Sacramento River Group Meeting Packet

Thursday, July 23, 2026

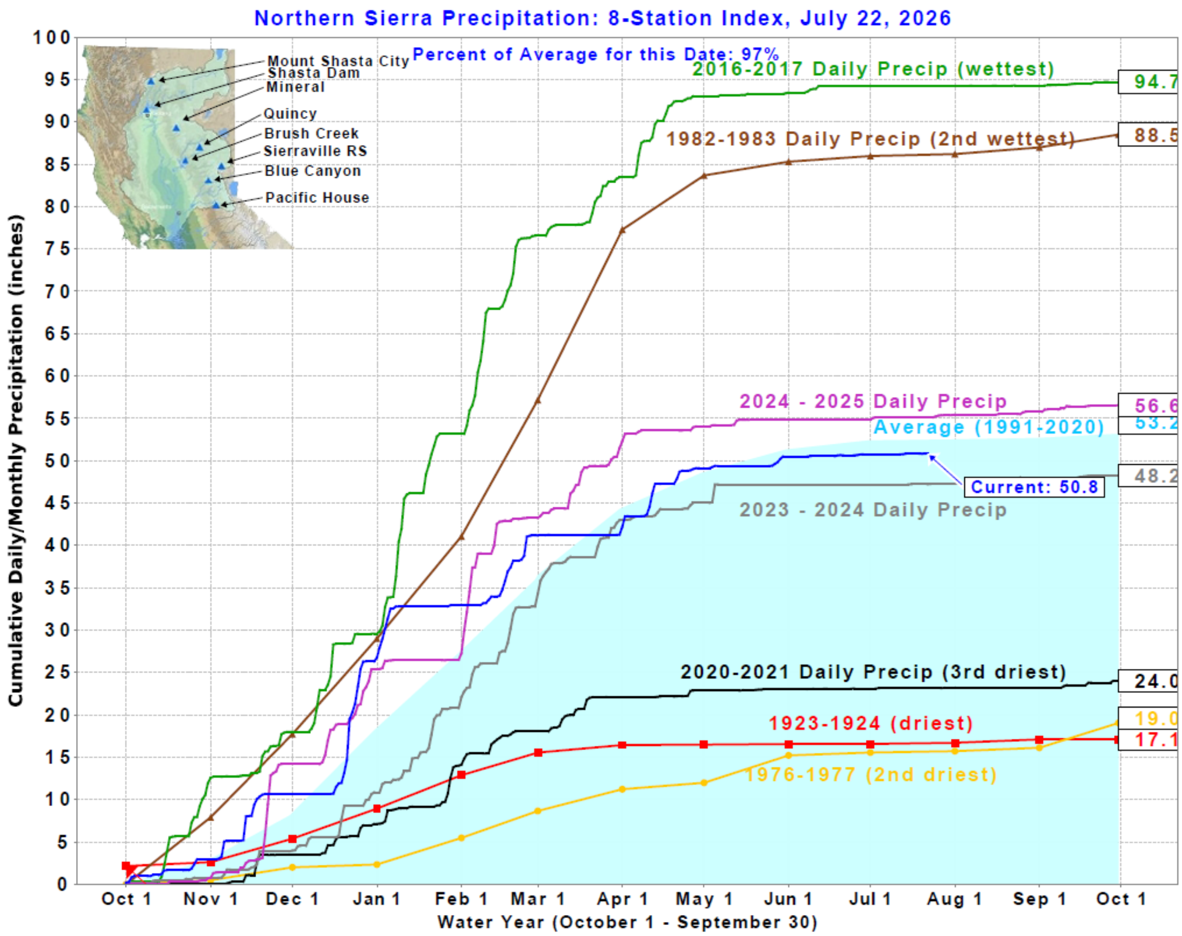

Figure 1: Northern Sierra Precipitation: 8-Station Index, July 22, 2026

Line chart showing cumulative precipitation for the Northern Sierra 8-Station Index over the water year (October 1 to September 30), updated July 22, 2026. The current 2025-2026 water year (blue line) has accumulated 50.8 inches of precipitation, which is 97% of the historical average for this date. The current year closely tracks the 1991-2020 average (53.2 inches) and finishes above the 2023-2024 water year (48.2 inches). For comparison, the wettest year shown, 2016-2017, reached 94.7 inches, and the second wettest year, 1982-1983, reached 88.5 inches. The driest years shown are 1923-1924 with 17.1 inches and 1976-1977 with 19.0 inches. The chart illustrates that 2025-2026 precipitation was near average and substantially below the wettest years but well above the driest years on record.

Historical Archive and Reports Database
Daily CVP Water Supply
Run Date: 07/22/2026

Table 1. Reservoir Releases in Cubic Feet/Second

Reservoir	Dam	WY 2025	WY 2026	15 Yr Median
Trinity	Lewiston	699	448	464
Sacramento	Keswick	13,995	12,949	10,890
Feather	Oroville (SWP)	7,500	8,001	5,500
American	Nimbus	4,571	4,487	4,005
Stanislaus	Goodwin	276	252	304
San Joaquin	Friant	237	350	374

Table 2. Storage in Major Reservoirs in Thousands of Acre-Feet

Reservoir	Capacity	15 Yr Avg	WY 2025	WY 2026	% of 15 Yr Avg
Trinity	2,448	1,571	2,125	1,926	123
Shasta	4,552	3,021	3,423	3,230	107
Folsom	977	634	657	722	114
New Melones	2,420	1,441	1,755	1,642	114
Fed. San Luis	966	355	328	422	119
Total North CVP	11,363	7,022	8,288	7,942	113
Millerton	521	357	348	324	91
Oroville (SWP)	3,425	2,271	2,868	2,706	119

Table 3. Accumulated Inflow for Water Year to Date in Thousands of Acre-Feet

Reservoir	Current WY 2026	WY 1977	WY 1983	15 Yr Avg	% of 15 Yr Avg
Trinity	1,079	194	2,731	1,045	103
Shasta	4,517	2,138	10,109	4,382	103
Folsom	2,213	299	6,123	2,311	96
New Melones	693	NA	2,568	883	79
Millerton	1,284	246	4,067	1,346	95

Table 4. Accumulated Precipitation for Water Year To Date in Inches

Reservoir	Current WY 2026	WY 1977	WY 1983	Average (N Years)	% of Average	Last 24 Hours
Trinity at Fish Hatchery	31.01	12.06	54.19	30.12 (66)	103	0.00
Sacramento at Shasta Dam	68.76	17.42	112.58	58.88 (71)	117	0.00
American at Blue Canyon	59.36	15.64	103.88	63.72 (52)	93	0.00
Stanislaus at New Melones	28.38	NA	45.33	26.61 (49)	107	0.00
San Joaquin at Huntington Lk	31.45	17.20	81.40	39.42 (53)	80	0.00

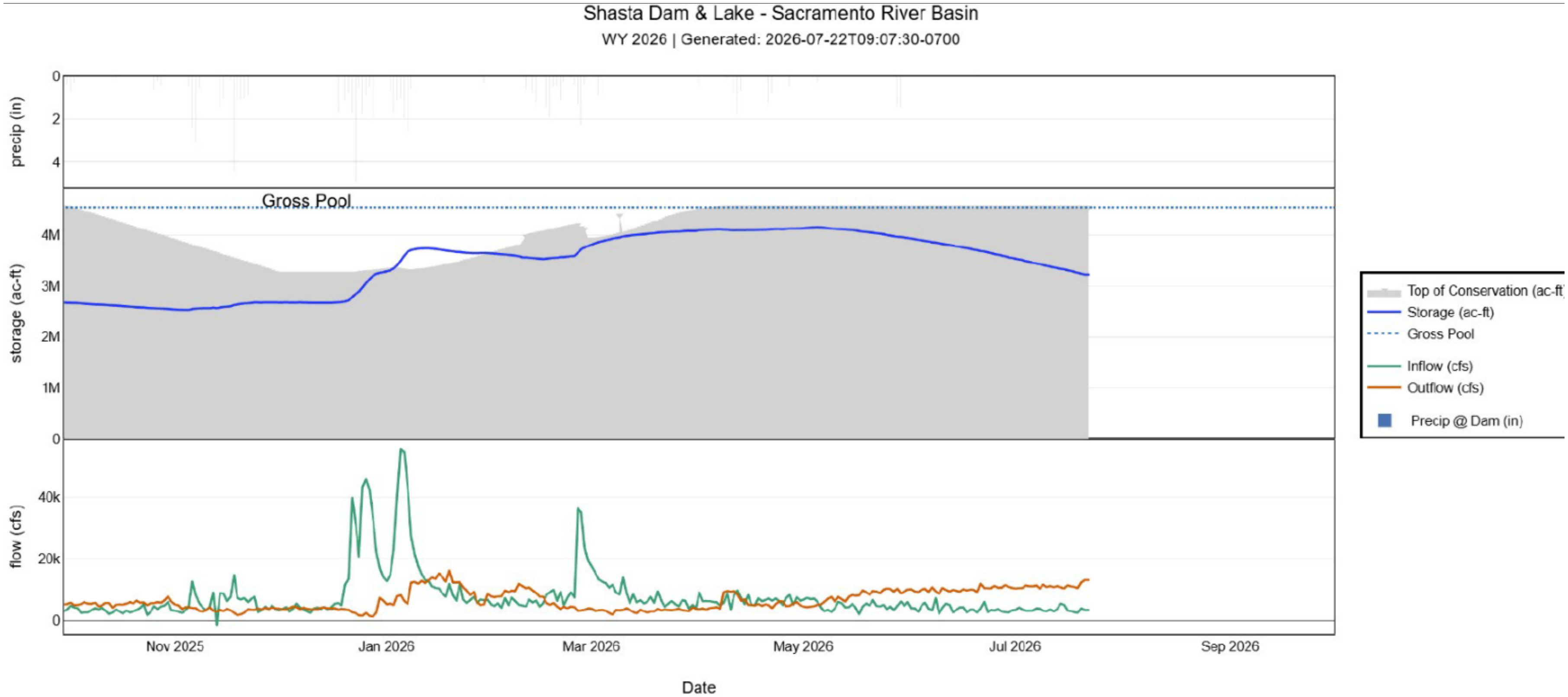

Figure 2. Shasta Dam & Lake – Sacramento River Basin

This chart shows reservoir conditions at Shasta Dam and Lake in the Sacramento River Basin during Water Year 2026, from October 2025 through July 22, 2026. Reservoir storage increased from approximately 2.7 million acre-feet in October to a peak of about 4.1 million acre-feet during April and May, remaining below the gross pool elevation of roughly 4.5 million acre-feet throughout the period. Storage then gradually declined to about 3.2 million acre-feet by late July as summer water releases exceeded incoming flows. Inflow to the reservoir was characterized by several major winter storm events, with peak inflows approaching 60,000 cubic feet per second (cfs) in January 2026 and additional surge events in late December and early March. Outflows were more stable, generally ranging from 4,000 to 15,000 cfs, and increased during late spring and summer. Daily precipitation at the dam was limited and occurred primarily during the winter months. Overall, the chart indicates that winter storms and snowmelt substantially increased reservoir storage, followed by seasonal drawdown during the dry summer period while storage remained below full capacity

Table 5. Sacramento River Station Temperature Summary Report

Date	MDWT TCD[1]	MDWT SHD	MDWT SPP[1]	MDWT KWK	MDWT SAC[2]	MDWT CCR	MDWT BSF	MDWT BND	MDWT RBD	MDWT IGO	MDWT LWS	MDWT DGC[3]	MDWT NFH	MDR Shasta Gene-ration	MDR Spring Creek PP	MDR Keswick Total	MDAT RDD	MDAT BSF	MDAT RDB
Jun	51.7	50.4	56.0	52.0	52.5	53.2	55.0	56.6	58.5	57.0	50.5	58.2	60.8	9637	1574	11699	79.9	76.5	76.9
07/01	51.3[X]	50.7	57.0	52.5	52.9	53.6	55.1	56.4	58.1	58.8	50.7	58.4	62.9	10459	1907	12359	82.0	76.1	76.6
07/02	51.3[X]	50.6	57.0	52.4	52.9	53.6	55.2	56.6	58.5	58.9	50.7	59.4	63.2	10583	1848	12538	78.5	75.3	74.8
07/03	51.3	50.6	NA[C]	52.4	52.9	53.6	55.2	56.8	58.8	59.6	50.5	60.3	64.4	10616	1711	13031	82.5	78.3	78.2
07/04	51.2[X]	50.5	57.1	52.4	53.0	53.7	55.3	56.8	58.8	59.7	50.7	60.4	65.7	11437	1819	13007	84.0	79.2	79.7
07/05	51.1	50.4	57.1	52.2	52.8	53.4	55.1	56.7	58.7	58.9	50.6	59.7	66.1	11216	1702	12997	83.0	77.8	76.8
07/06	51.2	50.4	57.2	52.1	52.7	53.2	54.8[A]	NA[B]	58.2	59.2	50.7	60.0	65.7	11188	1847	12995	80.5	77.0	75.1
07/07	51.3	50.5	57.2	52.2	52.8	53.4	55.0	NA[C]	58.2	59.2	50.8	60.1	65.7	11431	1737	13035	78.5	75.1	73.3
07/08	51.2[X]	50.5	57.3	52.3	52.8	53.5	55.0	NA[C]	58.3	59.4	50.8	60.6	65.7	10419	1714	13025	80.0	76.1	74.4
07/09	51.3	50.5	57.3	52.2	52.8	53.5	55.2	NA[C]	58.6	59.9	51.0	60.7	66.3	11737	1846	12996	85.0	80.2	79.0
07/10	51.2[X]	50.2	57.4	52.4	52.9	53.7	55.4	NA[B]	58.8	60.1	50.9	60.0	66.5	10934	1846	12960	84.5	80.5	80.3
07/11	51.2	50.1	57.4	52.2	52.8	53.4	55.1	56.6	58.7	59.5	50.8	59.6	65.2	11278	1847	12983	82.5	79.0	79.1

Date	MDWT TCD[1]	MDWT SHD	MDWT SPP[1]	MDWT KWK	MDWT SAC[2]	MDWT CCR	MDWT BSF	MDWT BND	MDWT RBD	MDWT IGO	MDWT LWS	MDWT DGC[3]	MDWT NFH	MDR Shasta Generation	MDR Spring Creek PP	MDR Keswick Total	MDAT RDD	MDAT BSF	MDAT RDB
07/12	51.1	50.1	57.5	52.1	52.6	53.2	54.7	55.9	57.8	59.8	50.7	59.7	65.6	10886	1771	12946	86.5	79.3	79.2
07/13	51.1	50.2	57.5	52.0	52.6	53.1	54.5	55.9	57.7	59.8	50.8	59.9	65.6	11270	1846	12977	85.5	80.0	81.6
07/14	51.1	50.1	57.6	52.2	52.7	53.4	55.1	56.5	58.3	60.4	50.6	60.1	65.9	10867	1847	12998	90.0	86.1	86.2
07/15	51.1	50.1	57.6	52.2	52.7	53.4	55.1	56.6	58.6	59.9	50.5	59.8	65.8	10512	1844	12897	90.0	84.0	85.8
07/16	51.2	50.2	57.6	52.1	52.7	53.3	54.9	56.5	58.5	59.1	50.6	59.7	64.5	11488	1754	12912	82.5	79.5	81.3
07/17	51.1	50.1	57.8	52.2	52.7	53.3	54.8	56.2	58.1	58.9	50.9	59.7	65.1	11135	1801	12789	81.0	77.0	77.3
07/18	51.3	50.2	57.7	52.2	52.7	53.3	54.8	56.1	58.0	58.6	50.8	59.2	65.6	10898	1844	12773	80.5	76.3	75.3
07/19	51.4	50.3[A]	57.7	52.2	52.7	53.1	54.5	55.8	57.5	58.2	50.6	58.7	65.0	10624	1844	12883	80.5	79.0	78.9
07/20	51.3	50.4[A]	57.8	51.9	52.5	53.1	54.5	55.7	57.4	NA[C]	50.2	57.5	64.8	12415	587	12933	87.0	81.4	79.3
07/21	51.4	50.5[A]	57.2	51.5	52.2	52.7	54.4	55.7	57.6	NA[C]	50.0	58.2	63.4	13218	10	12949	88.5	84.2	83.5
Jul	51.2	50.3	57.4	52.2	52.7	53.4	54.9	56.3	58.2	59.4	50.7	59.6	65.2	11172	1665	12904	83.5	79.1	78.8
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Total CFS	234611	34972	270983	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Total AF	465341	69366	537484	N/A	N/A	N/A

Legend

A = 1-9 hours of data missing (Average includes estimations)
B = 10 or more hours of data missing (Average not calculated)
C = Station out of service
D = Record high air temperature
E = Record low air temperature
MDWT = Mean Daily Water Temperature (Fahrenheit)
MDR = Mean Daily Release (CFS)
MDAT = Mean Daily Air Temperatures (Fahrenheit)

Notes

1 Temperatures are weighted averages based on individual penstock flow and temperature
X Highlighted cells in the TCD column indicate a TCD change was made on that day
2 Current Sacramento River control point (see page 4 for more details)
3 Data is currently being collected locally and periodically downloaded.
Once downloaded and certified by USGS, missing data will be added.

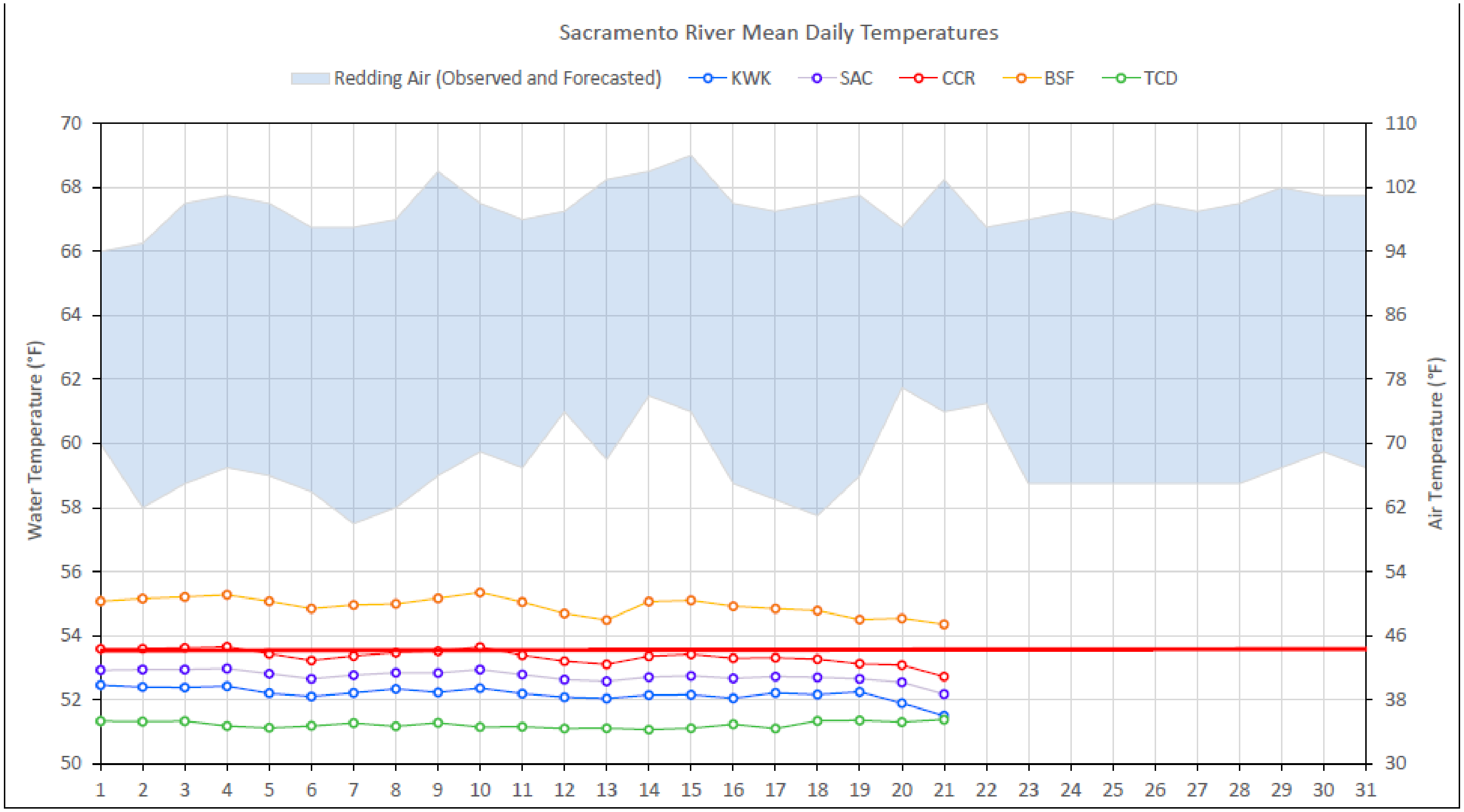

Figure 3. Sacramento River Mean Daily Temperatures

This chart shows mean daily water temperatures at five Sacramento River monitoring locations (KWK, SAC, CCR, BSF, and TCD) during the first 21 days of the month, together with a shaded band representing observed and forecasted air temperatures in Redding. Water temperatures remain relatively stable throughout the monitoring period, ranging from approximately 51°F to 55.5°F, with only minor daily fluctuations. BSF consistently records the warmest temperatures, generally between 54.5°F and 55.5°F, while TCD remains the coolest site, varying near 51.0°F to 51.5°F. CCR remains relatively constant around 53.0°F to 53.6°F, and both KWK and SAC fluctuate within a narrow range between approximately 52.0°F and 53.0°F. A modest cooling trend is evident around days 12-13 and again near days 19-21 across most stations, followed by slight warming during the intervening period. In contrast, Redding air temperatures exhibit substantially greater variability, with daily minimum temperatures generally ranging from the upper 50s to low 60s°F and maximum temperatures ranging from the mid-60s to nearly 70°F. Although short-term changes in river temperature appear to correspond loosely with shifts in air temperature, the Sacramento River maintains a well-moderated thermal regime, exhibiting far less variability than the surrounding atmospheric conditions during the period shown.

