

Arizona WRRC Annual Conference

OUR WORN OUT WATER SECURITY BLANKETS

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Reliance on Historical Record

- Look at the past to predict the future
- Stationarity

STATE OF COLORADO
Engineering Department

Discharge of DOLORIS RIVER
At DOLORIS for year ending Sept. 30, 1924.

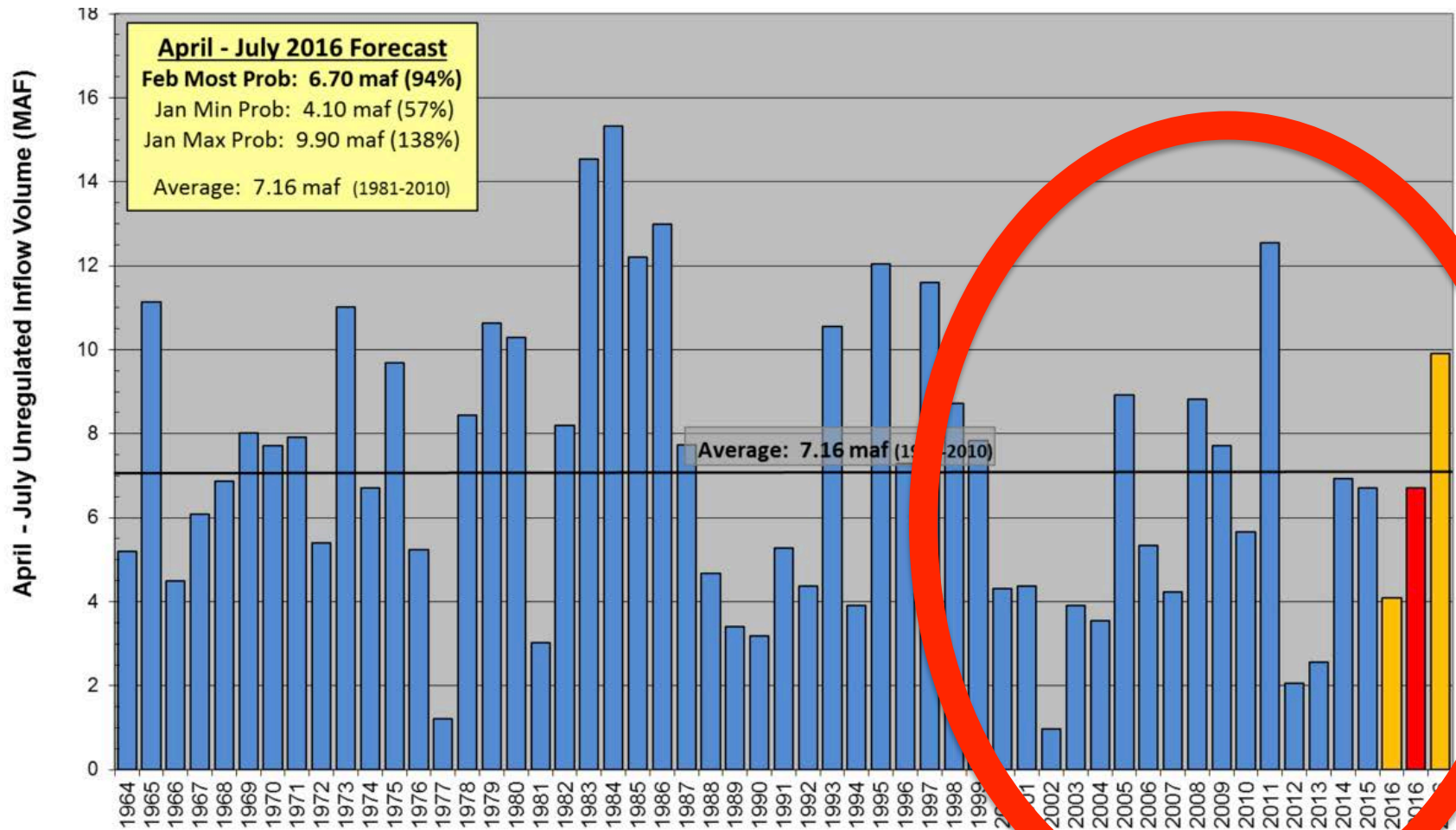
Drainage area 524 Sq. miles. Altitude 6,954 feet above sea level.

