Environmental Harm of California WaterFix and Protection by the Modified FMS

Part 2 Testimony

November 29, 2017

EXHIBIT ARWA-501

Contents

Panel 1 – California WaterFix Injury to Lower American River (LAR) Fish

Panel 2 – Modified Flow Management Standard (Modified FMS) as Terms and Conditions to Address That Injury

Contents

Panel 1 – California WaterFix Injury to LAR Fish

- Tom Gohring
- Paul Bratovich

Co-Equal Objectives

- Provide a reliable and safe water supply for the region's economic health and planned development to the year 2030; and
- Preserve the fishery, wildlife, recreational, and aesthetic values of the lower American River.

Folsom Reservoir in 2015

The drought showed, in real time, what could happen more often with WaterFix

WaterFix reduces Folsom Storage in June and July (2016 USBR BA)

Proposed Action (Q0) minus No Action Alternative (Q0)

	End-of-Month Folsom Reservoir Storage											
Statistic	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Probability of Exceedance												
10%	0	2	0	0	0	0	0	0	0	0	0	-55
20%	-16	23	0	2	1	0	0	0	0	-45	-25	-37
30%	-9	29	7	6	0	0	0	0	0	-18	-23	-10
40%	-31	30	18	10	0	0	0	0	-2	-10	-42	-25
50%	-28	8	25	8	1	0	0	0	-63	-50	-37	-23
60%	-25	-6	1	-5	4	0	0	0	-25	-17	-2	21
70%	1	-22	-4	2	10	0	9	3	-51	-26	-14	7
80%	-8	-3	-11	5	11	7	6	17	-8	8	-8	-4
90%	-28	-6	-22	-15	10	9	11	-5	-23	-41	-13	-29
Long Term												
Full Simulation Period[1]	-14	4	1	2	1	0	1	1	-24	-21	-21	-17
Water Year Types[2,3]												
Wet (32%)	-14	8	1	2	0	0	0	0	-9	-23	-21	-24
Above Normal (15%)	4	26	23	15	5	0	0	0	-17	-15	-17	-1
Below Normal (17%)	-20	2	-1	8	3	3	0	0	-31	6	-18	-7
Dry (22%)	-21	-6	-6	-6	2	0	8	6	-46	-52	-35	-28
Critical (15%)	-16	-12	-10	-9	-3	0	-2	-6	-19	-8	-11	-13

Exhibit ARWA-504

WaterFix reduces Folsom Storage in June and July (2016 USBR BA)

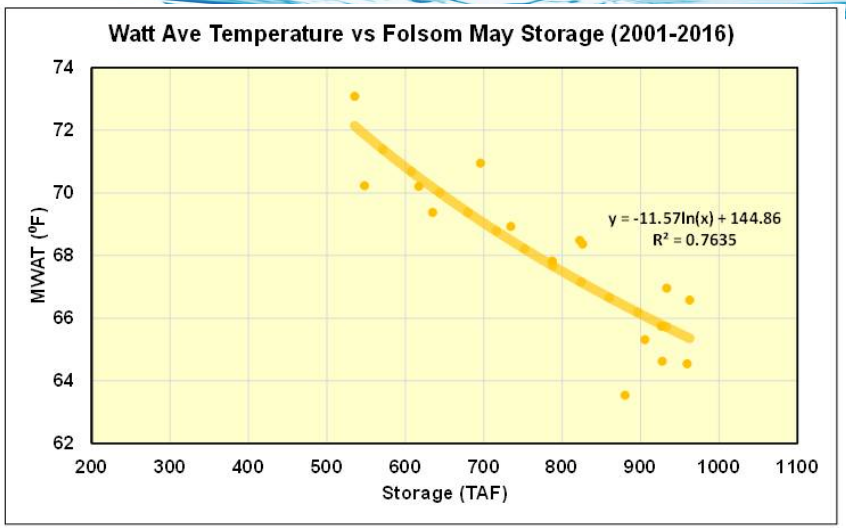
BA - PA (Q5 - Central Tendency Climate) minus BA - NAA (Q5 - Central Tendency Climate)

	End-of-Month Folsom Reservoir Storage											
Statistic	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Probability of Exceedance												
10%	-11	4	0	0	0	0	0	0	0	-52	-11	-45
20%	-6	18	0	2	1	0	0	0	0	-46	-57	-14
30%	-20	19	16	4	2	0	0	0	-10	-17	-54	-12
40%	-12	22	14	9	3	0	0	0	-44	-11	-35	-22
50%	-13	3	25	32	13	2	0	11	-88	-10	11	29
60%	20	-18	-5	1	5	0	-4	2	-31	8	20	23
70%	-7	-1	-19	2	4	0	0	11	-46	6	12	-10
80%	-4	2	-26	-7	9	-1	20	-14	-27	-10	-28	0
90%	-18	15	7	-14	-23	29	18	15	-29	-7	-19	-29
Long Term												
Full Simulation Period[1]	-8	7	3	4	1	0	1	0	-22	-16	-18	-11
Water Year Types[2,3]												
Wet (32%)	-6	15	4	2	0	0	0	1	-13	-20	-19	-8
Above Normal (16%)	6	20	16	16	8	0	0	0	-32	0	-5	10
Below Normal (13%)	-21	2	4	24	4	4	3	0	-36	10	-8	-7
Dry (24%)	-6	0	0	1	5	2	3	1	-39	-42	-34	-33
Critical (15%)	-16	-9	-10	-15	-14	-8	-3	-5	7	-4	-12	-3

Exhibit ARWA-505

Reduced Storage = Warmer River

(Folsom Reservoir in June/July) (Lower American River)



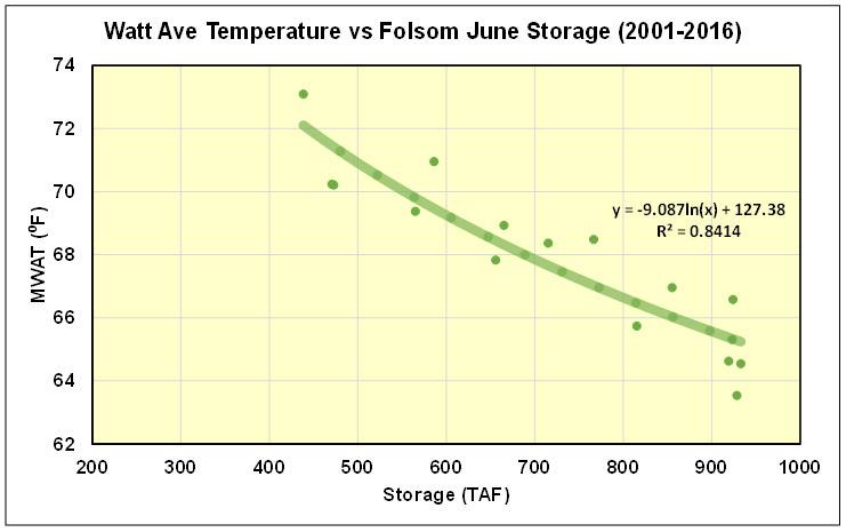


Exhibit ARWA-702 Figure 23

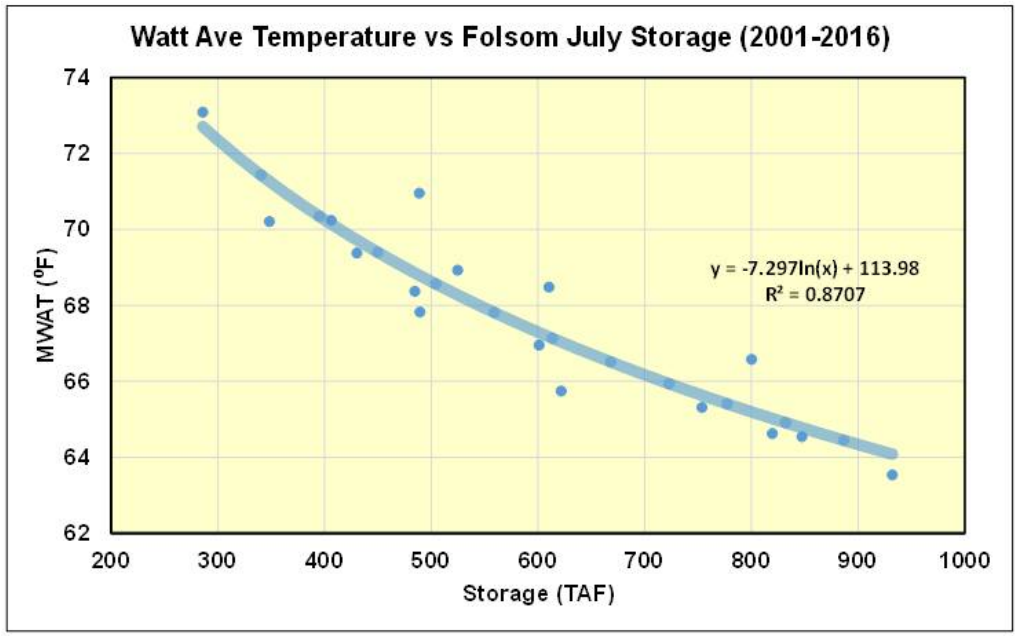
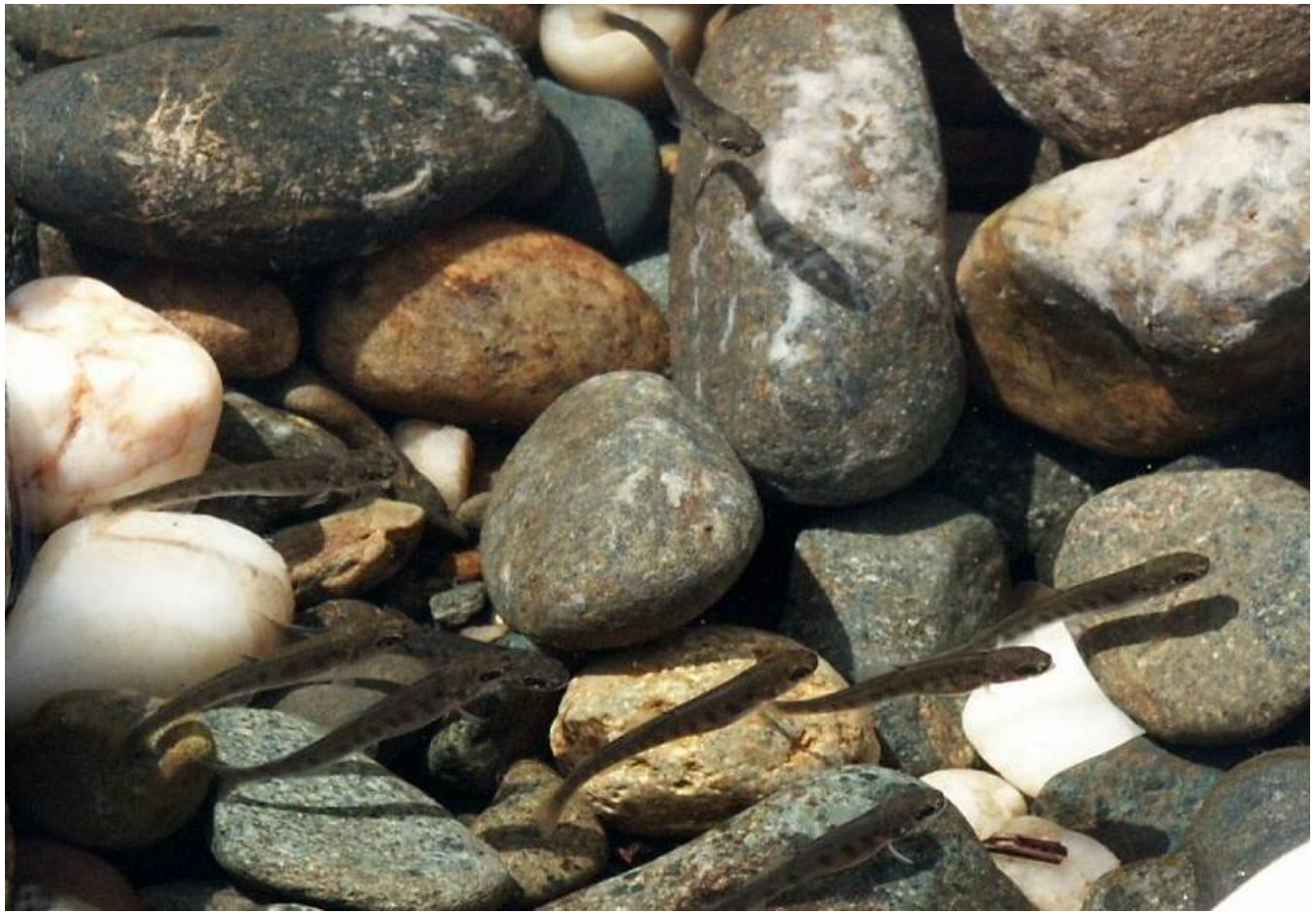


Figure 23. Relationship between Folsom Reservoir End-of-May storage (top) and June and July storage (middle and bottom, respectively) and the annual maximum weekly average temperature in the American River at Watt Avenue (source: Cardno ENTRIX).

Warmer River = Harm to Steelhead

(Lower American River) (Juvenile CV Steelhead)



WaterFix = Harm to Steelhead

1. WaterFix = Lower Folsom in June/July
2. Lower Folsom in June/July = Warmer River
3. Warmer River = Harm to Steelhead

Therefore

WaterFix = Harm to Steelhead

SWRCB August 31, 2017 Ruling

Key Issue

"*Will the changes proposed in the petition unreasonably affect fish and wildlife or recreational uses of water, or other public trust resources?*“

To address this question, we focus our evaluation on steelhead in the LAR

- Listed as threatened under the Federal ESA
- Evaluated by NMFS in the 2017 WaterFix BO

Analytical Standard Applied to Assess "Unreasonable Effects"

SWRCB

- **SWRCB Corrected Order WR 2008-0014 (pp. 40-41) and Order WR 2008-0025 (pp. 40-41)**
  - Water temperature impacts to species listed under the ESA are "*of special concern*" and there is a "*low threshold for unreasonable impact for listed species*."

NMFS

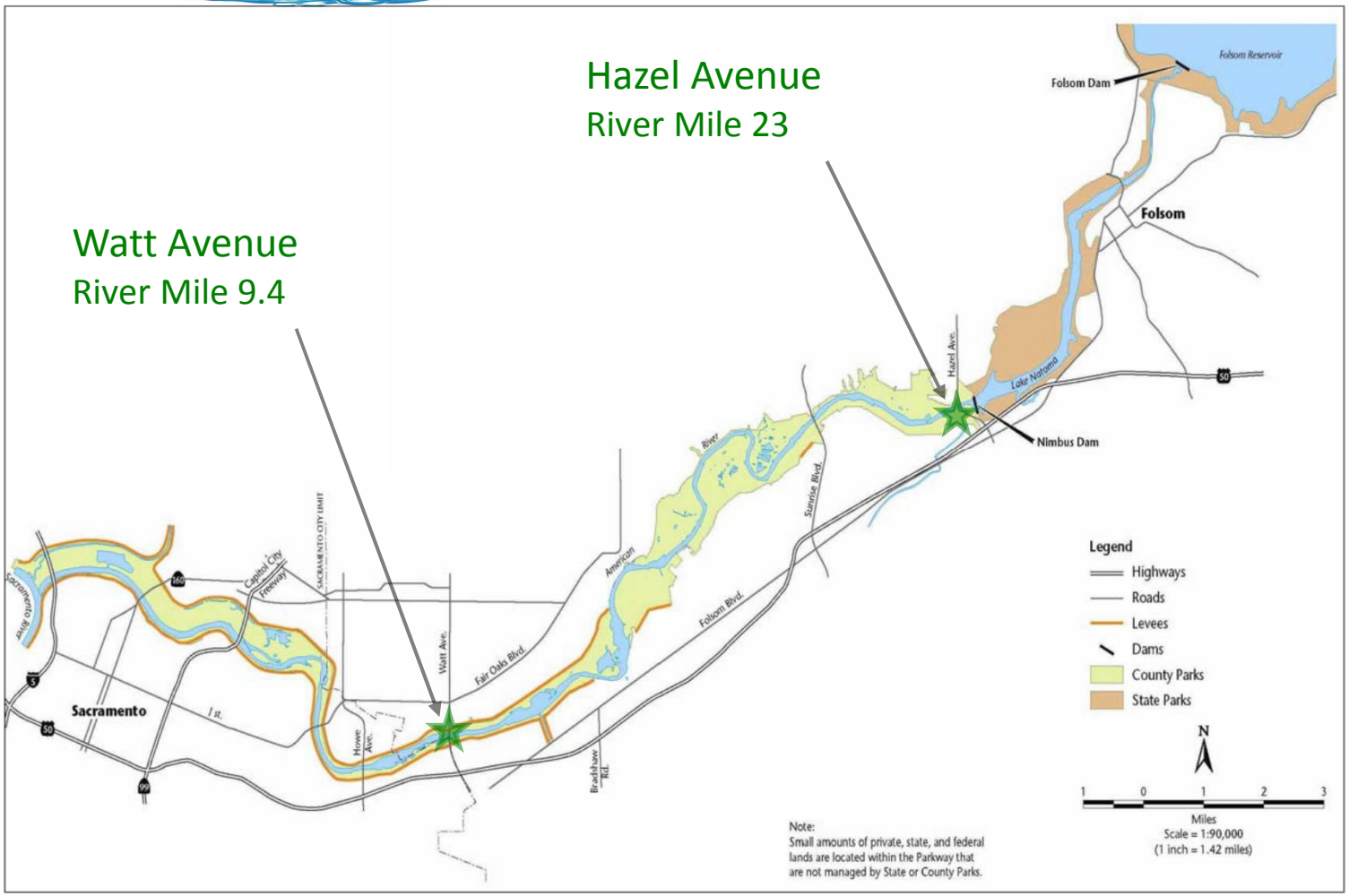
- "***The Habitat Approach - Implementation of Section 7 of the Endangered Species Act for Actions Affecting the Habitat of Pacific Anadromous Salmonids***" (NMFS 1999, p. 6)
  - "*…if the species' status is poor and the baseline is degraded at the time of consultation, it is more likely that any additional adverse effects caused by the proposed or continuing action will be significant*."