Station Details

Code	Body of Water	Location[1]
TCD	N/A	Shasta Power Plant
SHD	Sacramento River	0.3 miles downstream of Shasta Power Plant
SPP	N/A	Spring Creek Power Plant
KWK	Sacramento River	0.8 miles downstream of Keswick Dam
SAC	Sacramento River	4.8 miles downstream of Keswick Dam
CCR	Sacramento River	9.7 miles downstream of Keswick Dam
BSF	Sacramento River	25 miles downstream of Keswick Dam
JLF	Sacramento River	34 miles downstream of Keswick Dam
BND	Sacramento River	41 miles downstream of Keswick Dam
RDB	Sacramento River	58 miles downstream of Keswick Dam
IGO	Clear Creek	7.3 miles downstream of Whiskeytown Dam

Water Right Temperature Control Points

River	Point	Temp (˚F)	Begin Date	End Date
Sacramento	CCR	58.0	Mar-01	May-15
Sacramento	CCR	53.5	May-15	NA

Notes: [1] Distances are approximate

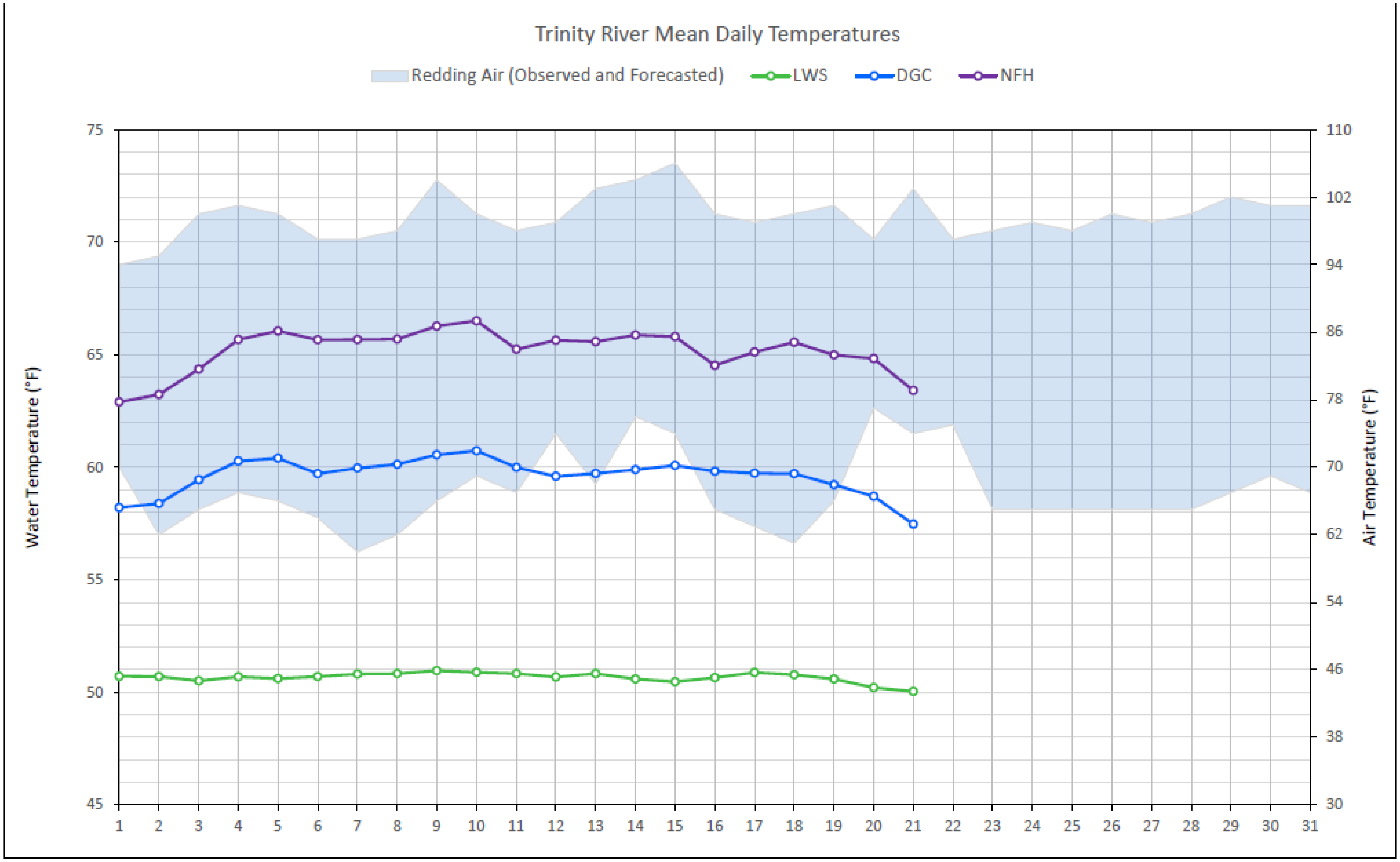

Figure 4. Trinity River Mean Daily Temperatures

This chart shows mean daily water temperatures at three Trinity River monitoring locations (LWS, DGC, and NFH) during the first 21 days of the month, together with a shaded band representing observed and forecasted air temperatures in Redding. Water temperatures exhibit distinct differences among monitoring sites while remaining relatively stable within each location over time. NFH consistently records the warmest temperatures, generally ranging from approximately 63°F to 66.5°F, while LWS remains the coolest site, varying only slightly around 50°F to 51°F. DGC temperatures fall between these stations, fluctuating from about 57.5°F to 60.8°F.

Station Details

Code	Body of Water	Location[1]
LWS	Trinity River	1.1 miles downstream of Lewiston Dam
DGC	Trinity River	19 miles downstream of Lewiston Dam
NFH	Trinity River	38 miles downstream of Lewiston Dam

Water Right Temperature Control Points

River	Point	Temp (˚F)	Begin Date	End Date
Trinity	DGC	56	Sep-15	Oct-01
Trinity	NFH	56	Oct-01	Dec-31

Notes: [1] Distances are approximate

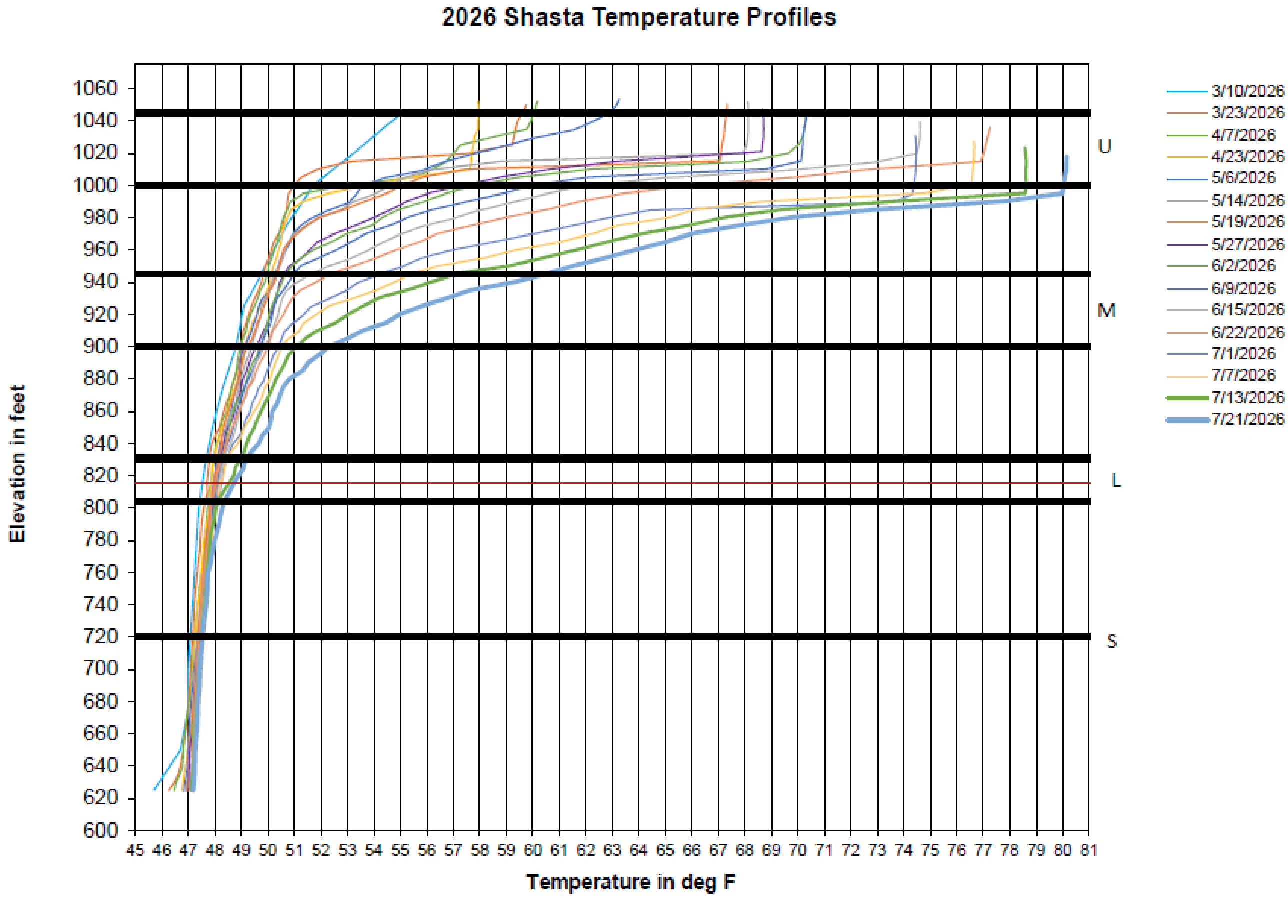

Figure 5. 2026 Shasta Temperature Profiles

This chart displays temperature profiles across elevations in Shasta Reservoir from late March through late July 2026, illustrating the seasonal evolution of reservoir thermal stratification. The horizontal axis represents water temperature (approximately 45°F to 80°F), while the vertical axis shows reservoir elevation (roughly 620 to 1,060 feet). Each colored line corresponds to a specific monitoring date, with earlier profiles in March and April generally exhibiting cooler and more vertically uniform temperatures, while profiles collected during May, June, and July show progressively warmer conditions, particularly in the upper water column. At lower elevations, temperatures remain tightly clustered between approximately 46°F and 49°F, indicating stable cold-water conditions throughout the monitoring period. In contrast, higher elevations display substantially greater variability, with near-surface temperatures increasing from the low- to mid-50s°F in March to nearly 80°F by late July.

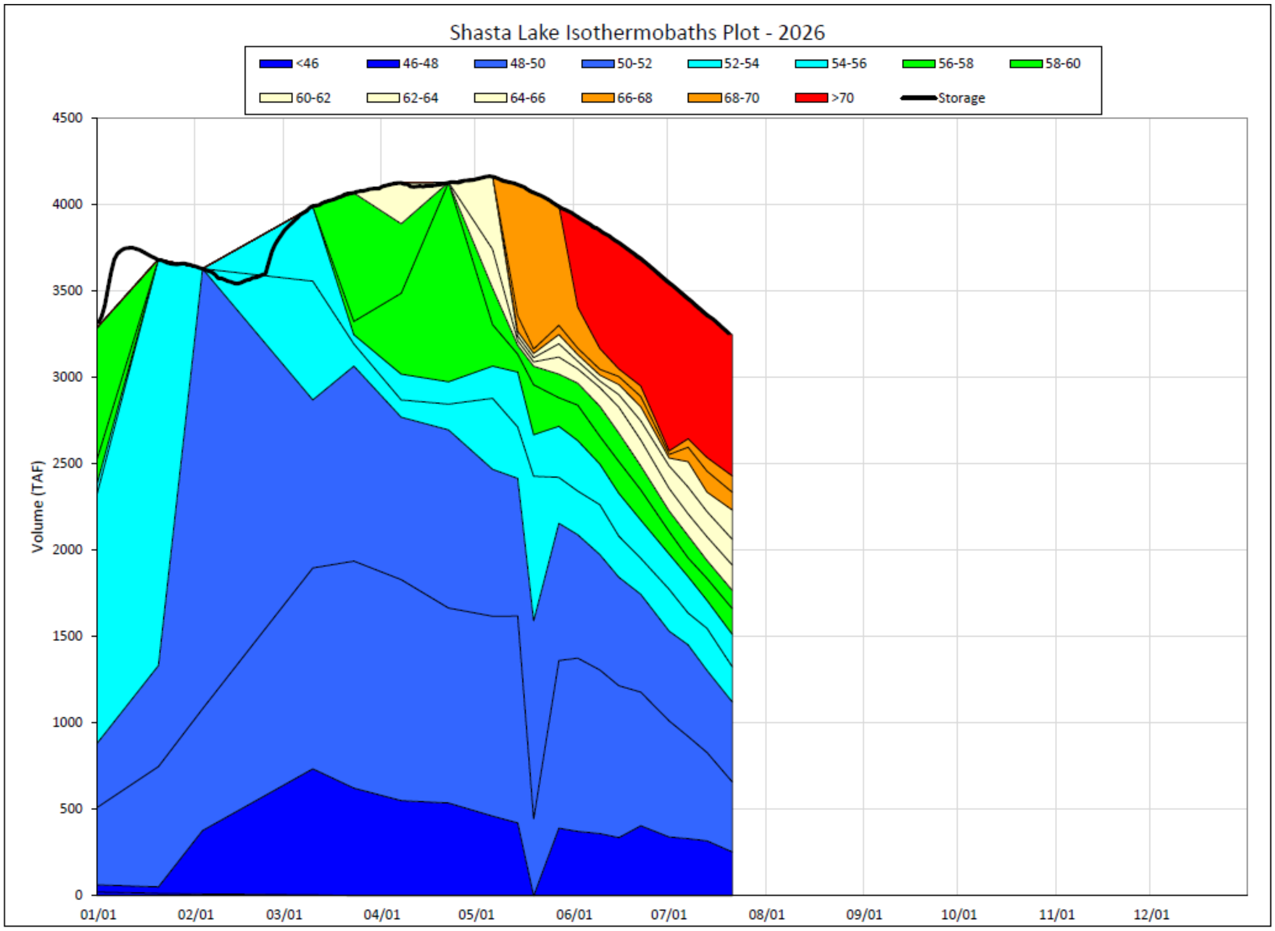

Figure 6. Shasta Lake Isothermobaths Plot - 2026

This chart illustrates the seasonal distribution of water temperatures and reservoir storage in Shasta Lake during 2026. Colored bands represent the volume of water within different temperature ranges, from less than 46°F (dark blue) to greater than 70°F (red), while the black line shows total reservoir storage. During winter and early spring, most of the reservoir volume is concentrated in cooler temperature ranges below 52°F. As the year progresses and storage increases to a peak in late spring, warmer water layers develop near the surface, with temperatures above 60°F becoming increasingly prominent. By early summer, a substantial volume of water exceeds 70°F, while a large cold-water pool below approximately 52°F remains at depth. Reservoir storage then gradually declines through July as thermal stratification becomes more pronounced, resulting in a greater separation between warm surface waters and cooler deep-water storage.

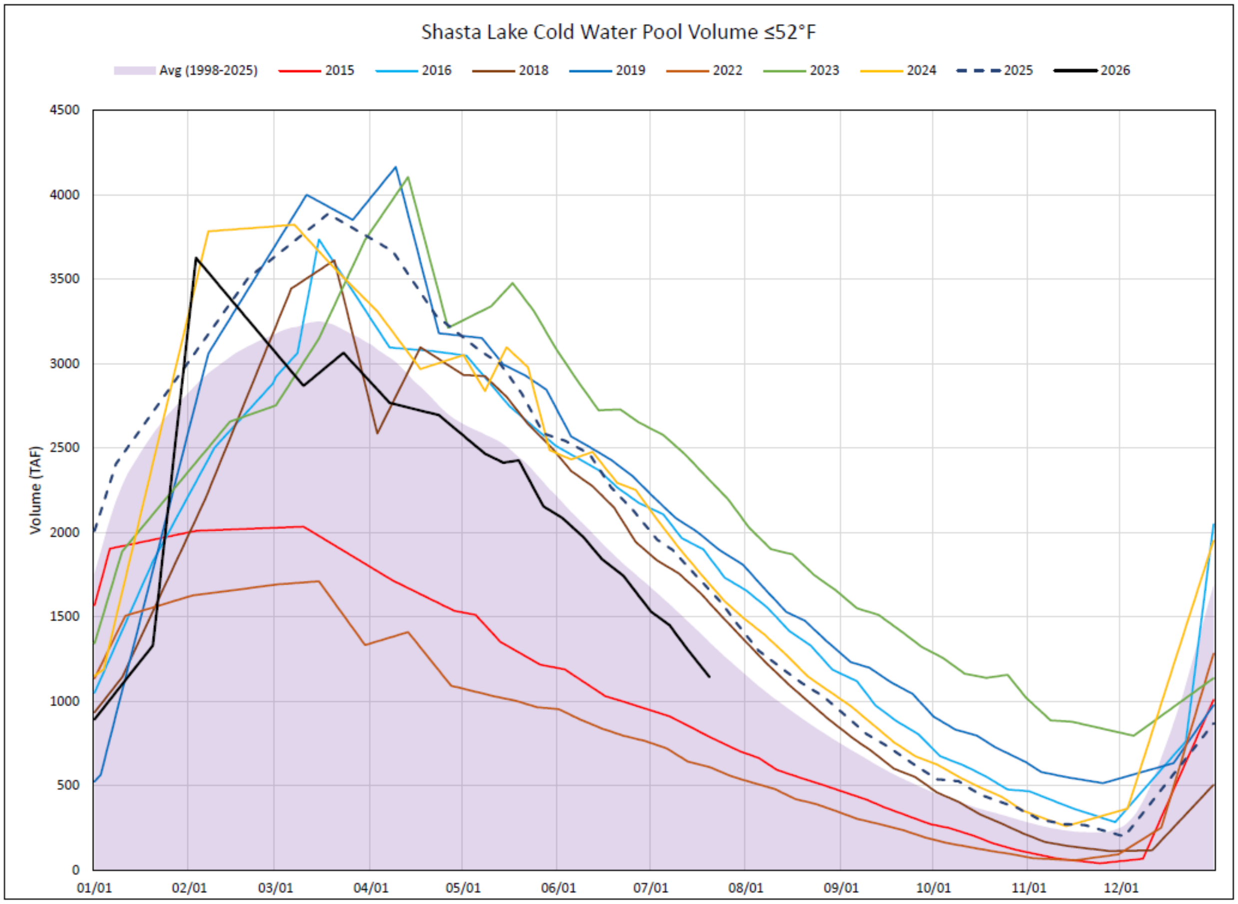

Figure 7. Shasta Lake Cold Water Pool Volume ≤52°F

This chart compares the estimated volume of Shasta Lake water colder than 52°F during 2026 (black line) with historical conditions, including the 1998–2025 average (shaded purple area) and selected water years. Cold-water pool volume increases during winter and early spring, peaking near 3.6 million acre-feet in early February before gradually declining through the spring and summer. By mid-July 2026, the cold-water pool volume decreases to approximately 1.1 million acre-feet. Overall, 2026 remains within the historical range but generally tracks below the long-term average during late spring and early summer, indicating faster seasonal depletion of cold-water storage compared with average conditions.

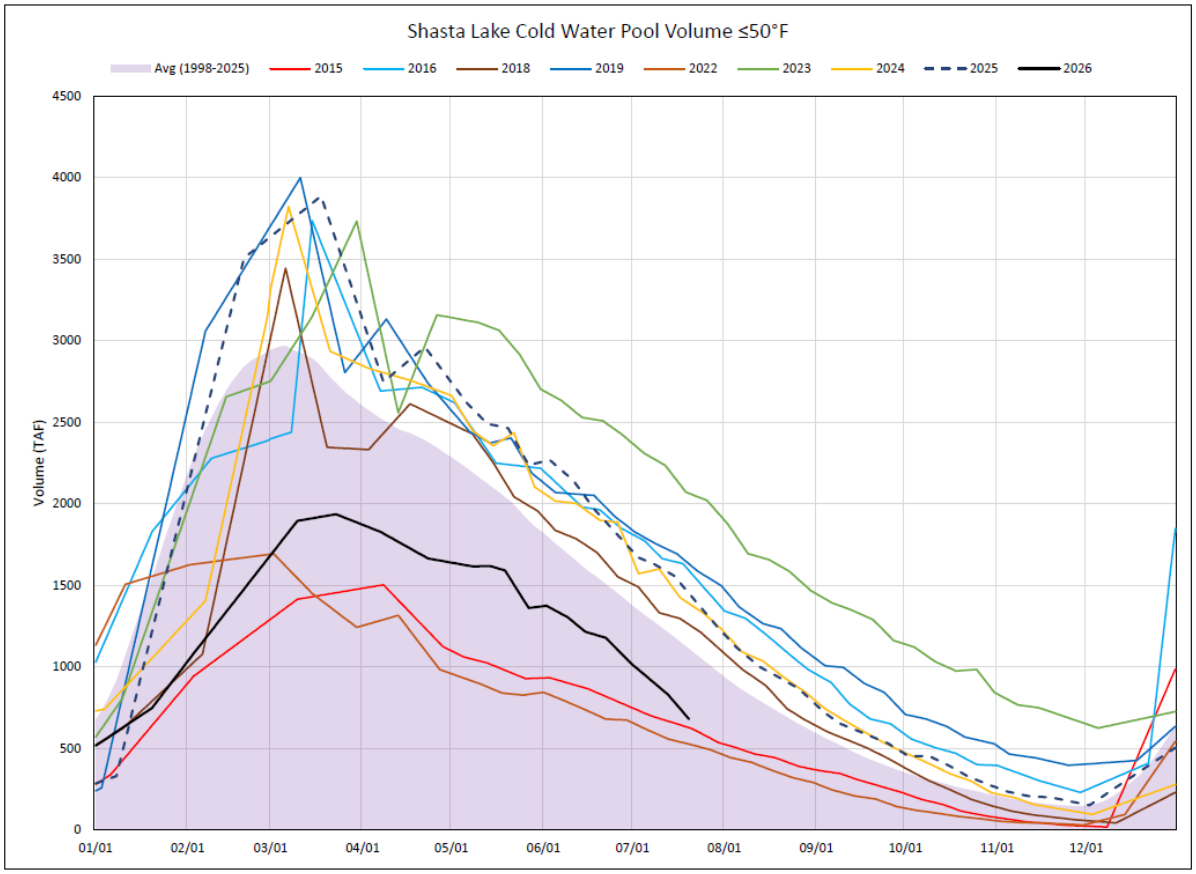

Figure 8. Shasta Lake Cold Water Pool Volume ≤50°F

This chart compares the estimated volume of Shasta Lake water colder than 50°F during 2026 (black line) with the historical average for 1998–2025 (shaded purple area) and selected water years. The cold-water pool volume increases during winter and early spring, reaching a peak of approximately 1.9 million acre-feet in March, before declining steadily through spring and summer. By mid-July 2026, the volume of water colder than 50°F decreases to roughly 700 thousand acre-feet. Compared with the historical average and most recent years shown, 2026 exhibits a smaller cold-water pool throughout much of the year, indicating below-average storage of the coldest reservoir water available for temperature management and downstream fisheries support.

