Tuolumne River Voluntary Agreement
Scientific Basis Report

Peter Drekmeier, Yosemite Rivers Alliance

C/CAG RMCP
February 18, 2026

The Tuolumne River

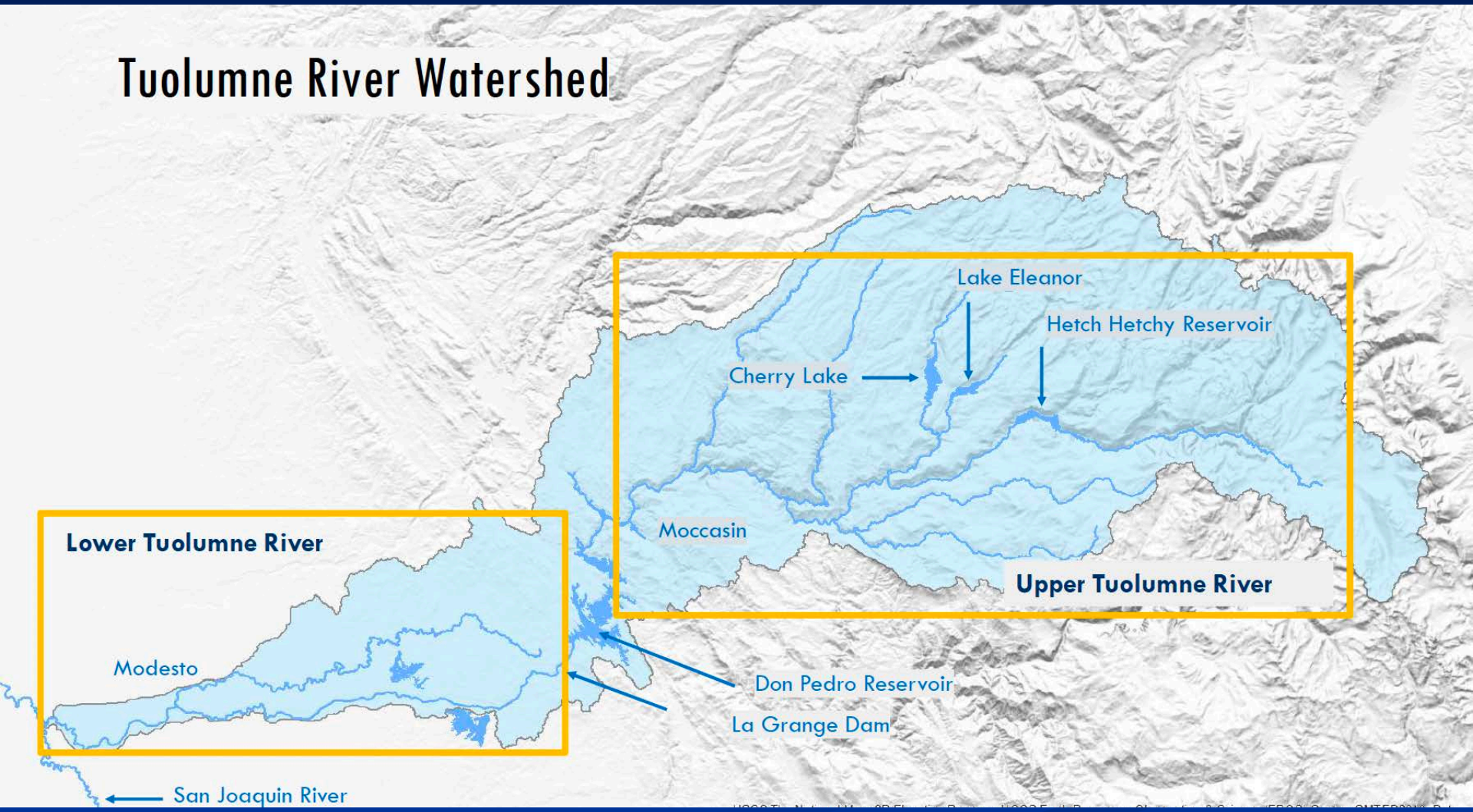
From Yosemite to San Francisco Bay

The Tuolumne River


To Sacramento
Sacramento/San Joaquin Delta
San Joaquin River
SF
LA
49
Sonora
Clavey River
Hetch Hetchy Reservoir
Tuolumne River
San Francisco
San Francisco Bay
120
Don Pedro Reservoir
132
Modesto
Tuolumne River
Yosemite National Park
Mt Lyell
To Los Angeles
N


Hetch Hetchy
Regional Water System
SAN FRANCISCO
SAN FRANCISCO BAY
PACIFIC OCEAN
PENINSULA
SERVICE AREA
SFO
SUNOL VALLEY
SAN JOAQUIN
HAYWARD
BAY DIVISION
HALF MOON BAY
PALO ALTO
SAN JOSE
TUOLUMNE RIVER
YOSEMITE NATIONAL PARK
STANISLAUS NATIONAL FOREST
San Andreas Fault
Hayward Fault
Calaveras Fault

Current focus is on the lower Tuolumne

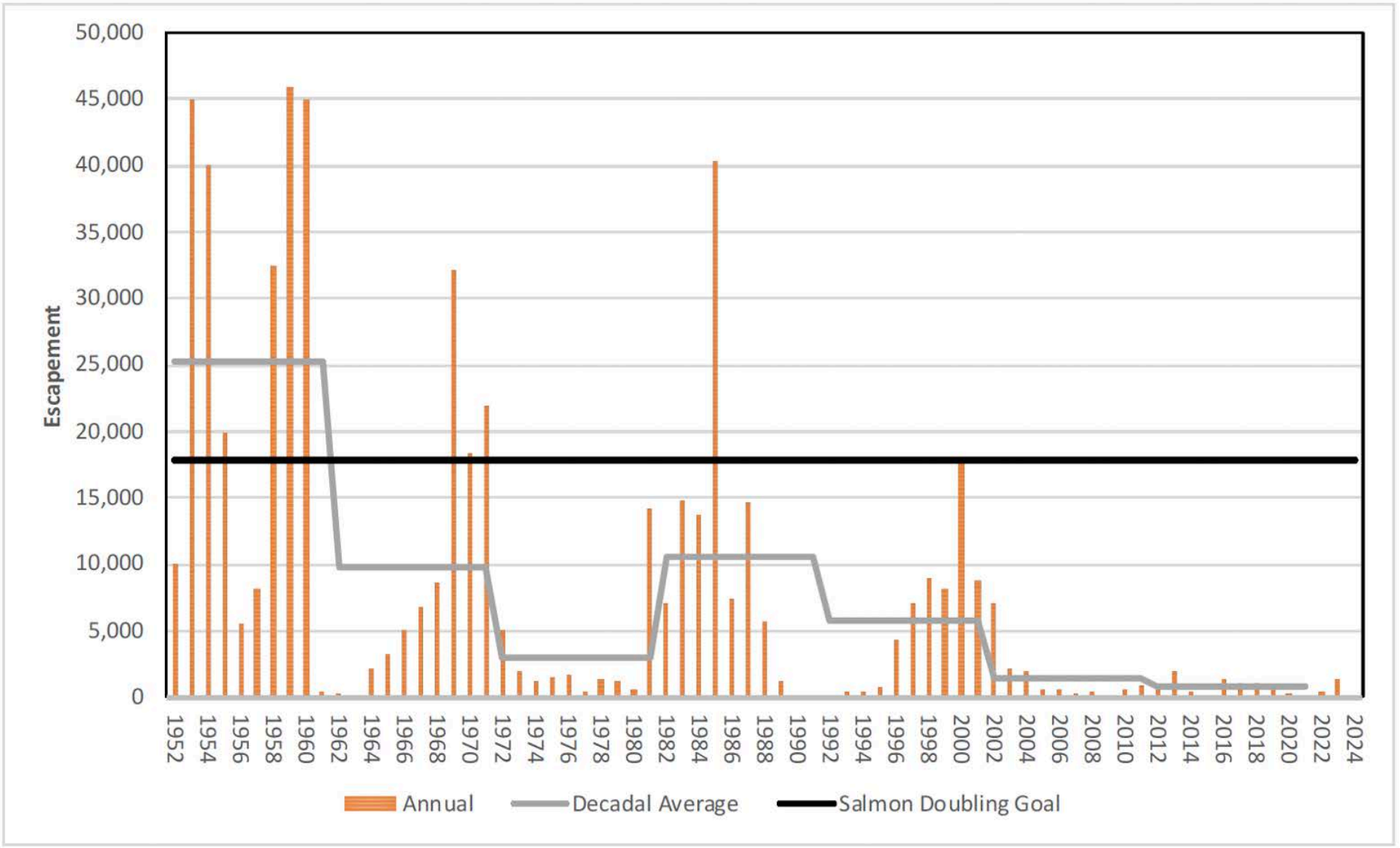


Where we still have salmon, steelhead and sturgeon

“The San Francisco Bay-Delta is an ecosystem in crisis.”

-Felicia Marcus, Former Chair, State Water Board

Tuolumne River Salmon Counts



Source: TVA Scientific Basis Report

Salmon are a “keystone” species

Supporting other species throughout their life stages

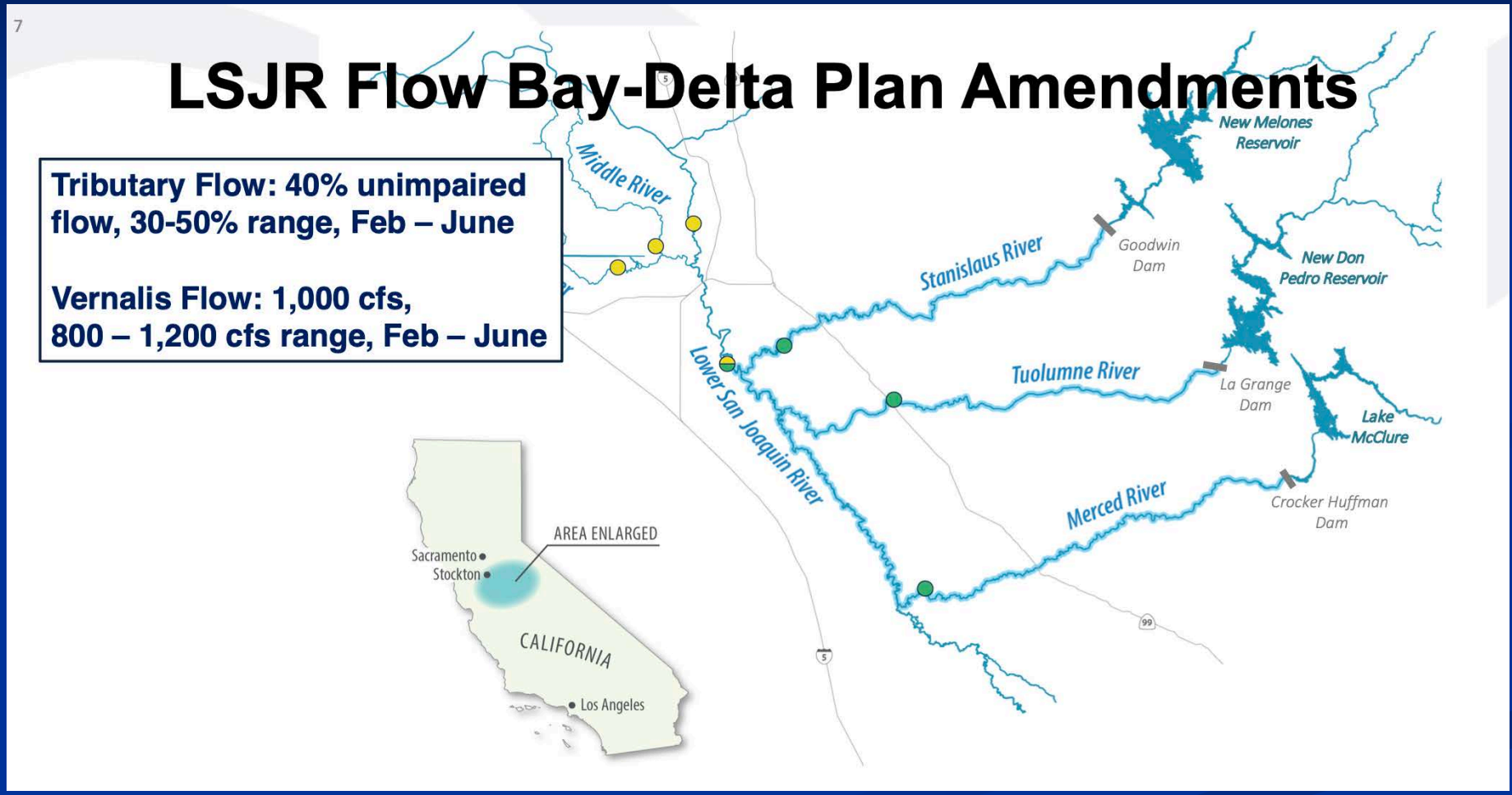
More than 100 species depend on salmon


Salmon are the modern day canary in the coalmine

Bay Delta Water Quality Control Plan

A once-in-a-generation opportunity
to revive the Bay-Delta and its tributaries

2018 Bay Delta Plan Update
40% of unimpaired flow between February and June



Current Flow Averages

Stanislaus: 40% Tuolumne: 21% Merced: 26%

Water Agencies Proposed a Voluntary Agreement

DRAFT SCIENTIFIC BASIS REPORT SUPPLEMENT FOR THE TUOLUMNE RIVER VOLUNTARY AGREEMENT PROPOSAL

Prepared by:

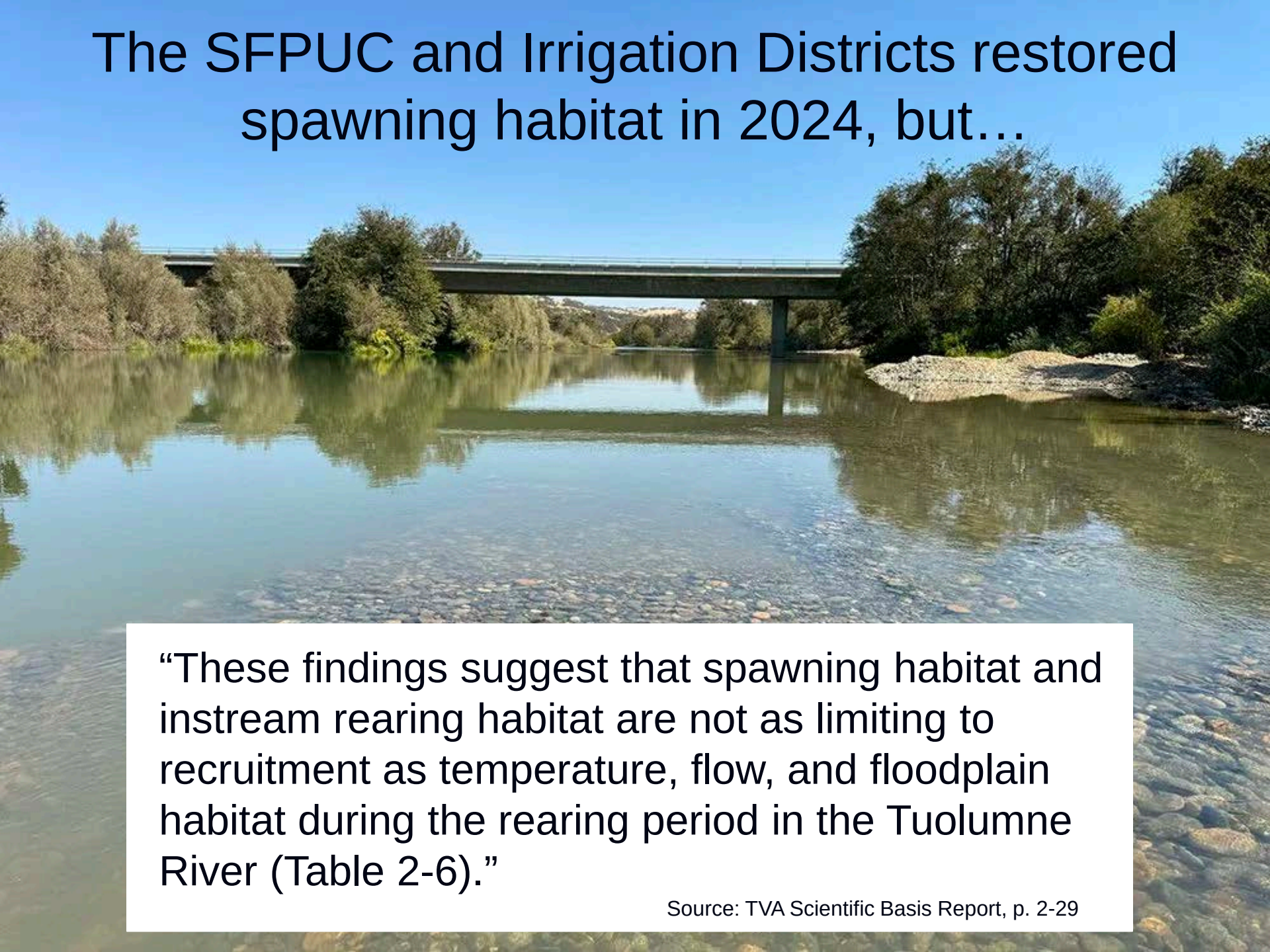
State Water Resources Control Board
California Department of Water Resources
California Department of Fish and Wildlife

September 2025

"Fish habitat quantity and quality on the Tuolumne River is primarily controlled by flows."

Source: TVA Scientific Basis Report, p. 2-15.

The SFPUC and Irrigation Districts restored spawning habitat in 2024, but…



"These findings suggest that spawning habitat and instream rearing habitat are not as limiting to recruitment as temperature, flow, and floodplain habitat during the rearing period in the Tuolumne River (Table 2-6)."

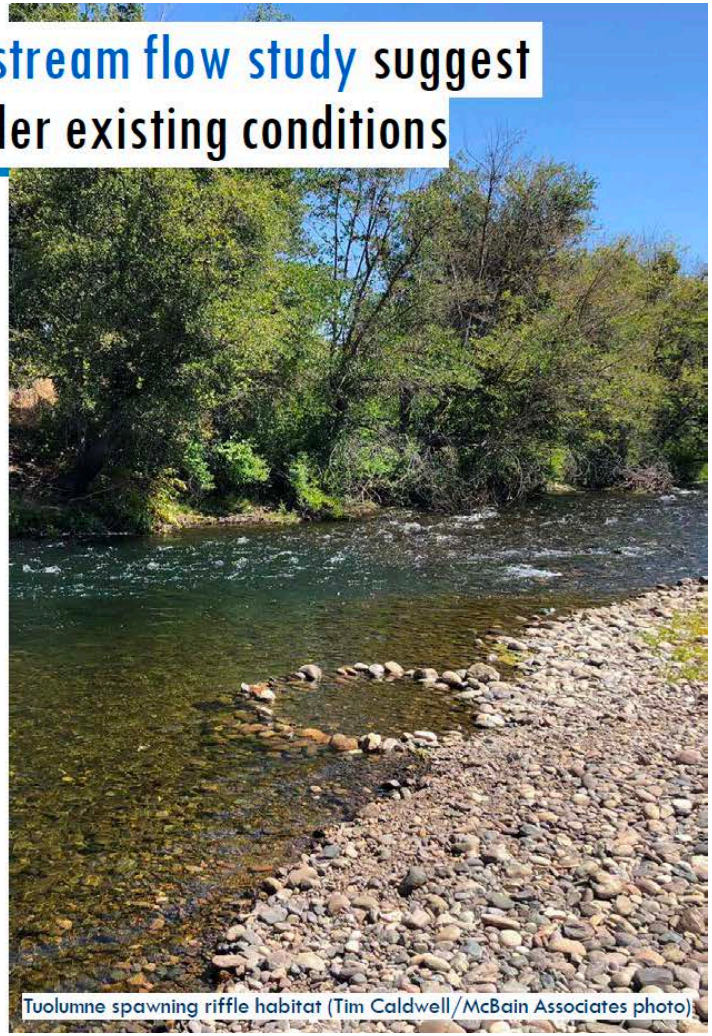
Source: TVA Scientific Basis Report, p. 2-29

The SFPUC acknowledged that spawning gravel is not a limiting factor

Hetch Hetchy Regional Water System

The spawning gravel study and instream flow study suggest spawning habitat isn't limiting under existing conditions

- Gravel available for ~40,000 fall-run Chinook spawners and several hundred thousand O. *mykiss* spawners
- However…spawning gravel moves downstream in high flows. Pre-dam, gravel replenishment from upper watershed; post-dam, augmentation needed
- Fine sediment embeds in gravels reducing egg-to-emergence survival
- Gravel mobilizes at flows of around 6,500 cfs, sorting and flushing fine sediment, improving gravel quality
- Estimated loss of ~8,000 tons of coarse sediment over the 7-mile dominant spawning reach from 2005-2012
- Redd mapping study and Chinook population model suggest a spawning habitat limitation at high escapements when spawners establish new redds over existing redds (superimposition)
- Studies support gravel augmentation and high flow releases for spawning habitat management; superimposition may need to be addressed



Tuolumne spawning riffle habitat (Tim Caldwell/McBain Associates photo)

Source: SFPUC, February 5, 2021

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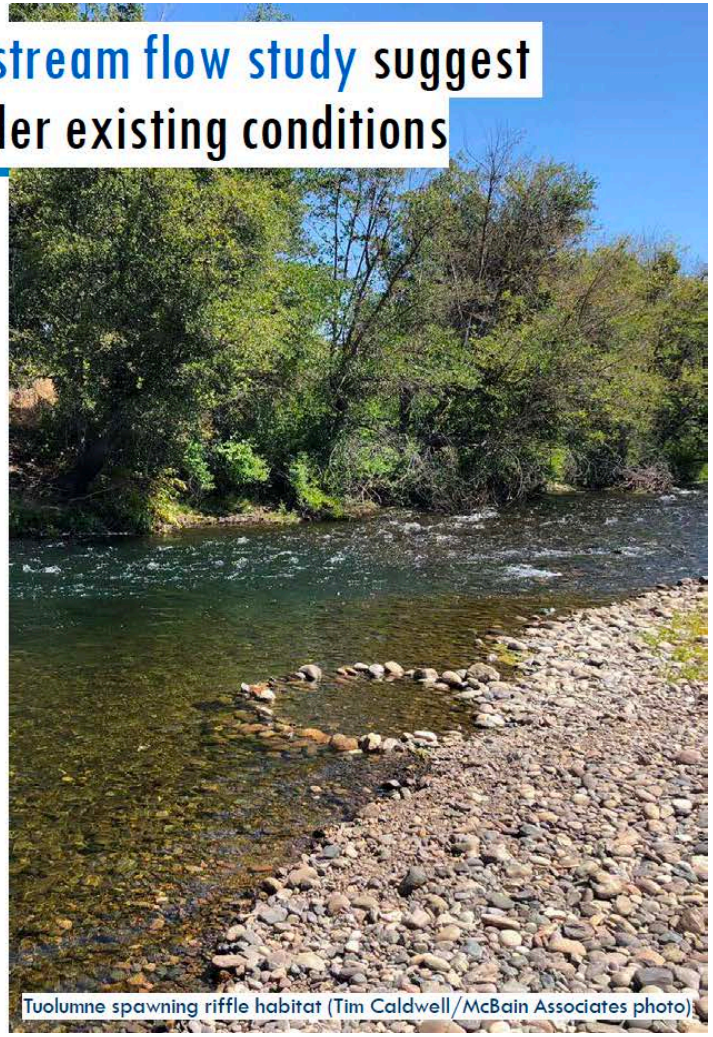

