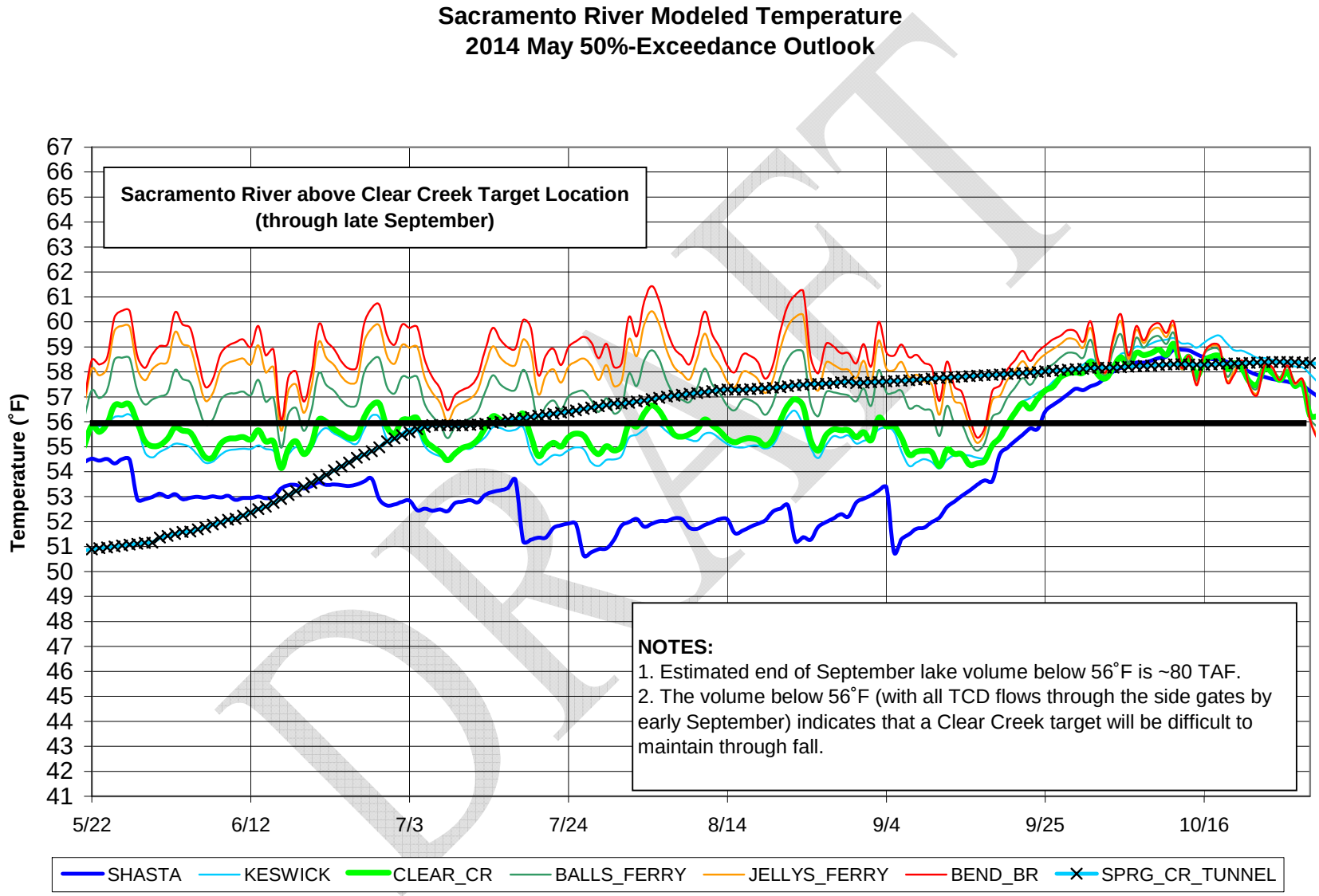

Sacramento River Modeled Temperature
2014 May 50%-Exceedance Outlook
Sacramento River above Clear Creek Target Location
(through late September)
Temperature (°F)
67
66
65
64
63
62
61
60
59
58
57
56
55
54
53
52
51
50
49
48
47
46
45
44
43
42
41
5/22
6/12
7/3
7/24
8/14
9/4
9/25
10/16
NOTES:
1. Estimated end of September lake volume below 56°F is ~80 TAF.
2. The volume below 56°F (with all TCD flows through the side gates by early September) indicates that a Clear Creek target will be difficult to maintain through fall.
SHASTA
KESWICK
CLEAR_CR
BALLS_FERRY
JELLYS_FERRY
BEND_BR
SPRG_CR_TUNNEL