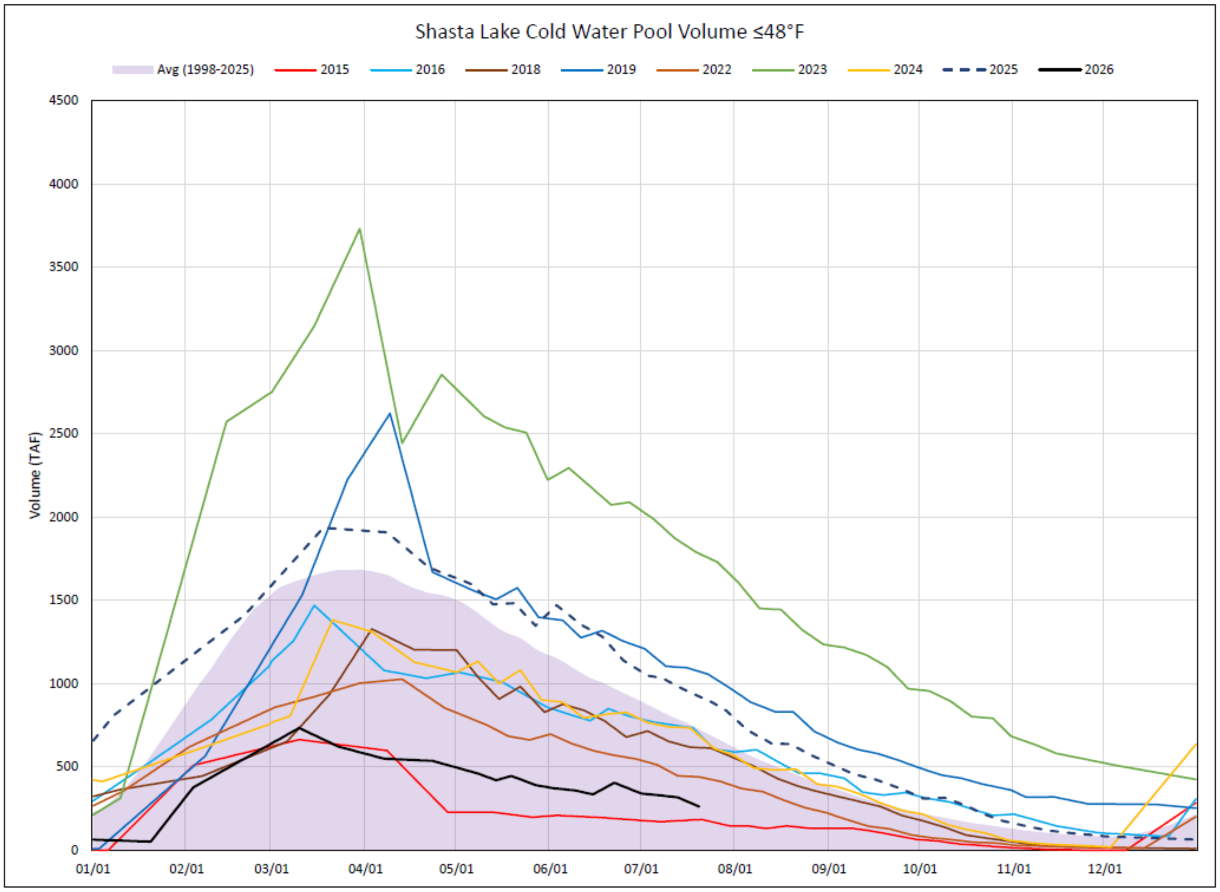

Figure 9. Shasta Lake Cold Water Pool Volume ≤48°F

This chart compares the estimated volume of Shasta Lake water colder than 48°F during 2026 (black line) with the historical average for 1998–2025 (shaded purple area) and selected water years. The volume of water below 48°F increases during winter and early spring, reaching about 650 thousand acre-feet in March, then gradually declines through spring and early summer to approximately 250 thousand acre-feet by mid-July. Compared with the historical average, the 2026 cold-water pool remains substantially smaller throughout most of the year and is lower than many recent water years shown. The chart indicates limited storage of the coldest water in 2026 and an earlier seasonal reduction in the volume of water below 48°F.

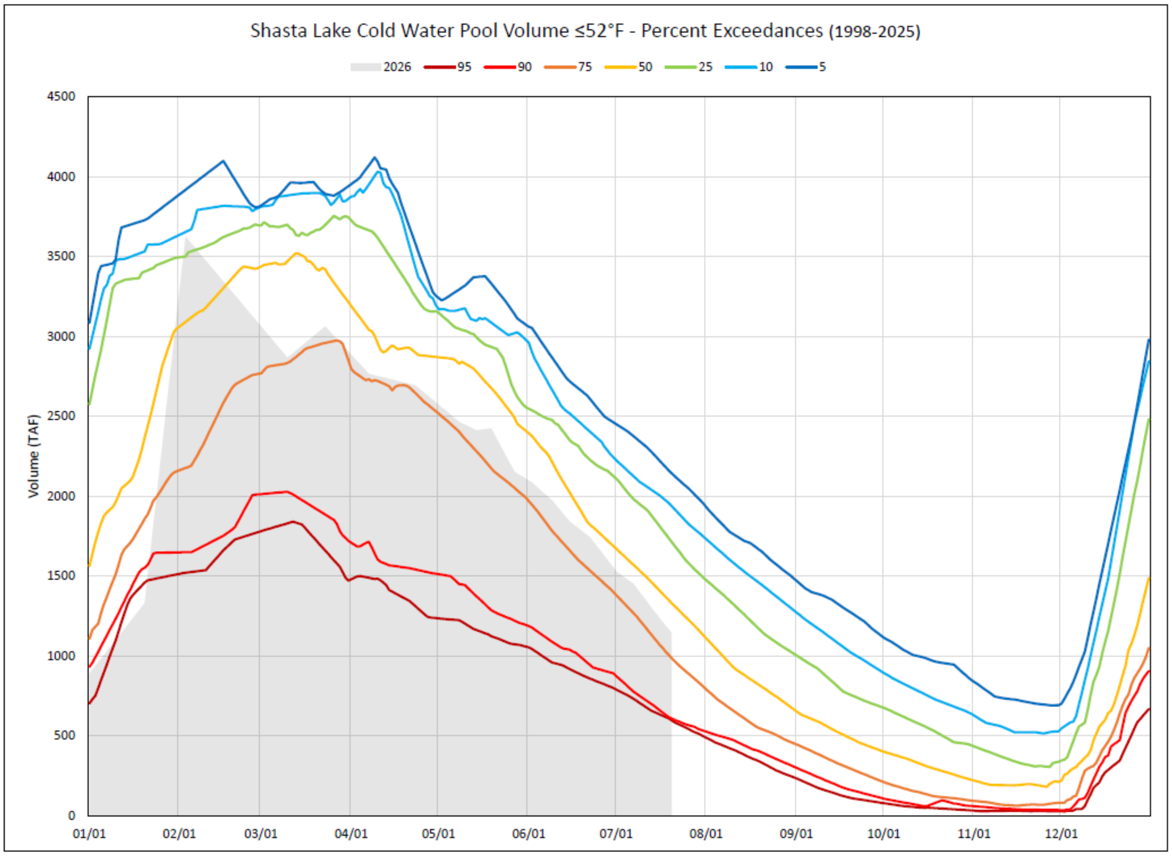

Figure 10. Shasta Lake Cold Water Pool Volume ≤52°F - Percent Exceedances (1998-2025)

This chart compares the 2026 volume of Shasta Lake water colder than 52°F (gray shaded area) with historical exceedance curves derived from 1998–2025 conditions. The colored lines represent percentile thresholds, ranging from the 95th percentile (lowest cold-water pool volumes) to the 5th percentile (highest cold-water pool volumes). In 2026, the cold-water pool volume increased during winter and spring, reaching approximately 3.5 million acre-feet in February, before steadily declining to about 1.1 million acre-feet by mid-July. Throughout most of the year shown, 2026 tracks near the middle of the historical range, generally between the 50th and 75th percentile exceedance levels, indicating below-average but not exceptionally low cold-water storage compared with historical conditions.

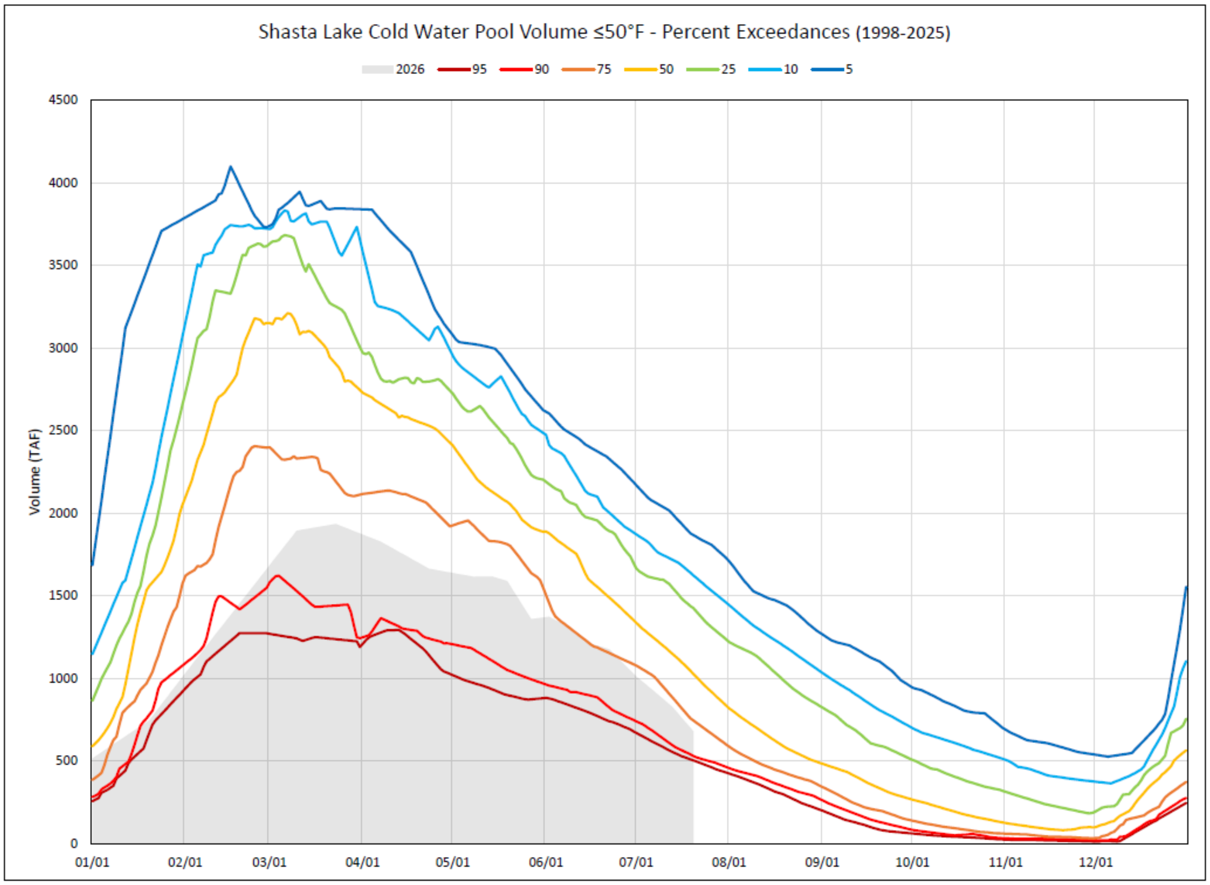

Figure 11. Shasta Lake Cold Water Pool Volume ≤50°F - Percent Exceedances (1998-2025)

This chart compares the 2026 volume of Shasta Lake water colder than 50°F (gray shaded area) with historical percentile exceedance curves calculated from 1998–2025 conditions. The colored lines represent percentile thresholds, from the 95th percentile (lowest cold-water pool volumes) to the 5th percentile (highest volumes). In 2026, the volume of water below 50°F increased to a seasonal peak of approximately 1.9 million acre-feet in March and then steadily declined to about 700 thousand acre-feet by mid-July. Throughout the period shown, 2026 remained near or below the 90th percentile exceedance level, indicating that the cold-water pool volume was lower than in most historical years and among the smaller volumes observed in the 1998–2025 record.

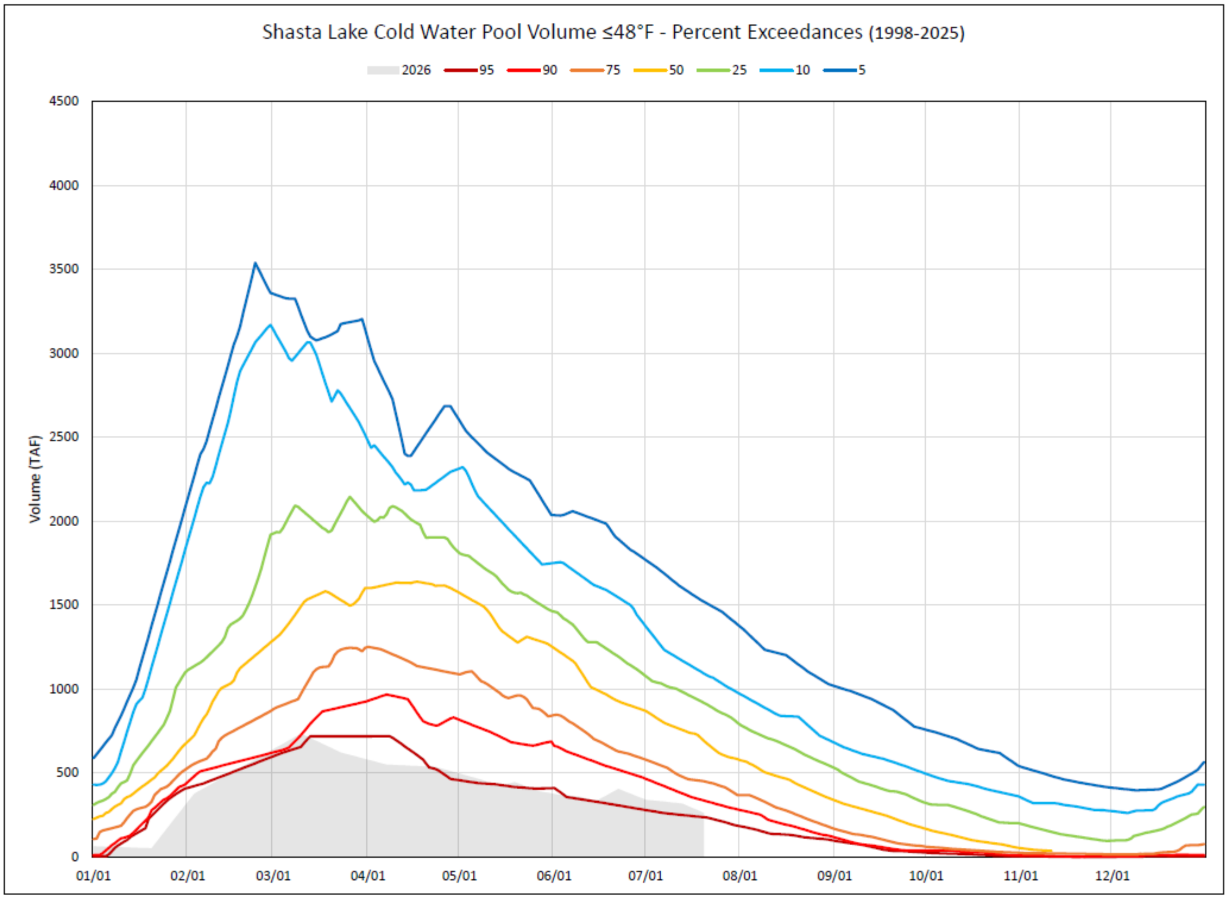

Figure 12. Shasta Lake Cold Water Pool Volume ≤48°F - Percent Exceedances (1998-2025)

This chart compares the 2026 volume of Shasta Lake water colder than 48°F (gray shaded area) with historical percentile exceedance curves based on 1998–2025 conditions. The colored lines represent percentile thresholds ranging from the 95th percentile (lowest cold-water pool volumes) to the 5th percentile (highest volumes). In 2026, the volume of water colder than 48°F increased during winter and early spring, peaking at approximately 700 thousand acre-feet in March, before declining to about 250 thousand acre-feet by mid-July. Throughout most of the period shown, 2026 remained near the 90th to 95th percentile exceedance levels, indicating that the volume of the coldest water in the reservoir was lower than in most historical years and among the smallest cold-water pools observed in the long-term record.

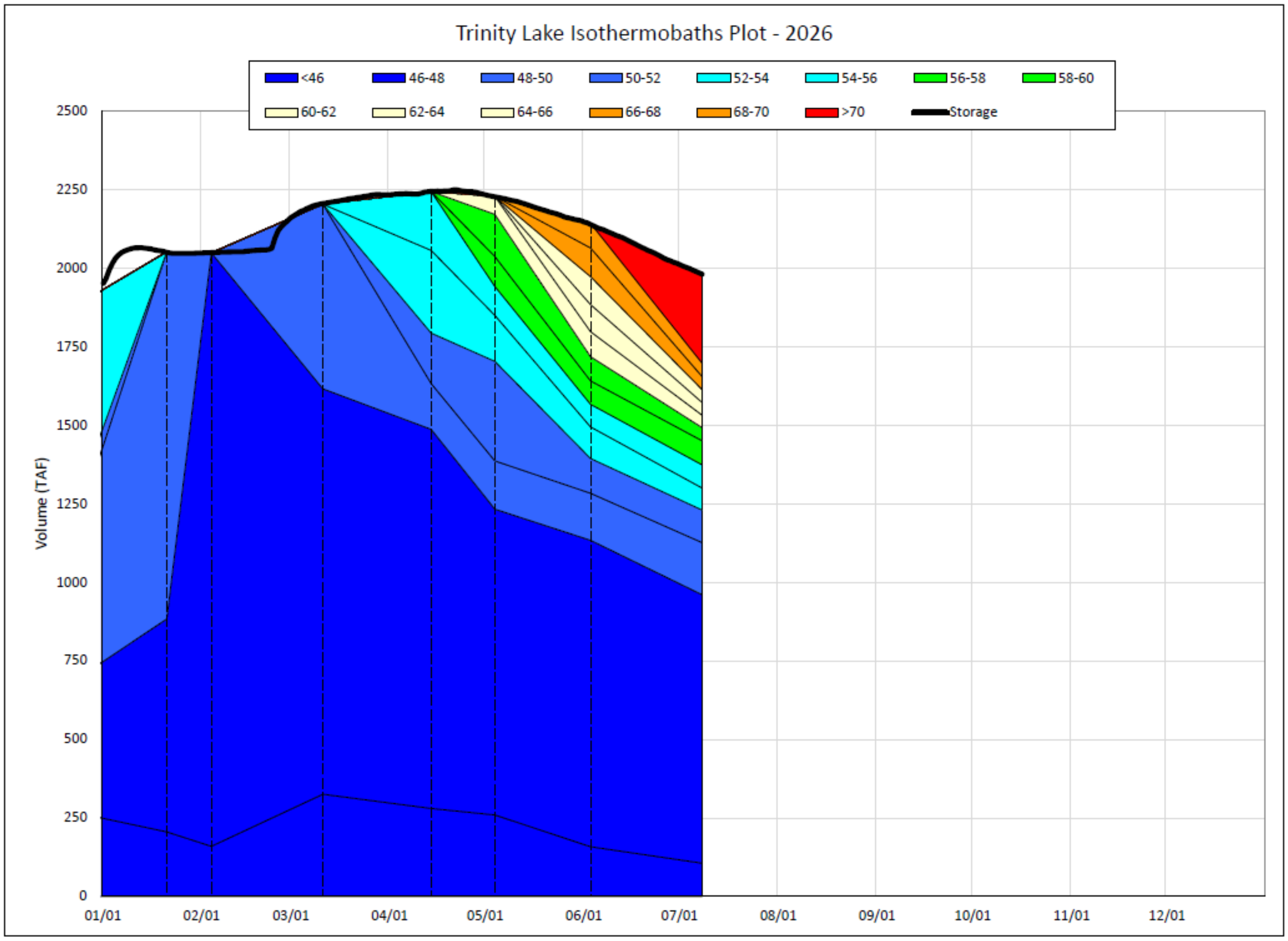

Figure 13. Trinity Lake Isothermobaths Plot - 2026

This chart illustrates the seasonal distribution of water temperatures and storage volume in Trinity Lake during 2026. Colored bands represent the volume of water within different temperature ranges, from less than 46°F (dark blue) to greater than 70°F (red), while the black line shows total reservoir storage. During winter and early spring, most of the reservoir volume is concentrated in colder temperature ranges below 50°F. As the reservoir fills and approaches peak storage in late spring, warmer water layers develop near the surface, with temperatures above 60°F becoming increasingly common. By early summer, a distinct warm surface layer exceeding 70°F is present, while a substantial volume of colder water below 50°F remains at depth. The chart shows increasing thermal stratification through the season, with warm surface waters expanding and cooler water becoming confined to deeper portions of the reservoir as storage gradually declines.

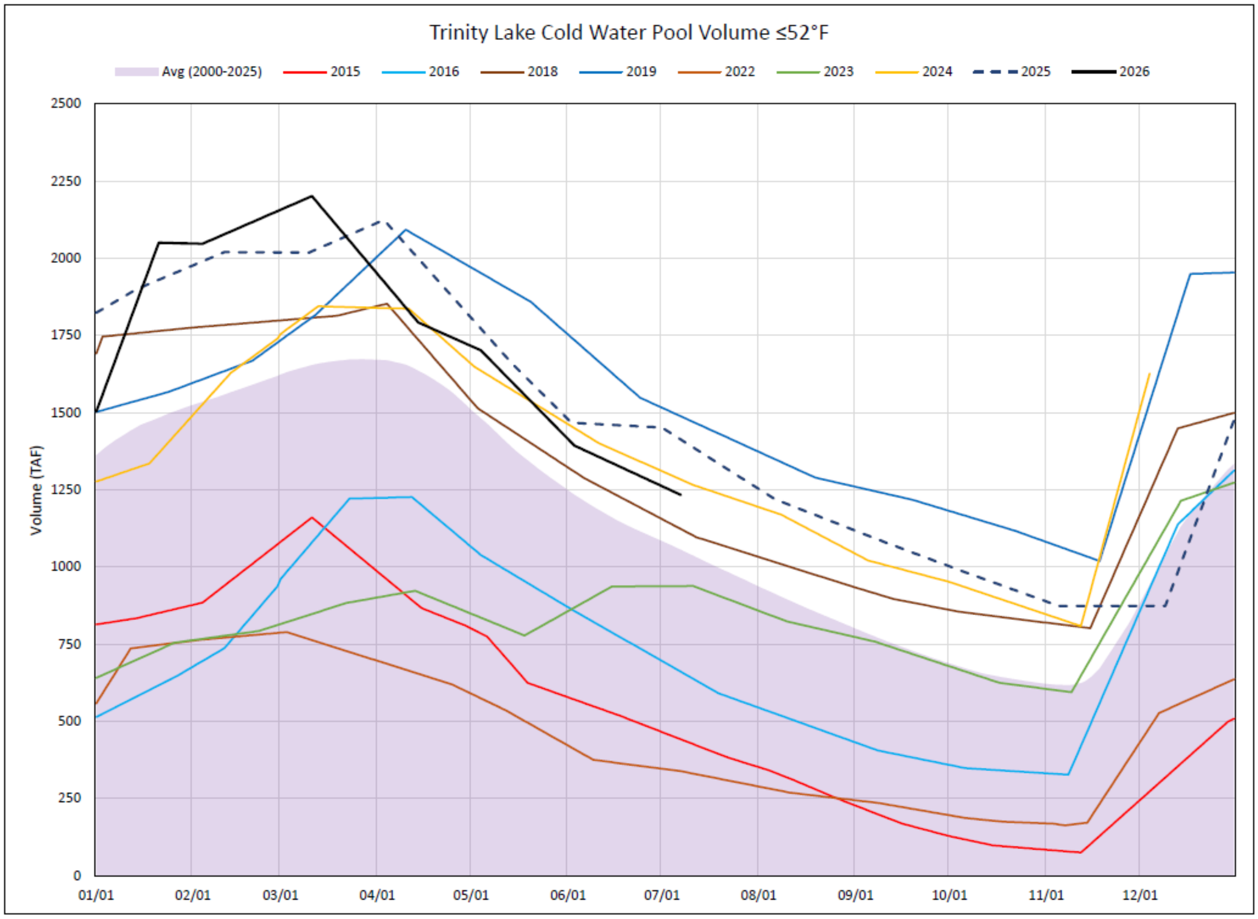

Figure 14. Trinity Lake Cold Water Pool Volume ≤52°F

This chart compares the estimated volume of Trinity Lake water colder than 52°F during 2026 (black line) with the long-term average for 2000–2025 (shaded purple area) and selected water years. The 2026 cold-water pool volume increased from approximately 1.5 million acre-feet in January to a peak of about 2.2 million acre-feet in March, then gradually declined to roughly 1.2 million acre-feet by mid-July. Throughout most of the period shown, 2026 remained above the historical average and among the higher cold-water pool volumes observed in recent years. The chart indicates that Trinity Lake maintained a relatively large volume of cold water during spring and early summer, although the cold-water pool decreased steadily as seasonal warming progressed.