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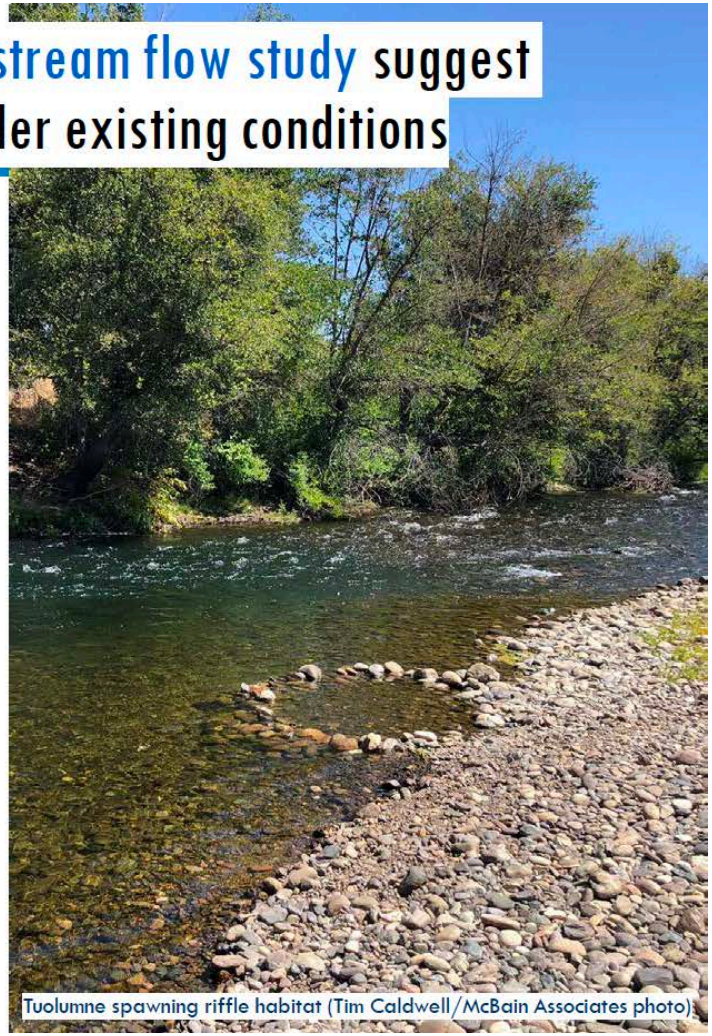

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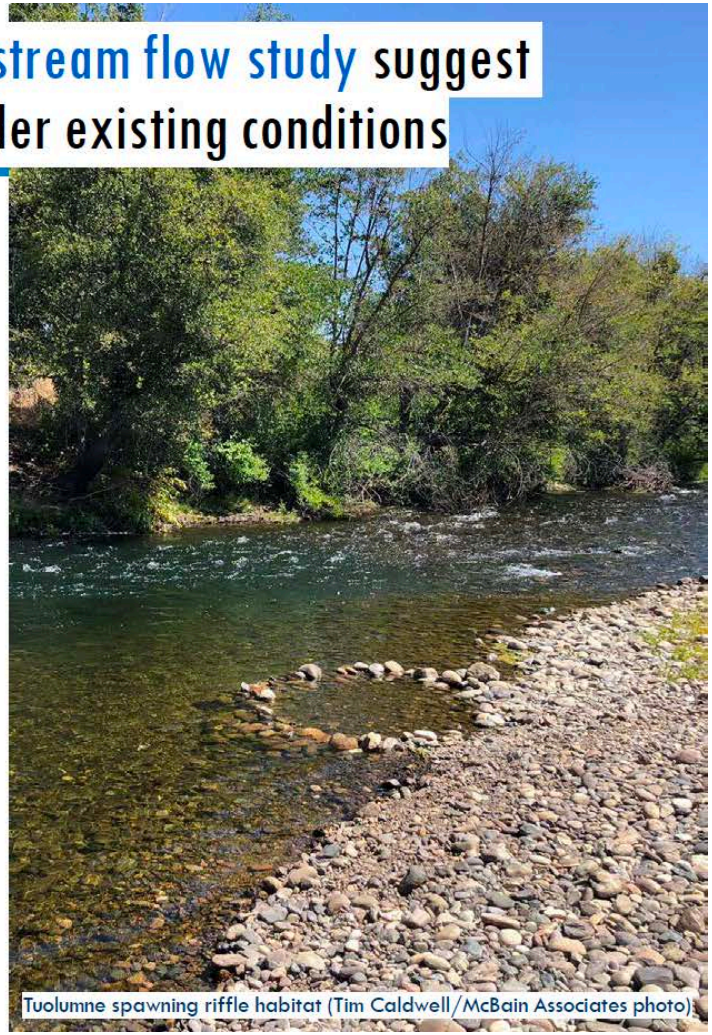
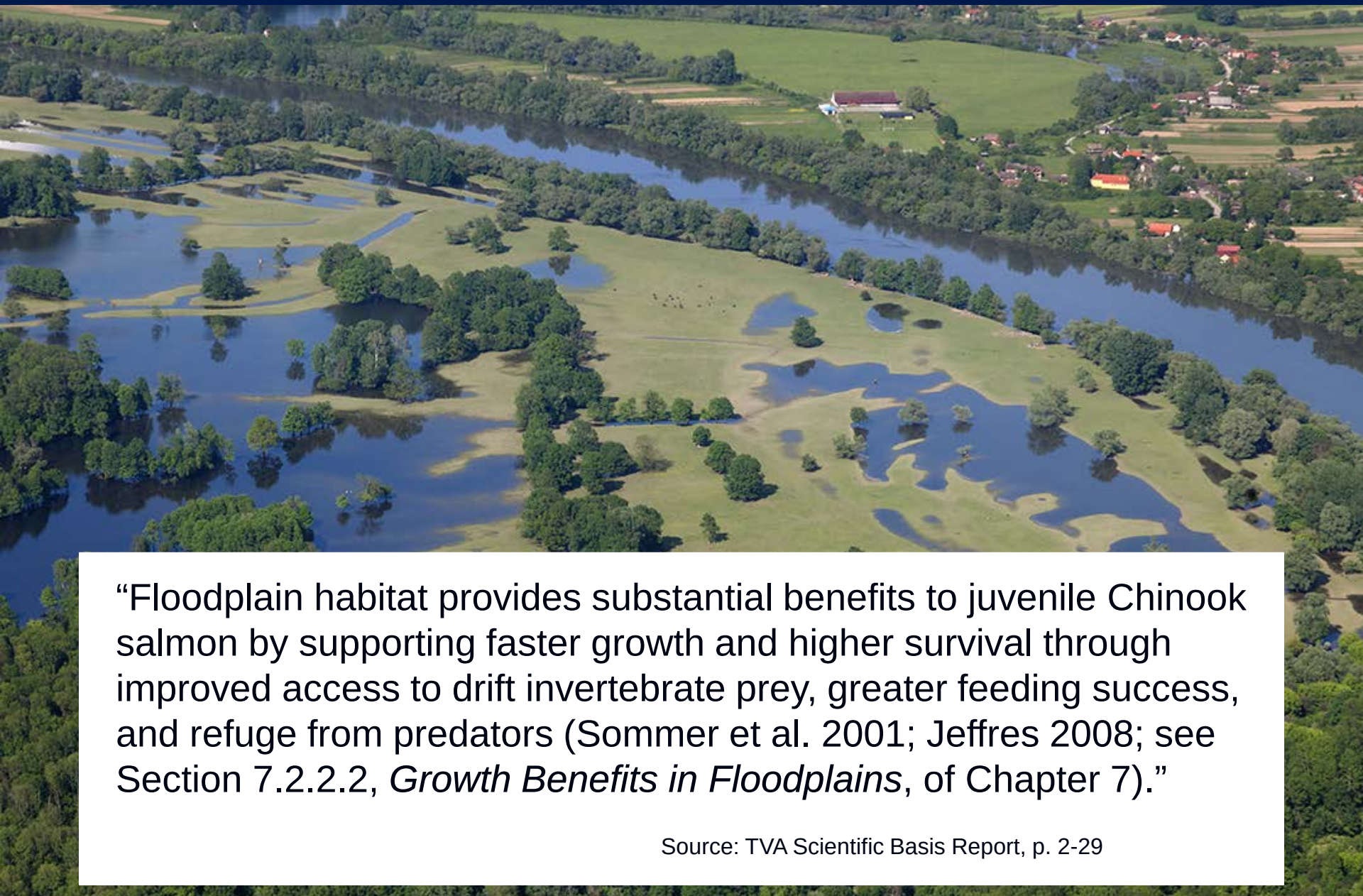


Tuolumne spawning riffle habitat (Tim Caldwell/McBain Associates photo)

Source: SFPUC, February 5, 2021

Floodplain rearing habitat is a limiting factor



"Floodplain habitat provides substantial benefits to juvenile Chinook salmon by supporting faster growth and higher survival through improved access to drift invertebrate prey, greater feeding success, and refuge from predators (Sommer et al. 2001; Jeffres 2008; see Section 7.2.2.2, *Growth Benefits in Floodplains*, of Chapter 7)."

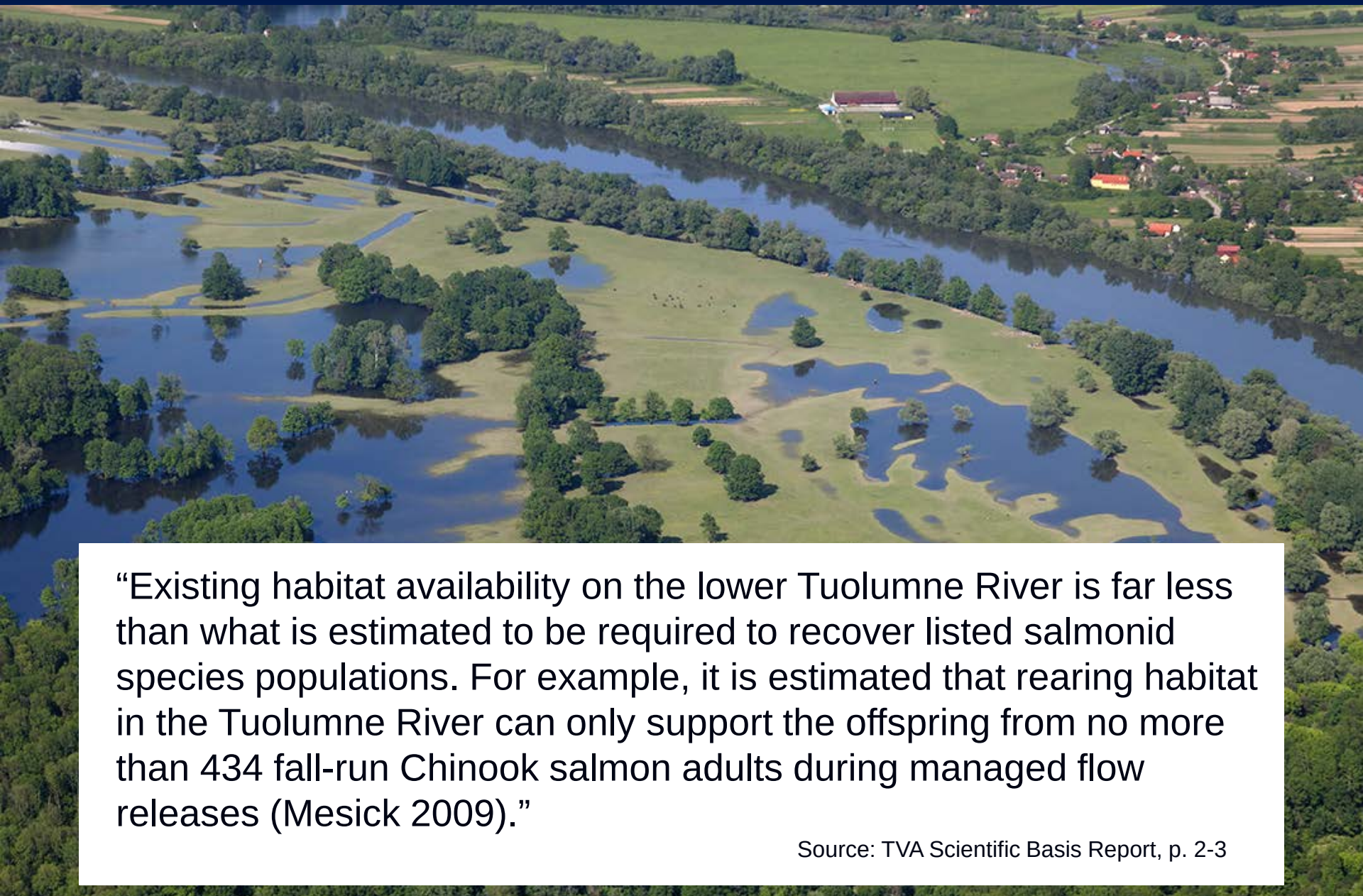
Source: TVA Scientific Basis Report, p. 2-29

Floodplain habitat produces robust fish

Source: TVA Scientific Basis Report, p. 7-16

Figure 7-5. Fork Length and Overall Health Condition Differences in Fish Reared for 54 Days in River Habitat (Length) and Floodplain Habitat (Right) (Source: Jeffres et al. 2008).