Figure 4

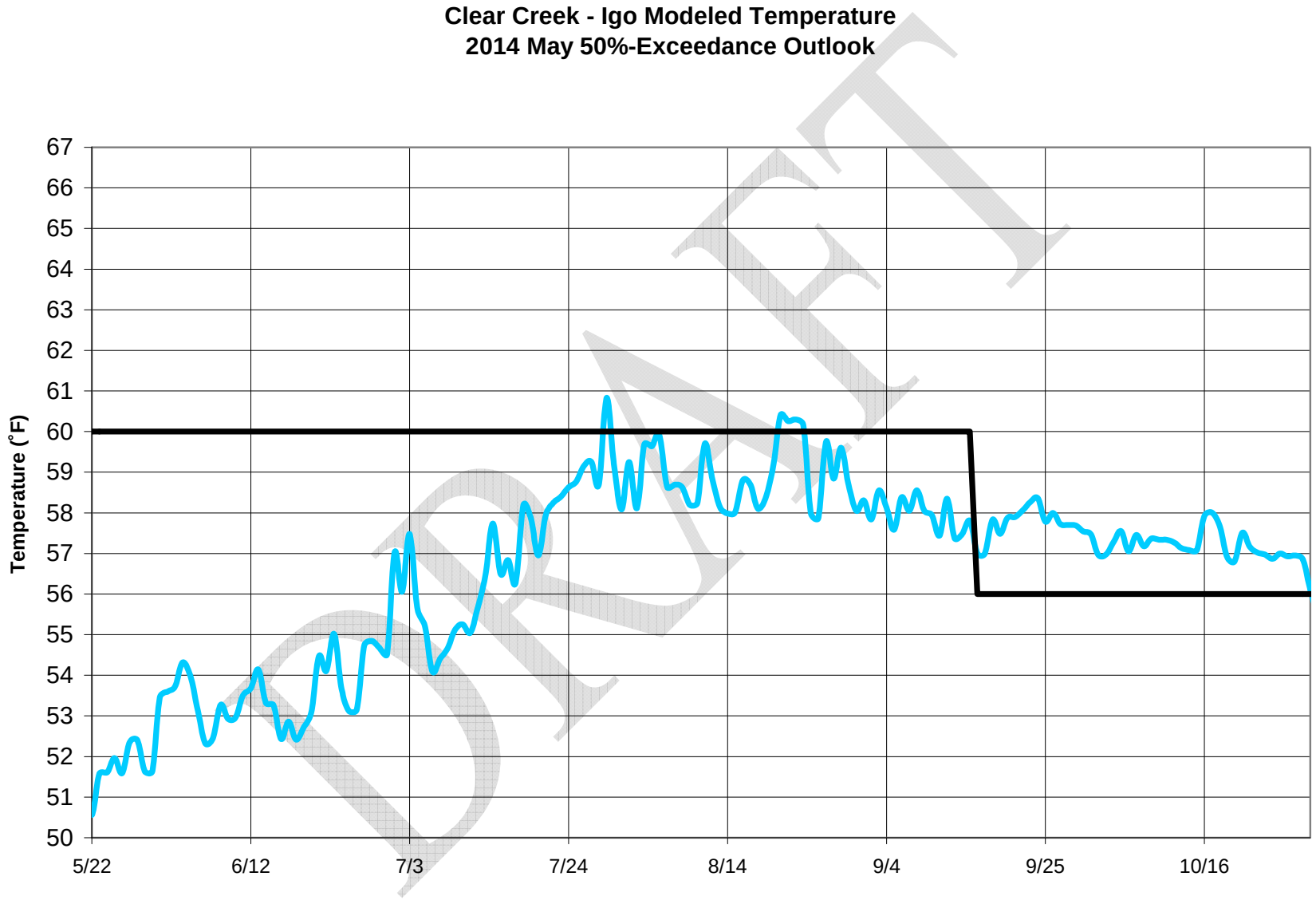

Clear Creek - Igo Modeled Temperature
2014 May 50%-Exceedance Outlook
Temperature (°F)
67
66
65
64
63
62
61
60
59
58
57
56
55
54
53
52
51
50
5/22
6/12
7/3
7/24
8/14
9/4
9/25
10/16
DRAFT