Analytical Standard

- **Would implementation of the WaterFix exacerbate water temperature conditions where the analytical baseline already represents degraded conditions for steelhead, for which the status is poor, in the lower American River?**

NMFS 2017 BO Lower American River Water Temperature Evaluation Sites

Exhibit ARWA-506



Review of the NMFS 2017 BO Water Temperature-Related Effects

Findings

1. Current Status of Steelhead in the LAR is Poor

- The poor status of steelhead in the lower American River is demonstrated in the NMFS 2017 BO by numerous direct statements. For example…
  - NMFS (2017, p. 74) – "*The American River [steelhead] population is small, with only a few hundred individuals returning to spawn each year (Reclamation 2015).*"
  - NMFS (2017, Appendix B, p. 43) – "*An average of 143* [steelhead] *redds have been counted on the American River from 2002 to 2015 (data from Hannon et al. 2003; Hannon and Deason 2008; Chase 2010).*"

Review of the NMFS 2017 BO Water Temperature-Related Effects

Findings

2. Conditions in the LAR are Degraded

- Current habitat conditions, and conditions under the analytical baseline used by NMFS (the No Action Alternative (NAA)) in its 2017 BO, in the LAR are degraded. For example…
  - NMFS (2017, p. 75) – "…[in] *the lower American River … freshwater spawning sites for these species has been degraded within the action area due to high water temperatures*..."
- The WaterFix BA (Reclamation 2016) referred to degraded habitat in the LAR associated with warm water temperatures.
  - Reclamation (2016, p. 4-36) – "*In the American River, NMFS (2009: 192) noted that there is general consensus that critical habitat for CCV steelhead is impaired, with particular concern being CVP operational effects: warm water temperatures during embryo incubation, rearing, and migration;*"

Review of the NMFS 2017 BO Water Temperature-Related Effects

Findings

3. **Differences in the water temperature exceedance distributions between the Proposed Action (PA) and the analytical baseline (NAA) for steelhead in the LAR are substantial**
   - As presented in the 2017 NMFS BO or 2016 Reclamation BA

Review of the NMFS 2017 BO Water Temperature-Related Effects

Steelhead Juvenile Rearing

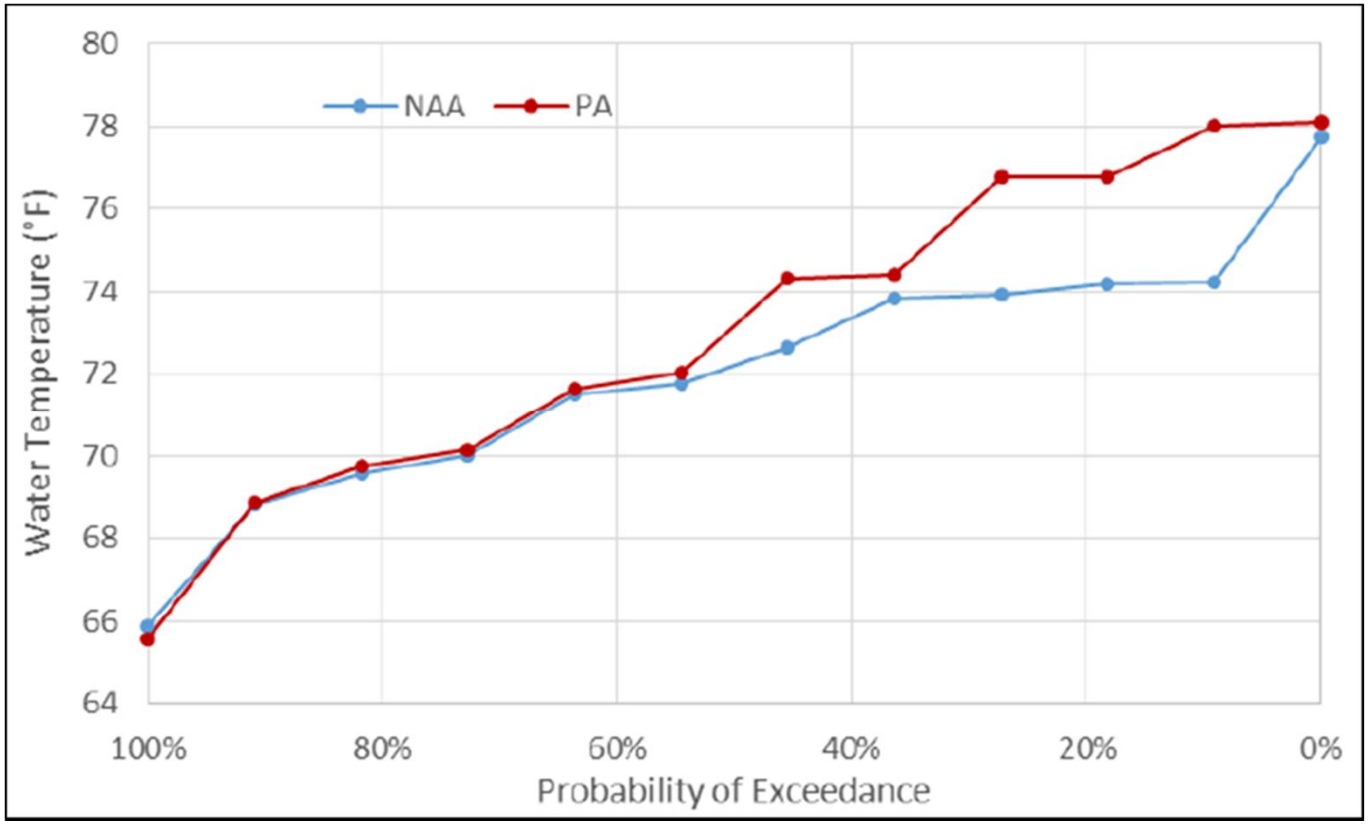


Exhibit ARWA-703. Figure 2-35. Exceedance Plot of Mean Monthly Water Temperatures (°F) in the American River at Watt Avenue in August of Critical Water Years. (Source: NMFS 2017 BO)

Finding

"PA would result in less suitable (> 0.5°F up to nearly 4°F warmer) water temperatures than the NAA over more than 50% of the time during August of critical years, when the water temperatures under both the PA and the NAA exceed 63°F and 69°F at Watt Avenue."

Review of the NMFS 2017 BO Water Temperature-Related Effects

Steelhead Smolt Emigration

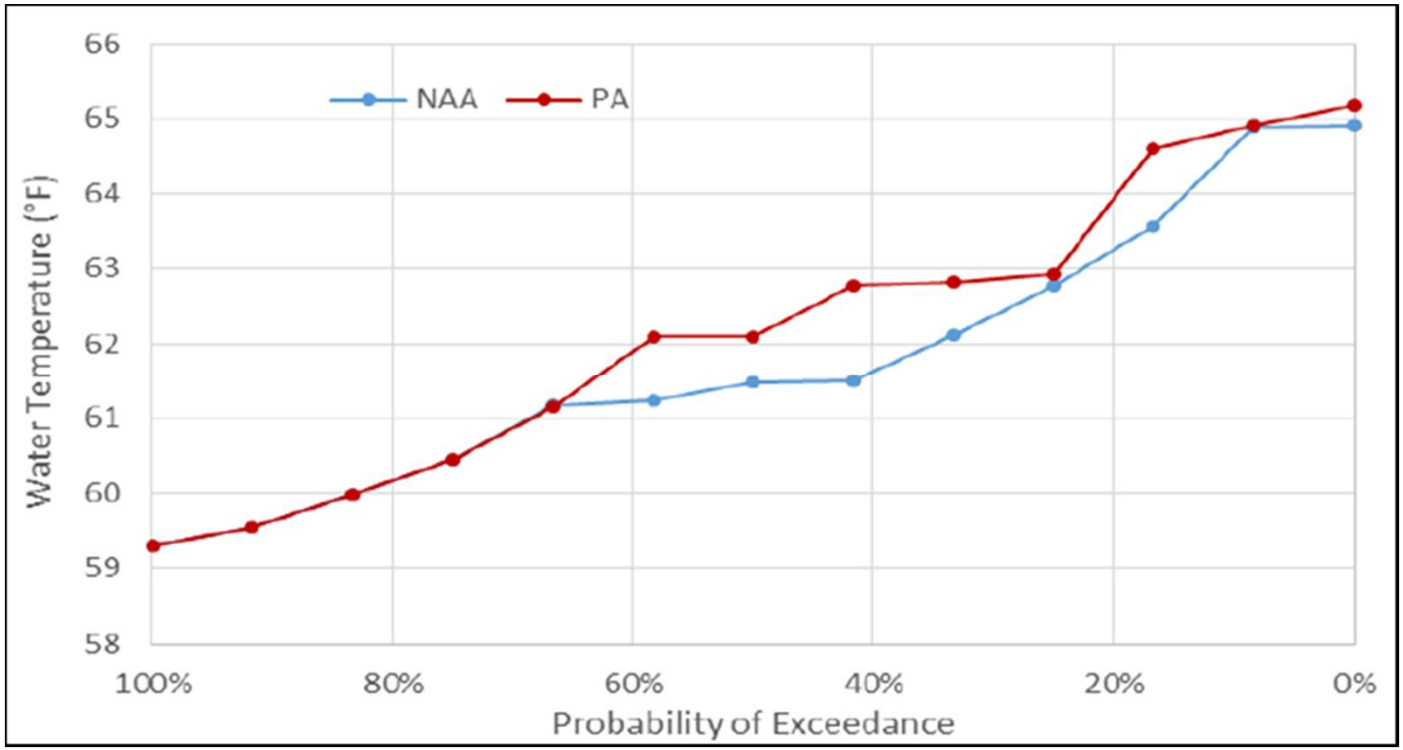


Exhibit ARWA-703. Figure 2-36. Exceedance Plot of Mean Monthly Water Temperatures (°F) in the American River at Hazel Avenue in June of Above Normal Water Years. (Source: NMFS 2017 BO)

Finding

"PA would result in less suitable (> 0.5°F up to more than 1°F warmer) water temperatures than the NAA over more than 40% of the time during June of above normal years, when the water temperatures under both the PA and the NAA exceed 61°F at Hazel Avenue."

Review of the NMFS 2017 BO Water Temperature-Related Effects

Steelhead Juvenile Rearing

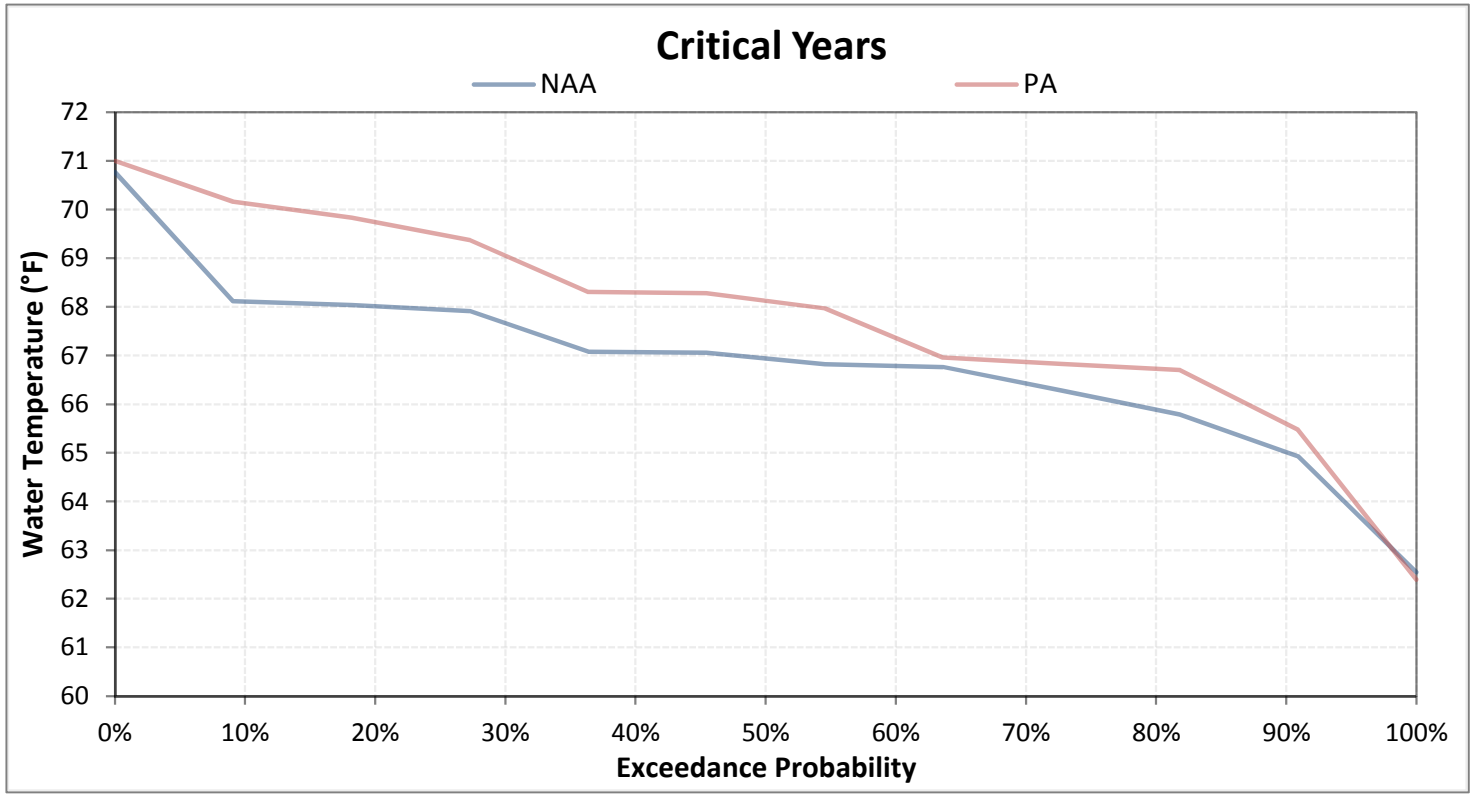


Exhibit ARWA-703. Figure BA Appendix 5.C.7-14-18. American River at Hazel Avenue, Monthly Temperature Probability of Exceedance (August, Critical excerpt). (Source: Reclamation 2016 BA)

Finding

"PA would result in less suitable (> 0.5°F up to about 2°F warmer) water temperatures over nearly 80% of the entire critical water year type exceedance distribution at Hazel Avenue under the PA relative to the NAA during August, when water temperatures exceed 63°F."

Review of the NMFS 2017 BO Water Temperature-Related Effects

Findings

4. Substantial Adverse Effects in NMFS 2017 BO and WaterFix BA are Significant

- NMFS (1999) Habitat Approach "…*if the species' status is poor and the baseline is degraded at the time of consultation, it is more likely that any additional adverse effects caused by the proposed or continuing action will be significant*."

5. The Significant Adverse Effects in NMFS 2017 BO and WaterFix BA are Unreasonable

- Implementation of the WaterFix would exacerbate water temperature conditions in the LAR, where the analytical baseline already represents degraded conditions for steelhead, for which the status is poor.