Floodplain rearing habitat is a limiting factor



"Existing habitat availability on the lower Tuolumne River is far less than what is estimated to be required to recover listed salmonid species populations. For example, it is estimated that rearing habitat in the Tuolumne River can only support the offspring from no more than 434 fall-run Chinook salmon adults during managed flow releases (Mesick 2009)."

Source: TVA Scientific Basis Report, p. 2-3

The TVA proposes meager flow increases

"The TVA is expected to result in new flow contributions (change relative to Existing Conditions) downstream of La Grange Dam from January through June that **range from 2 to 12 thousand-acre feet (TAF) per year on average**, depending on the model used for the calculation."

Source: TVA Scientific Basis Report, p. ES-6

Table 4-40. Estimates for New Flow Contributions Resulting from the TVA at La Grange Dam During January Through June Averaged for All Years and by WYT (in TAF).[a]

Water Year Type	Critically Dry	Dry	Below Normal	Above Normal	Wet	All Years
New TVA flow estimates using the TVA Parties' VA Accounting Spreadsheet [b]	37	50	58	-46	-89	2.1
New TVA flow estimates using the WSE model [c]	38	42	32	6	-28	12

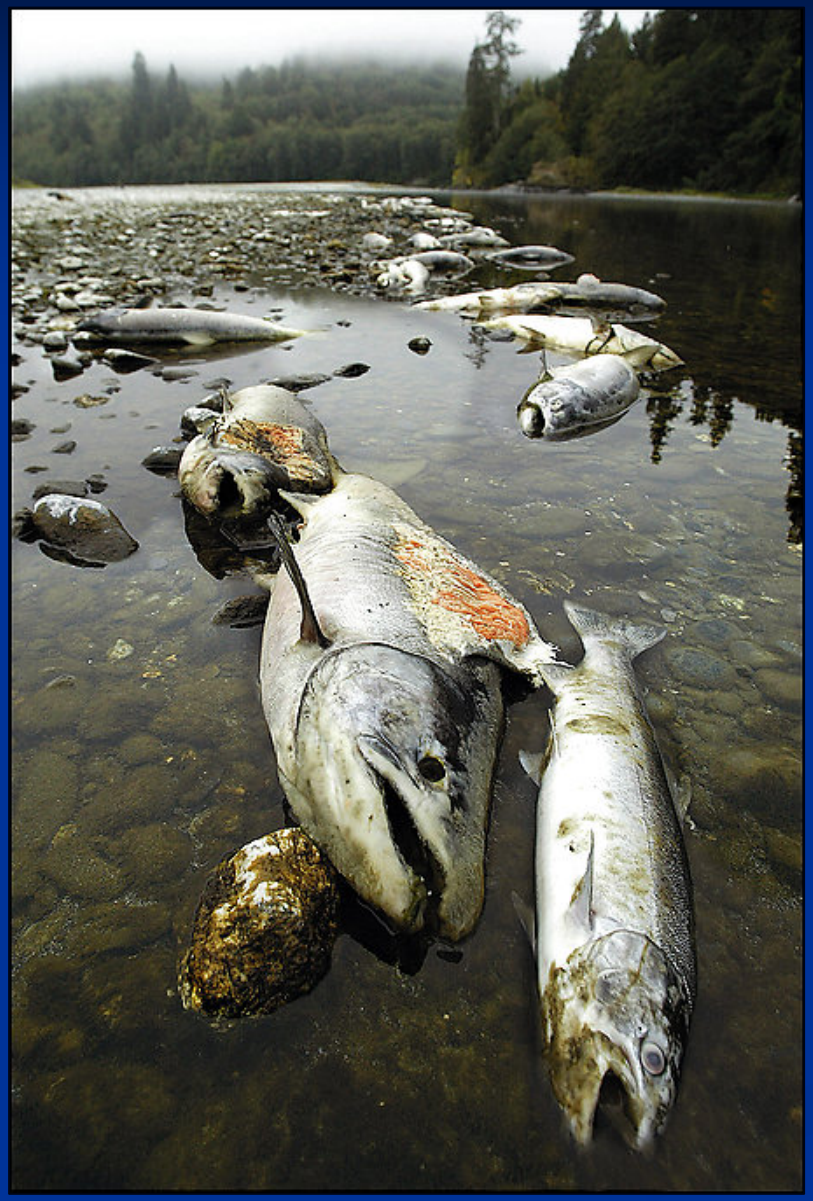
[a] The TVA Term Sheet included different numbers that were developed in 2022 using an older version of State Water Board's WSE model that had not received all the updates described in Appendix B, *Hydrologic and Water Quality Modeling*.

[b] Values from the draft TVA Accounting Spreadsheet are averaged over the 25-year period from 1999 through 2023.

[c] Values from the WSE model are averaged over the 82-year period from 1922 through 2003. Using a different range in years can contribute to different estimated values.

Source: TVA Scientific Basis Report, p. 4-57

Low flows impact water temperature



Klamath River salmon kill, 2002

"Water temperature is likely the most important abiotic factor (besides water itself), in the environment for fish and the ecosystem for which they depend, because without suitable water temperatures habitats become unusable."

Source: TVA Scientific Basis Report, p. 5-1

Water temperature is critical for native fish

"Providing suitable water temperatures is critical to the health of the lower Tuolumne River aquatic ecosystem. Water temperature influences every freshwater life stage of anadromous salmonids…"

Source: TVA Scientific Basis Report, p. 2-6

Non-native species thrive under low flow conditions

Low flows favor non-native predators, high flows favor salmon and trout

Bass eat baby salmon and trout.

"In general, reduced spring flows, elevated water temperatures, and the presence of low-velocity habitats…favor fish communities dominated by non-native, warmwater species, such as largemouth bass and other potential predators on native salmonids (EA 1992; McBain & Trush 2000; Brown and Ford 2002)."

Source: TVA Scientific Basis Report, p. 2-5

Higher flows support juvenile fish out-migration

Rotary screw traps count fish at Waterford (RM 29.8) and Grayson (RM 5.2)

Table 2-3. Survival Indices through the Lower Tuolumne River between Waterford and Grayson.

Year	Total Survival Index	Fry Survival Index	Peak Fry Daily Avg. Flow at MOD	Smolt Survival Index	Peak Smolt Daily Avg. Flow at MOD
2007	–	–	957	2.9	1,020
2008	6.2	6.5	1,690	6.4	1,320
2009	7.9	0.3	1,300	14.2	1,020
2010	3.0	0.8	767	3.4	3,300
2011	24.9	23.1	7,490	31.2	8,180
2012	3.8	0.2	599	9.7	1,950
2013	1.7	0.03	510	4.0	1,140
2014	– [a]	– [a]	279	– [a]	1,100
2016	– [a]	– [a]	2,200	6.3	2,170
2017	94.8	95.8	15,500	60.6	10,400

Source: Reproduced from 2017 Annual Report TID and MID 2018.

[a] Survival index not calculated due to incomplete sampling at Grayson.

Source: TVA Scientific Basis Report, p. 2-17

Proposed drought offramps are too generous

Table 3-1. Proposed Increases in Tributary Flow Requirements as Identified in the MOU (Thousand-Acre Feet; January through June).[a]

	Water Year				
	Critical	**Dry**	**Below Normal**	**Above Normal**	**Wet**
Tuolumne River downstream of La Grange Dam	86(17)	140(40)	127(98)	138	138

Source: TVA Scientific Basis Report, p. 3-3

"From 1970 to 2024, 17 out of the 55 years would have included sequential dry year off-ramps which is a frequency of 1 out of every 3 years."

Source: TVA Scientific Basis Report, p. 5-65

"…the TVA temperatures would exceed the Existing Conditions scenario from mid-April through mid-May when the off-ramps are being implemented."

Source: TVA Scientific Basis Report, p. 5-69

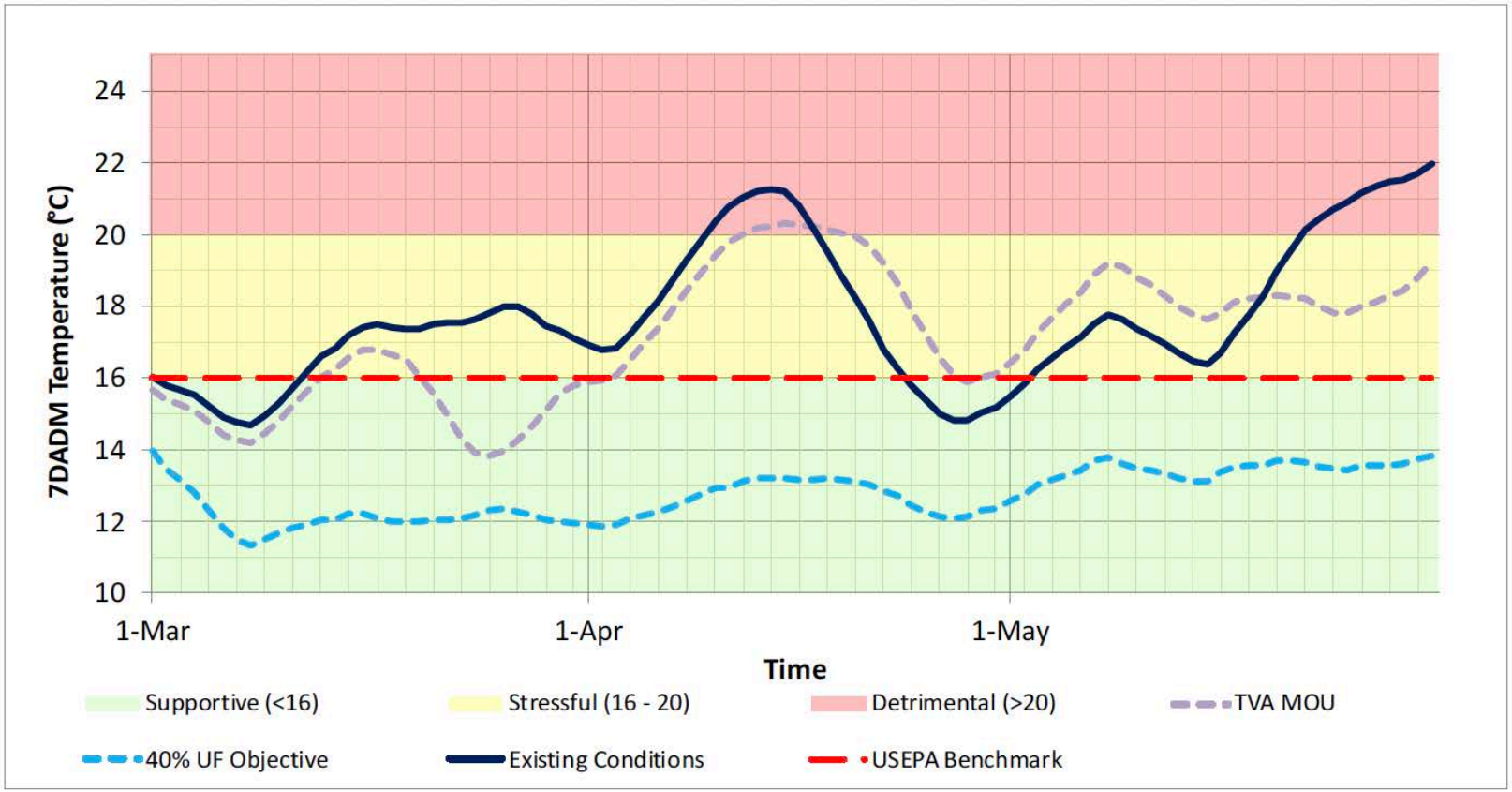


Figure 5-75. Tuolumne River Running 7DADM Water Temperatures at RM 28.1 During 1989 Which Is the Third Critical Water Year Type in a Sequence of Critical Years and Is an Off-Ramp Year.