Figure 5

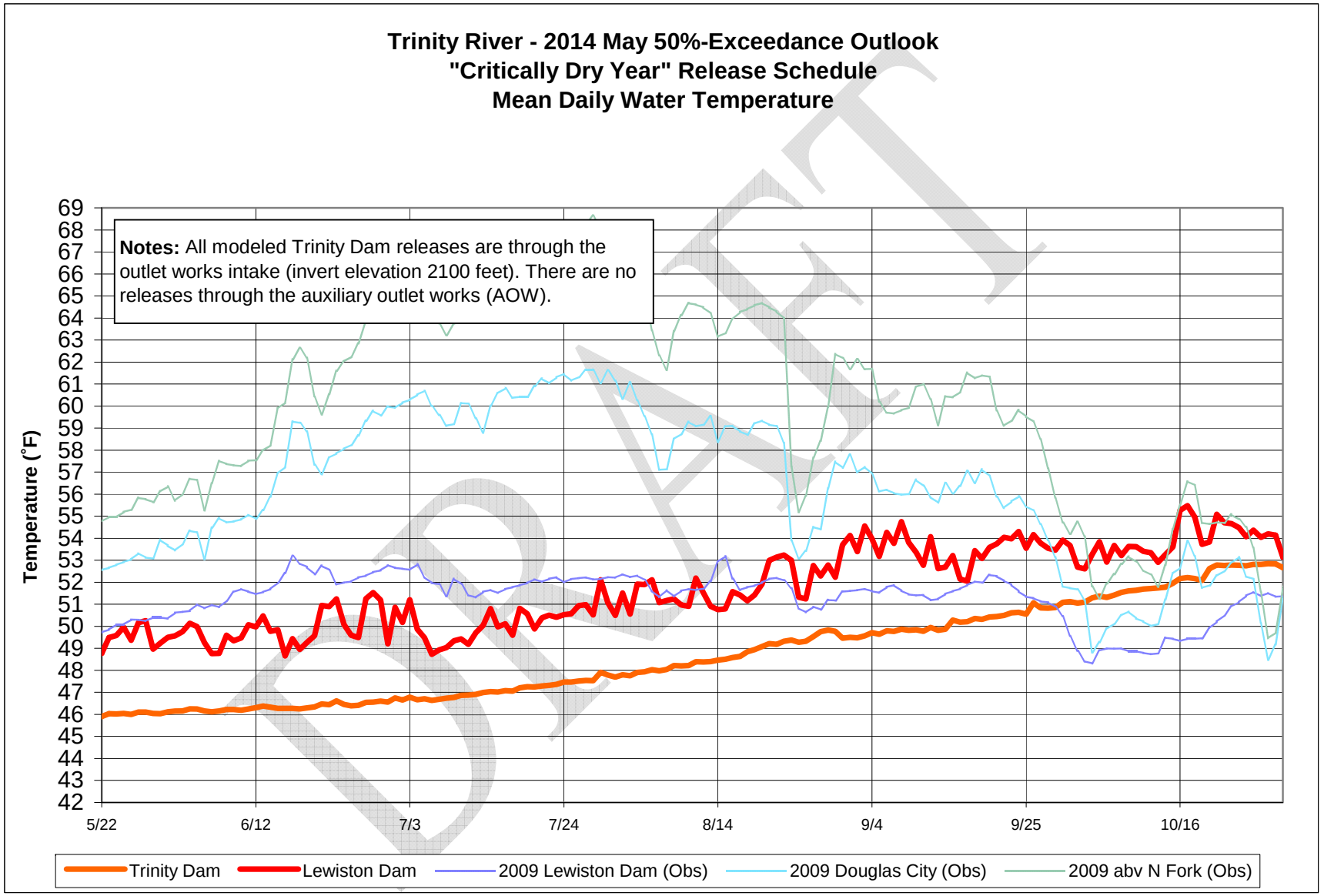