Review of the NMFS 2017 BO Water Temperature-Related Effects

The PA (relative to the NAA) would exacerbate water temperature conditions for steelhead in the LAR

Lifestage	Less Suitable	Frequency	Month	Year Type	Location
Juvenile Rearing	> 0.5°F up to nearly 4°F warmer	50%	August	Critical	Watt Ave
Juvenile Rearing	> 0.5°F up to more than 2°F warmer	25%	August	Dry	Watt Ave
Juvenile Rearing	> 0.5°F up to about 2°F warmer	80%	August	Critical	Hazel Ave
Smolt Emigration	> 0.5°F up to more than 1°F warmer	40%	June	Above Normal	Hazel Ave

Incremental Adverse Effects

Review of the NMFS 2017 BO Water Temperature-Related Effects

LAR Conclusions

The Current Status of Steelhead is Poor

↓

Conditions are Degraded

↓

Differences in the Water Temperature Exceedance Distributions between the Proposed Action and the Analytical Baseline for Steelhead are Substantial

↓

The Substantial Adverse Effects in the NMFS 2017 BO and the WaterFix BA are Significant

↓

The Significant Adverse Effects in the NMFS 2017 BO and the WaterFix BA are Unreasonable

Contents

Panel 2 –Modified Flow Management Standard (Modified FMS) as Terms and Conditions to Address That Injury

- Tom Gohring
- Paul Bratovich
- Jeff Weaver
- R. Craig Addley
- Chris Hammersmark

Modified FMS Responds to Increased Risk from WaterFix

- Risk of exacerbating the existing dry-year dangers
- Risk of drawing down Folsom Reservoir storage

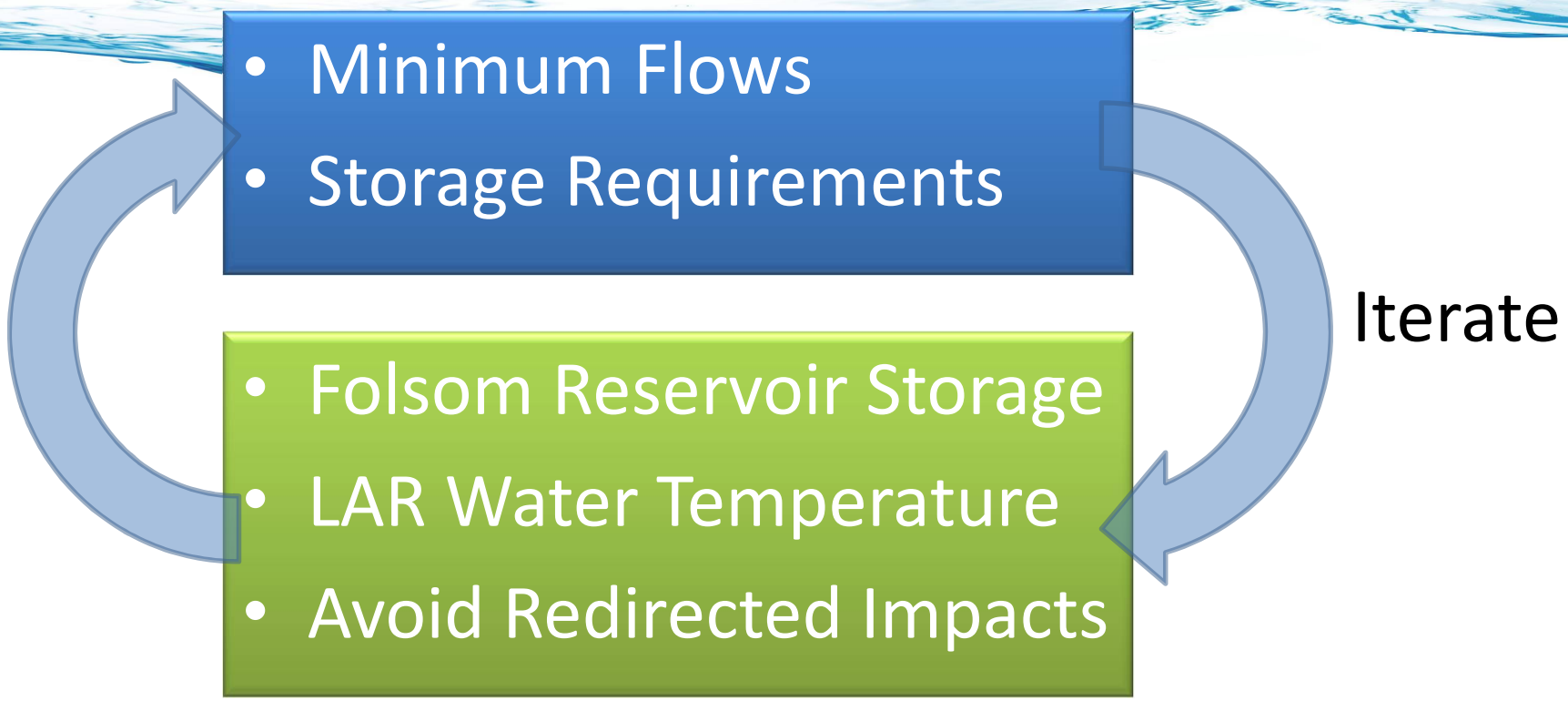
Summary of Lower American River Flow Management Approaches

Flow Approach	Minimum Flows	Approach to Water Temperature Management	Storage Requirements	Status
Pre-2000	250 or 500 cfs	None	None	Inactive
2006 FMS	800 to 2000 cfs in most years; 250 or 500 cfs in during drought exception	Annual temperature target set by Reclamation	None	Being implemented
Modified FMS	500 to 2000 cfs	Annual temperature target set by Reclamation	End-of-December: 300 TAF most years; 230 TAF during drought exception; End-of-May: Up to 900 TAF	Proposed

Objectives of Modified FMS

- Protect water supplies by avoiding low storage in Folsom Reservoir
- Address fisheries conditions in the lower American River – especially water temperature
- Avoid redirected impacts to Sacramento River

Multiple Objective: Sweet Spot

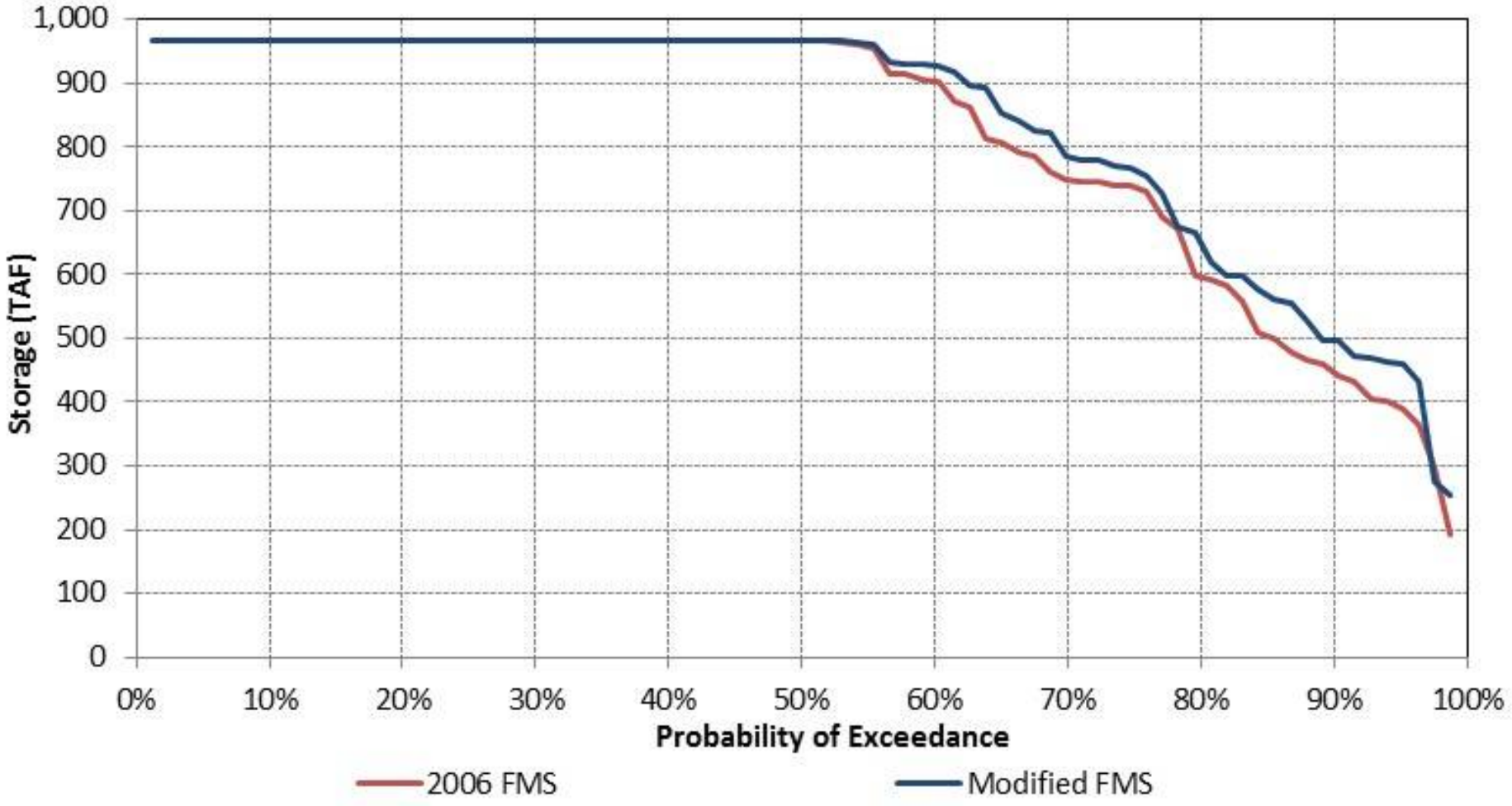


- Result: sweet spot meets multiple objectives
- Updated some parameters since Part 1

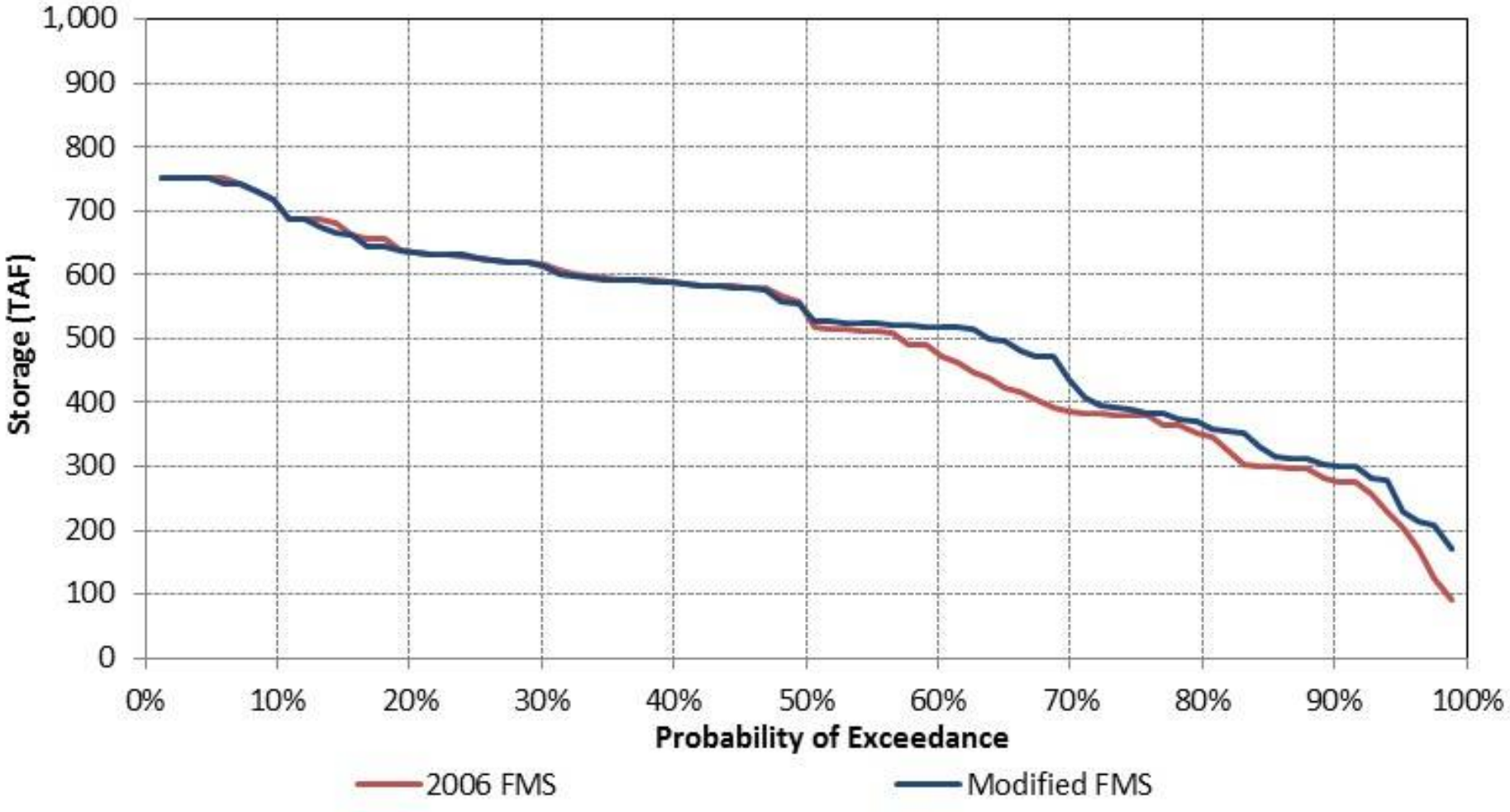
Updated Parameters (since Part 1)

- Received updated lower American River redd distribution data since Part 1
  - For fall-run Chinook salmon & steelhead
- Extended fall-run redd dewatering protection: February
- Added a fourth-year drought exception
- Altered the Minimum Release Requirement
- Simplified the fall-run redd dewatering algorithm
- CalSim II consistency updates

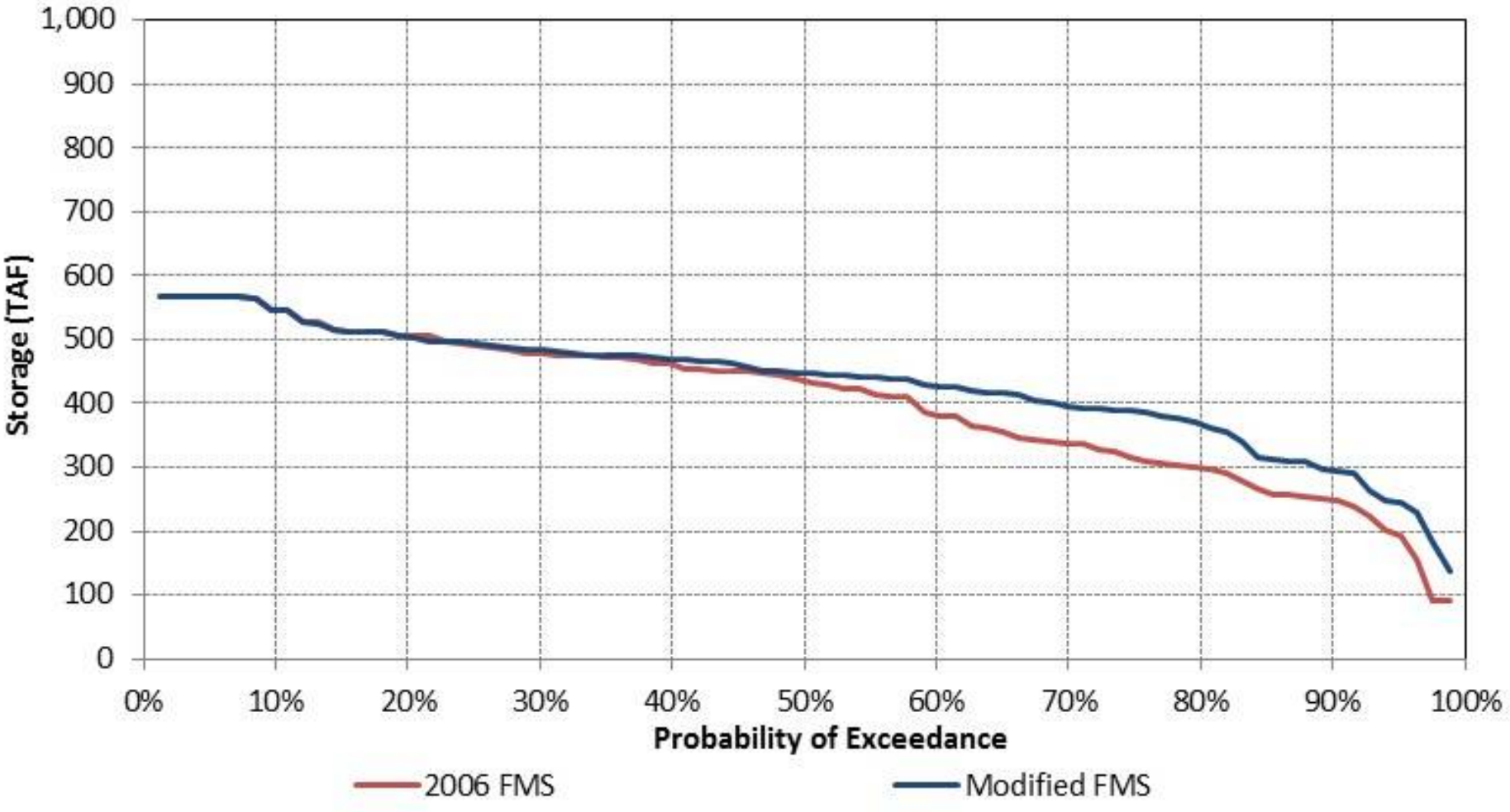
Exceedance Probability: End-of-May Folsom Reservoir Storage