Slow-moving, warm, nutrient-rich water causes toxic algae blooms in the Delta

"The TVA is expected to result in new contributions to Delta outflow that range from 7 to 17 TAF per year on average depending on the amount of TVA flow at Vernalis that is not diverted in the Delta."

Source: TVA Scientific Basis Report, p. ES-6

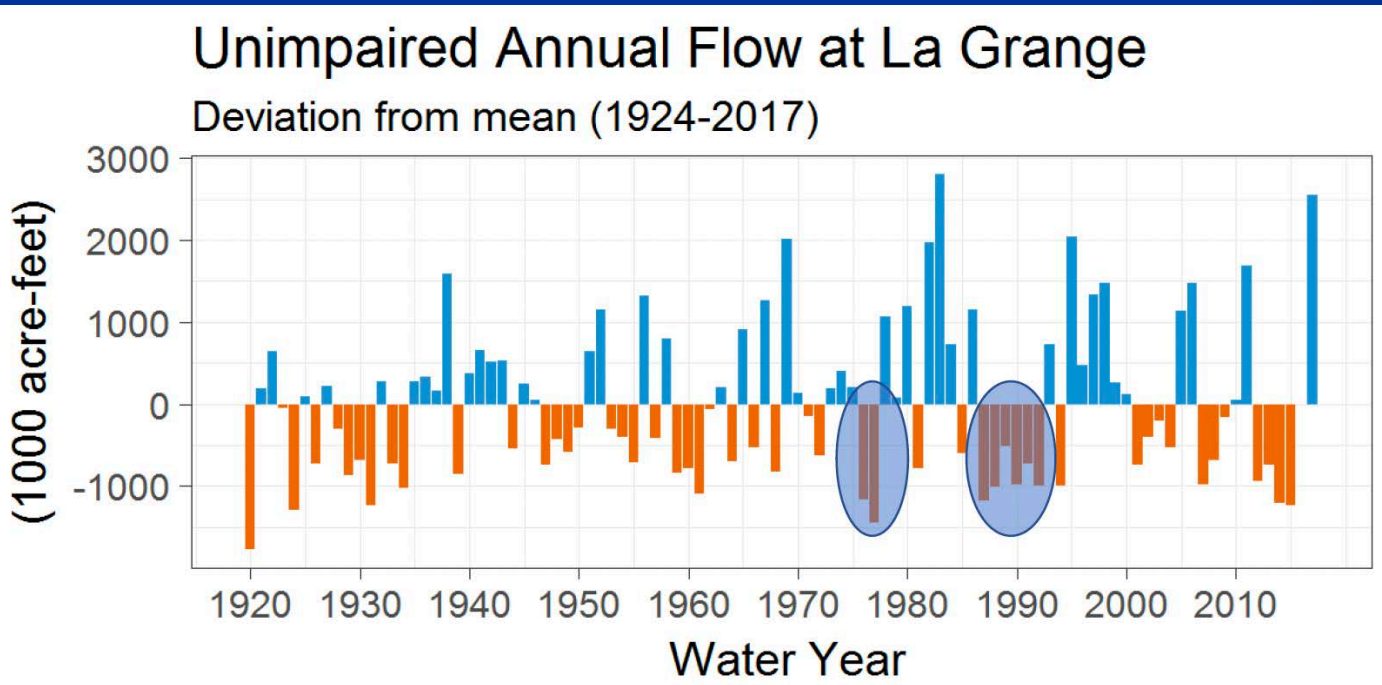
We can meet the State's coequal goals of ensuring a reliable water supply AND restoring the Bay-Delta ecosystem?

SFPUC Design Drought

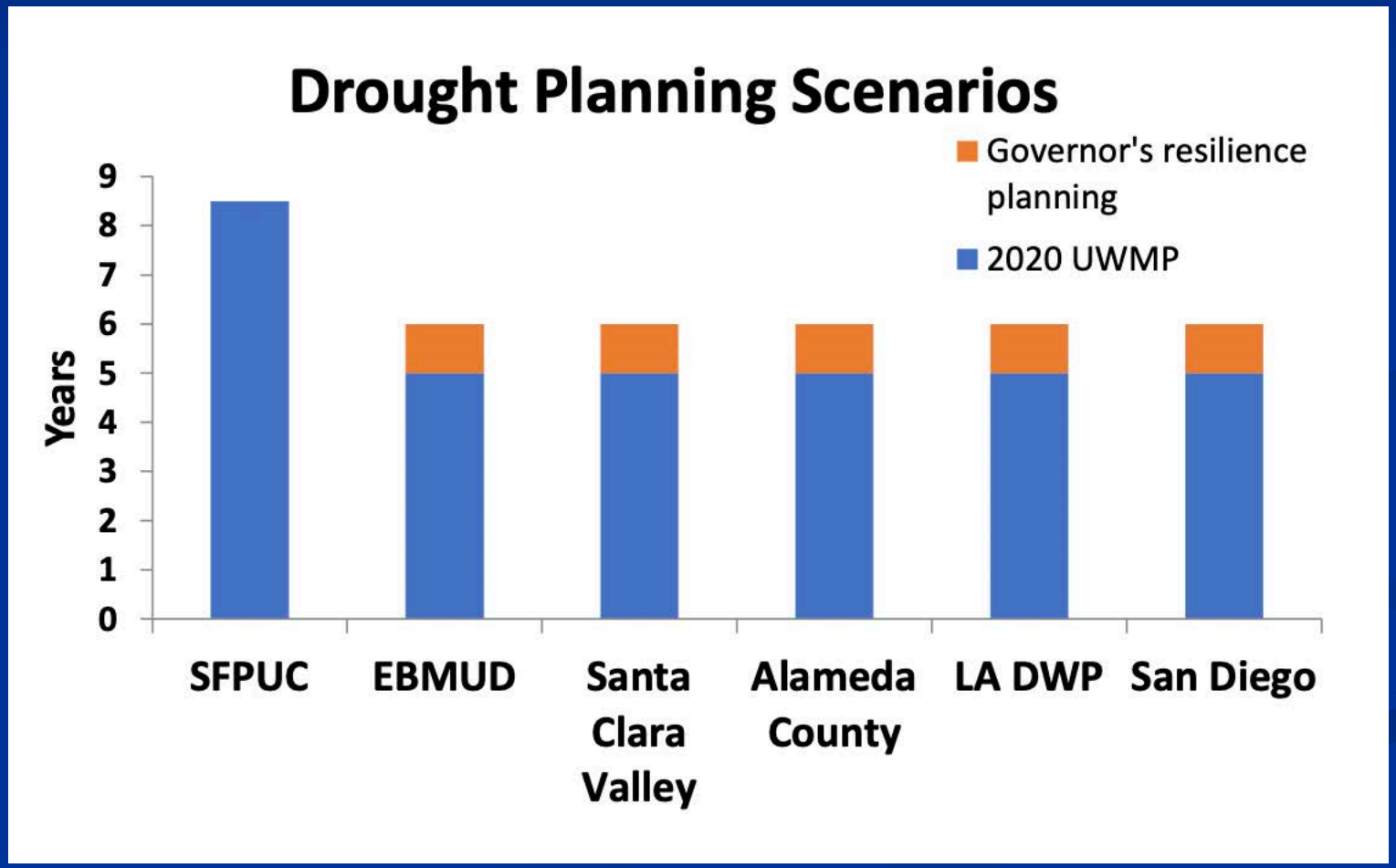
Hetch Hetchy Regional Water System

San Francisco Water Supply Planning

- Our Level of Service objective for water supply (used since 1994 and adopted in 2008) is to **survive a specific 8.5-year drought planning scenario (1987-92 followed by 1976-77) with no more than 20% rationing** from a **total system demand of 265 MGD**.



The SFPUC has the longest drought scenario of California's major urban water agencis



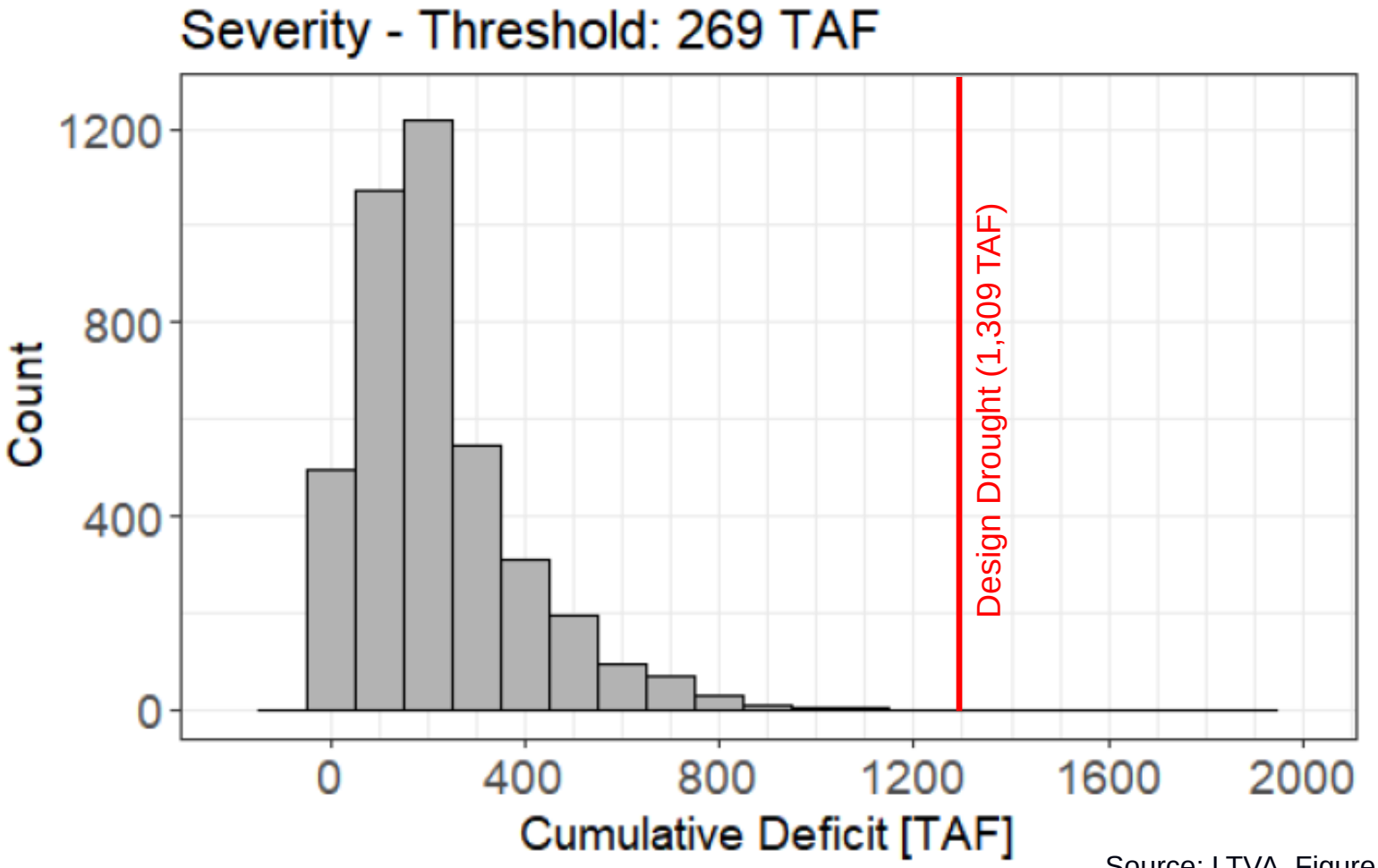
The Design Drought is 72% more severe than the worst drought on record

Table 3-9. Extracted Drought Events from Historical Tuolumne Flow at La Grange for Two Different Thresholds.
For each threshold, the drought events are sorted by decreasing severity.