YEAR PERIOD	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.
1	215	120					120	1600	2160	286	155	53
2	215	120					165	1700	1830	286	135	53
3	120	120					300	1700	1310	286	128	53
4	165	80					330	2280	1310	216	117	53
5	165	80					300	2070	973	128	117	53
6	165	80					363	2270	1160	193	117	53
7	165	80					430	2920	2800	236	112	50
8	165	80					663	2530	2530	429	108	50
9	165	80					930	2800	2160	281	102	52
10	165	80					880	3080	1910	344	105	54
11	165	80					980	3080	1490	281	105	60
12	165	80					930	3200	1450	286	110	57
13	165	80					880	3380	1240	198	115	55
14	165	80					1030	3580	1240	174	115	53
15	165	80					1480	3380	973	166	117	53
16	165	80					1140	3540	976	166	124	53
17	165	80					1030	3120	973	182	140	53
18	165	65					1080	3080	810	133	124	53
19	165	65					663	2800	762	117	112	53
20	165	50					620	2530	672	117	102	53
21	120	65					1470	2610	590	115	100	53
22	165	50					2070	2530	590	117	96	53
23	165	65					2240	2530	550	123	97	53
24	120	50					2210	2400	480	121	75	53
25	165	80					2000	2280	416	117	64	53
26	165	100					1660	2120	448	155	64	53
27	165	100					1500	1910	388	152	64	62
28	120	65					1600	2160	281	180	53	52
29	120	100					1580	2400	281	256	53	51
30	120	120					1700	2160	286	202	54	51
31	120							2160		198		53
TOTAL	4970	2240					32629	30094	31895	6024	3057	1698
Mean	160	78.0	91.9	58.8	75.2	93.1	1080	2580	1100	194	98.6	53.0
Maximum	215	120					2240	3540	2800	429	155	60
Minimum	120	50					120	1600	256	115	53	51
Run off per sq. mi.												
Run off depth, ins.												
Run off area - feet	9840	4640	5650	3670	4330	5720	6300	15900	65500	17900	6060	9150
Area - feet per sq. mi.												

NOTE: Unless otherwise noted, all discharges are in cubic feet per second.