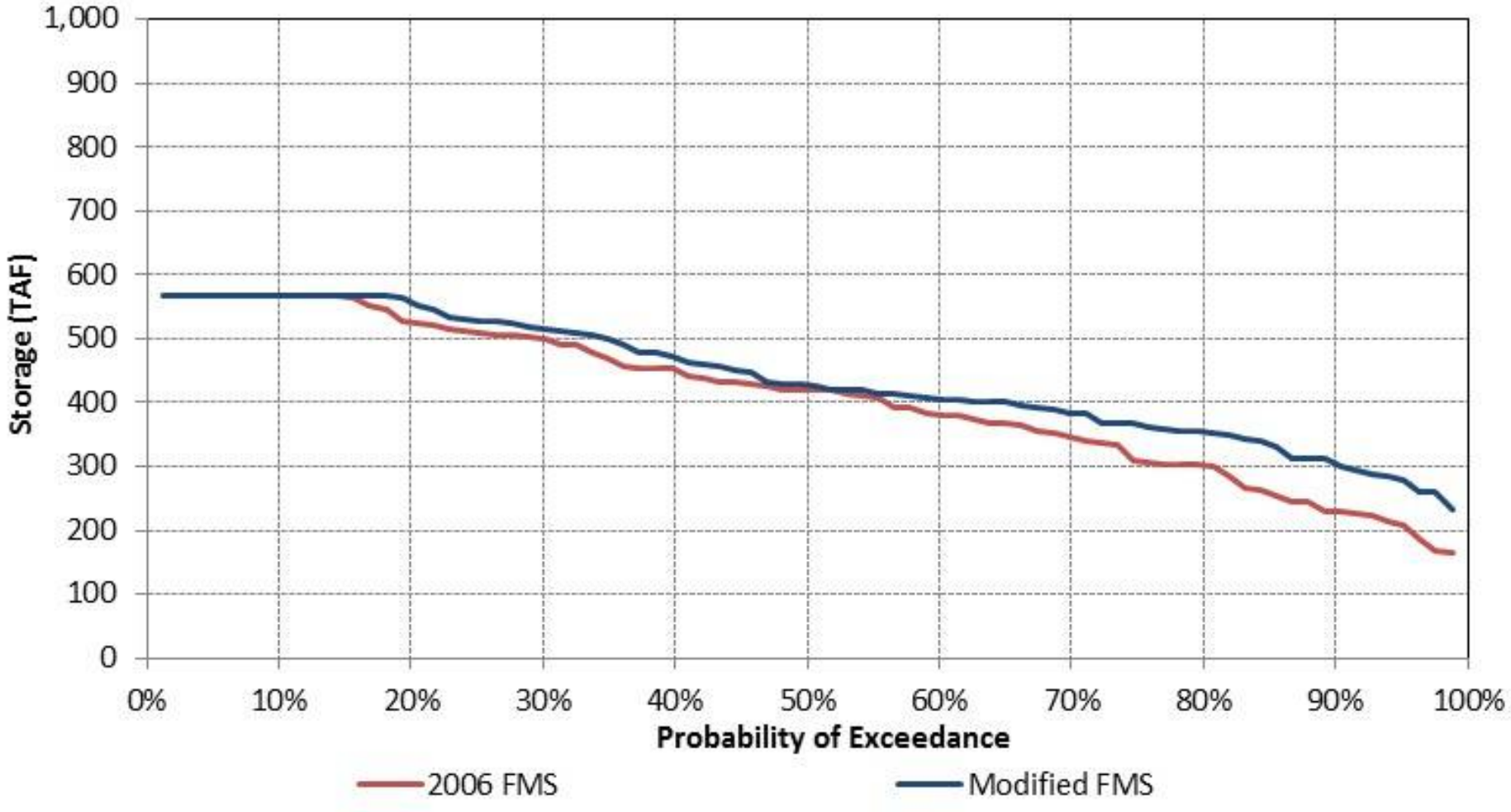
Exceedance Probability: End-of-September Folsom Reservoir Storage



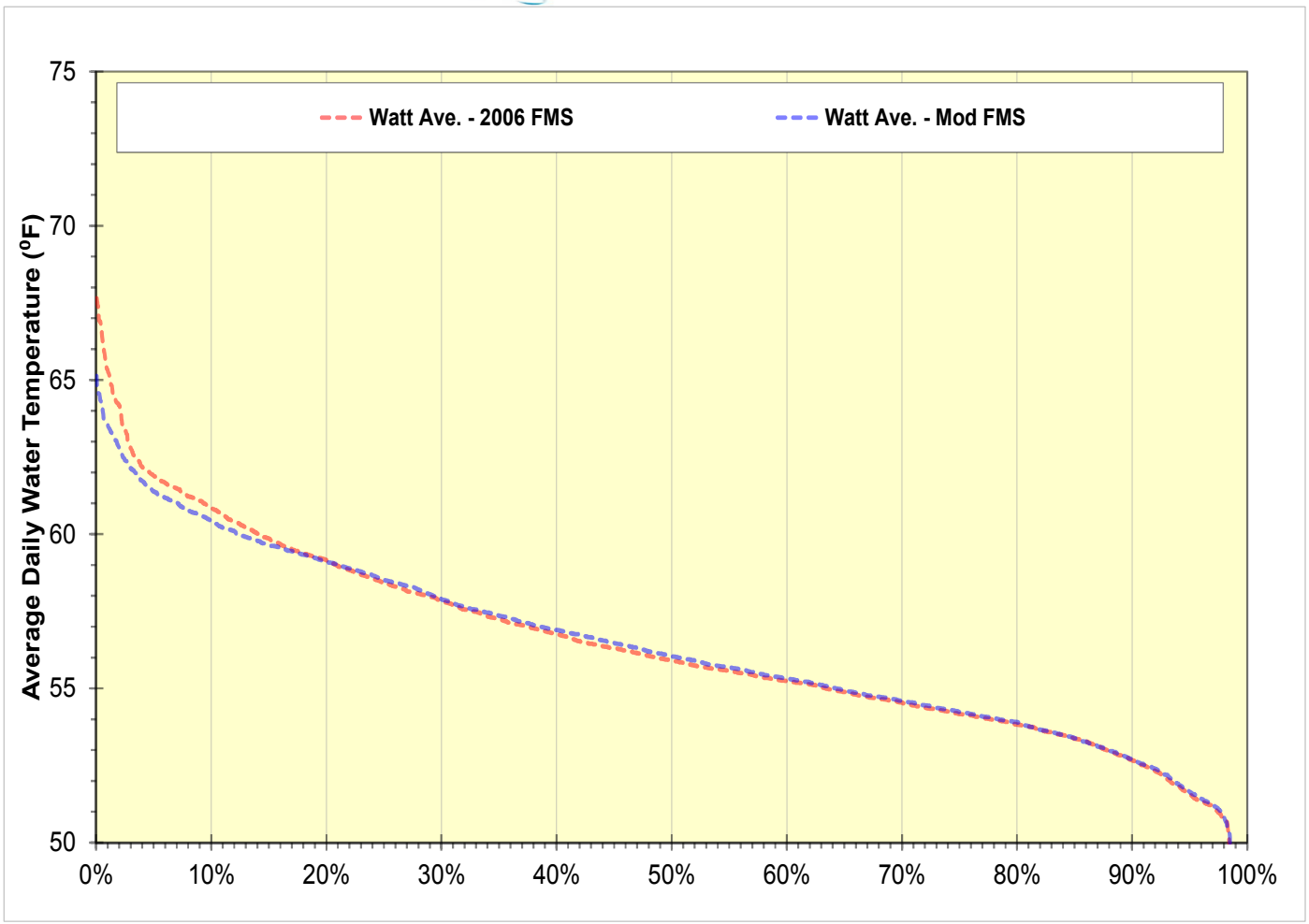
Exceedance Probability: End-of-November Folsom Reservoir Storage



Exceedance Probability: End-of-December Folsom Reservoir Storage

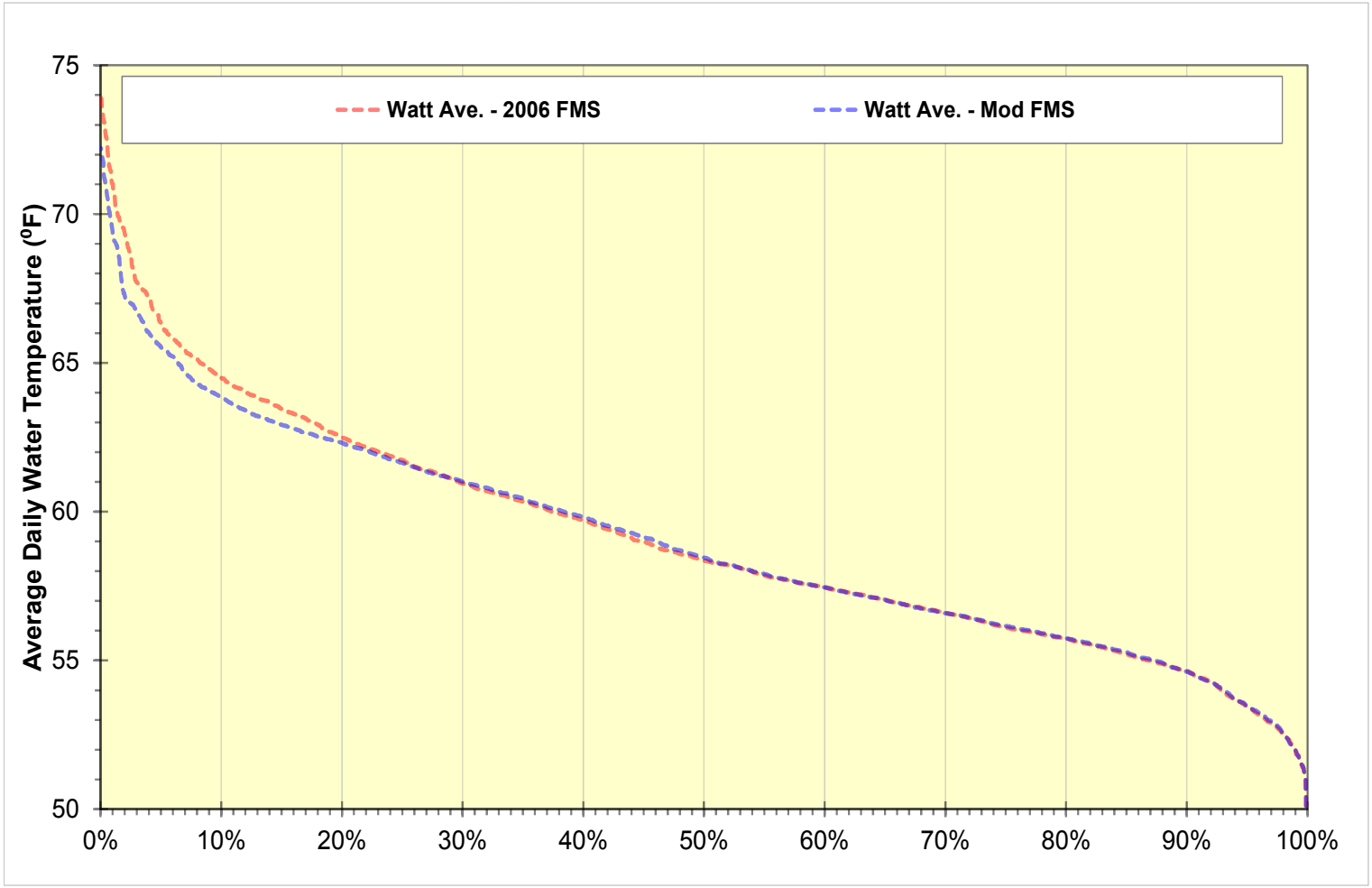


Exceedance Probability
Water Temperature in Lower American River
April



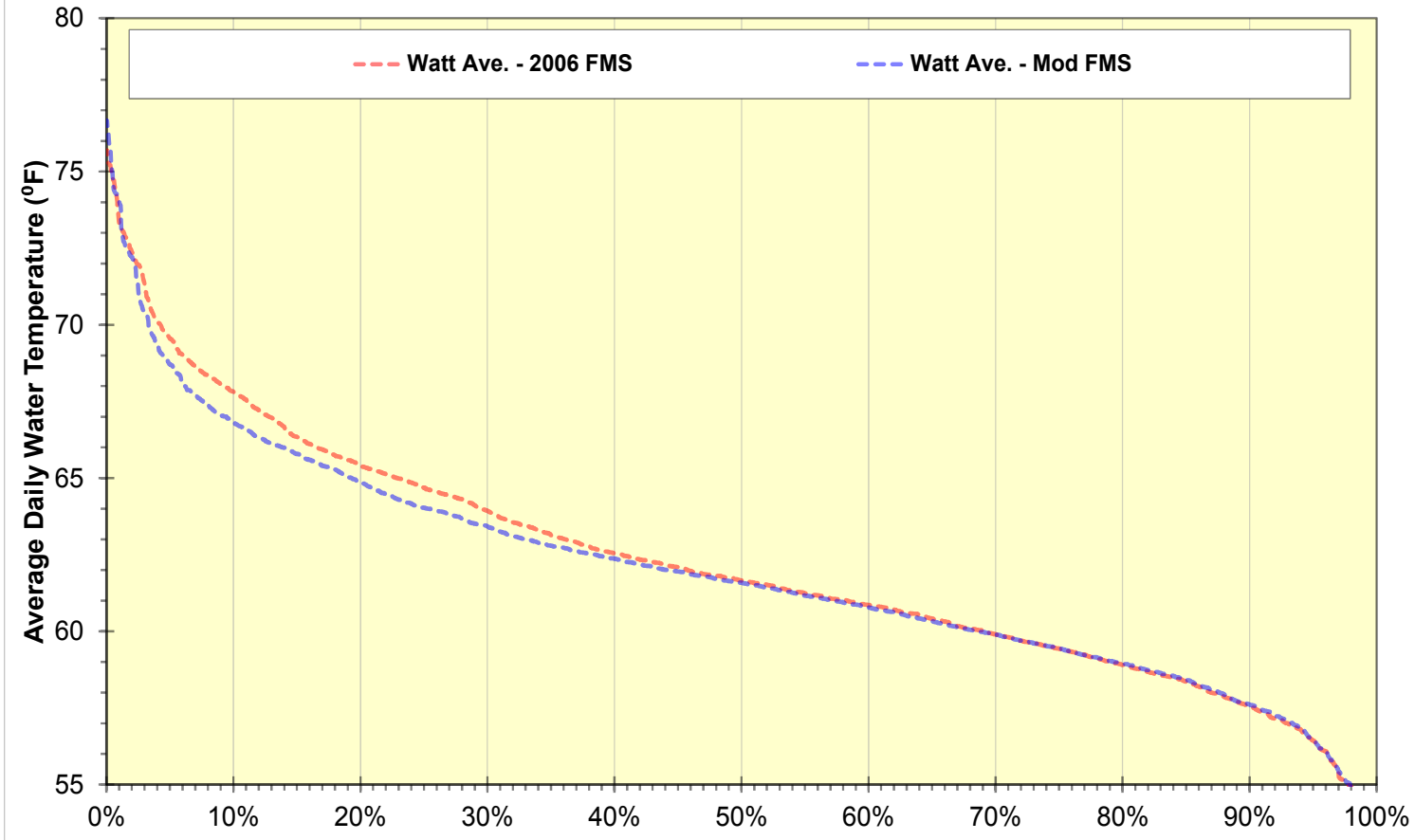
"cooler (up to about 2.5°F) over about the lowest (warmest) 15% of the distributions at Hazel Avenue and Paradise Beach, with up to about 3°F cooler water temperatures over the lowest 15% of the distribution at Watt Avenue. Water temperatures typically (more than 80% of the time) would remain at or below 55.5°F at Hazel Avenue, and below about 59°F at Watt Avenue and Paradise Beach."

Exceedance Probability
Water Temperature in Lower American River
May



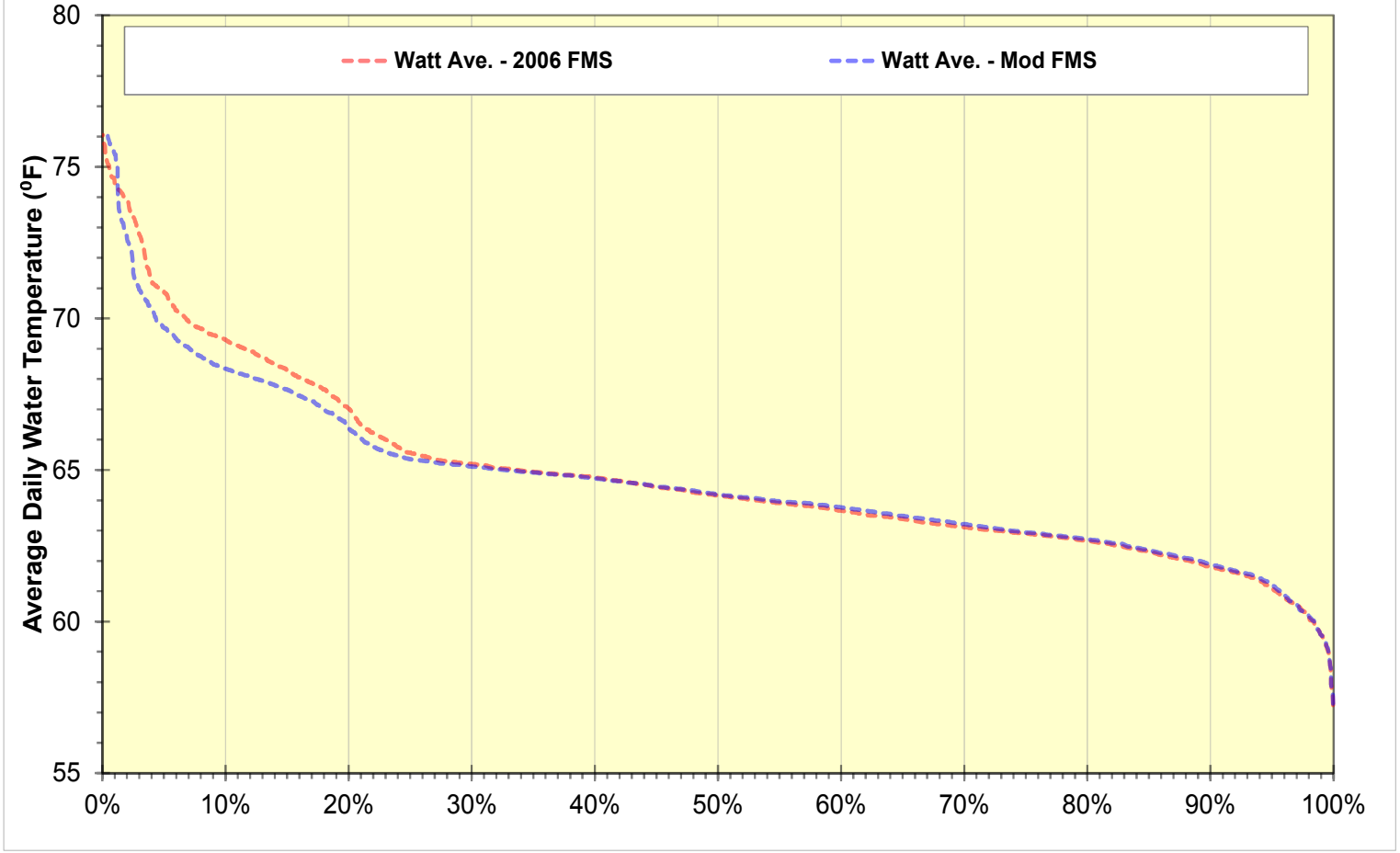
"cooler (up to about 2°F) over about the lowest (warmest) 20 – 35% of the distributions, varying by location. Water temperatures typically (more than 80% of the time) would remain below about 58°F, 62°F, and 62.5°F at Hazel Avenue, Watt Avenue, and Paradise Beach, respectively."