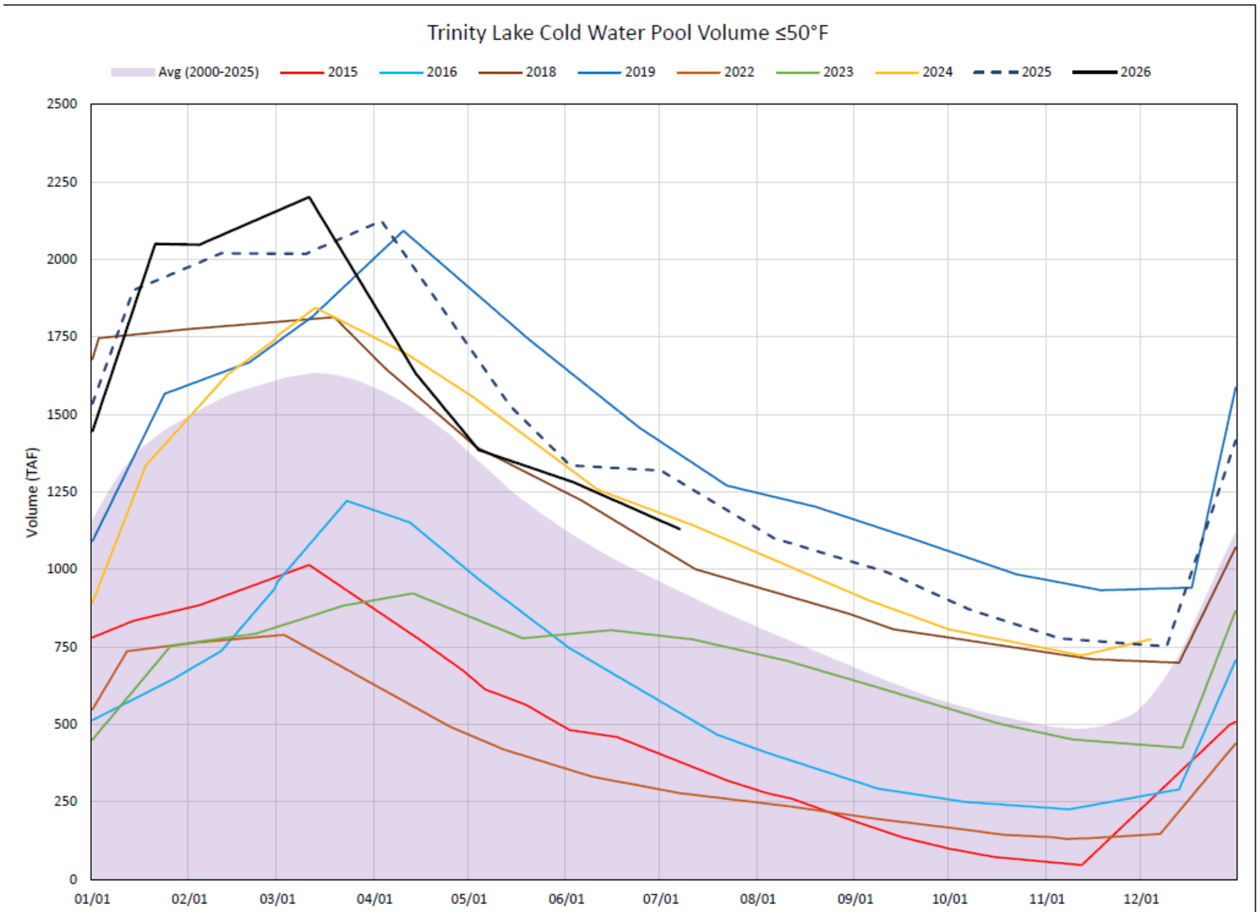

Figure 15. Trinity Lake Cold Water Pool Volume ≤50°F

This chart compares the estimated volume of Trinity Lake water colder than 50°F during 2026 (black line) with the long-term average for 2000–2025 (shaded purple area) and selected water years. The 2026 cold-water pool volume increased from approximately 1.4 million acre-feet in January to a peak of about 2.2 million acre-feet in March, then declined steadily to approximately 1.1 million acre-feet by early July. Throughout most of the period shown, 2026 remained above the historical average and near the upper range of recent years, indicating a relatively large volume of water colder than 50°F available during spring and early summer. The chart also shows a gradual seasonal reduction in cold-water storage as reservoir warming progressed.

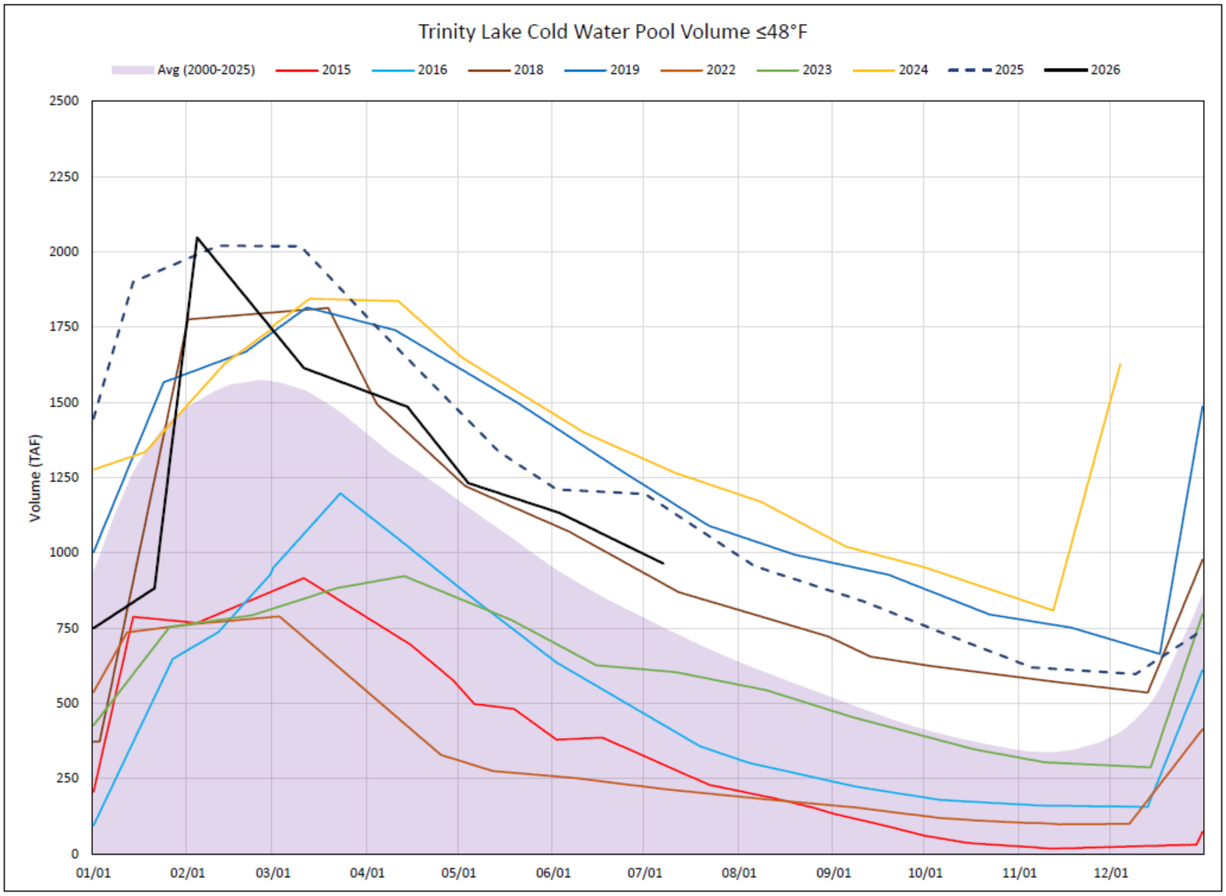

Figure 16. Trinity Lake Cold Water Pool Volume ≤48°F

This chart compares the estimated volume of Trinity Lake water colder than 48°F during 2026 (black line) with the long-term average for 2000–2025 (shaded purple area) and selected water years. The 2026 cold-water pool volume increased rapidly during winter, reaching a peak of approximately 2.0 million acre-feet in early February, then gradually declined to about 1.0 million acre-feet by mid-July. Throughout most of the period shown, 2026 remained above the historical average and among the higher cold-water pool volumes observed in recent years. The chart indicates that Trinity Lake maintained a relatively large volume of the coldest water through spring and early summer, although the volume steadily decreased as seasonal warming and reservoir stratification progressed.

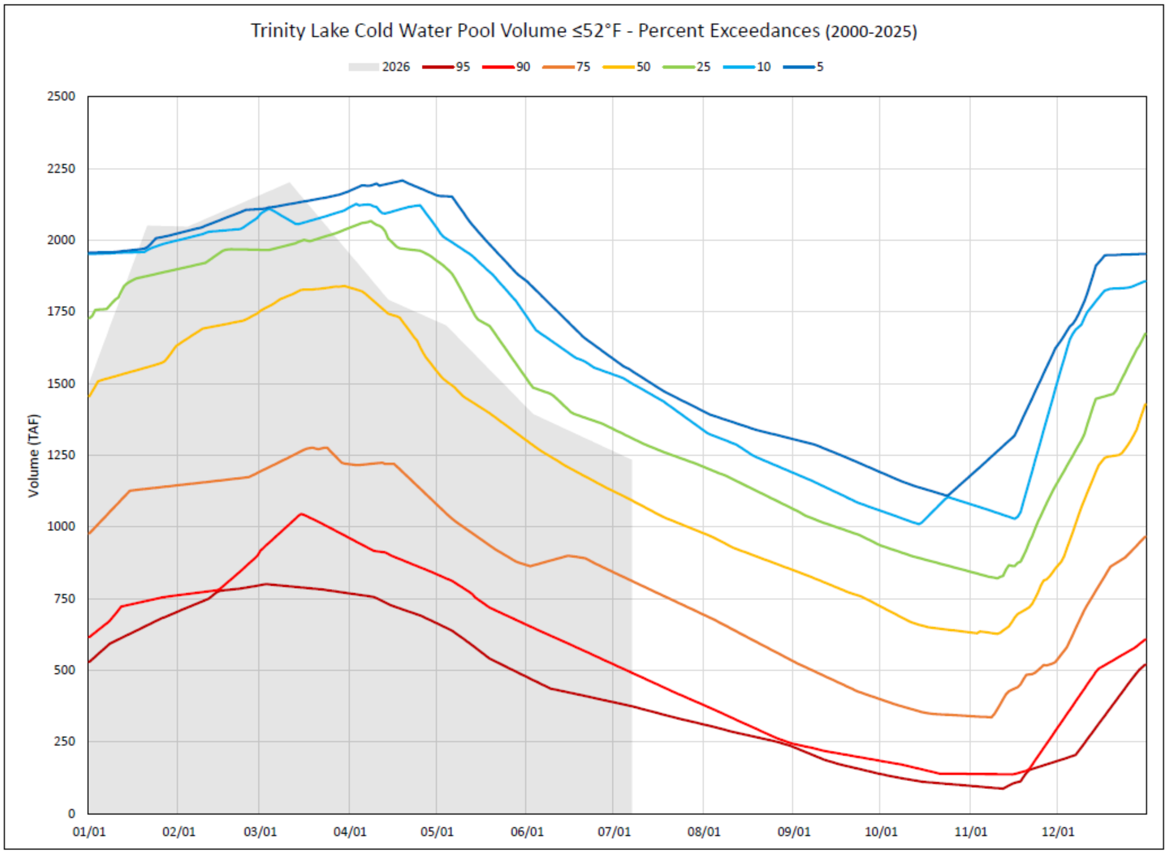

Figure 17. Trinity Lake Cold Water Pool Volume ≤52°F - Percent Exceedances (2000-2025)

This chart compares the 2026 volume of Trinity Lake water colder than 52°F (gray shaded area) with historical percentile exceedance curves derived from conditions between 2000 and 2025. Colored lines represent percentile thresholds, ranging from the 95th percentile (lowest cold-water pool volumes) to the 5th percentile (highest volumes). During 2026, the cold-water pool increased from approximately 1.5 million acre-feet in January to a peak near 2.2 million acre-feet in March, then declined to about 1.2 million acre-feet by mid-July. Throughout most of the period shown, 2026 remained between the 25th and 10th percentile exceedance levels, indicating above-average cold-water storage compared with the historical record and relatively favorable cold-water pool conditions through spring and early summer.

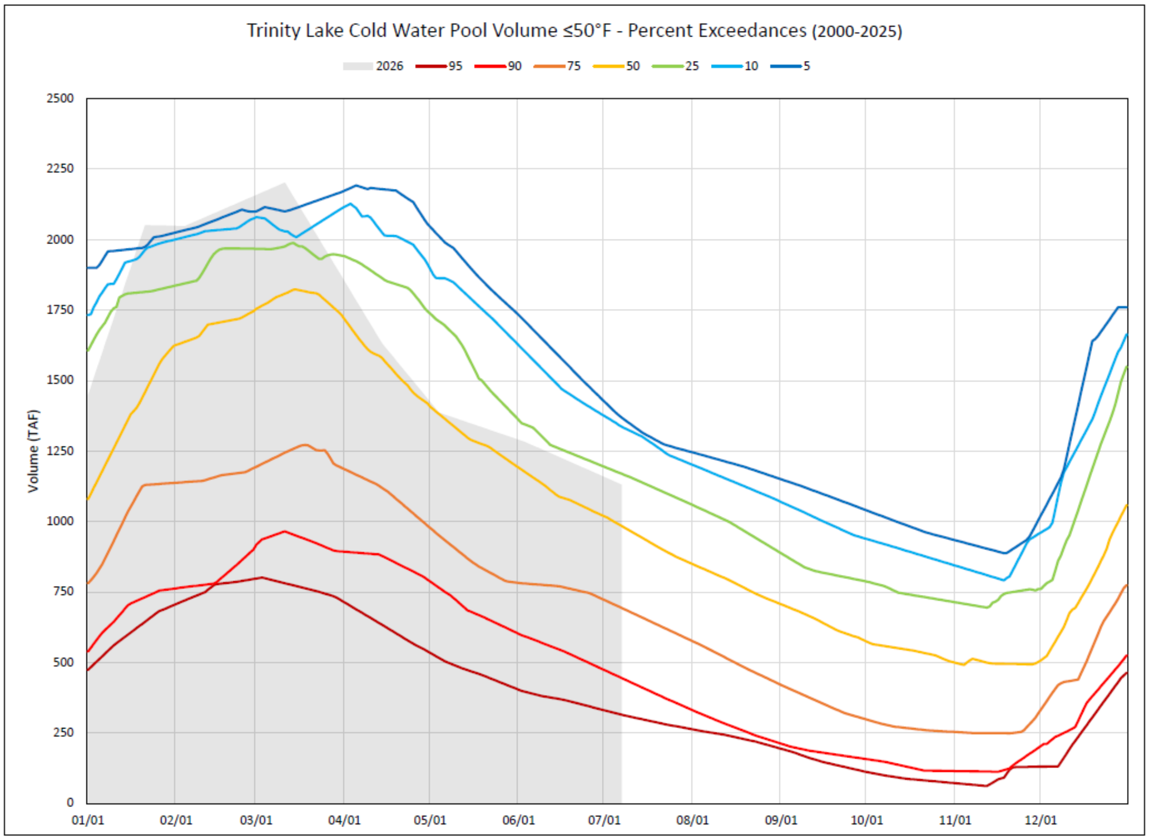

Figure 18. Trinity Lake Cold Water Pool Volume ≤50°F - Percent Exceedances (2000-2025)

This chart compares the 2026 volume of Trinity Lake water colder than 50°F (gray shaded area) with historical percentile exceedance curves derived from 2000–2025 conditions. The colored lines represent percentile thresholds, ranging from the 95th percentile (lowest cold-water pool volumes) to the 5th percentile (highest volumes). In 2026, the cold-water pool increased from approximately 1.5 million acre-feet in January to a peak near 2.2 million acre-feet in March, then gradually declined to about 1.1 million acre-feet by mid-July. Throughout most of the period shown, 2026 remained between the 25th and 10th percentile exceedance levels and near the upper portion of the historical range, indicating above-average storage of water colder than 50°F compared with most years in the record. The chart shows that Trinity Lake maintained relatively favorable cold-water pool conditions through spring and early summer despite a steady seasonal decline in volume.

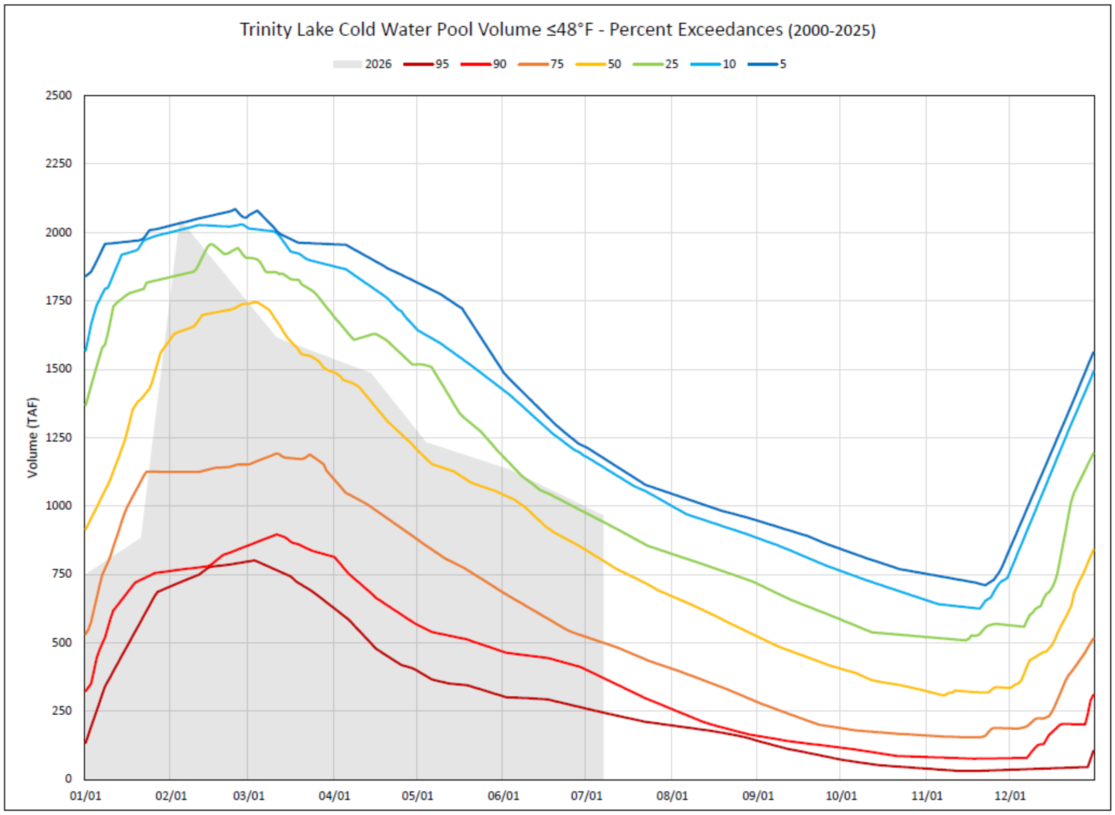

Figure 19. Trinity Lake Cold Water Pool Volume ≤48°F - Percent Exceedances (2000-2025)

This chart compares the 2026 volume of Trinity Lake water colder than 48°F (gray shaded area) with historical percentile exceedance curves based on conditions from 2000–2025. The colored lines represent percentile thresholds ranging from the 95th percentile (lowest cold-water pool volumes) to the 5th percentile (highest volumes). In 2026, the volume of water colder than 48°F increased from about 750 thousand acre-feet in January to a peak near 2.0 million acre-feet in February, then gradually declined to approximately 950 thousand acre-feet by mid-July. Throughout most of the period shown, 2026 tracked between the 25th and 10th percentile exceedance levels, indicating above-average storage of the coldest water compared with the historical record. The chart shows that Trinity Lake maintained relatively strong cold-water pool conditions through spring and early summer, despite a steady seasonal decline in volume as reservoir temperatures increased.