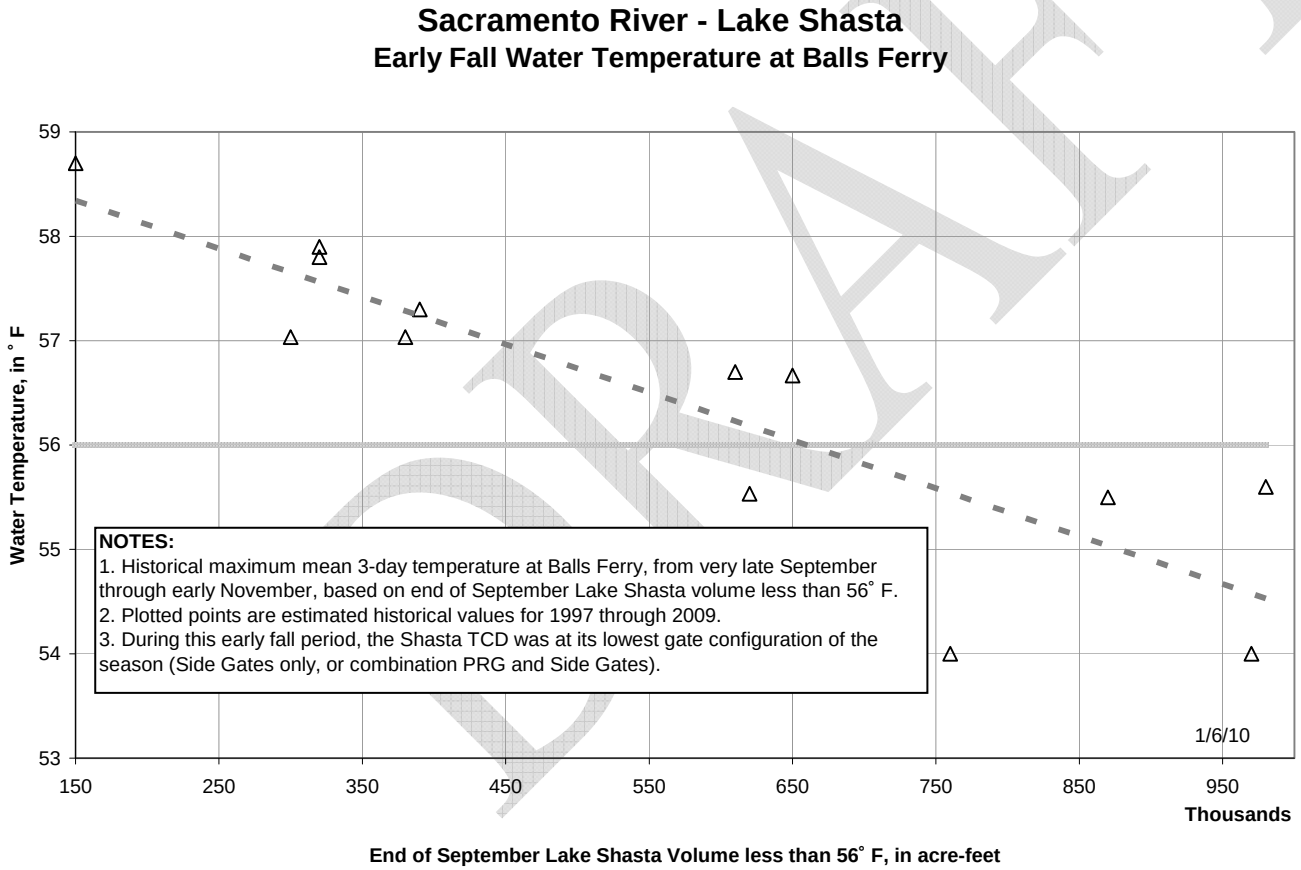