Threshold: 269 TAF			Threshold: 365 TAF		
Year Drought ends	Severity [TAF]	Duration of Deficit [Years]	Year Drought Ends	Severity [TAF]	Duration of Deficit [Years]
1992	707.39	6	1992	1283.39	6
2015	594.35	4	2015	978.35	4
1977	510.18	2	1977	702.18	2
1961	389.44	3	1961	677.44	3
1931	312.14	3	1931	600.14	3
1924	233.66	1	2008	418.98	2
2008	226.98	2	1934	357.10	2
1934	218.34	1	1924	329.66	1
1994	204.77	1	1968	229.06	1
1968	133.06	1	1939	223.20	1
1939	127.20	1	1947	190.42	1
1947	94.42	1	1964	189.19	1
1964	93.19	1	1981	165.90	1
1981	69.90	1	1972	154.99	1
1972	58.99	1	1985	118.42	1
1985	22.42	1	1955	104.96	1
1955	8.96	1	2001	75.15	1
			1926	72.70	1
			1966	45.69	1
			1944	37.45	1
			2004	37.09	1

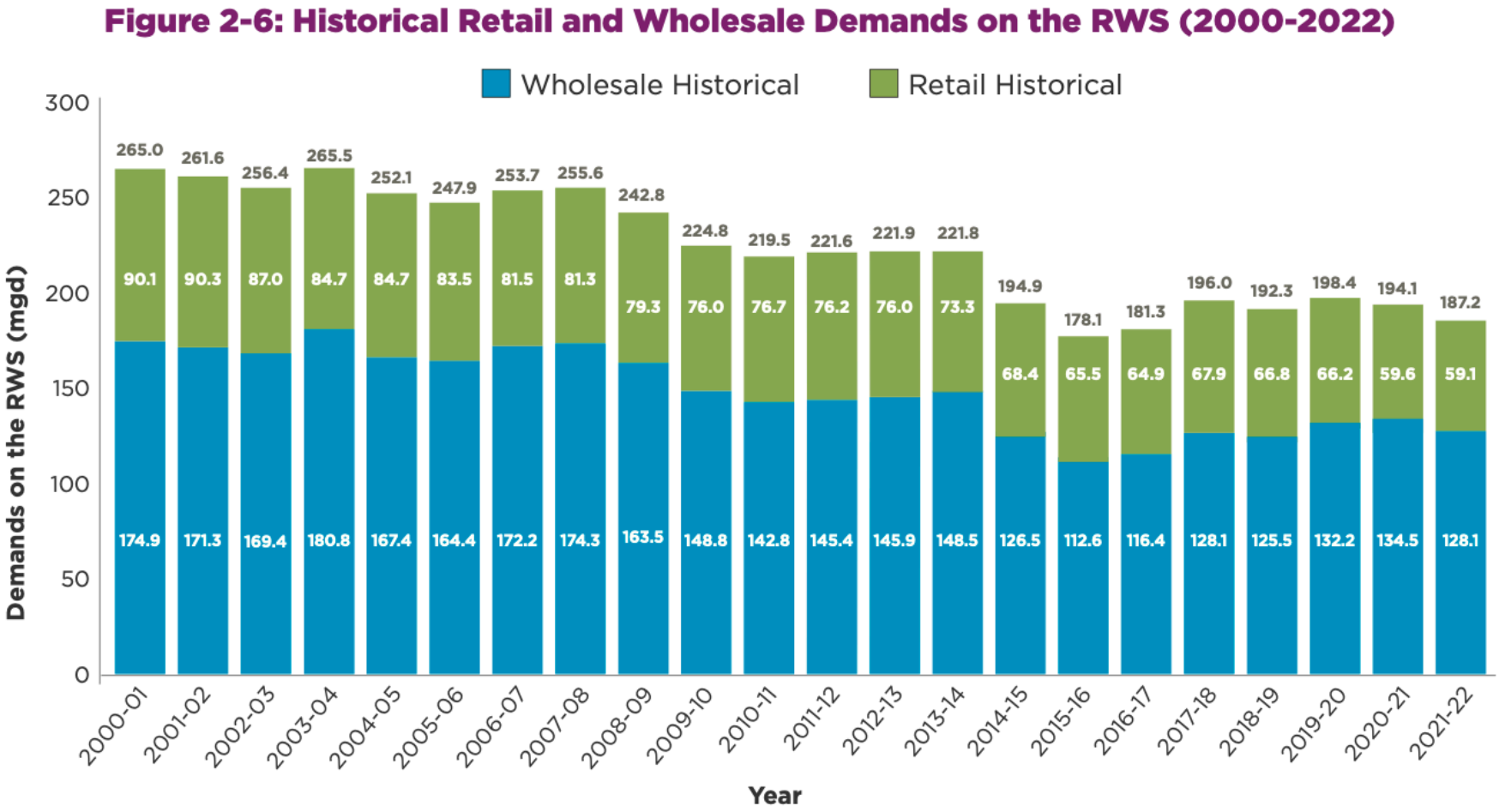
Source: SFPUC LTVA, 2021

The LTVA's most severe drought used 1,200 TAF of storage



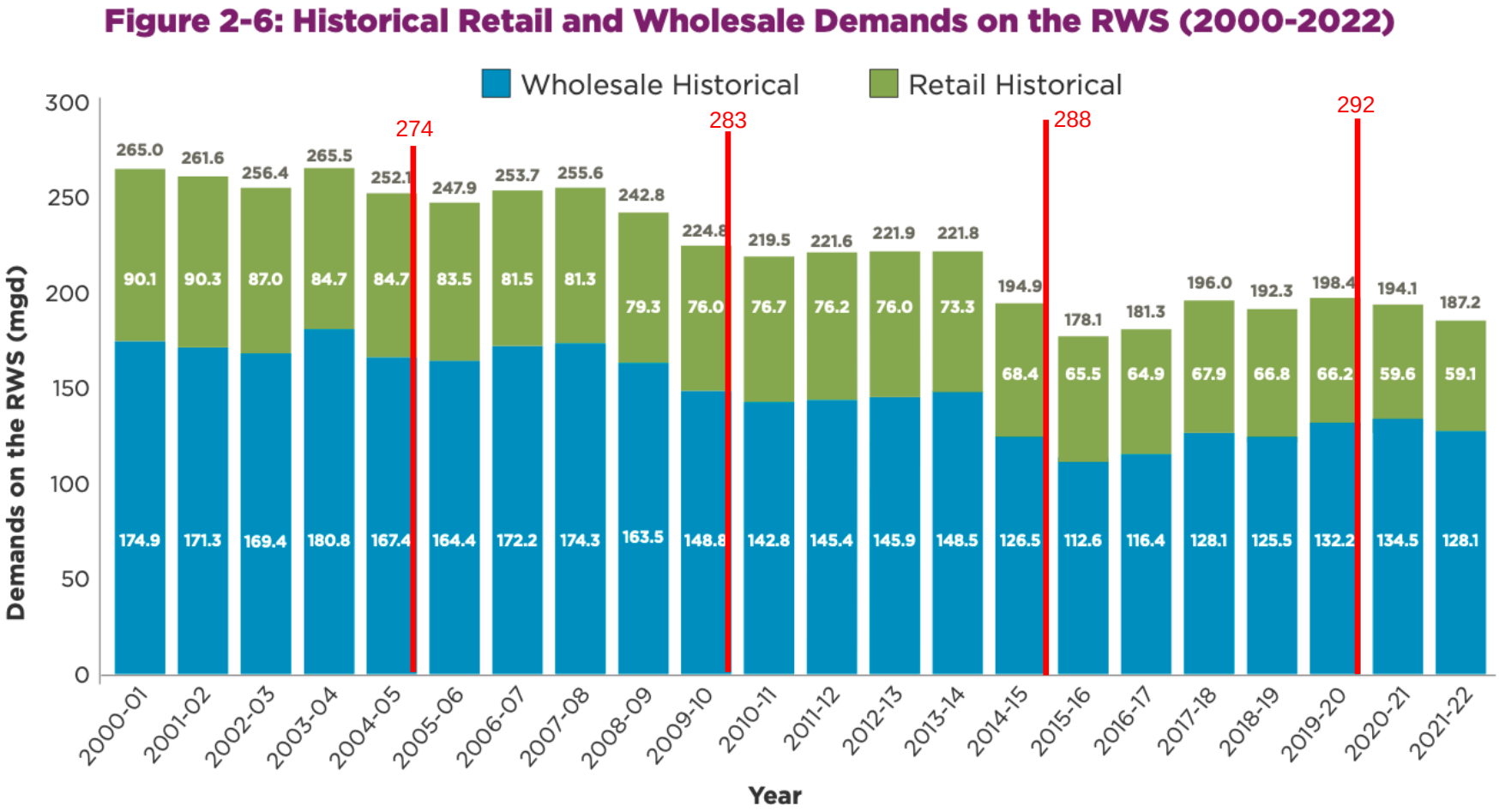
Source: LTVA, Figure 3-29

Observed Water Demand

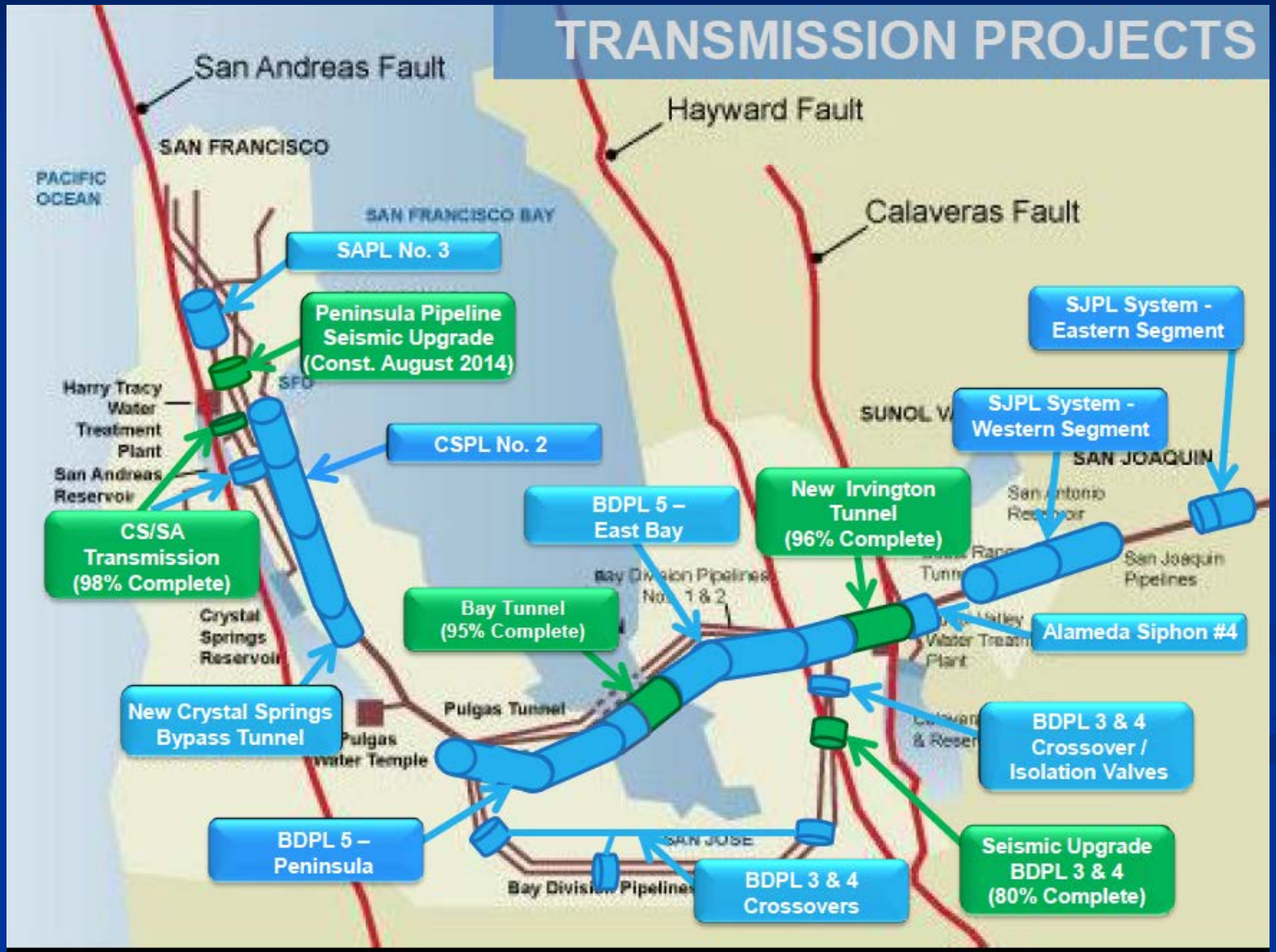


Source: SFPUC Alternative Water Supply Plan, February 2024

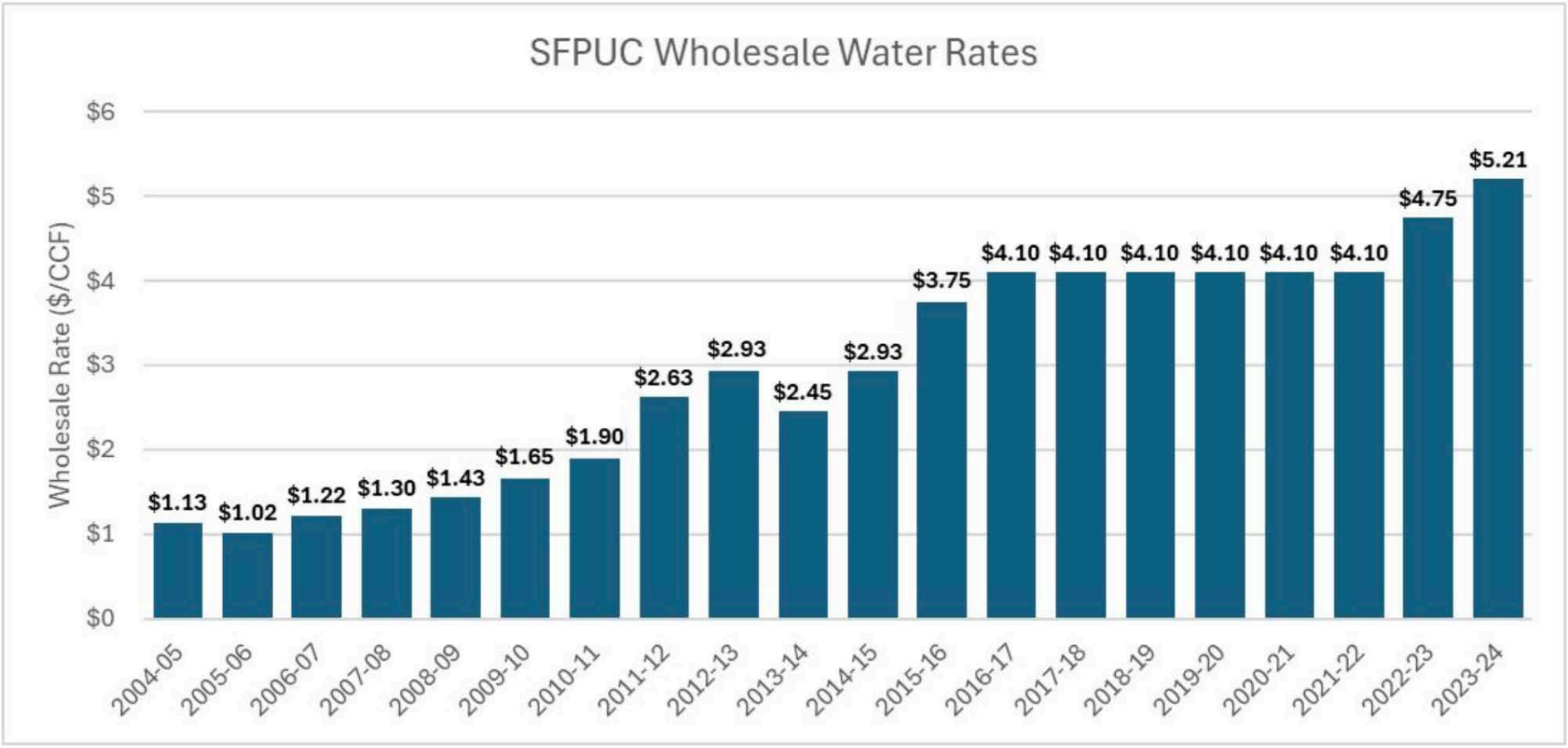
Water demand projections have always been inflated



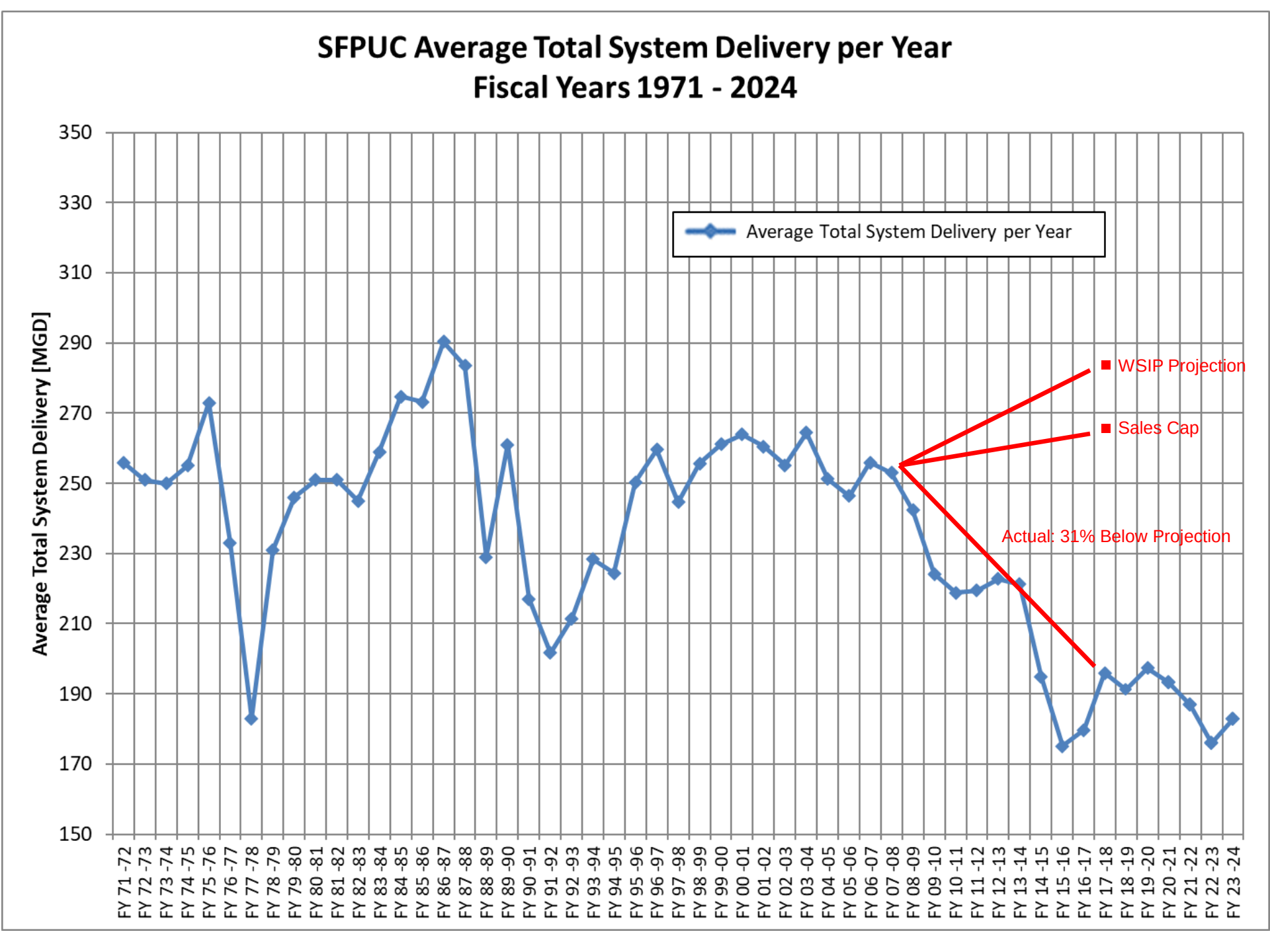
Water System Improvement Program
2008 – $4.8 billion