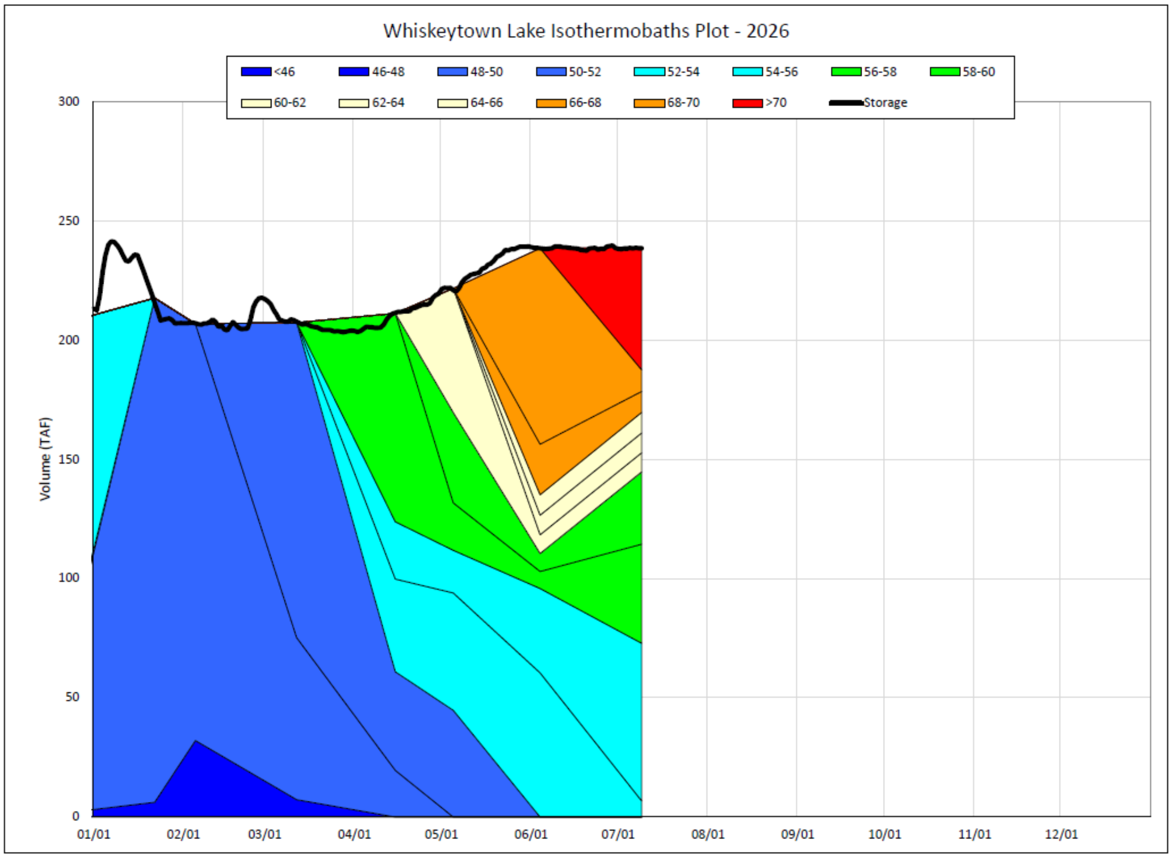

Figure 20. Whiskeytown Lake Isothermobaths Plot – 2026

This chart illustrates the seasonal distribution of water temperatures and storage volume in Whiskeytown Lake during 2026. Colored bands represent the volume of water within different temperature ranges, from less than 46°F (dark blue) to greater than 70°F (red), while the black line shows total reservoir storage. During winter and early spring, most of the reservoir volume is concentrated in cooler temperature ranges below 52°F. As the year progresses, warmer water layers develop and expand, with temperatures above 60°F appearing by late spring and temperatures exceeding 70°F present by early summer. At the same time, the volume of the coldest water decreases and becomes confined to a smaller portion of the reservoir. Reservoir storage remains relatively stable, ranging from approximately 205 to 240 thousand acre-feet, while thermal stratification becomes increasingly pronounced through June and early July.

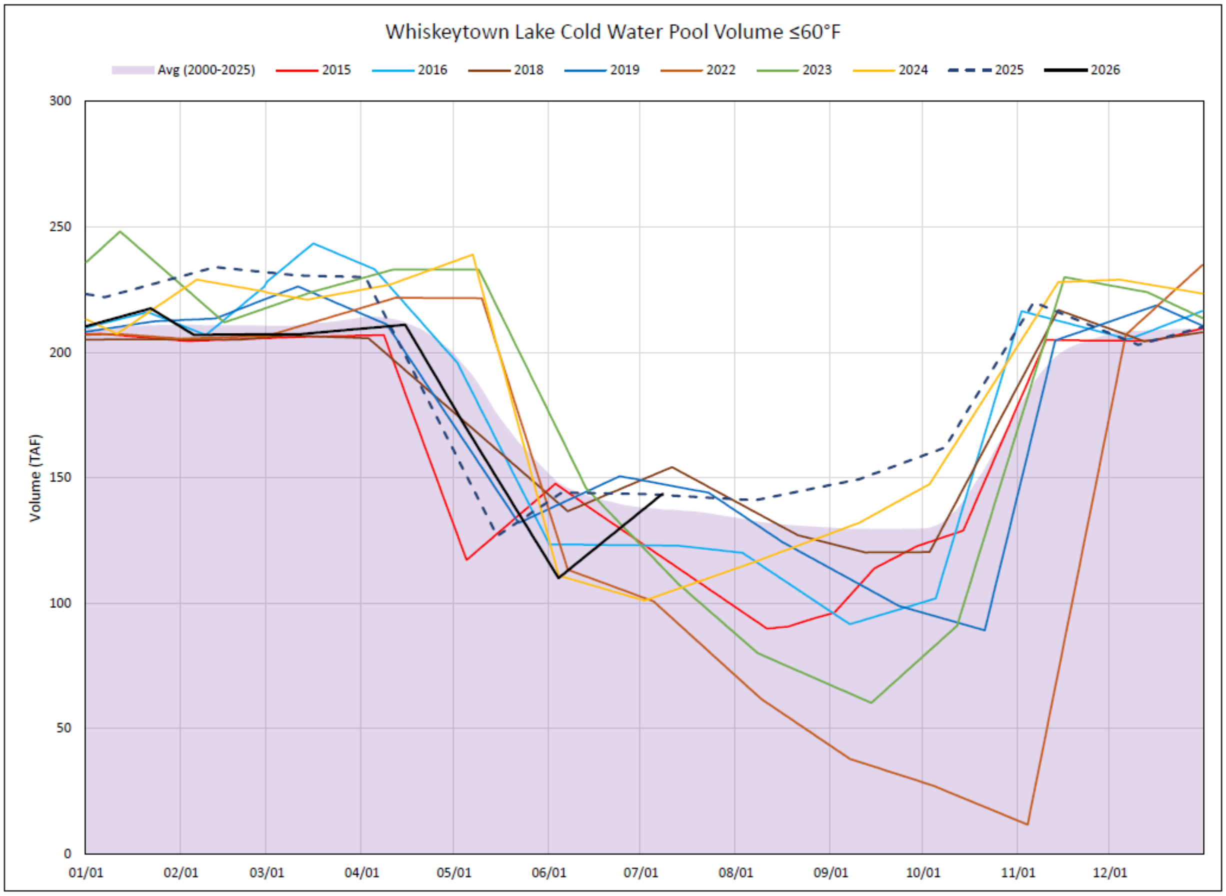

Figure 21. Whiskeytown Lake Cold Water Pool Volume ≤60°F

This chart compares the estimated volume of Whiskeytown Lake water colder than 60°F during 2026 (black line) with the long-term average for 2000–2025 (shaded purple area) and selected water years. The 2026 cold-water pool remained near full reservoir storage, approximately 205 to 210 thousand acre-feet, through late April before declining to about 110 thousand acre-feet in early June as seasonal warming increased. The volume then recovered slightly to approximately 140 thousand acre-feet by mid-July. Overall, 2026 tracked close to the historical average during winter and spring and remained within the range of recent years, indicating generally typical cold-water pool conditions in Whiskeytown Lake during the period shown.

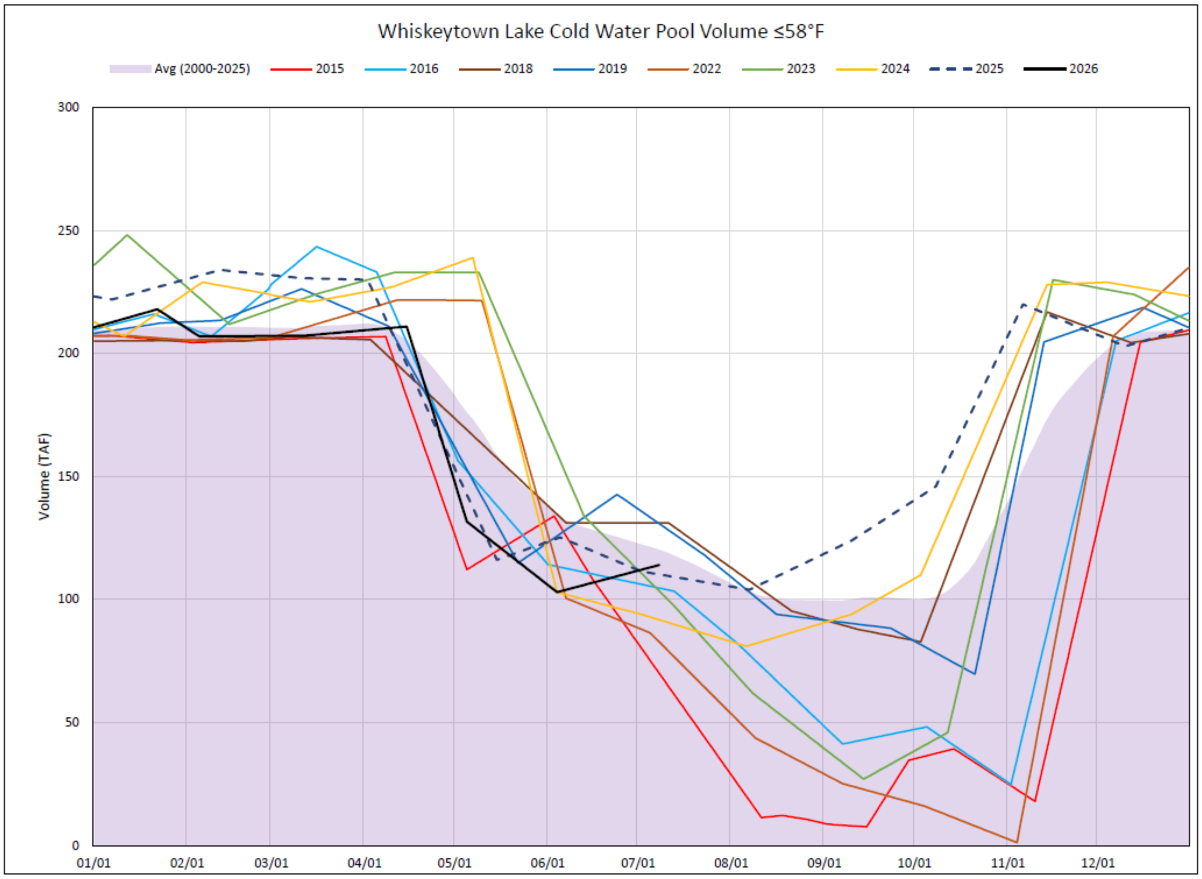

Figure 22. Whiskeytown Lake Cold Water Pool Volume ≤58°F

This chart compares the estimated volume of Whiskeytown Lake water colder than 58°F during 2026 (black line) with the long-term average for 2000–2025 (shaded purple area) and selected water years. The 2026 cold-water pool remained near full reservoir storage, approximately 205 to 210 thousand acre-feet, through late April before declining rapidly to about 100 thousand acre-feet in early June as reservoir temperatures warmed. The volume then increased slightly to approximately 110 thousand acre-feet by mid-July. Overall, 2026 tracked close to the historical average during winter and spring and remained within the range of recent years. The chart indicates that while the volume of water colder than 58°F decreased substantially during late spring and early summer, cold-water pool conditions remained generally comparable to typical historical conditions for the period shown.

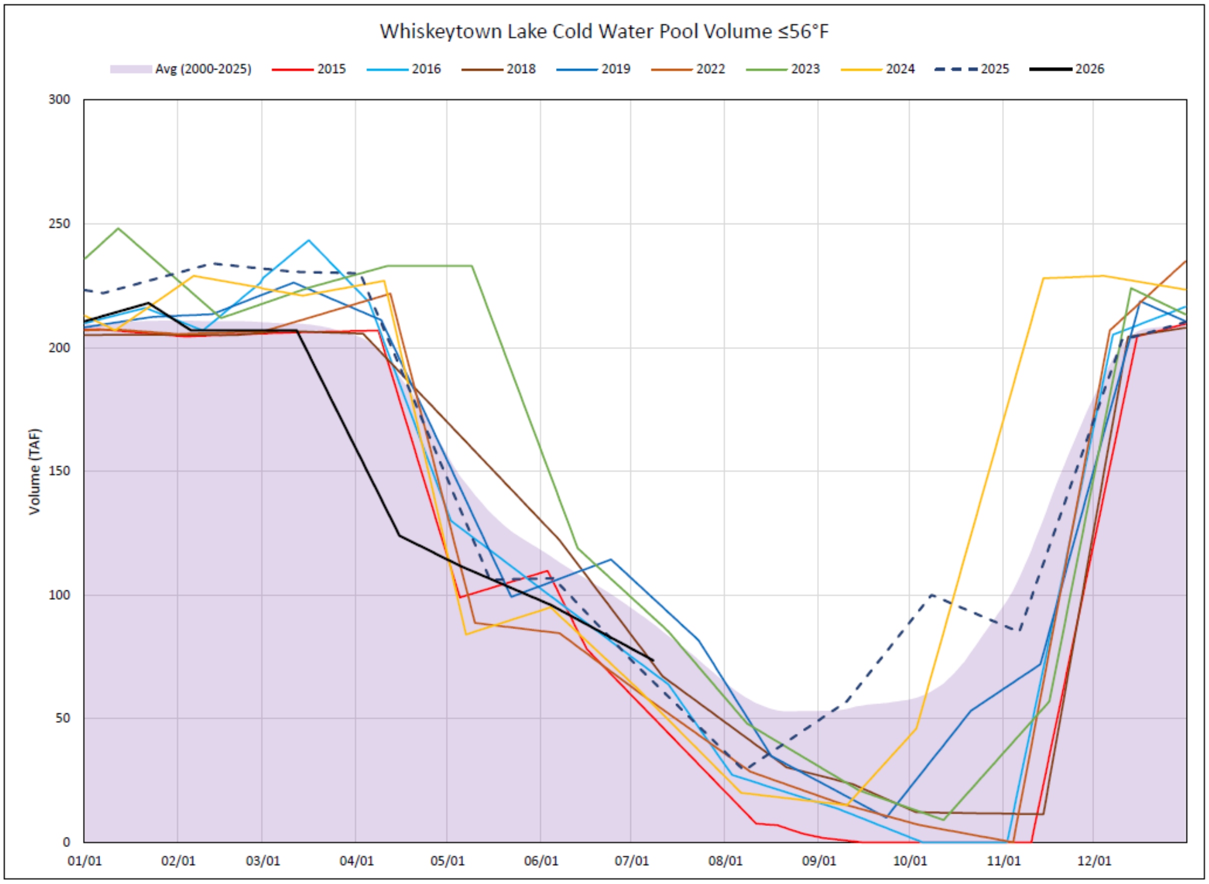

Figure 23. Whiskeytown Lake Cold Water Pool Volume ≤56°F

This chart compares the estimated volume of Whiskeytown Lake water colder than 56°F during 2026 (black line) with the long-term average for 2000–2025 (shaded purple area) and selected water years. The 2026 cold-water pool remained near 205 thousand acre-feet through late March, then declined steadily during spring and early summer, reaching approximately 75 thousand acre-feet by mid-July. Compared with the historical average, 2026 tracked near typical conditions during winter and early spring but fell below average during late spring as the volume of water colder than 56°F decreased. The chart shows a seasonal reduction in cold-water storage associated with reservoir warming, while remaining within the range of conditions observed in recent years.

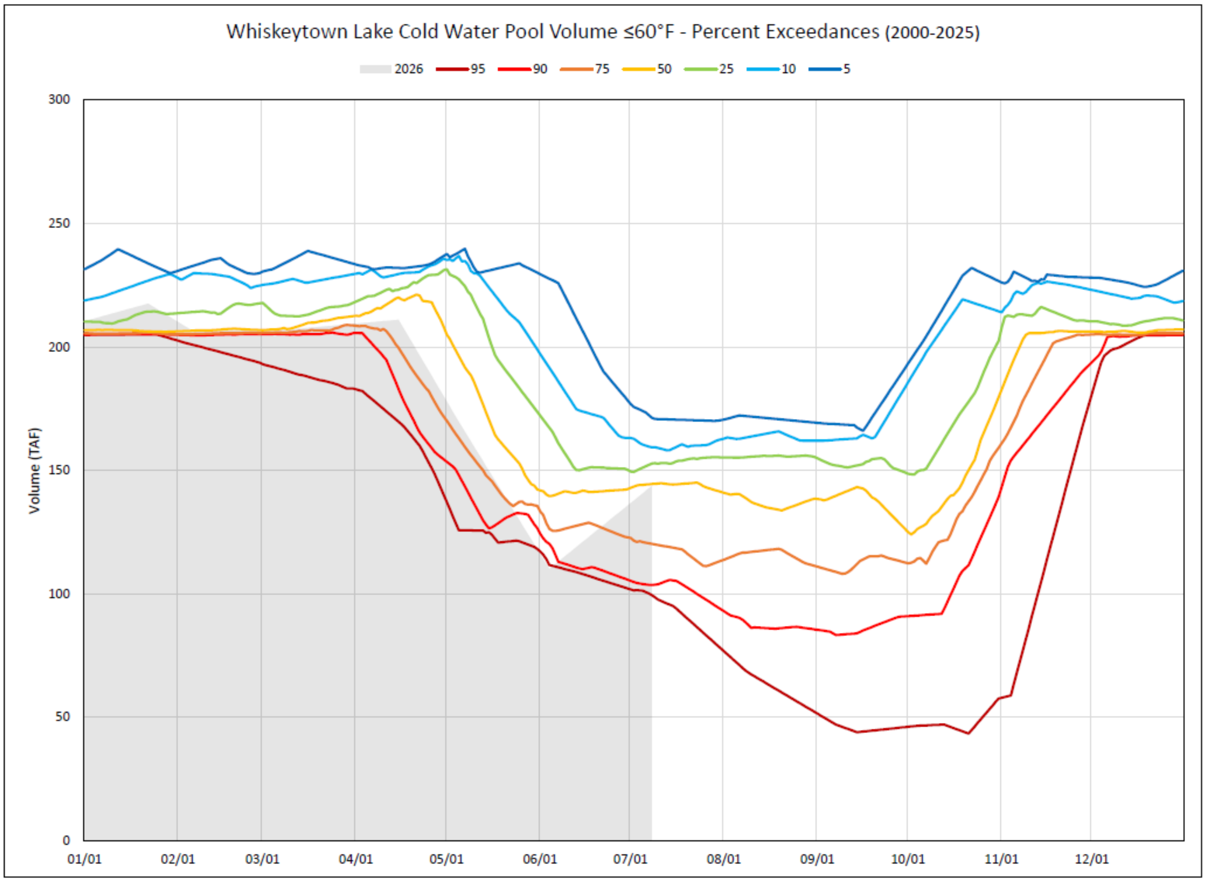

Figure 24. Whiskeytown Lake Cold Water Pool Volume ≤60°F - Percent Exceedances (2000-2025)

This chart compares the 2026 volume of Whiskeytown Lake water colder than 60°F (gray shaded area) with historical percentile exceedance curves based on conditions from 2000–2025. Colored lines represent percentile thresholds ranging from the 95th percentile (lowest cold-water pool volumes) to the 5th percentile (highest volumes). During 2026, the volume of water colder than 60°F remained near 205 thousand acre-feet through late April, declined to approximately 110 thousand acre-feet in early June, and then increased to about 145 thousand acre-feet by mid-July. Throughout the period shown, 2026 generally tracked between the 75th and 50th percentile exceedance levels, indicating near-average to slightly below-average cold-water pool conditions compared with the historical record. The chart shows a seasonal reduction in cold-water storage during late spring and early summer, consistent with reservoir warming.

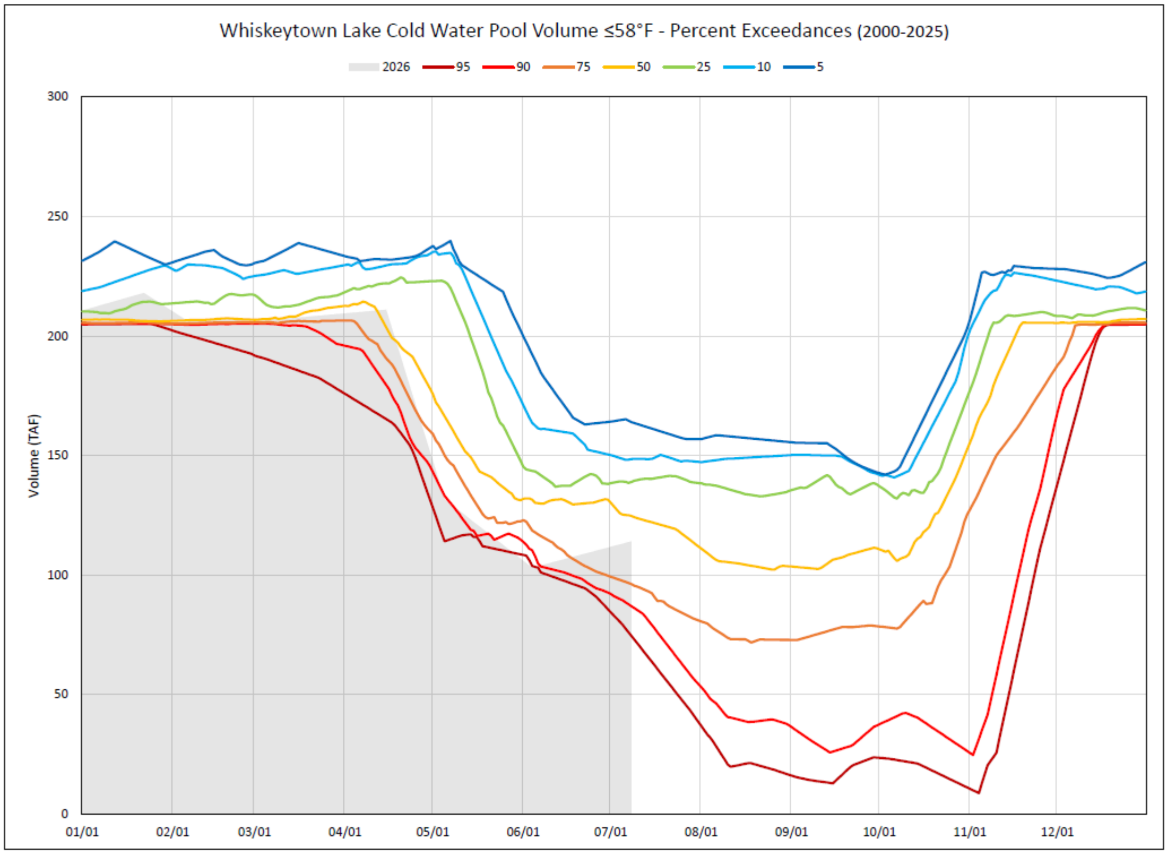

Figure 25. Whiskeytown Lake Cold Water Pool Volume ≤58°F - Percent Exceedances (2000-2025)

This chart compares the 2026 volume of Whiskeytown Lake water colder than 58°F (gray shaded area) with historical percentile exceedance curves based on conditions from 2000–2025. Colored lines represent percentile thresholds ranging from the 95th percentile (lowest cold-water pool volumes) to the 5th percentile (highest volumes). In 2026, the volume of water colder than 58°F remained near 205 thousand acre-feet through late April, then declined to approximately 100 thousand acre-feet by early June before increasing slightly to about 115 thousand acre-feet by mid-July. Throughout most of the period shown, 2026 tracked near the 75th percentile exceedance level, indicating somewhat below-average cold-water pool volumes compared with the historical record. The chart shows a seasonal reduction in cold-water storage during late spring and early summer as reservoir temperatures increased, while remaining within the historical range of observed conditions.