Exceedance Probability
Water Temperature in Lower American River
June



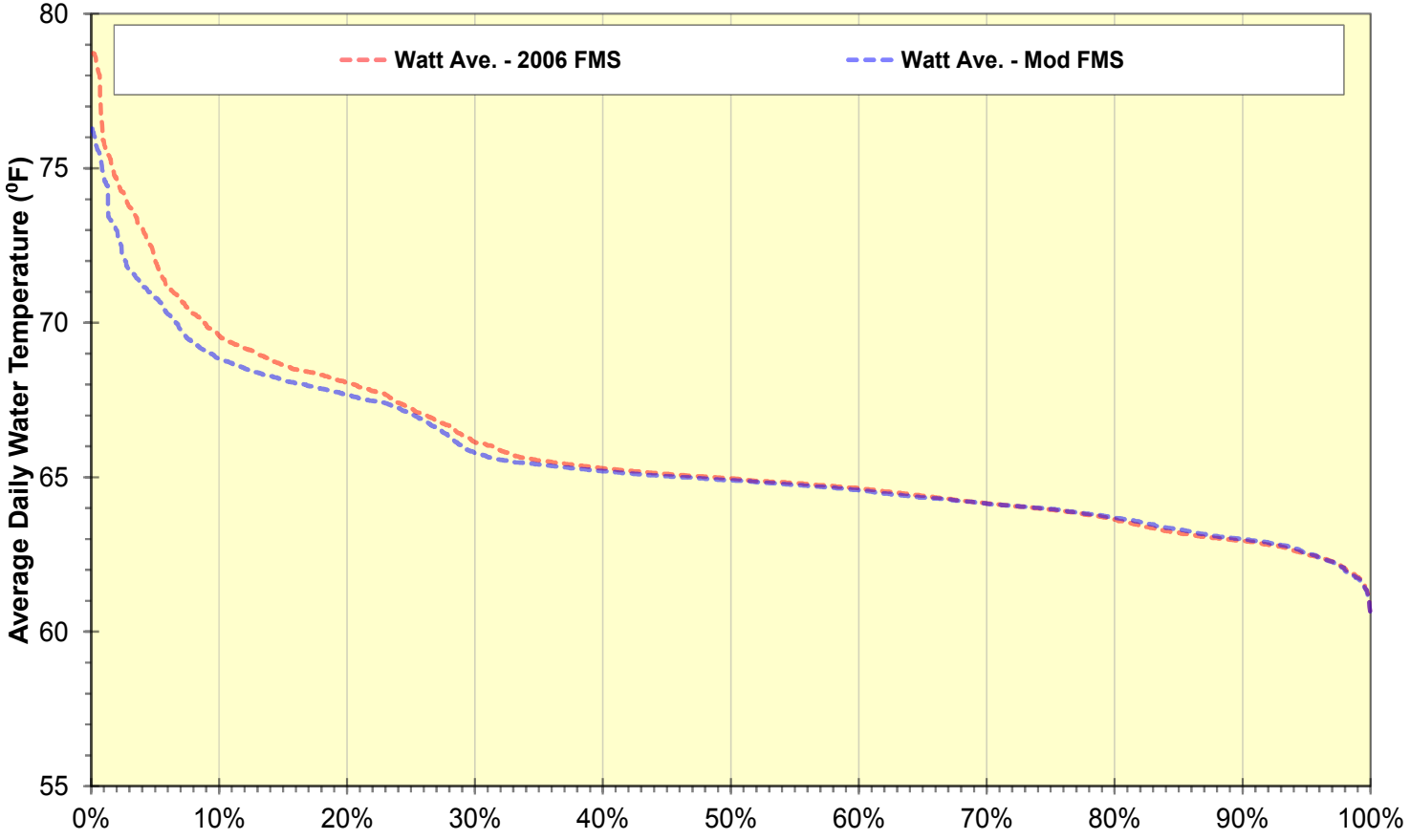
"cooler (up to about 1°F) over more than 35% of the lowest (warmest) portions of the distributions at all locations. Water temperatures typically (more than 80% of the time) would remain at or below 60.5°F at Hazel Avenue, and 65°F at Watt Avenue and Paradise Beach."

Exceedance Probability
Water Temperature in Lower American River
July



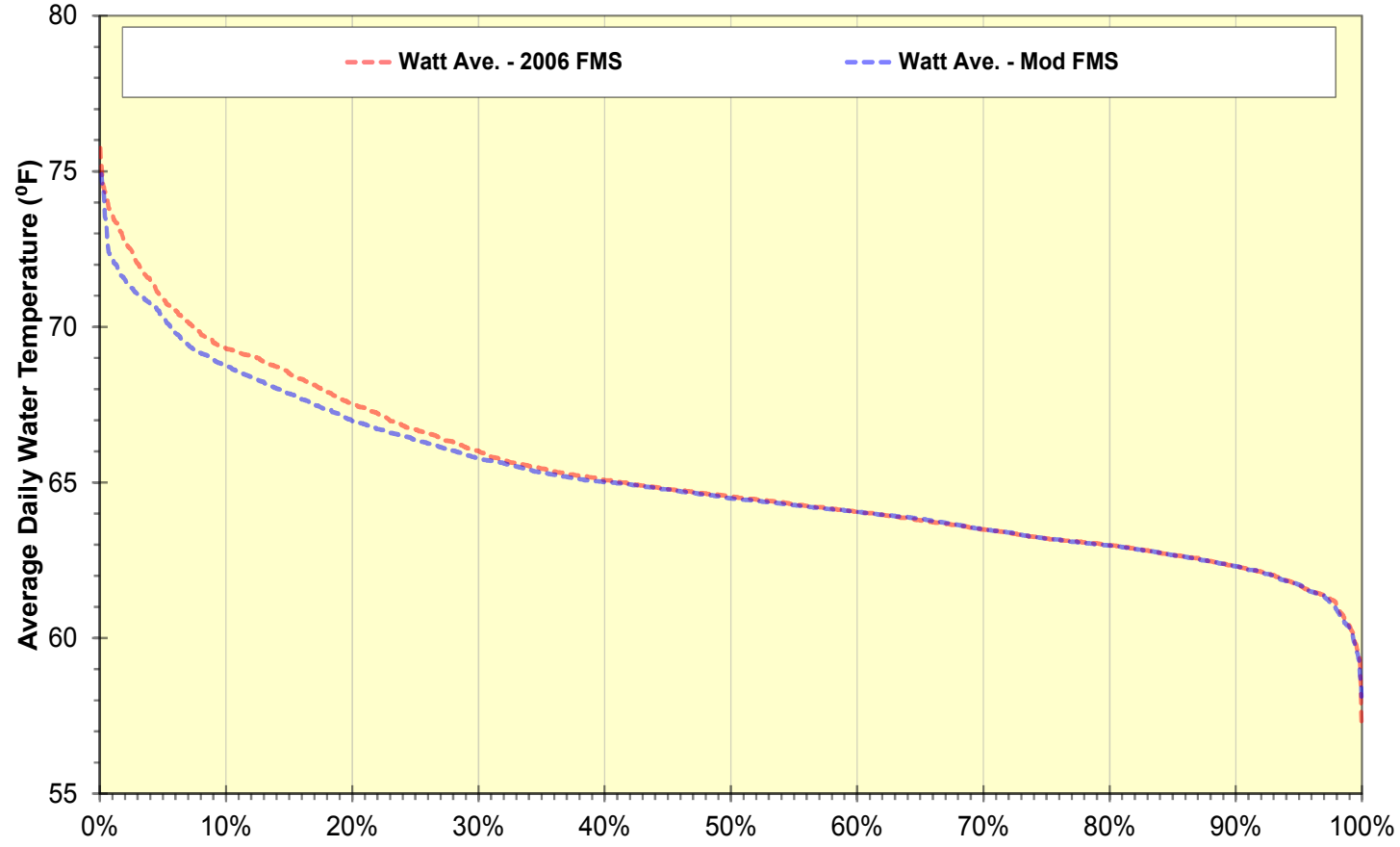
"cooler over about 25% of the lowest (warmest) portions of the distributions, by up to about 1.5°F at Hazel Avenue, and about 2°F at Watt Avenue and Paradise Beach. Water temperatures typically (more than 80% of the time) would remain below about 63.5°F at Hazel Avenue, 66.5°F at Watt Avenue, and 67°F at Paradise Beach."

Exceedance Probability
Water Temperature in Lower American River
August



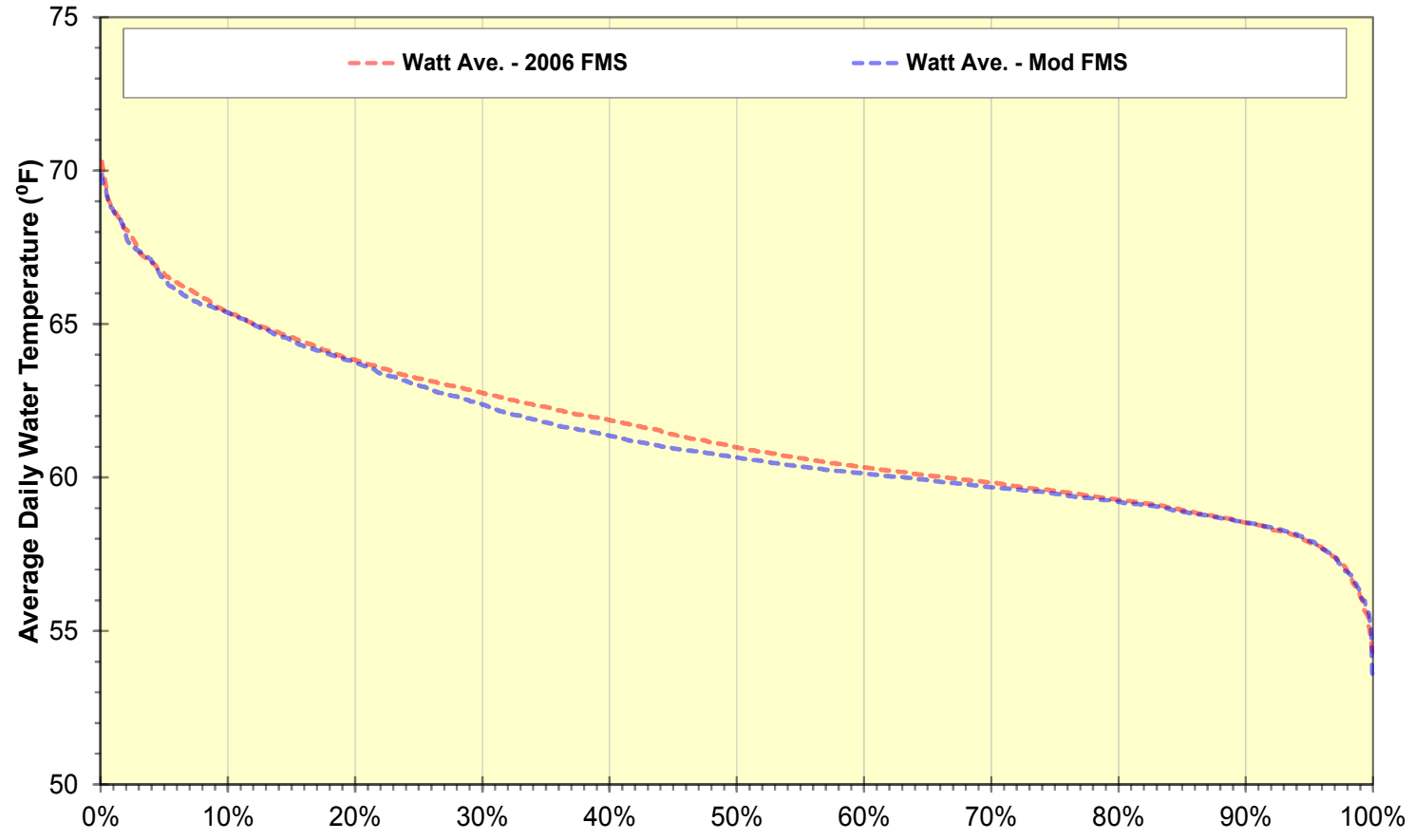
"cooler (up to about 2.5°F) over the lowest (warmest) about 30 – 40% of the distributions, varying by location, at Hazel Avenue, Watt Avenue, and Paradise Beach, Water temperatures typically (more than 80% of the time) would remain below about 63.5°F at Hazel Avenue, 67.5°F at Watt Avenue, and 68°F at Paradise Beach."

Exceedance Probability
Water Temperature in Lower American River
September



"cooler (up to about 1.5°F) over about the lowest (warmest) 30% of the distributions at Hazel Avenue, Watt Avenue, and Paradise Beach. Water temperatures typically (more than 80% of the time) would remain at or below about 64°F at Hazel Avenue, 67°F at Watt Avenue and 67.5°F at Paradise Beach."

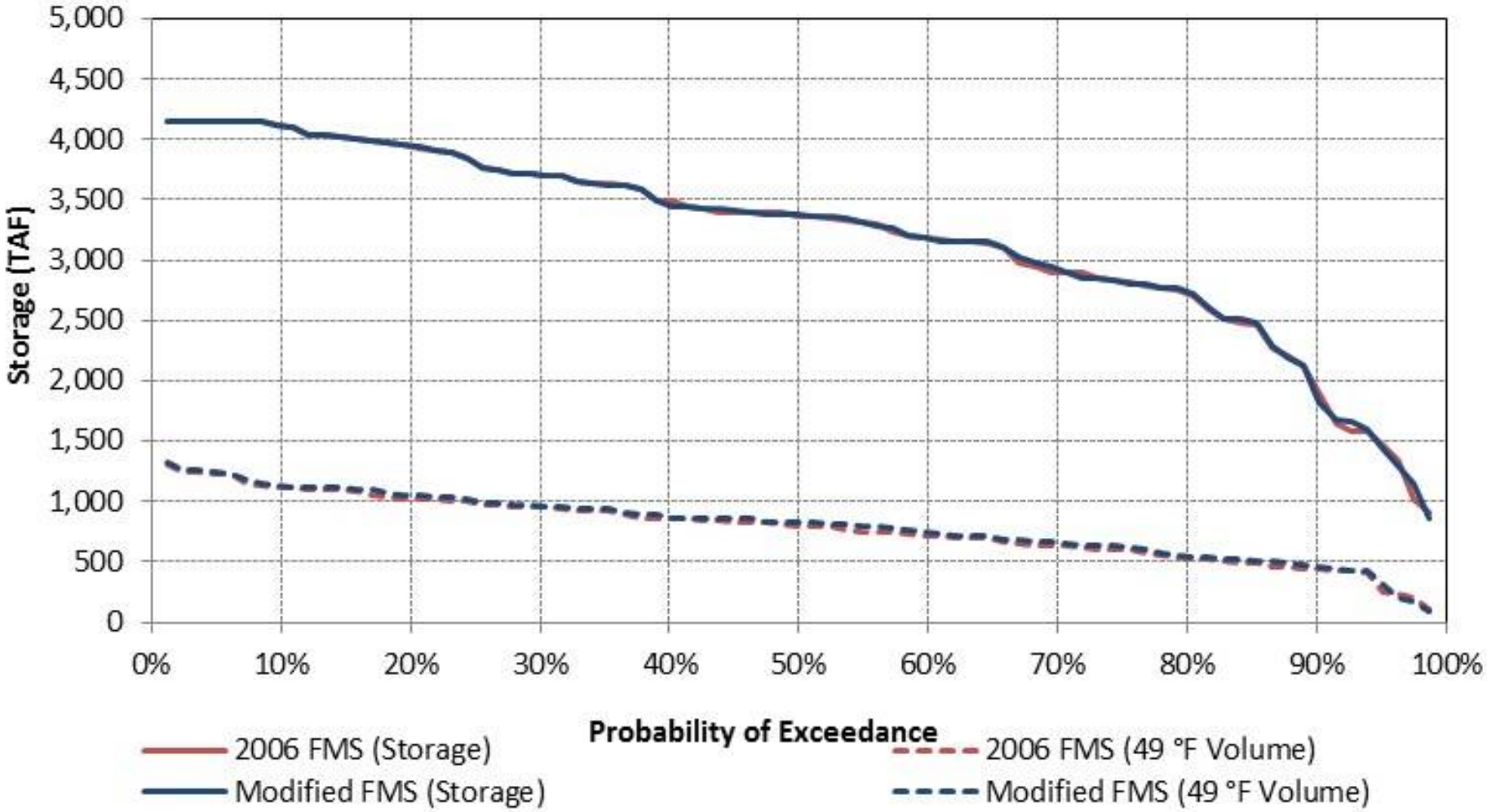
Exceedance Probability
Water Temperature in Lower American River
October



"slightly cooler (up to about 0.5°F) varying by location, with cooler water temperatures over about 40% of the distribution at Watt Avenue. Water temperatures typically (more than 80% of the time) would remain at or below 64°F at Hazel Avenue and Watt Avenue."