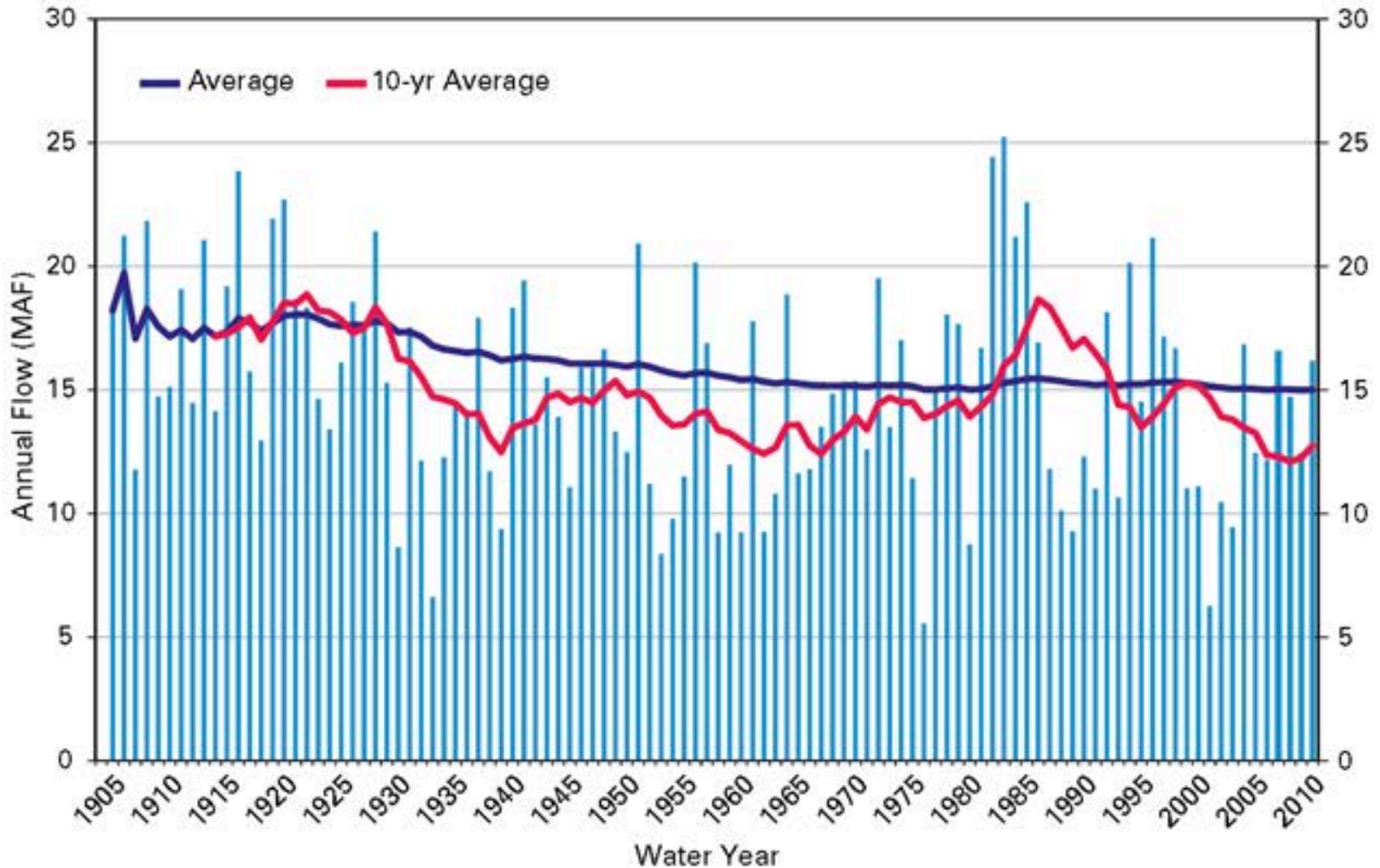
Historic Drought in Colorado River

Comparison With History



April - July Inflows to Lake Powell (Source: US Bureau of Reclamation)

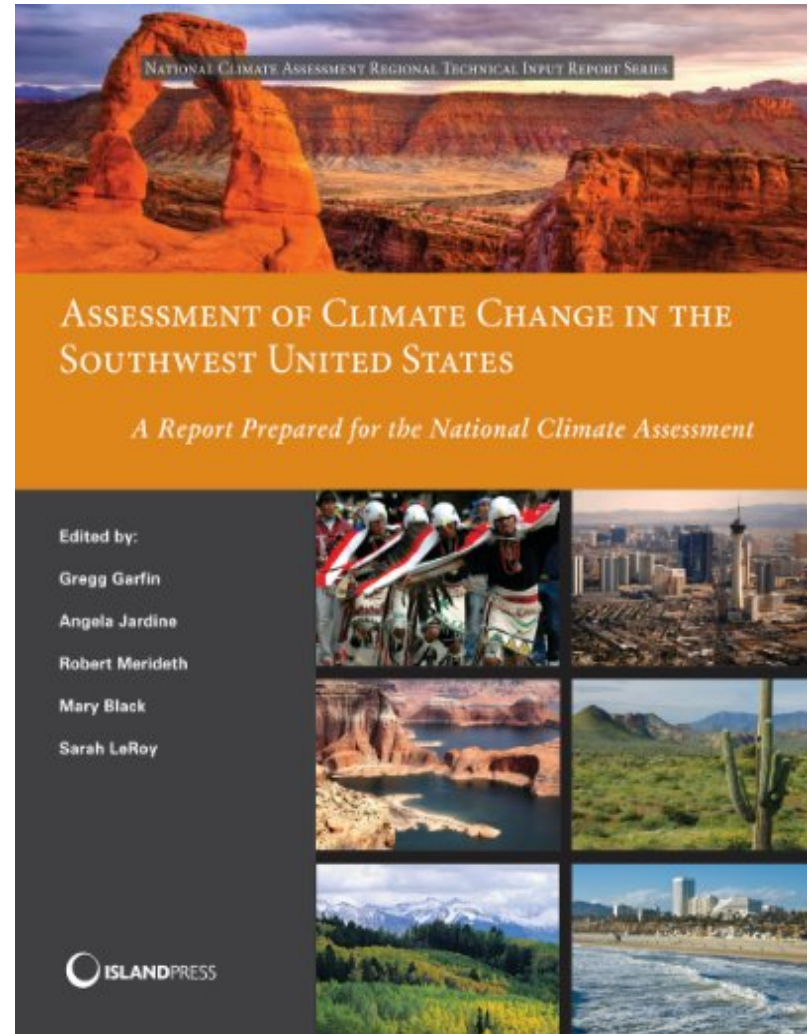
Historic Drought in Colorado River



Source: U.S. Bureau of Reclamation

More Changes Predicted

- Warmer Temperatures = More Decreases in Runoff
- 5 - 20% less runoff by 2050
- Some show > 50% by 2100
- Stationarity – not a good planning tool