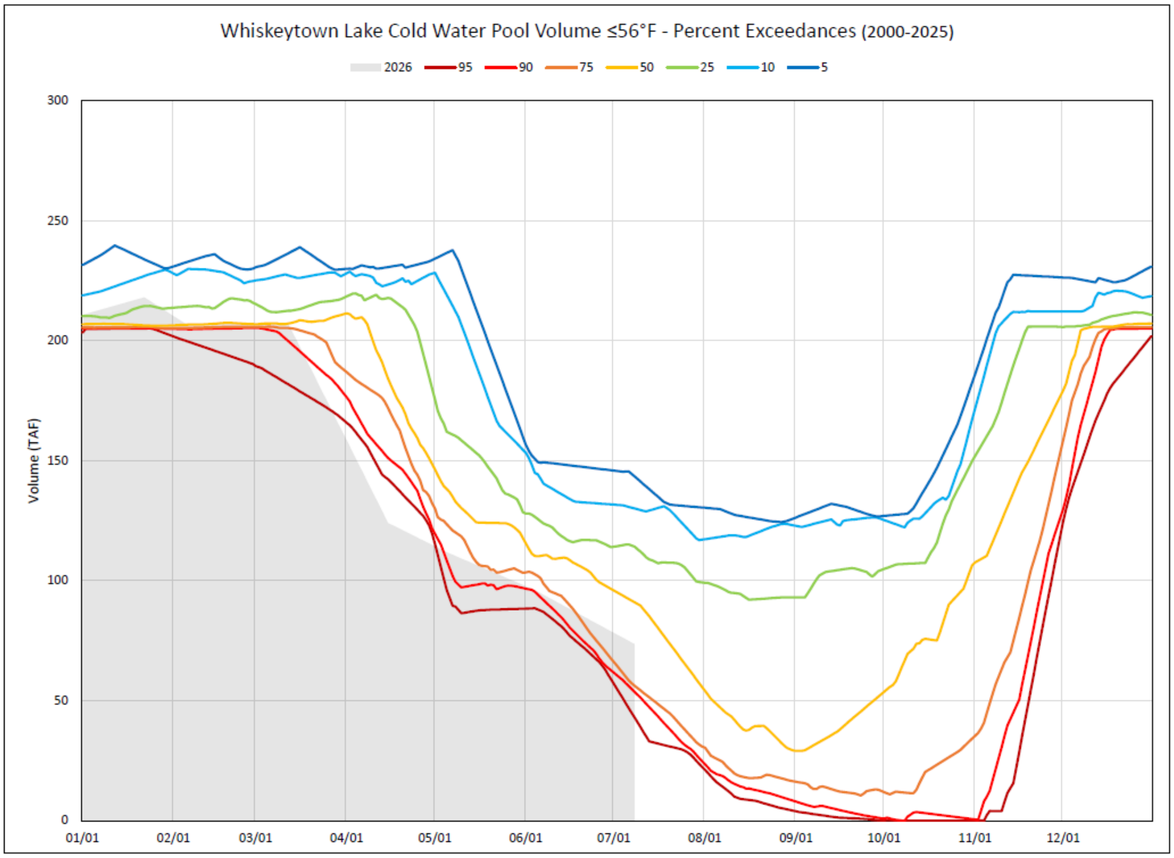

Figure 26. Whiskeytown Lake Cold Water Pool Volume ≤58°F - Percent Exceedances (2000-2025)

This chart compares the 2026 volume of Whiskeytown Lake water colder than 56°F (gray shaded area) with historical percentile exceedance curves based on conditions from 2000–2025. The colored lines represent percentile thresholds, ranging from the 95th percentile (lowest cold-water pool volumes) to the 5th percentile (highest volumes). In 2026, the volume of water colder than 56°F remained near 205 thousand acre-feet through late March, then declined steadily during spring, reaching approximately 75 thousand acre-feet by mid-July. Throughout the period shown, 2026 generally tracked between the 75th and 90th percentile exceedance levels, indicating below-average storage of water colder than 56°F compared with the historical record. The chart shows a seasonal reduction in the cold-water pool as reservoir temperatures increased, with 2026 conditions remaining within the range of historical variability but trending toward the lower end of the distribution.

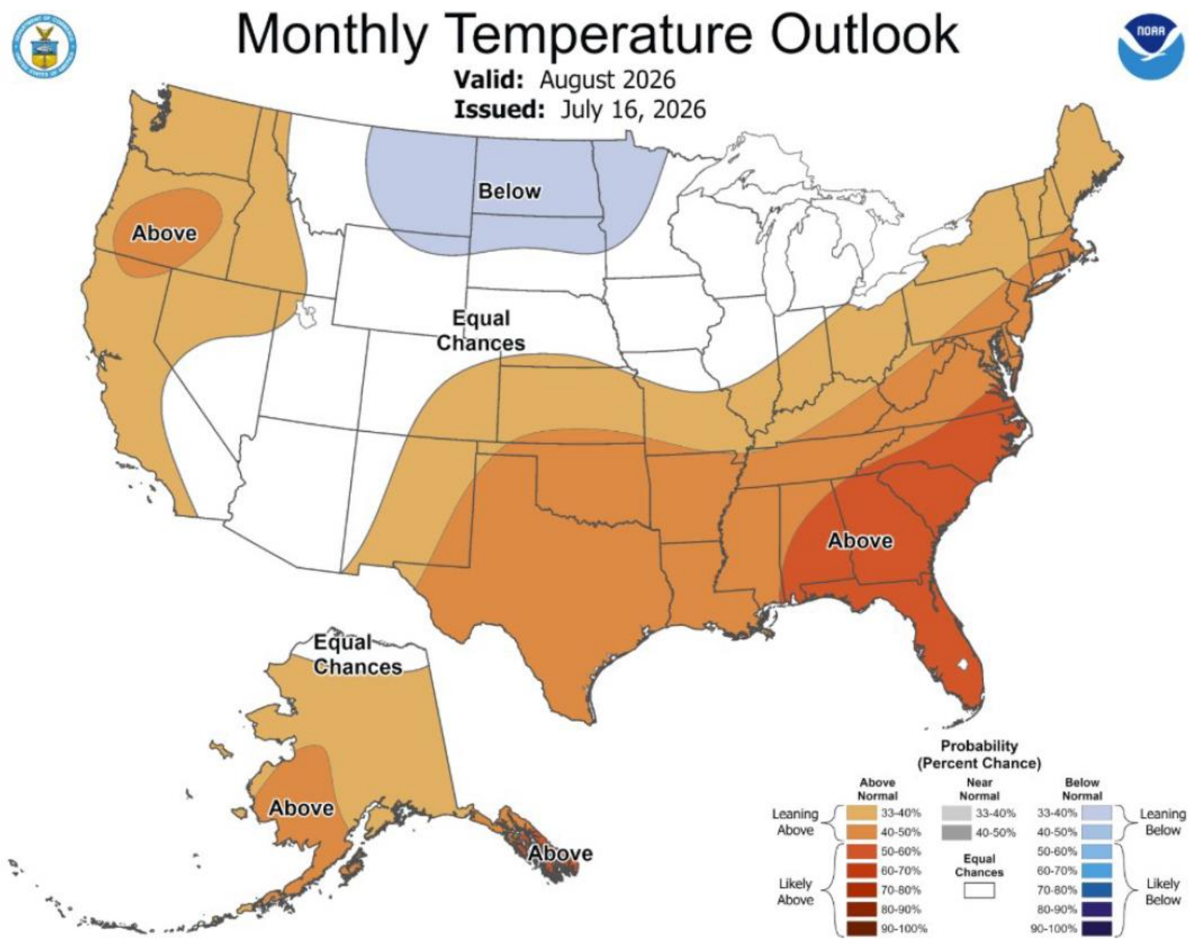

Figure 27. Monthly Temperature Outlook

The NOAA Climate Prediction Center's August 2026 Monthly Temperature Outlook indicates an increased likelihood of above-normal temperatures across much of the southern and eastern United States, including the Southeast, Gulf Coast, Mid-Atlantic, and portions of the Northeast. Forecast probabilities for above-normal temperatures generally range from 33% to 60%, with the highest confidence centered over the southeastern Atlantic Coast and parts of Florida, Georgia, and the Carolinas. Above-normal temperatures are also favored across much of the Pacific Northwest and portions of Alaska. In contrast, a broad area of the northern Great Plains and northern Rocky Mountains is forecast to have an increased likelihood of below-normal temperatures, with probabilities generally ranging from 33% to 50%. Much of the central United States, including portions of the Plains, Midwest, and interior West, is classified as having equal chances of above-, near-, or below-normal temperatures, indicating no strong temperature signal for August 2026.

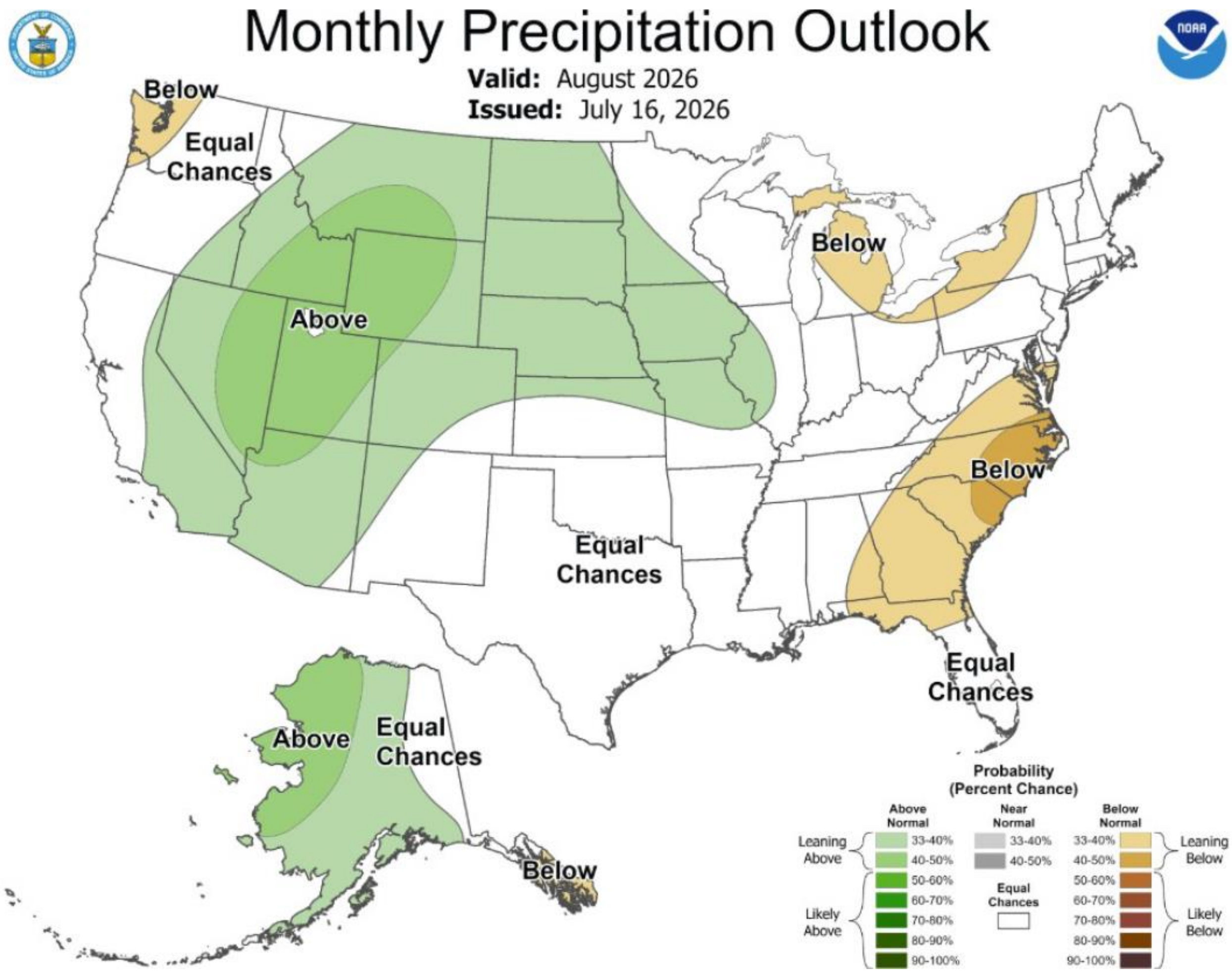

Figure 28. Monthly Precipitation Outlook

This NOAA Climate Prediction Center August 2026 Monthly Precipitation Outlook indicates an increased likelihood of above-normal precipitation across portions of the western United States, including the Great Basin, central Rocky Mountains, and northern Plains, as well as parts of Alaska. Forecast probabilities for above-normal precipitation generally range from 33% to 50%, with the highest confidence centered over portions of the Intermountain West. In contrast, below-normal precipitation is favored across parts of the Pacific Northwest, the Great Lakes region, and much of the Southeast and Mid-Atlantic coast, with probabilities generally ranging from 33% to 50%. Large portions of the southern Plains, lower Mississippi Valley, Northeast, Florida, and parts of Alaska are classified as having equal chances of above-, near-, or below-normal precipitation, indicating no strong precipitation signal for August 2026.

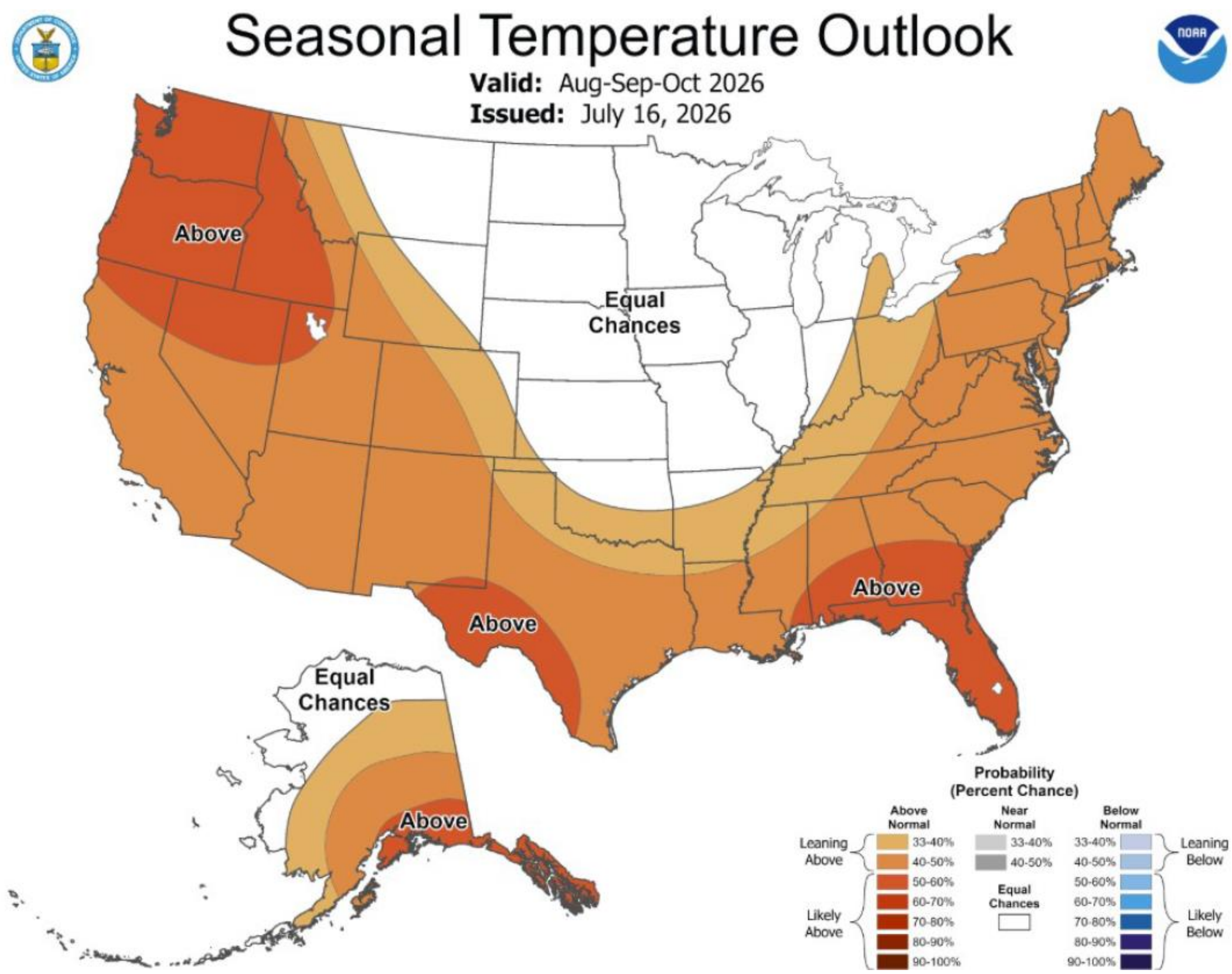

Figure 29. Seasonal Temperature Outlook

This NOAA Climate Prediction Center Seasonal Temperature Outlook for August through October 2026 indicates an increased likelihood of above-normal temperatures across most of the United States. The highest probabilities, generally ranging from 40% to 70%, are centered over the Pacific Northwest, portions of the Southwest, the Gulf Coast, and the Southeast, including Florida. Above-normal temperatures are also favored across much of the Northeast and Alaska. In contrast, a region extending across portions of the northern and central Great Plains is classified as having equal chances of above-, near-, or below-normal temperatures, indicating no strong seasonal temperature signal. Overall, the outlook favors warmer-than-normal conditions across most of the country during the August through October 2026 period.

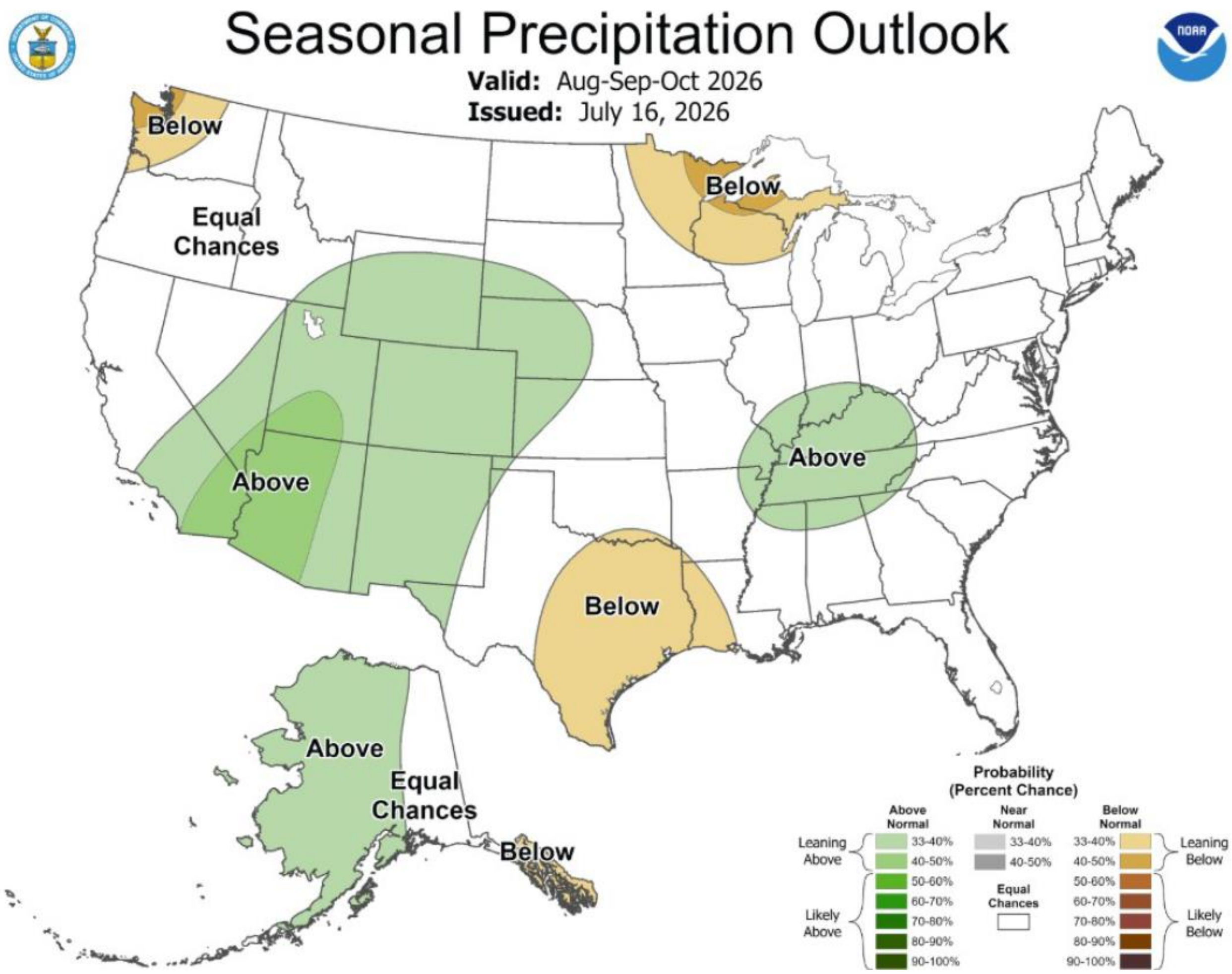

Figure 30. Seasonal Precipitation Outlook

This NOAA Climate Prediction Center Seasonal Precipitation Outlook for August through October 2026 indicates an increased likelihood of above-normal precipitation across portions of the Southwest, central Rocky Mountains, and lower Ohio and Tennessee Valley regions, as well as much of Alaska. Forecast probabilities for above-normal precipitation generally range from 33% to 50%. In contrast, below-normal precipitation is favored across parts of the Pacific Northwest, the western Great Lakes region, southern Texas, and portions of the Alaska Panhandle, with probabilities generally ranging from 33% to 50%. Much of the remaining United States, including large areas of the West Coast, Great Plains, Southeast, Mid-Atlantic, and Northeast, is classified as having equal chances of above-, near-, or below-normal precipitation, indicating no strong seasonal precipitation signal for the August through October 2026 period.