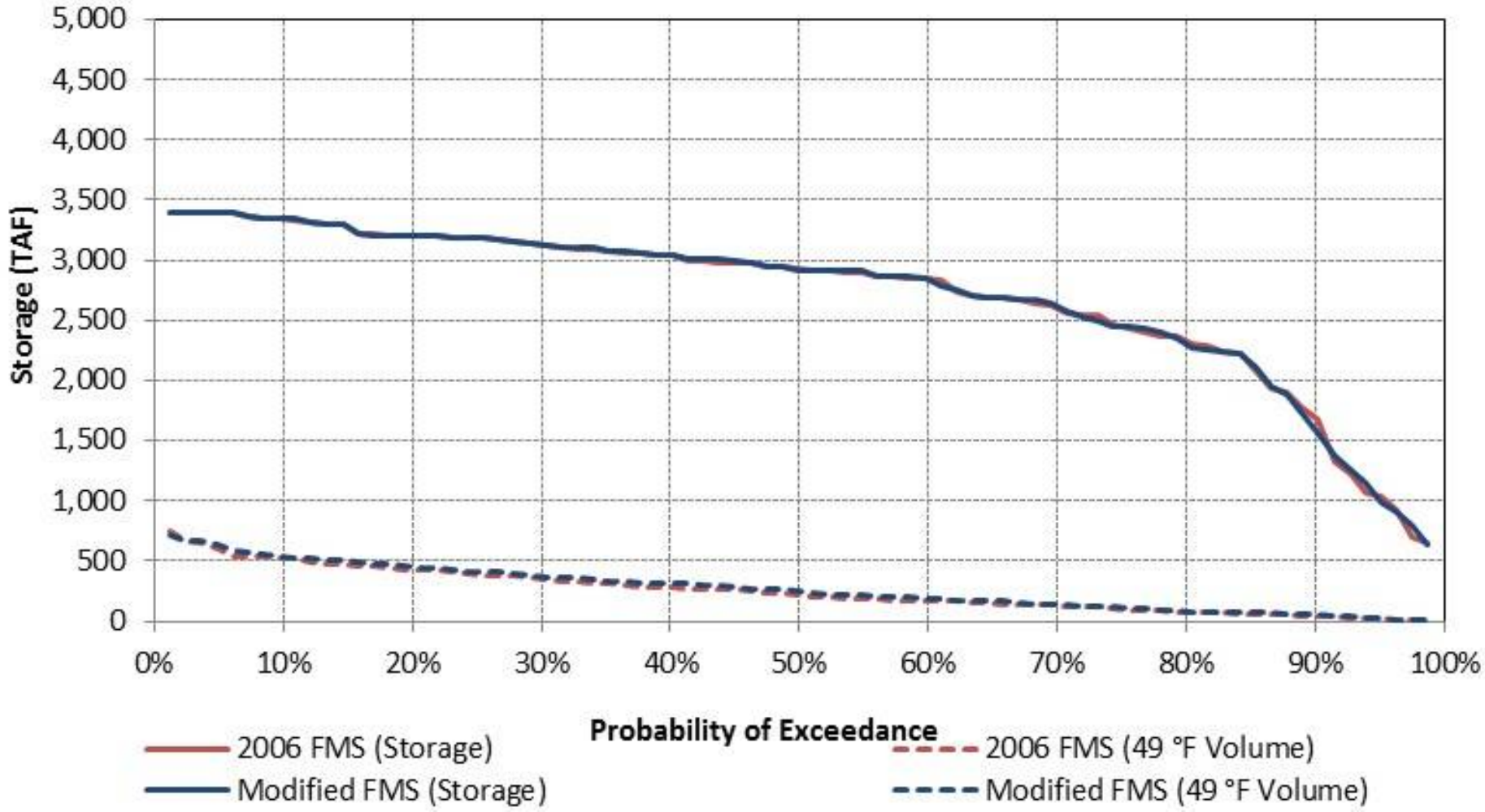
Exceedance Probability: Shasta Coldwater Pool

Total Storage and Volume of 49°F Water in July



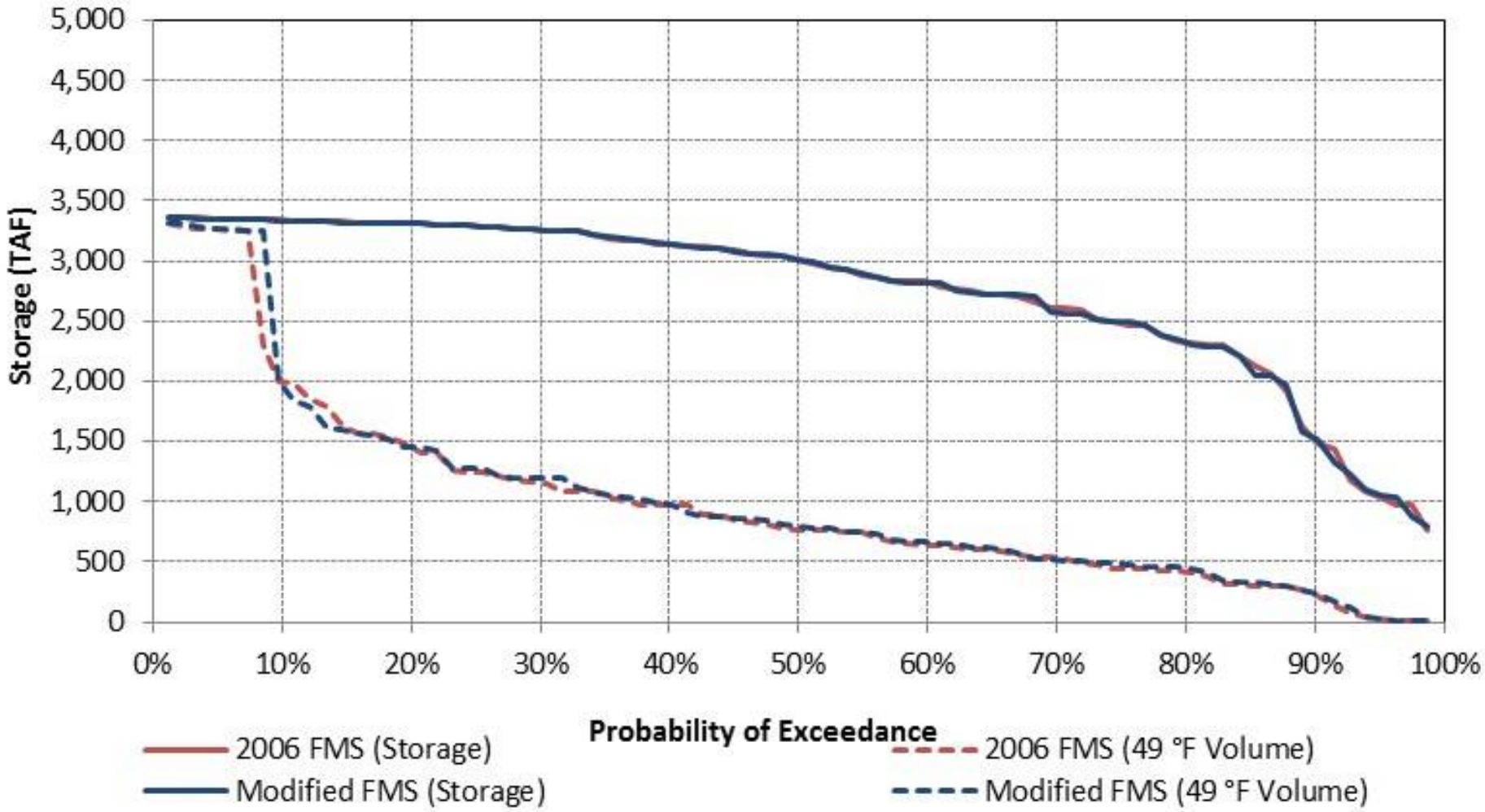
Exceedance Probability: Shasta Coldwater Pool

Total Storage and Volume of 49°F Water in September

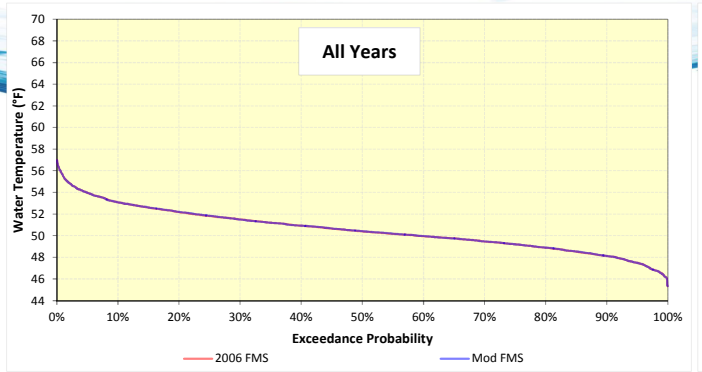


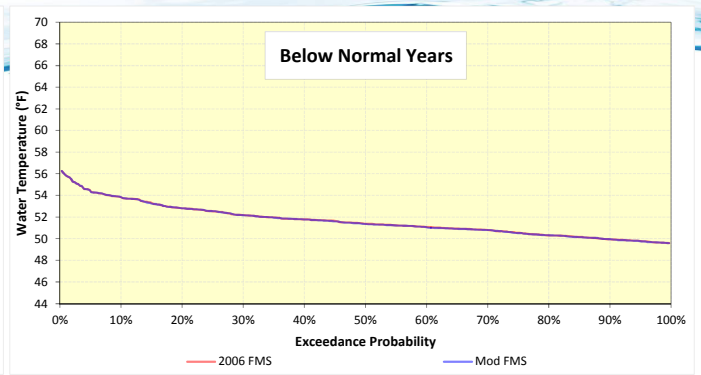
Exceedance Probability: Shasta Coldwater Pool

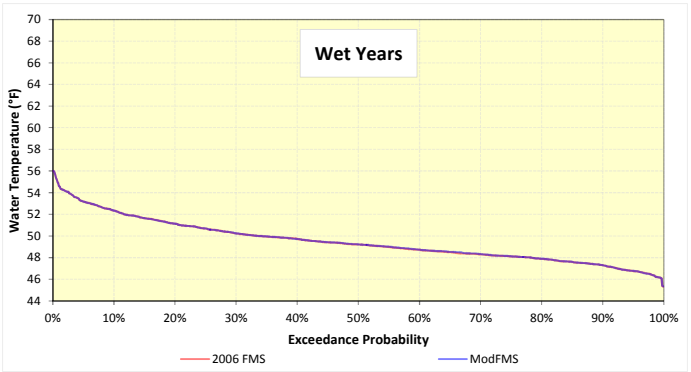
Total Storage and Volume of 49°F Water in December

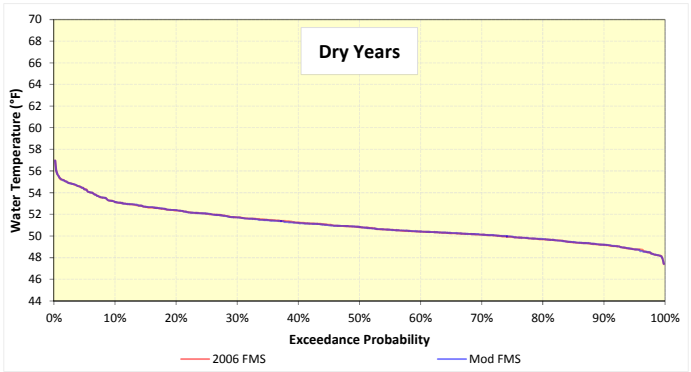


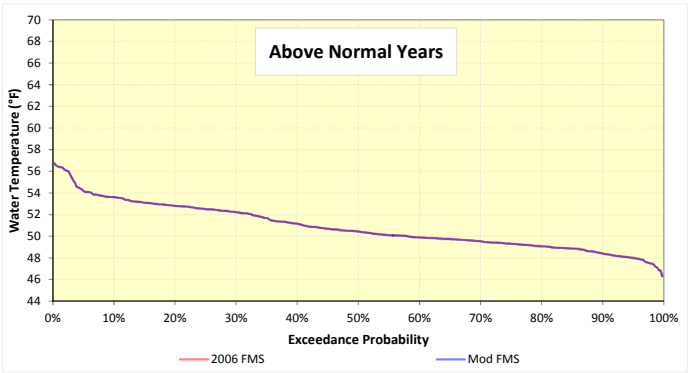
Exceedance Probability
Water Temperature in the Sacramento River at Balls Ferry
April

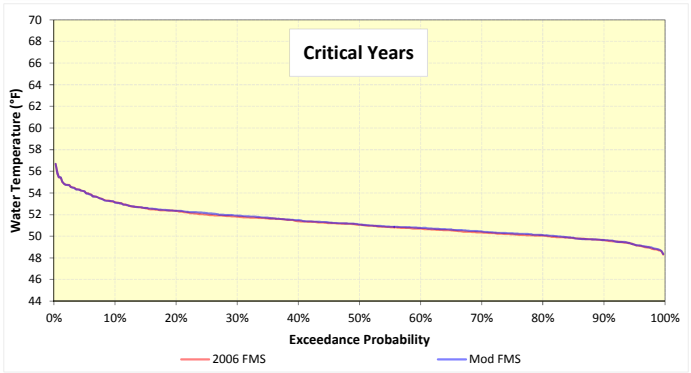




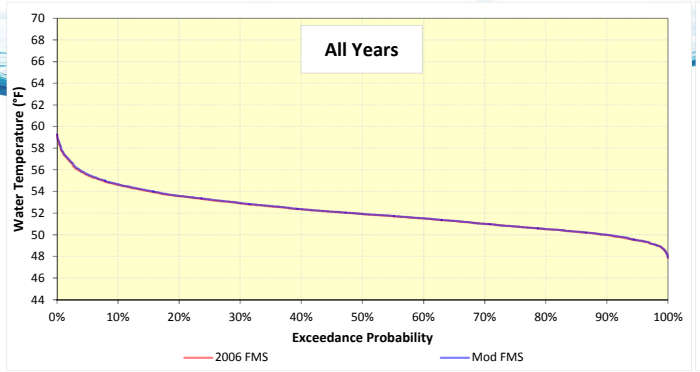


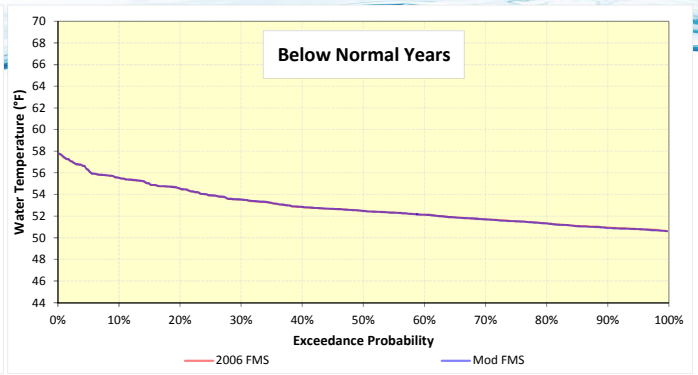


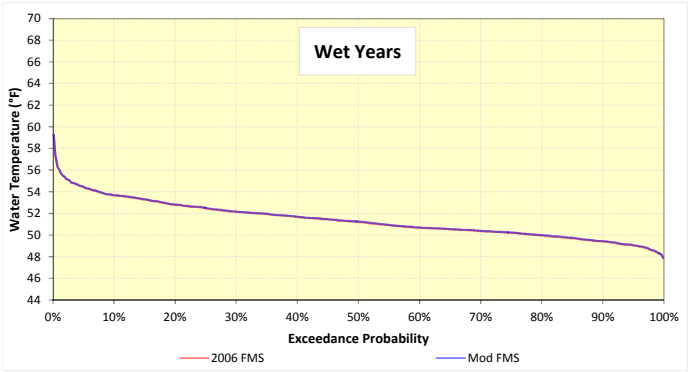


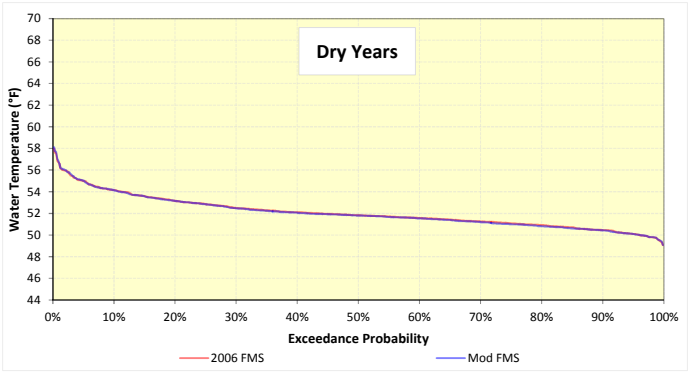


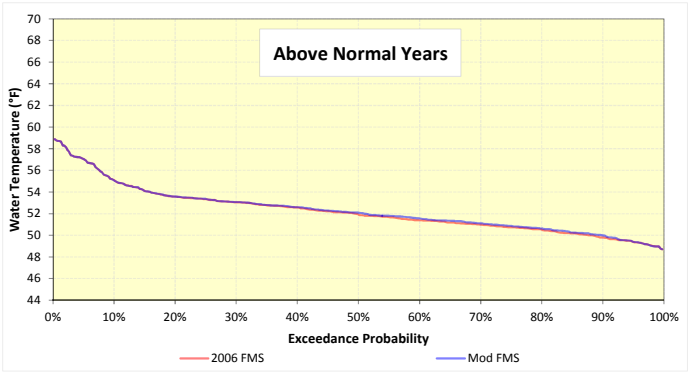
Exceedance Probability
Water Temperature in the Sacramento River at Balls Ferry
May