Trinity River - 2014 May 50%-Exceedance Outlook
"Critically Dry Year" Release Schedule
Mean Daily Water Temperature
Notes: All modeled Trinity Dam releases are through the outlet works intake (invert elevation 2100 feet). There are no releases through the auxiliary outlet works (AOW).
Temperature (°F)
69
68
67
66
65
64
63
62
61
60
59
58
57
56
55
54
53
52
51
50
49
48
47
46
45
44
43
42
5/22
6/12
7/3
7/24
8/14
9/4
9/25
10/16
Trinity Dam
Lewiston Dam
2009 Lewiston Dam (Obs)
2009 Douglas City (Obs)
2009 abv N Fork (Obs)

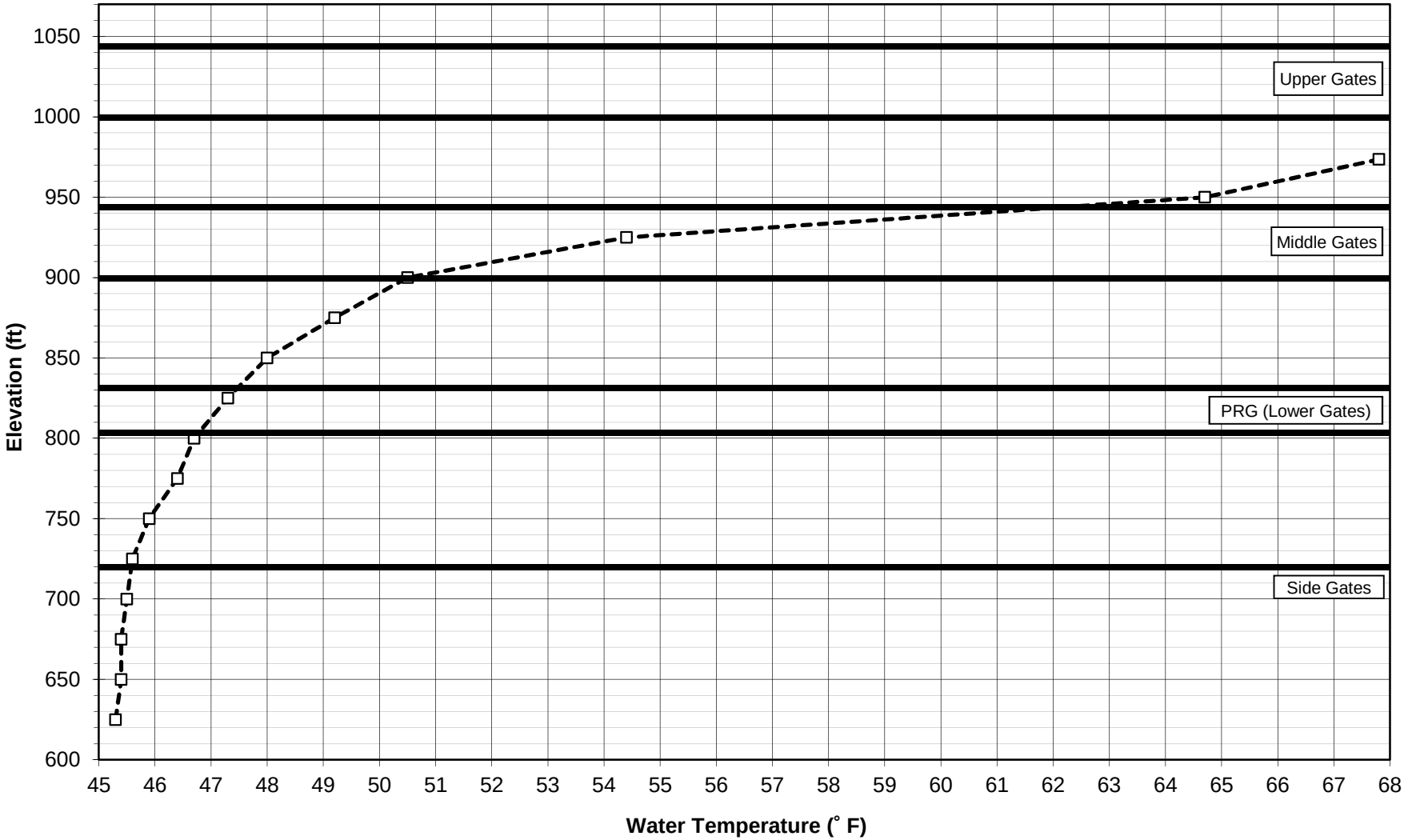
Figure 6

Model Performance and Fall Temperature Index:

1. Based on past analyses, the temperature model does not perform well from late September through fall. 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 reasonable 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 650 TAF, see figure below:



Lake Shasta Temperature Profile - 5/19/14



Trinity Lake Temperature Profile - 5/14/14