Big Reservoirs Will Protect Us

The Colorado River system has 60 million acre feet of storage capacity



Lake Mead

- Two largest reservoirs in US
- 4-5 times the annual flows

Lake Mead Annual Water Budget

Inflow = 9.0 MAF

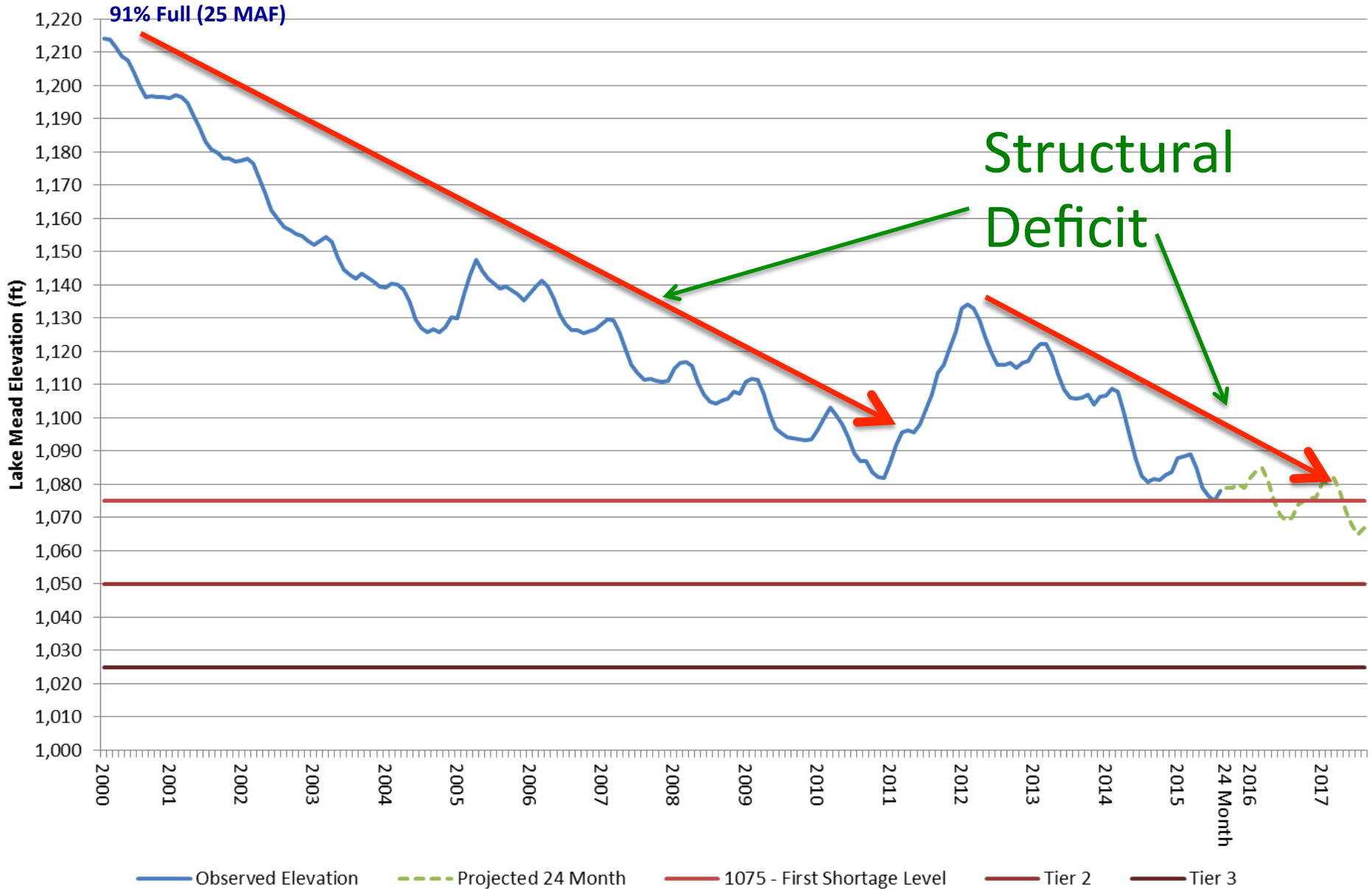
Outflow = 9.6 MAF

Mead Evap = 0.6 MAF

Balance = -1.2 MAF

Source: US Bureau of Reclamation

Lake Mead Since 2000



Source: Central Arizona Project

Lake Powell Annual Water Budget

Inflow (15 yr avg) = 12 MAF

Release Obligations = 8.2 MAF

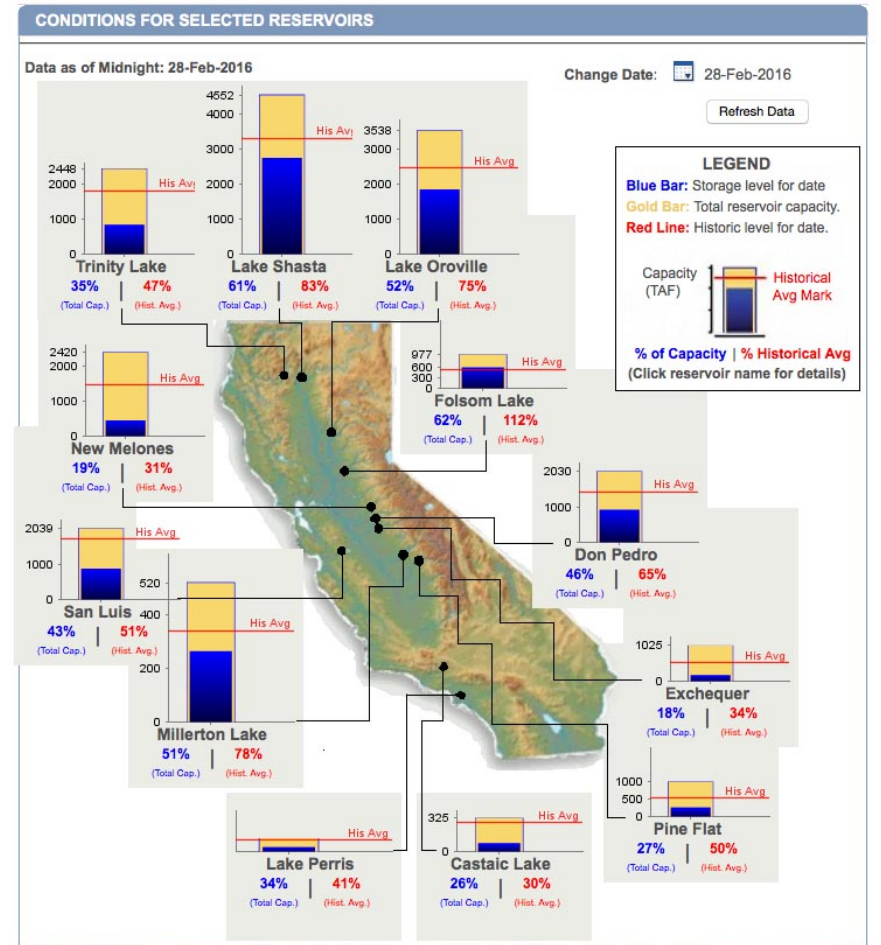
Remaining \approx 4 MAF

UB Usage (5 yr avg) = 4.5 MAF

Balance = -0.5 MAF

California Reservoirs

- 42 MAF surface storage
- Currently about half full
- Managed for fish and environmental purposes, not just water supply



No Injury Rule

- Standard used to judge a proposed change of water right
 - Change in type or place of use
- Can't injure or harm other water rights



No Injury Rule

- Water right owners are entitled to no change in stream conditions
- Essential to protection of property interests

No Injury Rule - Problems

- Proving a negative
- No recognition of uncertainty
- No scaling of process relative to potential for adverse impact
- Can create risk to water right itself

No Injury Rule - Problems

- Time consuming
- Very expensive
- Incentivizes permanent “buy-and-dry” transactions



Strategies



- Scenario planning
- Drought contingency planning
- Triggers for levels of response actions

Strategies

- Flexible processes
 - Nimble
 - Scaled to size, need, potential for injury
- New legal structures
 - Water banks
 - Water trusts
 - Split season leases

New and Better Security Blankets