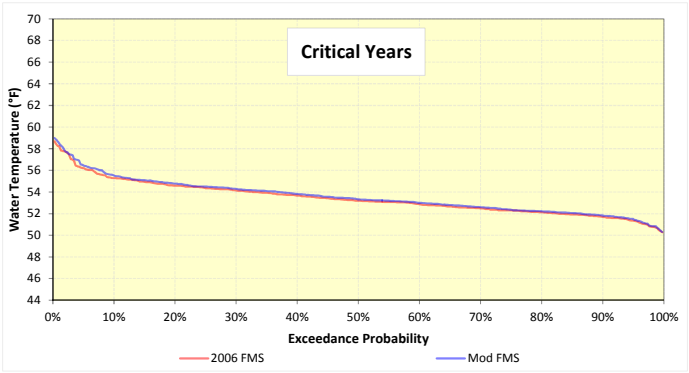




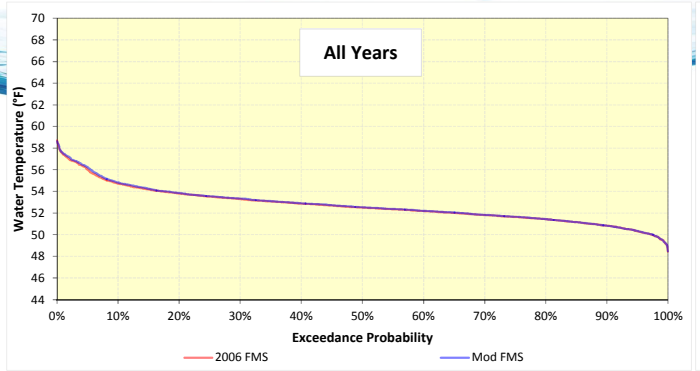


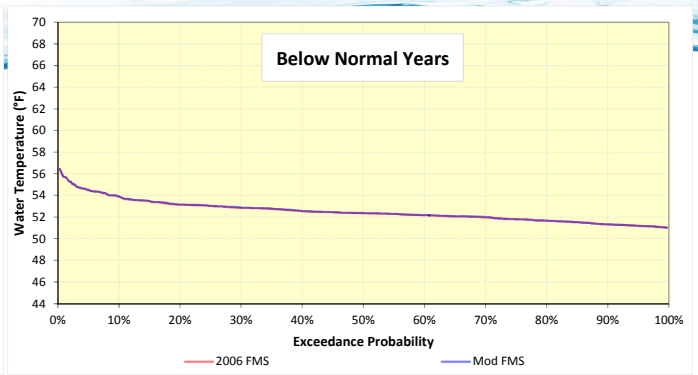


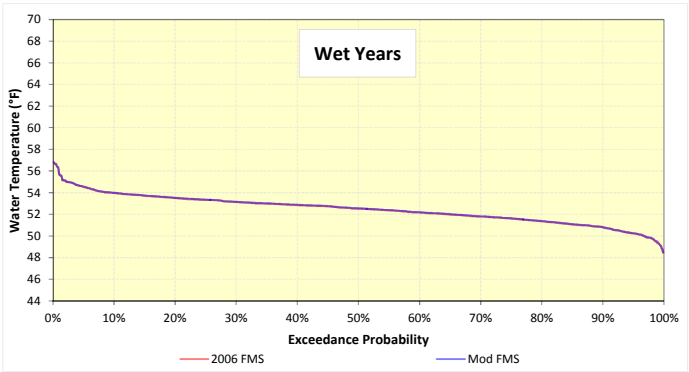


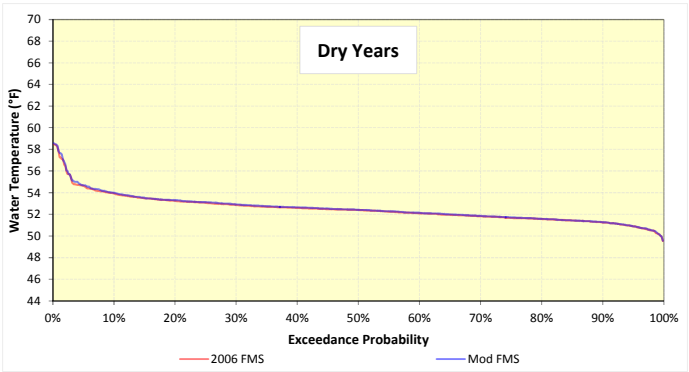


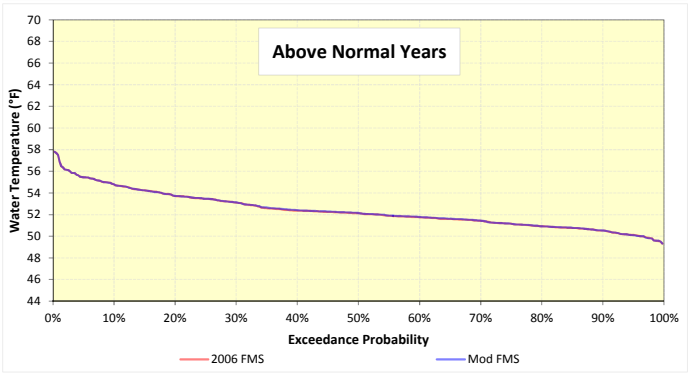
Exceedance Probability
Water Temperature in the Sacramento River at Balls Ferry
June

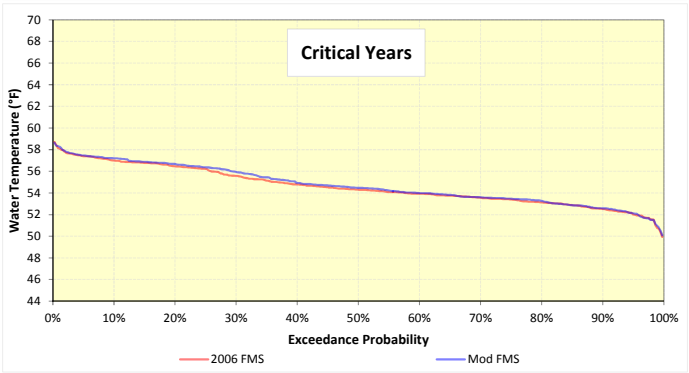




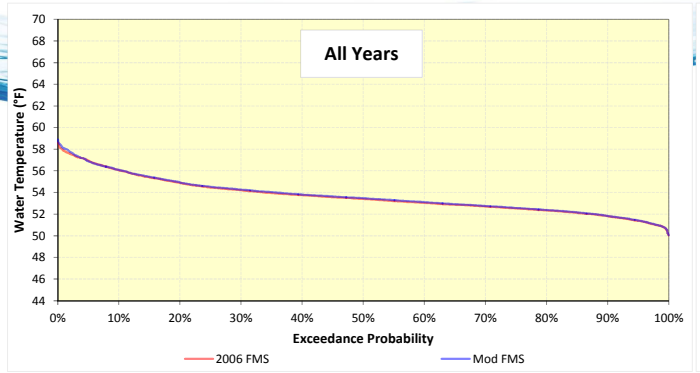


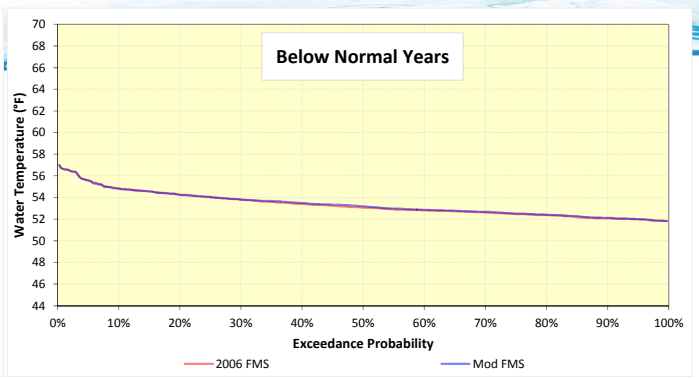


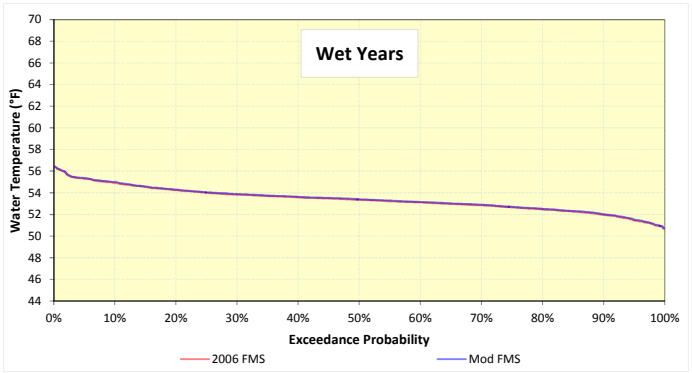


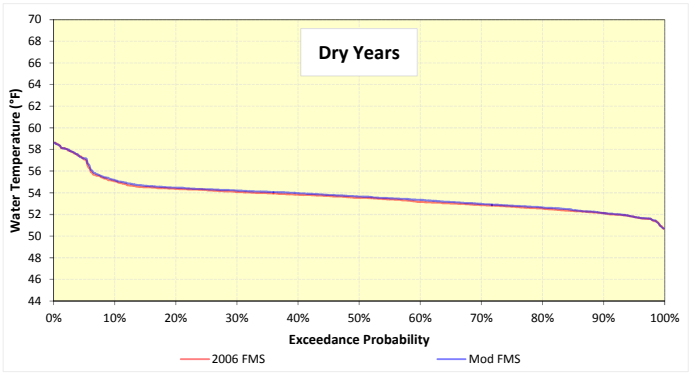


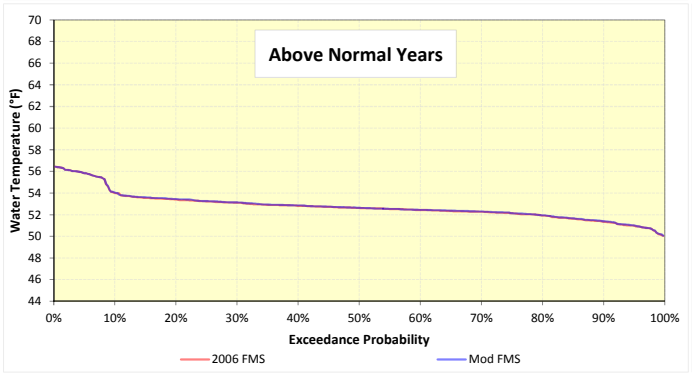
Exceedance Probability
Water Temperature in the Sacramento River at Balls Ferry
July

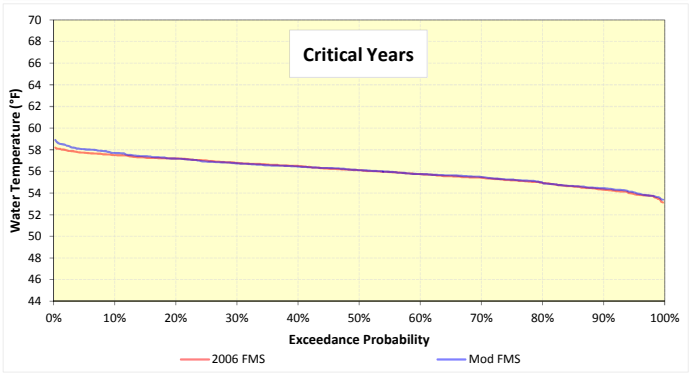




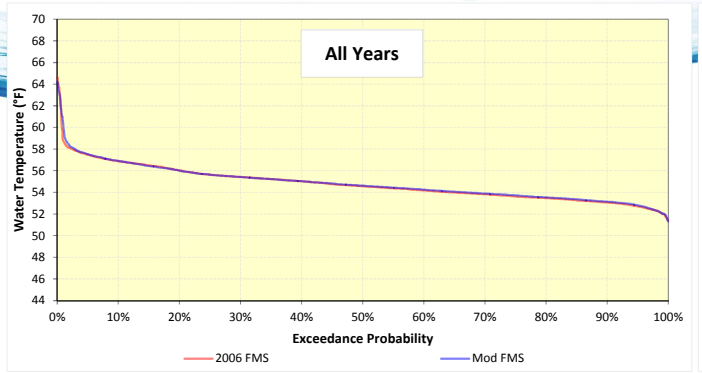


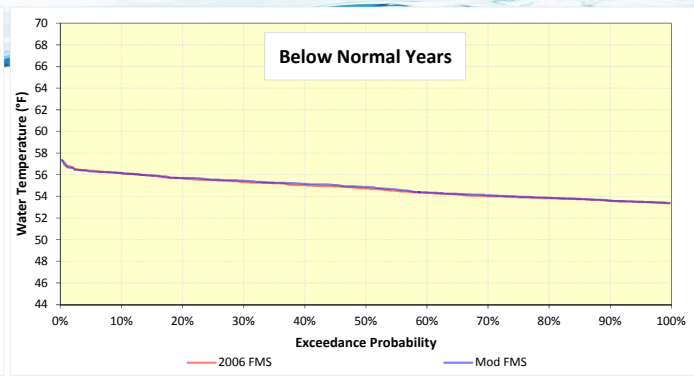


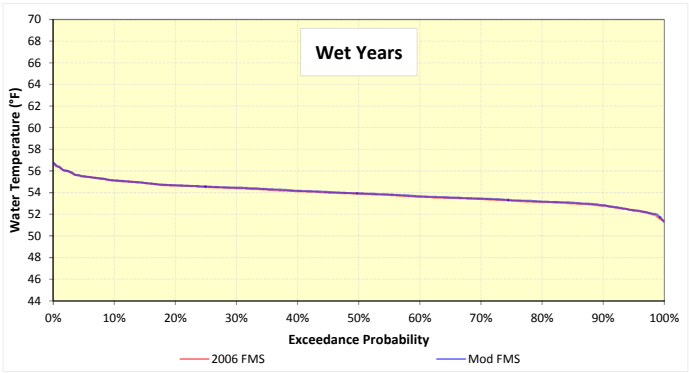


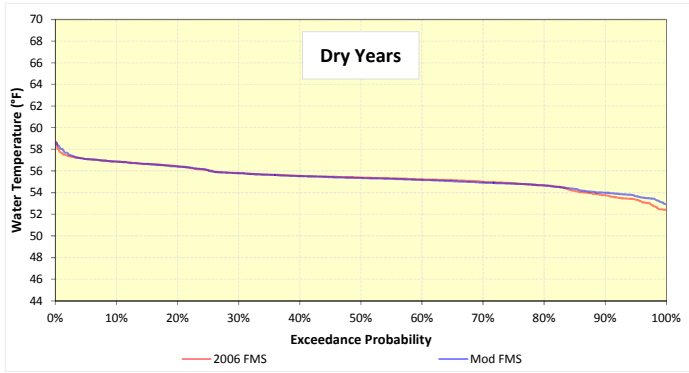


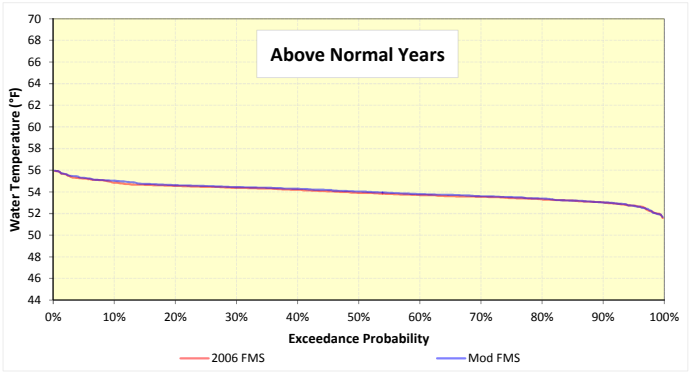
Exceedance Probability
Water Temperature in the Sacramento River at Balls Ferry
August