Estimated CVP Operations 50% Exceedance

Table 6. Storages – Federal End of the Month Storage/Elevation (TAF/Feet)

Facility	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Trinity	2014	1900	1752	1615	1558	1524	1502	1462	1507	1636	1766	1596	1470
Trinity Elev.	N/A	2334	2323	2313	2308	2305	2303	2300	2304	2314	2324	2311	2301
Whiskeytown	239	238	238	238	206	206	206	206	206	206	206	238	238
Whiskeytown Elev.	N/A	1209	1209	1209	1199	1199	1199	1199	1199	1199	1199	1209	1209
Shasta	3558	2970	2395	2201	2075	2168	2505	2909	3483	4062	4280	4402	4091
Shasta Elev.	N/A	1006	979	969	962	967	984	1004	1028	1050	1058	1062	1051
Folsom	864	595	425	300	289	290	311	402	501	690	836	900	873
Folsom Elev.	N/A	428	407	387	385	385	389	403	417	438	453	459	456
New Melones	1694	1618	1560	1513	1463	1474	1492	1528	1557	1618	1628	1715	1719
New Melones Elev.	N/A	1016	1009	1004	999	1000	1002	1006	1009	1016	1017	1025	1026
Federal San Luis	580	272	208	164	214	190	247	434	556	674	647	505	383
Total	8949	7594	6577	6030	5803	5852	6263	6941	7811	8886	9363	9356	8774

Table 7. State End of the Month Reservoir Storage (TAF)

Facility	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Oroville	3082	2535	2032	1630	1413	1376	1422	1640	2031	2414	2824	2993	2818
Oroville Elev.	N/A	829	786	745	720	716	721	746	786	819	851	864	851
State San Luis	618	676	734	761	753	697	918	941	971	943	888	692	556
Total San Luis (TAF)	1198	948	942	925	967	887	1165	1375	1527	1616	1536	1196	939
Total San Luis Elev.	N/A	448	447	445	450	441	469	488	502	509	502	472	447

Table 8. Monthly River Releases (TAF/cfs)

Facility	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Trinity (TAF)	28	53	52	23	18	78	123	83	18	59	258	126
Trinity (cfs)	450	857	870	373	300	1,276	2,000	1,500	300	1,000	4,189	2,120
Clear Creek (TAF)	7	6	7	10	12	16	18	17	18	15	18	13
Clear Creek (cfs)	113	100	120	157	210	260	293	300	286	247	295	215
Sacramento (TAF)	848	830	422	430	244	200	200	180	246	416	434	684
Sacramento (cfs)	13800	13500	7100	7000	4100	3250	3250	3250	4000	7000	7057	11500
American (TAF)	332	241	178	92	92	92	61	133	123	280	400	249
American (cfs)	5402	3914	3000	1500	1552	1500	1000	2400	2000	4700	6500	4183
Stanislaus (TAF)	12	12	12	39	12	12	12	28	32	53	54	37
Stanislaus (cfs)	200	200	200	635	200	200	200	497	523	898	880	630
Feather (TAF)	467	473	458	246	74	77	65	58	65	62	65	226
Feather (cfs)	7600	7700	7700	4000	1250	1250	1050	1050	1050	1050	1050	3800

Table 9. Trinity Diversions (TAF)

Diversion Facility	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Carr PP	95	96	87	45	46	0	0	0	0	16	126	97
Spring Creek PP	90	90	80	70	40	0	17	28	20	25	90	90

Table 10. Delta Summary (TAF)

Facility	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Tracy	97	258	143	214	70	107	235	225	250	152	169	250
USBR Banks	18	18	48	0	0	0	0	0	0	0	0	0
Contra Costa	11.1	12.7	14.0	14.0	16.0	18.0	14.0	14.0	12.7	12.7	12.7	9.8
Total USBR	126	289	205	228	86	125	249	239	263	164	182	260
State Export	376	362	319	232	148	351	155	150	165	60	49	129
Total Export	502	651	524	460	234	476	404	389	428	224	231	389
COA Balance	0	0	0	0	0	0	0	0	0	0	0	0
Vernalis (TAF)	51	49	54	108	83	83	91	127	140	143	146	84
Vernalis (cfs)	834	802	906	1757	1393	1355	1485	2280	2280	2398	2380	1420
Old/Middle River calc.	-6,504	-8,380	-6,965	-5,561	-2,992	-5,943	-4,982	-4,959	-4,921	-2,407	-2,414	-4,983

Facility	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Computed DOI	11501	9500	8506	8004	8001	8004	13665	19955	20074	17499	12249	9497
Excess Outflow	0	0	504	0	0	0	5661	8555	8670	6102	2928	0
% Export/Inflow	33%	43%	42%	42%	28%	47%	33%	26%	25%	16%	20%	33%
% Export/inflow std.	65%	65%	65%	65%	65%	65%	65%	45%	35%	35%	35%	35%

Table 11. Hydrology

Statistic	Trinity	Shasta	Folsom	New Melones
Water Year Inflow (TAF)	1105	4897	2407	785
Year to Date + Forecasted % of mean	91%	88%	88%	74%

CVP actual operations do not follow any forecasted operation or outlook; actual operations are based on real-time conditions.

CVP operational forecasts or outlooks represent general system-wide dynamics and do not necessarily address specific watershed/tributary details.

CVP releases or export values represent monthly averages.

CVP Operations are updated monthly as new hydrology information is made available December through May.

Estimated CVP Operations 90% Exceedance

Table 12. Storages – Federal End of the Month Storage/Elevation (TAF/Feet)

Facility	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Trinity	2014	1869	1695	1528	1449	1393	1323	1325	1357	1415	1518	1349	1233
Trinity Elev.	N/A	2332	2319	2305	2299	2294	2288	2288	2291	2296	2305	2290	2279
Whiskeytown	239	238	238	238	206	206	206	206	206	206	206	238	238
Whiskeytown Elev.	N/A	1209	1209	1209	1199	1199	1199	1199	1199	1199	1199	1209	1209
Shasta	3558	2974	2434	2202	2051	2036	2067	2184	2367	2630	2627	2493	2148
Shasta Elev.	N/A	1007	981	969	960	959	961	968	977	991	991	984	966
Folsom	864	575	363	318	274	268	270	283	311	434	542	536	409

Facility	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Folsom Elev.	N/A	426	398	390	382	381	382	384	389	408	422	421	404
New Melones	1694	1615	1555	1507	1447	1444	1442	1448	1406	1385	1295	1195	1074
New Melones Elev.	N/A	1015	1009	1004	997	997	997	997	993	990	980	968	952
Federal San Luis	580	290	263	208	258	218	234	425	382	349	294	156	25
Total	8949	7561	6549	6001	5685	5564	5540	5872	6030	6419	6482	5967	5128

Table 13. State End of the Month Reservoir Storage (TAF)

Facility	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Oroville	3082	2518	2007	1625	1386	1259	1186	1242	1383	1596	1696	1617	1311
Oroville Elev.	N/A	828	783	745	717	701	691	699	716	741	752	744	707
State San Luis	618	743	872	935	941	922	937	969	930	914	840	710	580
Total San Luis (TAF)	1198	1032	1135	1143	1199	1140	1171	1394	1312	1263	1134	866	606
Total San Luis Elev.	N/A	456	466	467	472	466	469	490	483	478	466	439	410

Table 14. Monthly River Releases (TAF/cfs)

Facility	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Trinity (TAF)	28	53	52	23	18	78	18	17	28	32	180	47
Trinity (cfs)	450	857	870	373	300	1,276	300	300	450	540	2,924	783
Clear Creek (TAF)	7	6	7	10	12	16	18	17	18	15	18	13
Clear Creek (cfs)	113	100	120	157	210	260	293	300	286	247	295	215
Sacramento (TAF)	854	784	476	430	283	227	200	194	255	446	553	684
Sacramento (cfs)	13900	12750	8000	7000	4750	3700	3250	3500	4150	7500	9000	11500
American (TAF)	348	277	95	85	50	51	49	75	49	99	181	199
American (cfs)	5658	4500	1600	1386	835	834	800	1353	805	1657	2950	3349
Stanislaus (TAF)	12	12	12	39	12	12	12	57	54	68	72	53
Stanislaus (cfs)	200	200	200	635	200	200	200	1019	881	1151	1167	899
Feather (TAF)	424	421	410	227	74	77	77	58	65	134	105	250
Feather (cfs)	6900	6850	6900	3700	1250	1250	1250	1050	1050	2250	1700	4200

Table 15. Trinity Diversions (TAF)

Diversion Facility	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Carr PP	121	122	118	61	51	12	10	5	0	1	134	121
Spring Creek PP	115	115	110	85	40	0	0	0	2	1	90	110

Table 16. Delta Summary (TAF)

Facility	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Tracy	55	258	107	201	48	51	232	45	54	54	55	100
USBR Banks	11	11	41	0	0	0	0	0	0	0	0	0
Contra Costa	11.0	12.0	12.0	14.0	14.0	14.0	14.0	14.0	12.0	12.0	12.0	10.0
Total USBR	77	281	160	215	62	65	246	59	66	66	67	110
State Export	370	360	266	220	124	144	152	78	160	36	37	51
Total Export	447	641	426	435	186	209	398	137	226	101	104	161
COA Balance	0	0	0	0	0	0	0	0	0	-5	26	26
Vernalis (TAF)	45	40	46	98	74	75	75	127	140	125	132	84
Vernalis (cfs)	737	655	772	1595	1242	1225	1225	2280	2280	2109	2143	1420
Old/Middle River calc.	-5,857	-8,324	-5,757	-5,321	-2,438	-2,657	-5,024	-1,464	-2,395	-952	-931	-2,035
Computed DOI	9516	7532	8506	6507	6505	6507	6670	11400	11403	11397	9321	9497
Excess Outflow	0	0	504	0	0	0	163	0	0	0	0	0
% Export/Inflow	34%	47%	38%	46%	28%	31%	51%	16%	24%	11%	11%	16%
% Export/inflow std.	65%	65%	65%	65%	65%	65%	65%	45%	35%	35%	35%	35%

Table 17. Hydrology

Statistic	Trinity	Shasta	Folsom	New Melones
Water Year Inflow (TAF)	1100	4832	2393	779.588849
Year to Date + Forecasted % of mean	91%	87%	88%	74%

CVP actual operations do not follow any forecasted operation or outlook; actual operations are based on real-time conditions.

CVP operational forecasts or outlooks represent general system-wide dynamics and do not necessarily address specific watershed/tributary details.

CVP releases or export values represent monthly averages.

CVP Operations are updated monthly as new hydrology information is made available December through May.

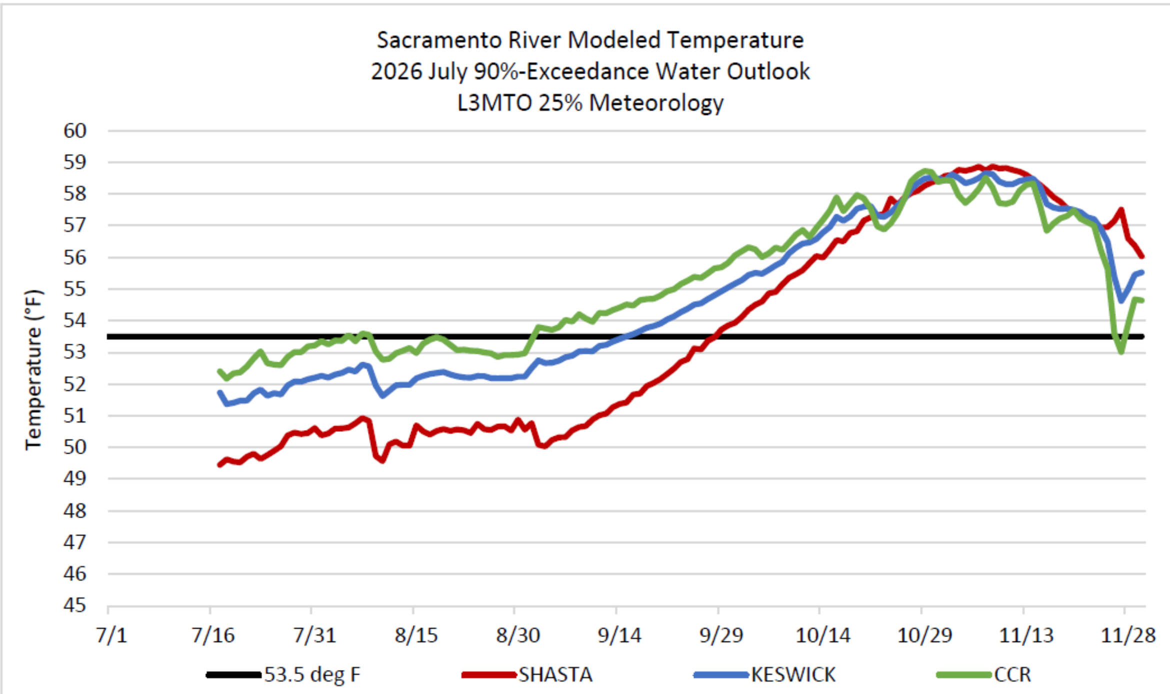

Figure 31. Sacramento River Modeled Temperature – July 2026 90%-Exceedance Water Outlook L3MTO 25% Meteorology.

This chart presents modeled Sacramento River water temperatures under the 2026 July 90% exceedance water outlook and L3MTO 25% meteorology scenario at three locations: Shasta (red), Keswick (blue), and Clear Creek Road (CCR; green). A horizontal black line marks the 53.5°F temperature target. Temperatures at all three locations increase gradually from mid-July through late October, rising from approximately 50–53°F to seasonal peaks near 58–59°F. Shasta remains the coolest site through September but converges with the other locations by late October. Temperatures generally remain above the 53.5°F reference line from early September through most of November. During late November, temperatures decline at all locations, with CCR showing the largest short-term decrease before recovering slightly. Overall, the chart indicates a seasonal warming trend followed by cooling at the end of the modeled period.

Run date: 07/13/2026

EOM Sept storage: 2.2 MAF

Trinity profile date: 07/08/2026

Whiskeytown profile date: 07/09/2026

Shasta profile date: 07/13/2026

Projected Side gates: First Aug 9th Full Aug 29th

End of September Cold-Water-Pool less than 56 deg F: 174 TAF

End of September Cold-Water-Pool less than 52 deg F: 58 TAF

End of September Cold-Water-Pool less than 48 deg F: 17 TAF

Table 18. Facility Temperature Outlook in Degrees Fahrenheit

Month	Shasta	Keswick	CCR
August	50.1	52.2	53.3
September	52.0	54.1	55.0
October	56.7	57.2	57.4
November	57.5	57.6	57.4

Temperature-Dependent Mortality (TDM) Estimates for the 2026 Sacramento River Temperature Management Season

July 22, 2026

Southwest Fisheries Science Center · UC Santa Cruz · CVTEMP Operational Platform

The Southwest Fisheries Science Center (SWFSC) simulated one Keswick release scenario - a USBR 90th-exceedance forecast (Forecast_90) - to evaluate temperature-dependent mortality (TDM). The Forecast_90 values were provided by USBR in the July 90% forecast (received 7/21/2026). The scenario was forced with hydrology from the May B120 90th percentile Shasta inflow and meteorology from the historical year 2014, selected as a representative warm year consistent with the NOAA seasonal outlook for summer 2026, and a downstream temperature target at Clear Creek (53.5 °F). TDM was estimated using the stage-independent egg-mortality model (Martin et al., 2017) and the stage-dependent model (Anderson *et al.,* 2022) over 13 historical redd-year distributions (2013–2025).

During this run, two additional pieces of information were added. First, carcass survey data were used as another method to estimate where and when spawning occurred relative to aerial redd survey data. Secondly, water temperatures from USBR's Water Temperature Modeling Platform (WTMP) were included as a comparison to the SWFSC temperature models. Outputs from the WTMP were based on a start date of July 17, 2026.

Predicted mean monthly water temperatures from the SWFSC and USBR temperature model are shown in Table 1. These values represent monthly averages of daily mean water temperatures under the July forecast (90 scenario) at three sites - Shasta, Keswick, and CCR - from July through December. Predicted monthly mean water temperatures under the July Forecast_90 scenario were nearly identical between the SWFSC and USBR sources through summer and diverged modestly in fall. In July and August, the two sources agreed to within about 0.2 °F at all three locations, with USBR marginally cooler, and both showed the expected downstream warming from the Shasta release (50.0 °F in July) through Keswick (52.2 °F) to CCR (53.0 °F). Predicted temperatures rose steadily to a November peak. Beginning in October the sources diverged-USBR was ~0.7 °F warmer than SWFSC at Keswick and CCR, while by November SWFSC was warmer at all sites, most notably at Shasta (59.5 vs 57.9 °F).

Across all analyses, predicted TDM was driven more by the choice of mortality model than by either temperature source or spawning distribution. The stage-independent model produced higher mortality than the stage-dependent model: 2013–2025 mean mortality of roughly 17–22% versus 2–5%. Within each model, the USBR-based temperatures yielded marginally lower mortality than the SWFSC forecast (e.g., redd stage-independent mean of 20% versus 22%; redd stage-dependent 2% versus 5%). Redd and carcass-based spawning distributions produced broadly similar long-term means (e.g., 22% versus 19% for the SWFSC stage-independent model), but the two diverged in individual years: carcass-based mortality exceeded redd-based in 2017 and 2018, whereas the reverse occurred in 2025, reflecting the different spatial and temporal egg placements the two methods assume. 2025 was often the highest TDM year across all methods, but not always. For example in stage-dependent SWFSC carcass based methods for 2025 were lower (5%) than 2017 (11%).

Below is a summary of the model setup, followed by results.

For additional details see https://cvtemp.ucsc.edu/

Overview

Total release scenarios simulated: 1

- Keswick (KWK) release scenario based on USBR July 90% operations forecast (Forecast_90)

TDM Forecast start date: 04/01/2026

Reservoir Forecast start date: 07/21/2026

Simulation start date: 07/21/2026

Simulation end date: 12/31/2026

Models used:

Shasta Reservoir: CE-QUAL-W2 hydrodynamic model (Cole & Wells, 2006; Daniels et al., 2018)

Keswick Reservoir: CE-QUAL-W2 hydrodynamic model (Cole & Wells, 2006)

Upper Sacramento River: RAFT river temperature model (Pike et al., 2013; Daniels et al., 2018)

Temperature-dependent egg mortality: Stage-independent model (Martin et al., 2017) & Stage-dependent model (Anderson et al., 2022)

Reservoir Release Scenarios

A single reservoir release scenario was simulated and paired with a Spring Creek (SPP; Trinity import) profile.

Table 19. Keswick Releases (CFS) — monthly mean

Label	Description	Jul	Aug	Sep	Oct	Nov	Dec
Forecast_90	USBR 90th exceedance flow forecast	13900	12750	8000	7000	4750	3700

Table 20. Trinity Imports via Spring Creek PP (TAF/month)

Month	Jul	Aug	Sep	Oct	Nov	Dec
Release	115	115	110	85	40	0

Hydrology

All simulations were forced with DWR Bulletin 120 (B120) Shasta Reservoir inflow forecasts at the exceedance level of 90th percentile. Exceedance level affects only Shasta Reservoir inflow.

Inflow method: B120 (DWR Bulletin 120)

B120 file date: May 2026

Exceedance level: 90th percentile

Meteorology

All simulations used the meteorological time series from the historical record for year 2014 applied over the full forecast window (7/21/2026 – 12/31/2026). Over the hindcast window (4/01/2026 – 7/21/2026) output from the Global Forecast System (GFS; NCEP 2004) was used. The 2014 meteorological year was selected for this single-year simulation as a representative warm-year condition. Previous analyses (shared 5/11/2026) identified 2014 as a comparatively warm year in the historical record, and the NOAA 90-day seasonal outlook (as of 6/18/2026) projects above-normal temperatures across the Shasta region for July through September.

Initial Shasta Conditions

Temperature profile date: 07/21/2026

Temperature Window / Target Parameters

All scenarios share the same temperature window shaping parameters.

Target location: Clear Creek (CCR)

Window temperature: 12.0°C (53.6°F)

Shoulder temperature: 14.4°C (57.9°F)

Window length: 26 weeks

Center date: 08/15/2026

Window start (derived): 05/16/2026

Window end (derived): 11/14/2026

TDM Model Parameters

All scenarios estimated TDM based on two models.

Table 21. TDM Models

Model	Tcrit (°C)	bT (°C-1 day-1)	Critical window	Egg data source
Stage-independent	12.00	0.0240	Deposition to emergence	Aerial and carcass survey **
Stage-dependent	11.82	0.4361	4 days prior to hatch	Aerial and carcass survey **

*see references for more information
**note, stage-independent model was calibrated with aerial survey data and stage-dependent model was calibrated using carcass survey data

Disclaimer

Results presented here are derived from numerical simulation and statistical models. All models are simplifications of complex physical and biological systems subject to structural uncertainty, parameter uncertainty, and errors in boundary condition data. Model outputs should not be interpreted as precise predictions or relied upon as the sole basis for operational or regulatory decisions without independent validation and expert judgment. Specifically, the CE-QUAL-W2 simulations include an automated Temperature Control Device (TCD) gate selection algorithm that adjusts Shasta Dam outlet configurations to minimize deviation from a prescribed downstream temperature target. This algorithm may achieve temperature targets with greater consistency than is attainable in real-world operations.

These simulations carry additional biological uncertainty as well: the temperature-dependent mortality (TDM) estimates translate simulated water temperatures into predicted mortality using relationships that are themselves simplified statistical representations calibrated from laboratory and field observations. Therefore, simulation results are intended to evaluate the relative merit of alternative strategies, not to guarantee achievable outcomes.

Results

Mean Monthly Temperatures

To provide context for the TDM results that follow, mean monthly water temperatures from the SWFSC and USBR simulations are shown (Table 1) at three locations: Shasta Dam release, Keswick Dam release, and Clear Creek (CCR). Values represent the mean across a single meteorology source used to drive the simulation.

Table 22. Mean monthly water temperatures (°F) based on daily means at Shasta Reservoir, Keswick Reservoir, and Clear Creek Gage (CCR) for July–December 2026 under the July Forecast_90 scenario from the SWFSC and USBR temperature models.