Water rates have quadrupled since the WSIP was adopted



Source: Mid-Peninsula Water District


SFPUC Average Total System Delivery per Year
Fiscal Years 1971 - 2024
Average Total System Delivery [MGD]
350
330
310
290
270
250
230
210
190
170
150
Average Total System Delivery per Year
WSIP Projection
Sales Cap
Actual: 31% Below Projection
FY 71 -72
FY 72 -73
FY 73 -74
FY 74 -75
FY 75 -76
FY 76 -77
FY 77 -78
FY 78 -79
FY 79 -80
FY 80 -81
FY 81 -82
FY 82 -83
FY 83 -84
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FY 14 -15
FY 15 -16
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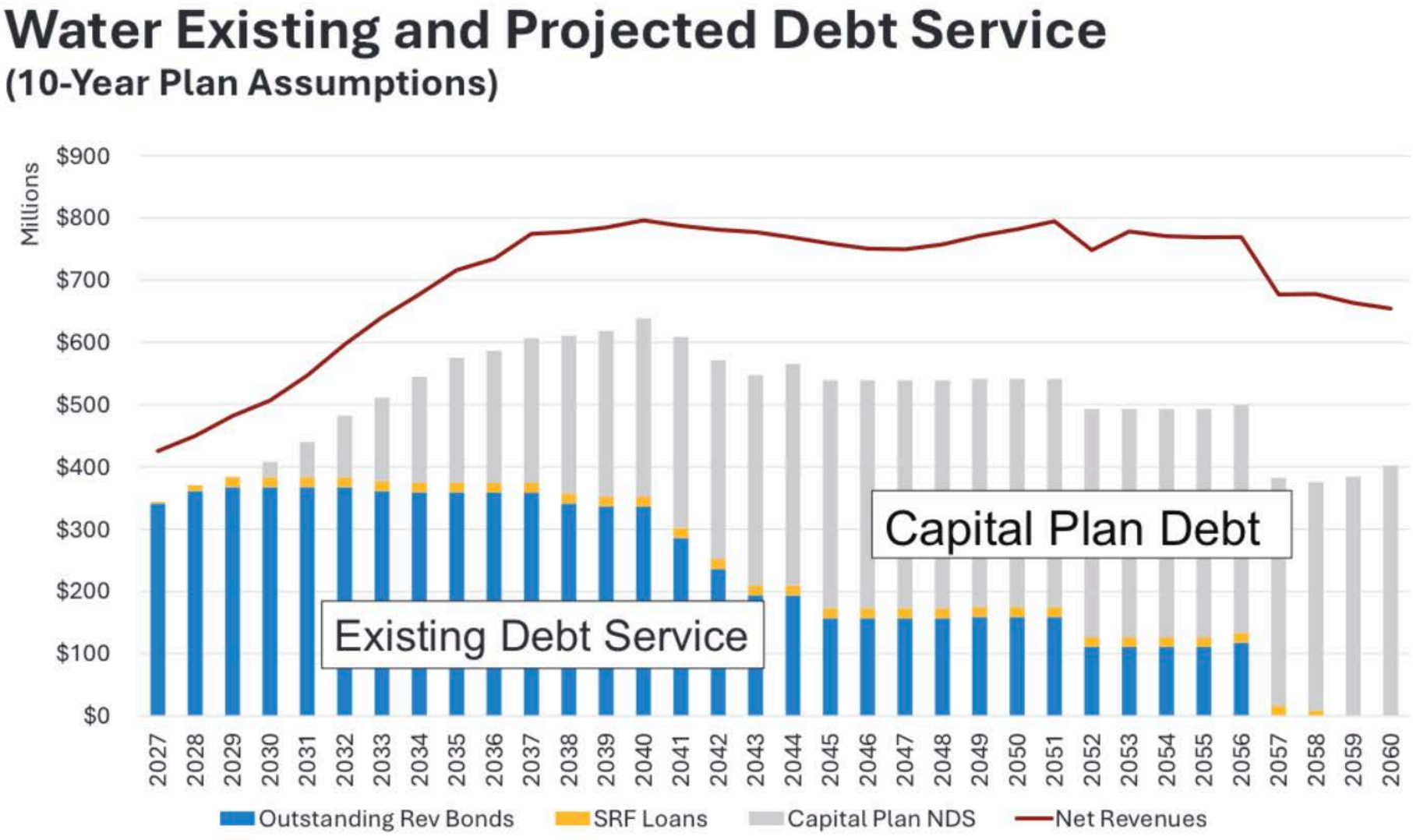
FY 21 -22
FY 22 -23
FY 23 -24

Debt service doubles the cost of projects



Source: SFPUC Budget Hearing, January 12, 2026

Drought of Record Repeat

(With Bay Delta Plan flows in place)

Year	Demand (MGD)	Rationing (%)	Storage Reduction (TAF)	Water in Storage (TAF)
=1986				1,517
=1987	190	0	441	1,076
=1988	190	0	312	764
=1989	190	0	35	729
=1990	190	0	282	447
=1991	190	0	90	357
=1992	190	0	235	**122**

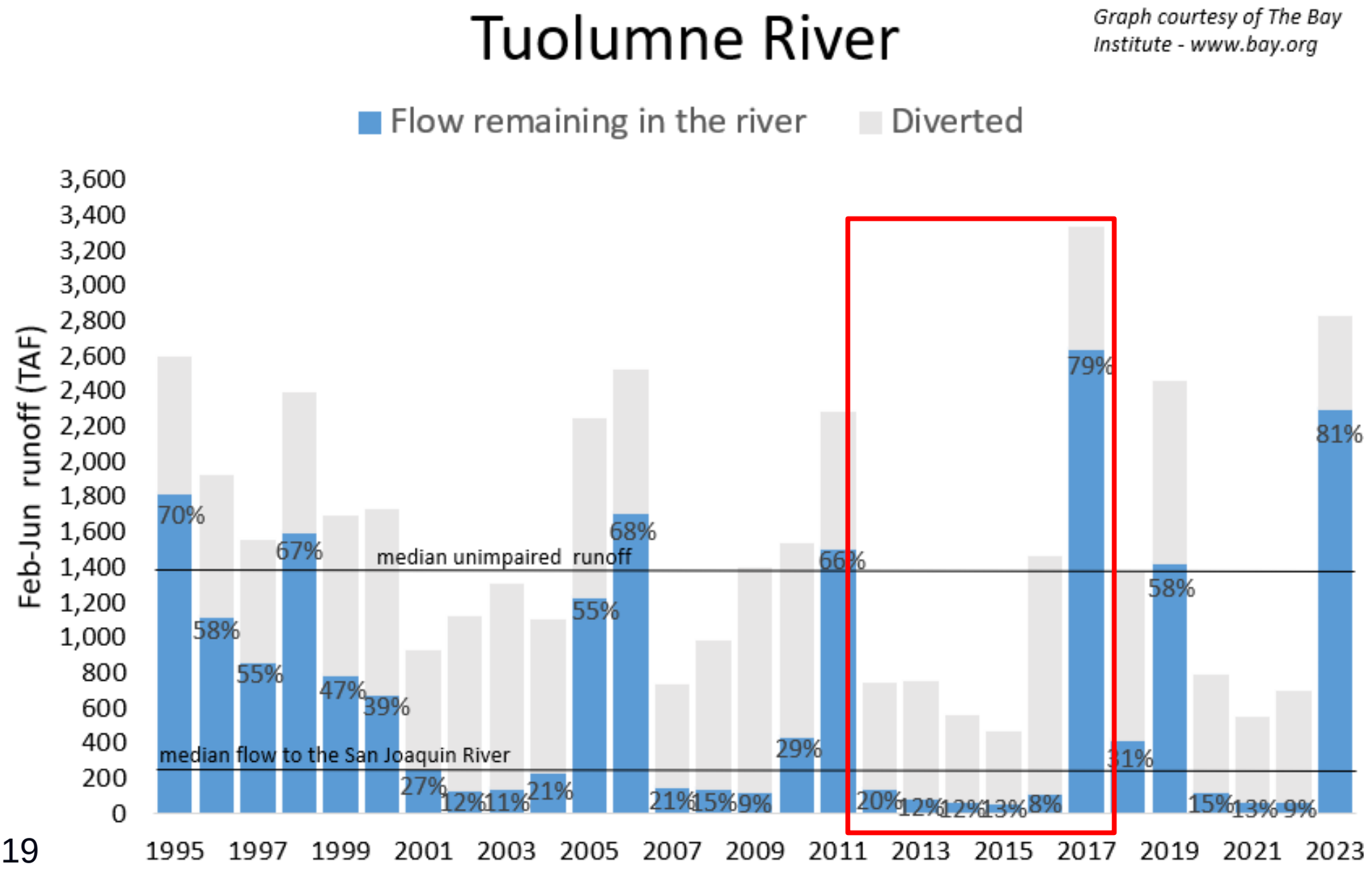
If the worst drought on record were to repeat, and the Bay Delta Plan flows were in place, the SFPUC could manage the drought without requiring any rationing or developing any new water supplies.

Drought of Record Repeat

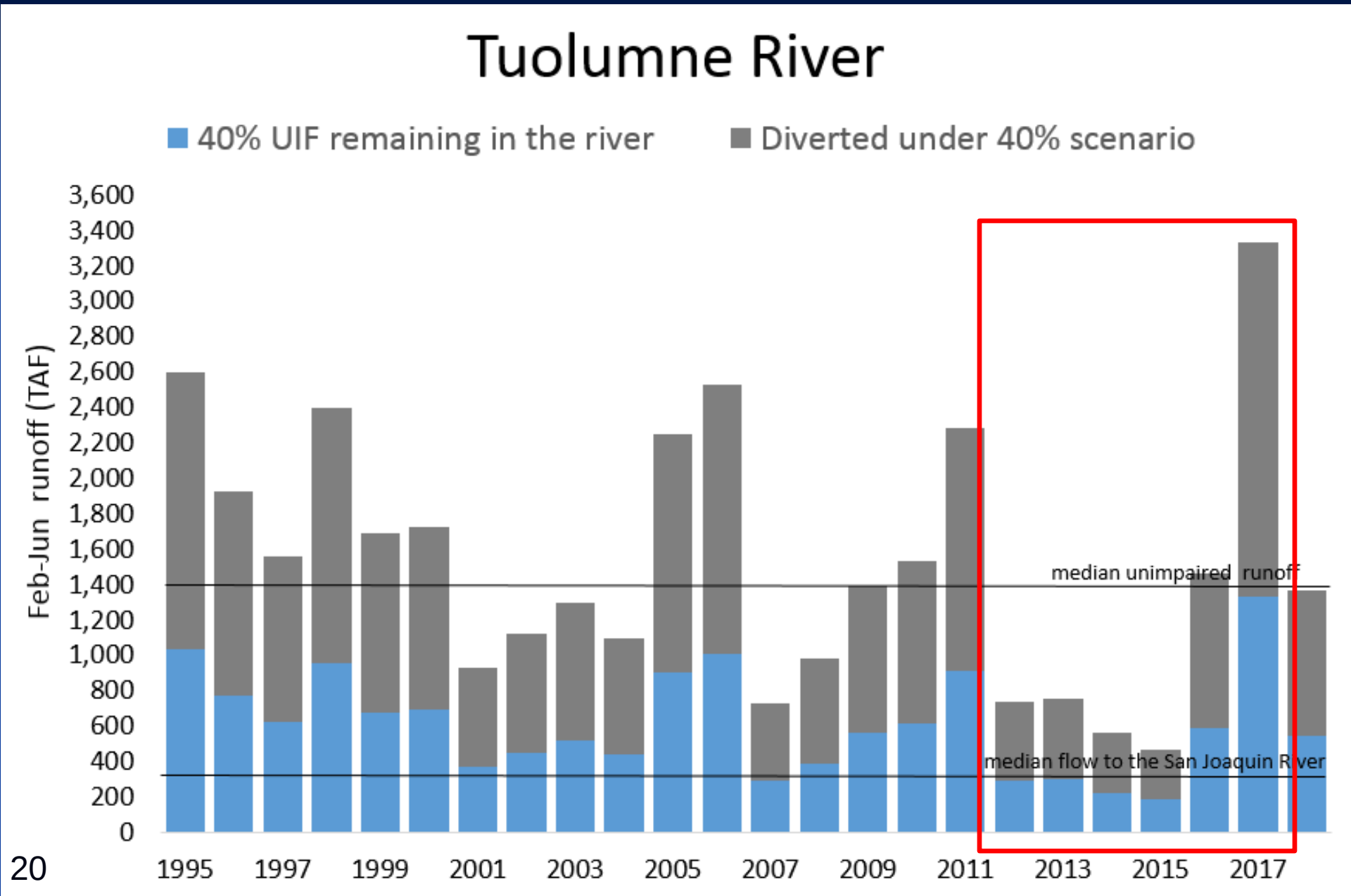
(With Bay Delta Plan flows in place)
(Includes rationing)

Year	Demand (MGD)	Rationing (%)	Storage Reduction (TAF)	Water in Storage (TAF)
=1986				1,517
=1987	190	0	441	1,076
=1988	190	0	312	764
=1989	190	10	14	750
=1990	190	10	261	489
=1991	190	20	47	442
=1992	190	20	192	250
=1976	190	20	241	**9**

The Tuolumne is devastated in dry years



The Bay Delta Plan would improve conditions



Thank you for the opportunity to present.

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