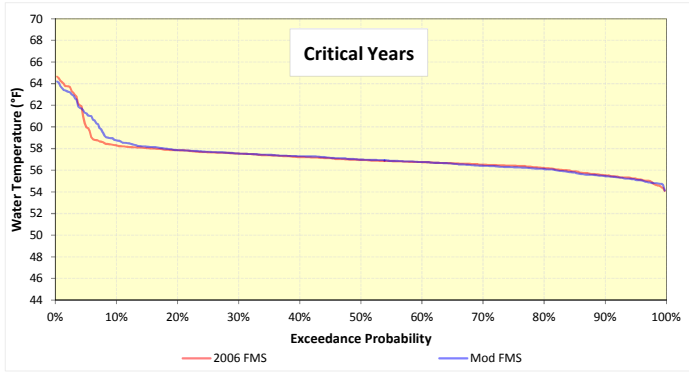




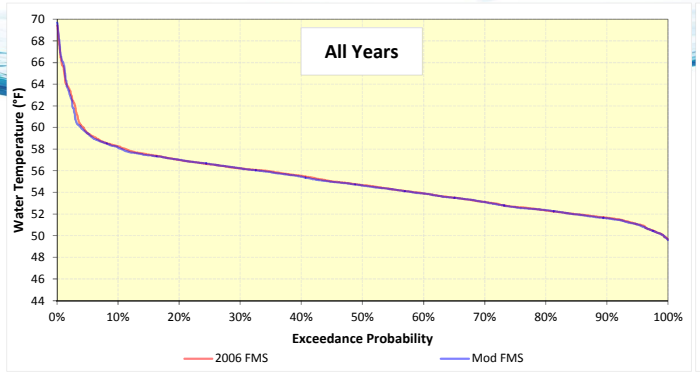


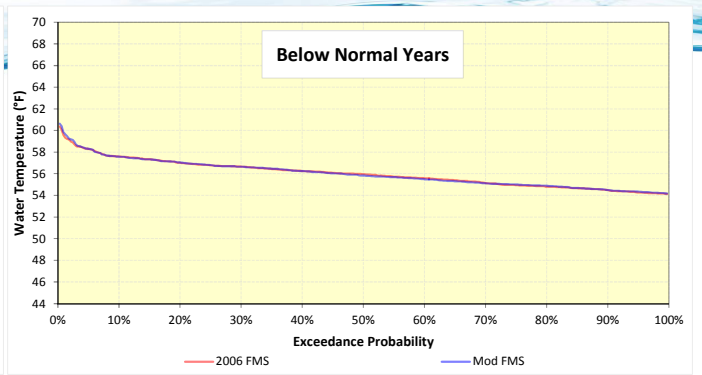


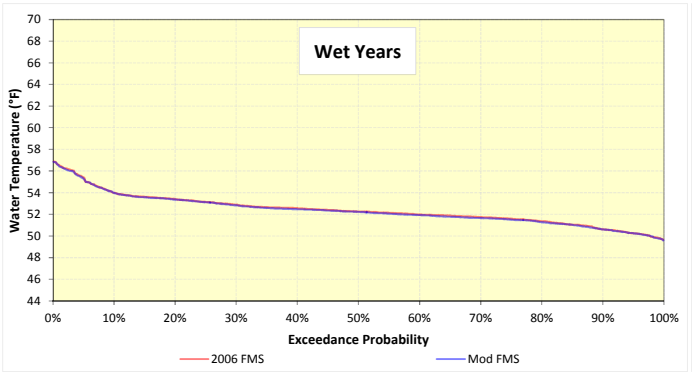


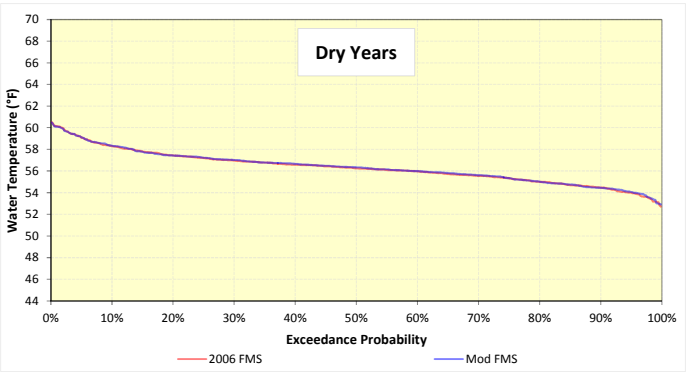


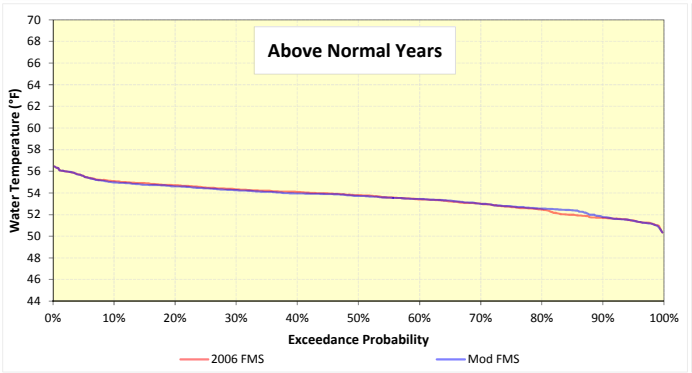
Exceedance Probability
Water Temperature in the Sacramento River at Balls Ferry
September

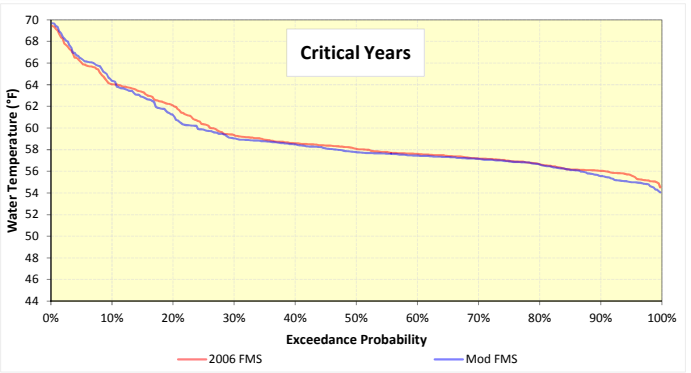




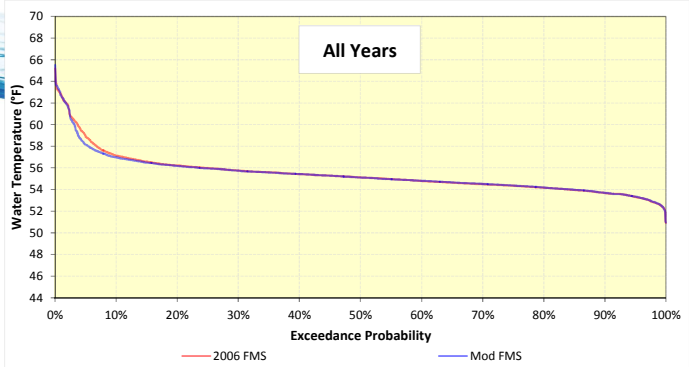


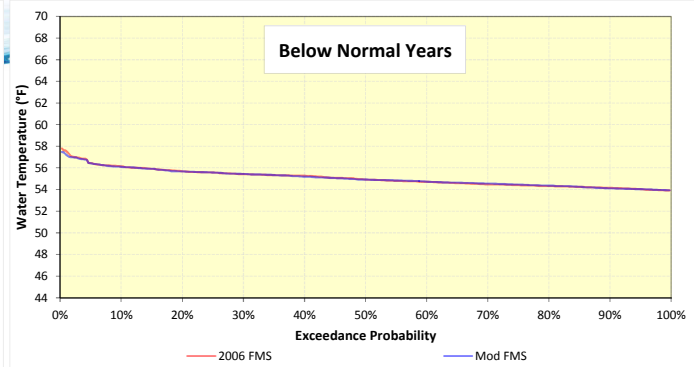


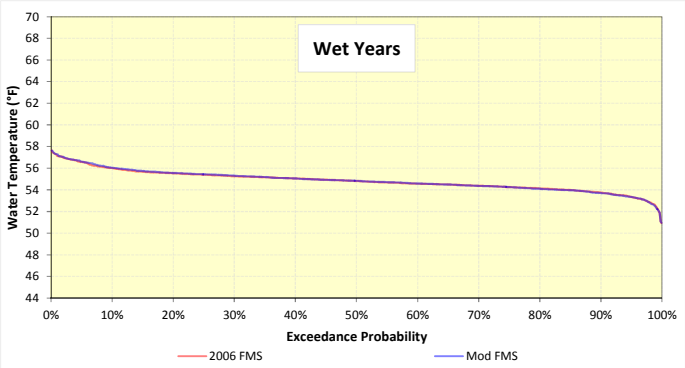


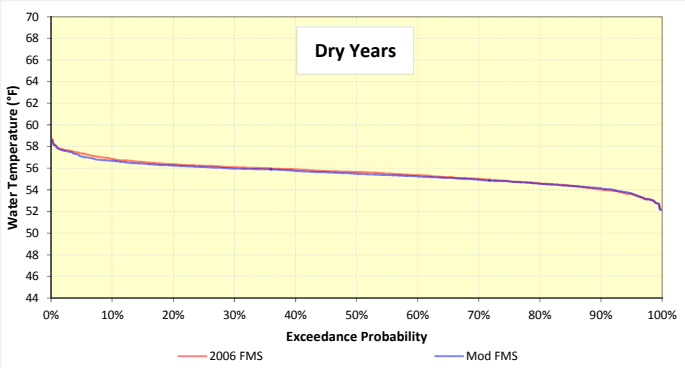


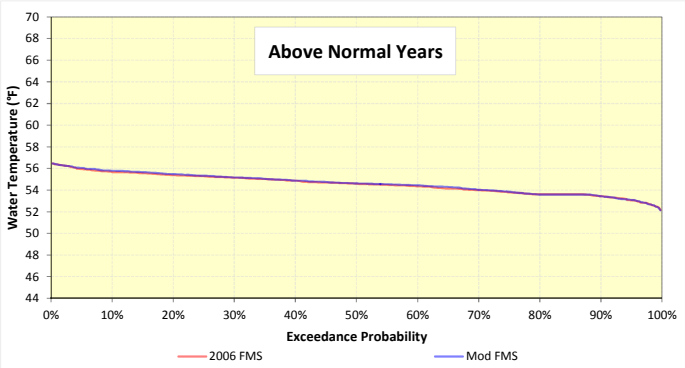
Exceedance Probability
Water Temperature in the Sacramento River at Balls Ferry
October

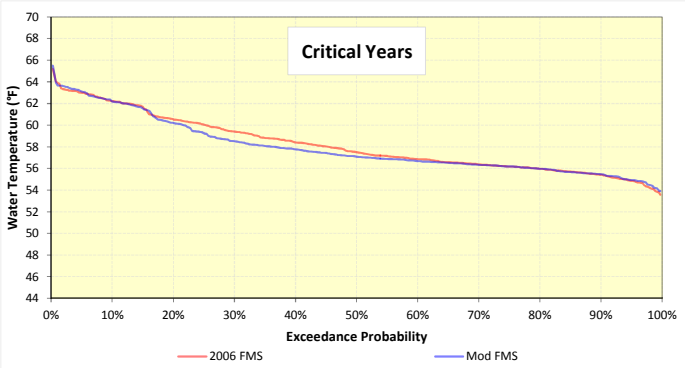












Conclusions
Sacramento River Fisheries Resources

- The Modified FMS would avoid redirected (water temperature) impacts to Sacramento River fisheries resources

Source: NMFS 2017 (https://www.fisheries.noaa.gov/species/chinook-salmon-protected

Source: https://news.ucsc.edu/2012/02/hatchery-salmon.html

Other Indications of No Redirected Impacts

- Deliveries to:
  - Sacramento River Settlement Contractors
  - SWP Contractors
  - CVP Ag Contractors
- Hydro-power generation

Table 4.3-6. Comparison of Long-Term Average and Water Year Type Monthly CVP Sacramento River Settlement Contractor Deliveries

Analysis Period	Average Flow (cfs)												Total (TAF)
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
Long-Term Average													
Full Simulation Period													
2006 FMS	1,085	343	100	19	11	112	4,548	4,750	6,871	6,683	4,910	1,271	1,862
Modified FMS	1,085	343	100	19	11	112	4,548	4,750	6,871	6,682	4,909	1,271	1,862
Difference	0	0	0	0	0	0	0	0	0	-1	-1	0	0
Percent Difference	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Water Year-Type Averages													
Wet													
2006 FMS	1,033	265	53	11	0	51	4,063	4,738	6,995	6,799	4,997	1,347	1,841
Modified FMS	1,033	265	53	11	0	51	4,063	4,738	6,994	6,796	4,995	1,346	1,841
Difference	0	0	0	0	0	0	0	0	-2	-3	-2	-2	-1
Percent Difference	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Above Normal													
2006 FMS	1,023	346	101	2	0	21	4,399	4,659	7,102	6,823	4,965	1,302	1,864
Modified FMS	1,023	346	101	2	0	21	4,399	4,659	7,103	6,824	4,966	1,303	1,864
Difference	0	0	0	0	0	0	0	0	1	1	1	1	0
Percent Difference	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Below Normal													
2006 FMS	1,145	357	128	27	9	129	4,763	5,025	6,925	6,792	4,981	1,255	1,913
Modified FMS	1,145	357	128	27	9	129	4,763	5,025	6,924	6,791	4,981	1,255	1,913
Difference	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Difference	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Dry													
2006 FMS	1,139	381	108	28	18	122	4,868	4,886	6,963	6,724	4,961	1,219	1,905
Modified FMS	1,139	381	108	28	18	122	4,868	4,886	6,963	6,724	4,961	1,219	1,905
Difference	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Difference	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Critical													
2006 FMS	1,107	438	155	34	35	303	5,017	4,337	6,170	6,105	4,504	1,172	1,781
Modified FMS	1,107	438	155	34	35	303	5,017	4,337	6,170	6,105	4,504	1,172	1,781
Difference	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Difference	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 4.3-6 of **Exhibit ARWA-601**

LAR Conclusions
Fall-run Chinook Salmon

Modified FMS (relative to the 2006 FMS) would result in an equivalent or increased level of protection for fall-run Chinook salmon in the LAR

- **More suitable** adult immigration conditions and adult pre-spawn staging conditions due to improved water temperature conditions, particularly during June, July, August and September.
- **Generally similar** adult spawning conditions, due to: (1) similar amounts of spawning habitat when both the Modified FMS and 2006 FMS provide <80% of maximum WUA; and (2) slightly cooler water temperatures in October, and slightly warmer water temperatures in November.
- **Generally similar** embryo incubation through emergence because: (1) the difference in the long-term average of potential fall-run Chinook salmon redd dewatering is <1% and, during critical years (when conditions could be expected to be most stressful for fall-run Chinook salmon), the Modified FMS would reduce potential redd dewatering by 1.9%; and (2) of slightly cooler water temperatures in October and March, and slightly warmer water temperatures in November.
- **More suitable** juvenile rearing and emigration conditions, because of an increased occurrence of pulse flows generally corresponding to dry and below normal water year types, and improved water temperature conditions particularly in May and June.

LAR Conclusions
Steelhead

Modified FMS (relative to the 2006 FMS) would result in an increased level of protection for steelhead in the LAR

- **More suitable** adult immigration conditions due to improved water temperatures, particularly in September.
- **More suitable** adult holding conditions due to improved water temperatures, particularly in September and October.
- **Generally similar** adult spawning conditions, due to similar amounts of spawning habitat when both the Modified FMS and 2006 FMS provide <80% of maximum WUA, and because of slightly cooler water temperatures in March.
- **More suitable** embryo incubation through emergence conditions due to: (1) an estimated 1.1% long-term average reduction in potential steelhead redd dewatering relative to the 2006 FMS and, during critical years (when conditions could be expected to be most stressful for steelhead), the Modified FMS would reduce potential redd dewatering by 5.1%; and (2) improved water temperatures, particularly in March, April & May.
- **More suitable** juvenile rearing and emigration conditions due to an increased occurrence of pulse flows generally corresponding to dry and below normal water year types, and improved water temperatures from May through September.
- **More suitable** smolt emigration conditions due to an increased occurrence of pulse flows generally corresponding to dry and below normal water year types, and generally similar water temperature conditions.

Conclusions

- Modified FMS would:
  - Protect against uncertainty and reduced storage,
  - Improve conditions for steelhead on the lower American River, and
  - Avoid redirected impacts to Sacramento River fisheries resources

Conclusions

- We respectfully submit Terms and Conditions (Exhibit ARWA-502)
  - Modify Reclamation permits
  - Implement the Modified FMS
  - Updated from Part 1 submittal
  - Edited parameters to account for updated redd distribution data to find new “sweet spot”
  - Committed to best available science