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Month	SWFSC July Forecast_90 Shasta (°F)	SWFSC July Forecast_90 Keswick (°F)	SWFSC July Forecast_90 CCR (°F)	USBR July Forecast_90 Shasta (°F)	USBR July Forecast_90 Keswick (°F)	USBR July Forecast_90 CCR (°F)
July	50.2	52.4	53.2	50.0	52.0	52.9
August	50.6	52.4	53.2	50.5	52.2	53.1
September	51.7	53.9	54.6	51.7	53.6	54.5
October	56.1	56.4	56.6	56.4	56.9	57.2
November	59.5	58.2	58.1	57.9	57.5	57.0
December	58.2	57.2	56.8	NA	NA	NA

TDM Results

For both temperature models (SWFSC and USBR) TDM is computed using the stage-independent temperature dependent egg mortality model (Martin *et al*., 2017) and the stage-dependent model (Anderson *et al.,* 2022), run over 13 historical year distributions of redd and carcass data (2013–2025). Table 2 summarizes the population-mean TDM (with range across years) and the year 2025 case. Full year-by-year values are provided in Table 3 and Table 4.

Table 23. Predicted egg-to-fry mortality (%) under the July Forecast_90 scenario for two temperature sources (SWFSC and USBR), two mortality models (stage-independent and stage-dependent), and redd- and carcass-based spawning distributions. Each source shows the 2013–2025 population mean (range in parentheses) and the 2025 value.

Model	SWFSC July Forecast_90 Population mean (2013–2025)	SWFSC July Forecast_90 Year 2025	USBR July Forecast_90 Population mean (2013–2025)	USBR July Forecast_90 Year 2025
Redd Stage-independent	22 (12-50)	50	20 (10-50)	50
Carcass Stage-independent	19 (12-32)	32	17 (9-31)	31
Redd Stage-dependent	5 (0-21)	21	2 (0-13)	13
Carcass Stage-dependent	5 (2-11)	5	2 (1-9)	3

Table 24. Mean annual TDM (%) by redd and carcass year under the stage-independent model for the single flow scenario for the SWFSC and USBR temperature models. Values are mean TDM across all redds within each year (i.e., population average). *Estimates of uncertainty are available upon request.

Redd Year	SWFSC July Forecast_90 Redd stage-independent model	SWFSC July Forecast_90 Carcass stage-independent model	USBR July Forecast_90 Redd stage-independent model	USBR July Forecast_90 Carcass stage-independent model
2013	26	19	24	16
2014	16	15	13	13
2015	20	14	18	11
2016	22	18	20	16
2017	29	31	27	29
2018	14	27	11	25
2019	18	15	14	13
2020	14	15	12	12
2021	12	15	10	13
2022	16	15	14	13
2023	25	12	22	9
2024	21	19	20	17
2025	50	32	50	31
Population Mean (2013-2025)	22	19	20	17
Population Min (2013-2025)	12	12	10	9
Population Max (2013-2025)	50	32	50	31

Notes: Values are weighted by observed count per year and represent an annual mean value of TDM for a population.

Table 25. Mean annual TDM (%) by redd and carcass year under the stage-dependent model for the single flow scenario for the SWFSC and USBR temperature models. Values are mean TDM across all redds within each year (i.e., population average). *Estimates of uncertainty are available upon request.

Redd Year	SWFSC July Forecast_90 Redd stage-dependent model	SWFSC July Forecast_90 Carcass stage-dependent model	USBR July Forecast_90 Redd stage-dependent model	USBR July Forecast_90 Carcass stage-dependent model
2013	3	3	0	1
2014	1	2	0	1
2015	2	4	1	1
2016	10	3	3	1
2017	0	11	0	9
2018	2	6	0	4
2019	7	4	5	2
2020	2	4	1	2
2021	8	3	0	1
2022	4	2	0	1
2023	3	4	2	1
2024	7	6	4	4
2025	21	5	13	3
Population Mean (2013-2025)	5	5	2	2
Population Min (2013-2025)	0	2	0	1
Population Max (2013-2025)	21	11	13	9

Notes: Values are weighted by observed count per year and represent an annual mean value of TDM for a population.

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Winter-run Chinook Salmon Temperature Dependent Mortality Estimates

Background

Updated forecasts and water temperature modeling can be used to estimate temperature dependent mortality (TDM) of winter-run Chinook salmon. The modeling framework used spatially explicit, daily average water temperature forecasts from the Water Temperature Modeling Platform (WTMP) model. These forecasts were applied at five locations along the Sacramento River: Keswick Dam (river kilometer 483; RKM), Sacramento River at Clear Creek (RKM 474), and Balls Ferry (RKM 458). For locations between gauges, daily temperatures were estimated by linear interpolation along the river-kilometer axis. These water temperature estimates were then matched to the river-kilometer locations of simulated winter-run Chinook salmon redds.

Two redd distribution data sources were used in parallel to bracket the structural sensitivity of TDM estimates to this uncertainty: (1) carcass survey-derived redd locations and timing from the winter-run carcass survey record, brood years 2013–2025; and (2) aerial survey-derived redd locations and timing, brood years 2013–2025. Carcass-derived redds occupy four reach bands between Keswick (RKM 483) and approximately RKM 454. Aerial-derived redds occupy six reach centroids between Keswick (RKM 482) and Jellys Ferry (RKM 452), reflecting the broader spatial coverage of aerial surveys. Both sources were carried through the analysis independently; results are reported in parallel and are not combined into a single weighted estimate.

TDM was estimated by simulating the thermal history of each redd throughout its incubation period using two mortality models, both of which are referenced in the 2025 Long-Term Operations Record of Decision and supported by SacPAS Fish Model documentation. The stage-independent model (Martin et al. 2017) accumulates mortality continuously throughout the incubation period from spawn to emergence using a single critical-temperature threshold. The stage-dependent model (Anderson et al. 2022) accumulates mortality only during a 4-day pre-hatch critical window. Both models use the linear development model of Zeug et al. (2012), with hatching at 400 accumulated thermal units (ATU) and emergence at 958 ATU. Aggregate TDM is reported as 100 × (1 − mean V), where V is per-redd thermal survival and the mean is taken across all redds for the year. TDM was computed separately for each brood year using that year's observed redd distribution (Figure 1), and pooled values reported below are the simple mean across years. Stage-independent TDM predictions, regardless of redd timing and distribution, have increased with the July 17 modeling compared to the 2026 TMP due to the new WTMP's warmer late summer temperatures which expose emerging fry in redds to temperature greater than the model's temperature threshold (Figure 2).

Assumptions and limitations

Several assumptions and limitations bear on the interpretation of the TDM estimates (Table 1). This is a deterministic forward projection based on a single proposed temperature scenario. Year-to-year variation in Table 1 reflects only the variability in observed redd distributions across brood years. This modeling was done in the SacPAS fish model (Columbia Basin Research 2024) due to capacity constraints that kept us from relying on the same code used in the 2026 TMP (USBR 2026), which was run outside the SacPAS fish model web environment. We re-estimated the 2026 TMP results to consider potential differences between these WTMP TDM estimates using this same model. We compared the SacPAS-modeled and TMP-modeled 2026 TDM to compare results caused by the code used in these two sets of model code (Table 2). Predicted TDM results are similar between SacPAS and the previously used TDM code, except the estimates of TDM using aerial redd distribution with the stage-dependent model. In this case, the results were on average less when results were delivered from the SacPAS model.

Both TDM models share the same calibration and parameter assumptions that have not been validated in the Sacramento River and are described in the 2026 TMP. The Table 1 TDM values should be interpreted as conditional on this single parameterization rather than as the central tendency of a probability distribution and are most appropriately used for relative comparison among temperature management alternatives rather than as predicted egg-survival outcomes.

A difference between the July 17 WTMP scenario and the TMP is that the stage-dependent and stage-independent TDM models disagree on predicted absolute TDM levels: stage independent is approximately 8.2x greater than stage-dependent TDM under the carcass survey and approximately 3.3x higher under the stage-independent model (pooled across brood years). These differences are greater than the difference between TDM estimates with the same model with different run timings (e.g. aerial or carcass). Thus, the main difference in TDM predictions reported in Table 1 reflect methodological differences between the two TDM models and their assumptions regarding critical temperature and the per-degree-day mortality rate. As described in the 2026 TMP (Reclamation 2026), the parameterization of these models are challenged by structural non-identifiability concerns, since neither parameter has strong independent prior information. The models use of a single parameter value for these terms suggest results are most appropriate for relative comparison among alternatives rather than as predicted egg-survival outcomes.

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Table 26. Summary of winter-run Chinook salmon TDM estimates from July WTMP scenario using SacPAS fish model. Pooled values are the simple mean of per-brood-year TDM estimates across the 13 years available for each redd source. Range columns show the minimum and maximum per-year value across the same set of years; the 2025 column is the single-year estimate for brood year 2025 (the most recent year). The SD column reports the standard deviation of the 13 per-year estimates and reflects year-to-year variability in cohort outcomes under the fixed temperature scenario.

Redd source × Model	Pooled mean (%)	Range minimum (%)	Range maximum (%)	SD across brood years (%)	Brood year 2025 (%)
Carcass × Stage-dependent (Anderson et al., 2022)	2.4	0.2	9.6	2.7	3.1
Carcass × Stage-independent (Martin et al., 2017)	19.4	11.2	34.5	7.7	34.5
Aerial × Stage-dependent (Anderson et al., 2022)	7.1	0.8	24.8	7.9	24.8
Aerial × Stage-independent (Martin et al., 2017)	23.6	11.6	58.2	11.4	58.2

Table 27. Summary of winter-run Chinook salmon TDM estimates from 2026 Sacramento River Temperature Management Plan scenario (53.5°F at Clear Creek target) using SacPAS fish model and previously reported in the Temperature Management Plan. Values in bolded are from the SacPAS modeling and should be compared to information in Table 1, values that are in parentheses are from the 2026 TMP. Range columns show the minimum and maximum per-year value across the same set of years; the 2025 column is the single-year estimate for brood year 2025 (the most recent year). The Standard Deviation (SD) column reports the standard deviation of the 13 per-year estimates and reflects year-to-year variability in cohort outcomes under the fixed temperature scenario.

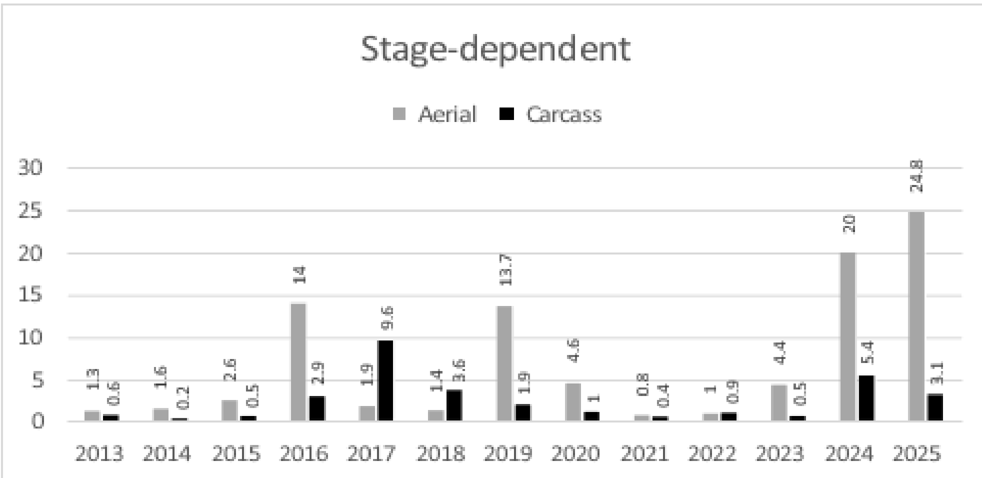
Redd source × Model	Pooled mean (%)	Range minimum (%)	Range maximum (%)	SD across brood years (%)	Brood year 2025 (%)
Carcass × Stage-dependent (Anderson et al., 2022)	1.1 (1.1)	0.0 (0.0)	6.0 (6.2)	1.6 (1.7)	0.4 (0.3)
Carcass × Stage-independent (Martin et al., 2017)	2.9 (2.8)	0.7 (0.7)	9.0 (8.6)	2.3 (2.3)	5.0 (5.0)
Aerial × Stage-dependent (Anderson et al., 2022)	5.5 (11.4)	0.0 (3.0)	19.6 (26.7)	5.8 (7.8)	9.8 (18.1)
Aerial × Stage-independent (Martin et al., 2017)	4.6 (4.7)	0.5 (0.8)	16.4 (16.5)	4.6 (4.7)	16.3 (16.5)

Table 28. Modeling assumptions for the TDM estimates in Table 1.

Parameter	Associated information
Meteorology source	25% exceedance L3MTO
Time period	1/1/2026 – 7/16/2026: observed temperatures; 7/17/2026 – 11/30/2026: simulated temperatures
Reservoir model	WTMP CE-QUAL-W2
River model	WTMP HEC-ResSim
Shasta profile date	7/13/2026
TCD gate operations	WTMP CE-QUAL-W2
Sacramento River water temperatures	WTMP CE-QUAL-W2 simulated daily mean output at five gauge stations (Keswick Dam, Clear Creek, Balls Ferry) from July 17 onward. Pre- July 17 observed temperatures pulled from CDEC for Keswick, Clear Creek, and Balls Ferry.

Parameter	Associated information
Gauge station RKM convention	All three gauge RKMs are derived from published USGS/CDEC station coordinates using great-circle distance from Keswick Dam. The two upstream RKMs (Keswick = 483, CCR = 474) follow the convention used in prior 2026 TMP analysis (Elissa Buttermore, pers. comm.); the slope between them (≈ −0.821 RKM per km) is then applied to the three downstream stations, yielding Airport = 467, Balls Ferry = 458, and Jellys Ferry = 451. The same formula reproduces the two upstream values exactly and extends them consistently downstream from a single set of station coordinates.
Spatial interpolation between gauges	Linear interpolation along the river-kilometer axis between adjacent gauge stations. Nearest-endpoint extrapolation is applied only outside the Keswick–Balls Ferry analysis envelope (RKM 483–458); all redds in this analysis fall within the envelope and use proper interpolated values
Biological framework	SacPAS Fish Model framework (temperature effect only). Model parameters, ATU thresholds, and integration conventions match SacPAS v3 manual specifications.
Temperature mortality models	Both models referenced in the 2025 LTO ROD: stage-independent (Martin et al., 2017) continuous hazard over the full incubation period; stage-dependent (Anderson et al., 2022) hazard concentrated in a 4-day pre-hatch critical window.
Model functional form	Both models of the form $V = \exp(-b \times \Sigma \max(T - T_{crit}, 0))$, where the summation window and the parameter values differ between models. Aggregate TDM = 100 × (1 − mean V) across redds.
Egg-emergence timing model	Linear (Zeug et al., 2012, as implemented in SacPAS): hatch at 400 ATU (accumulated thermal units, °C·days); emergence at 958 ATU.
T_crit (50th percentile)	Stage-independent: 12.10°C (53.78°F). Stage-dependent: 11.82°C (53.28°F). Both values are 50th-percentile point estimates from the original calibrations and match SacPAS Fish Model defaults.
Model rate parameter (50th percentile)	Stage-independent (α): 0.026 $°C^{-1} \cdot d^{-1}$. Stage-dependent (bδ): 0.436 $°C^{-1} \cdot d^{-1}$. Both values are 50th-percentile point estimates and match SacPAS Fish Model defaults. No parameter uncertainty is propagated; estimates are deterministic at these values.
Critical days (mortality accumulation window)	Stage-independent: full incubation period (spawn through emergence; ~120–180 days depending on incubation temperature). Stage-dependent: 4 days immediately preceding hatch
Redd time distribution — source 1	Carcass-survey daily redd counts from the SacPAS dbcarcass record, brood years 2013–2025.
Redd time distribution — source 2	Aerial-survey daily redd counts, brood years 2013–2025.
Redd space distribution — source 1	Carcass-survey reach reporting at four RKMs: 483, 479 (KWK_ACID), 474 (ACID_HWY44), 454 (downstream of CCR).
Redd space distribution — source 2	Aerial-survey reach reporting at six reach-centroid RKMs: 482 (KWK_ACID), 474 (ACID_HWY44), 470 (HWY44_BTL), 463 (Airport→Balls Ferry), 456 (Balls Ferry→Battle Creek), 452 (Battle Creek→Jellys Ferry).

Parameter	Associated information
Per-year analysis	TDM was computed for each brood year separately using that year’s redd distribution and the same July 17 temperature scenario. Pooled values are the simple mean of per-year TDM.
Treatment of redd sources	The two redd sources are not combined into a single weighted estimate. Both are reported in parallel because each represents real signal-plus-noise from a different sampling method, with different detection biases and different spatial coverage.



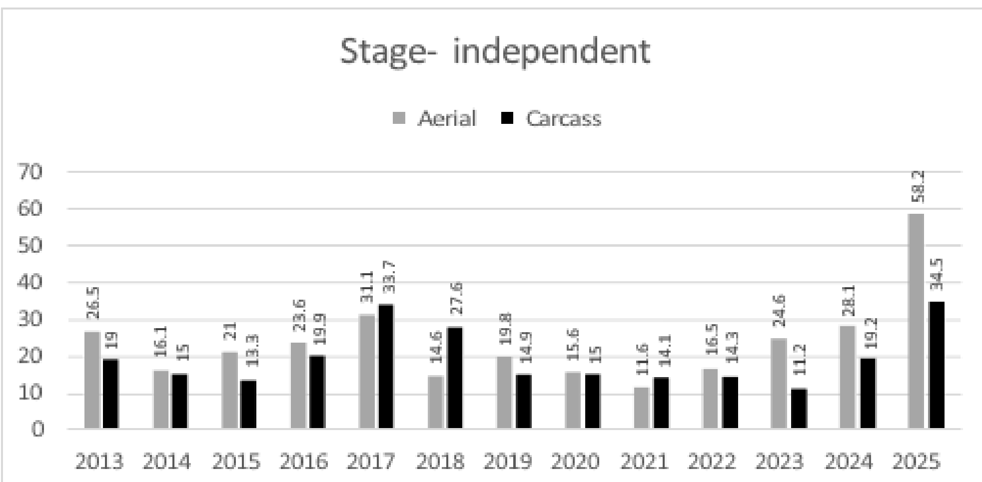


Figure 32. Egg to Emergence Temperature Dependent Mortality

Predicted egg-to-emergence temperature dependent mortality (TDM, %) for winter-run Chinook salmon under the July 17 WTMP scenario (53.5°F target at CCR), by brood year (2013–2025), data source, and model. Each year’s observed redd distribution was applied to the proposed-scenario temperature trace. Top panel: stage-dependent model (Anderson et al. 2022). Bottom panel: stage-independent model (Martin et al. 2017). Fill: redd source (carcass-derived, black; aerial-derived, gray). Pooled-across-year means for each source × model combination are reported in Table 27.

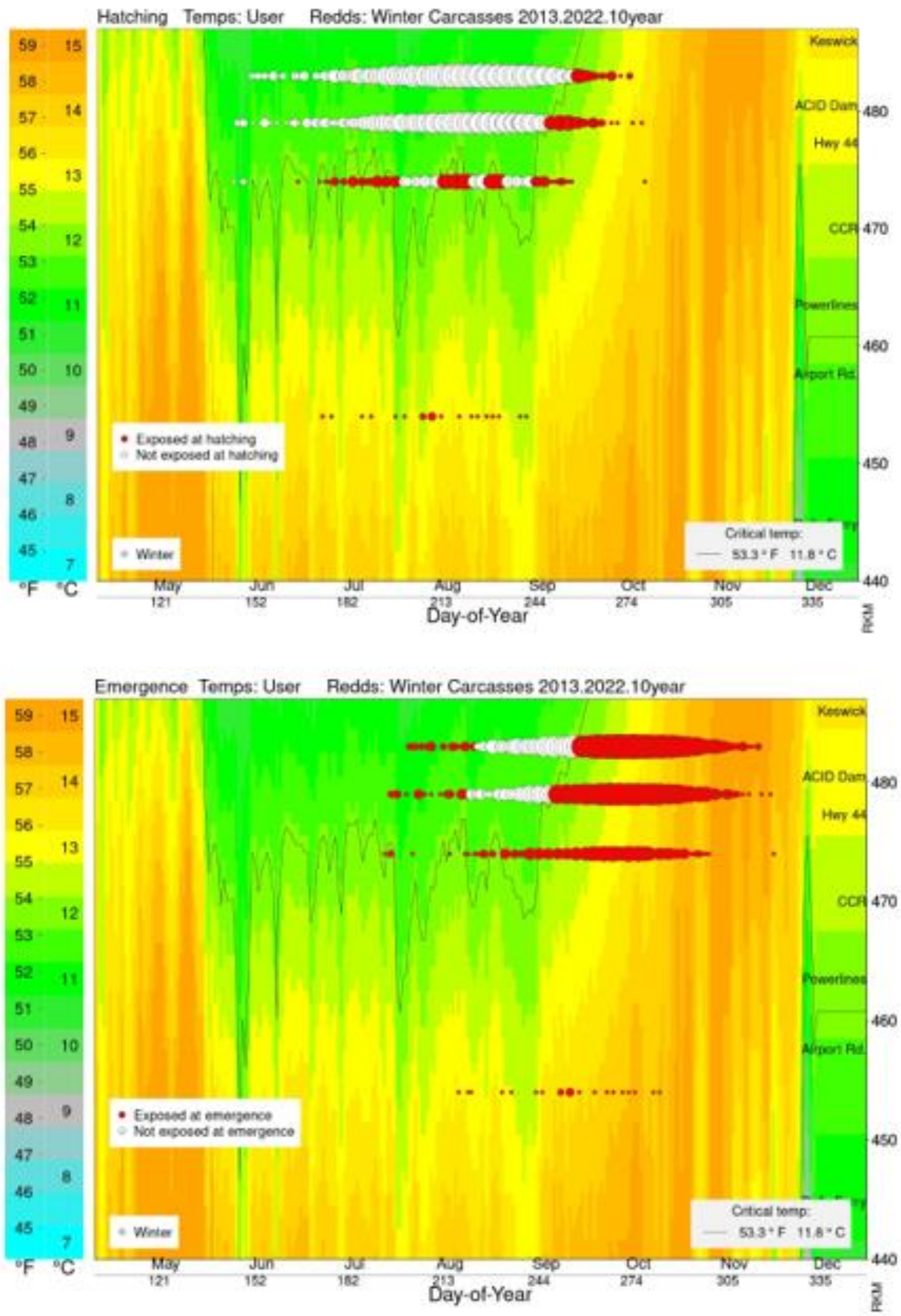


Figure 33. Predicted Temperature Exposures

Predicted temperature exposures for hatching redds (egg) and emerging redds (fry) for winter-run Chinook salmon under the July 17 WTMP scenario, with daily winter-run Chinook salmon redd-deposition counts summed across reaches and brood years 2013–2022 (carcass-derived). Most hatching and emergence events occurred when temperatures were at or above the critical threshold of 53.3°F (11.8°C), particularly during late summer (August to October), indicating substantial exposure of early life stages to elevated water temperatures. Emergence events appear more consistently exposed to warm conditions than hatching events, suggesting greater thermal risk during the emergence period.