

Certainty in Uncertain Times?

Policy Implications of the Colorado River Compact

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Uncertainty

- **Water availability**
(based upon wet hydrology)
- **Increasing Demands**
- **Gage Record**
(accuracy, period of record)
- **Climate**
(drought, variability)



Policy Objective

Should the objective be to “get through” the drought, which assumes conditions will return to “normal” OR should it be to address longer term structural problems caused by a demand for water which may exceed the average available supply?

What should the basin water officials do?



Law of the River

- **1922 Colorado River Compact**
- **Mexican Treaty of 1944**
- **1948 Upper Colorado River Basin Compact**



The 1922 Colorado River Compact

- Compact divides the Colorado River, including all tributaries, into an Upper and Lower Basin.
- The boundary between the two basins is Lee Ferry, Arizona.
- The Lower Division states are Nevada, California and Arizona.
- The Upper Division states are Wyoming, Colorado, New Mexico and Utah.
- Arizona, Utah and New Mexico have lands within both basins.





COLORADO RIVER WATER CONSERVATION DISTRICT

The Hydrologic Guts of the 1922 Compact are in Article III

- III (a). “There is hereby apportioned . . . in perpetuity to the Upper Basin and to the Lower Basin . . . the exclusive beneficial consumptive use of **7,500,000 af** per annum”
- III (b). “In addition to . . . paragraph (a) the Lower Basin is hereby given the right to increase its beneficial consumptive use . . . by one million af per annum.”



Article III (con't)

- III (c). Provides that water for Mexico “shall be supplied first from the waters over and above . . . paragraphs (a) and (b); and if such surplus shall prove insufficient . . . the burden . . . shall be equally borne by the Upper Basin and the Lower Basin and the Upper Division states shall deliver at Lee Ferry water to supply (its obligation) . . . in addition to that provided in paragraph (d).
- III (d). The states of the Upper Division will not cause the flow . . . at Lee Ferry to be depleted below an aggregate of **75,000,000 af** for any ten consecutive years . . . ”



Hydrological Assumptions in 1922

SOURCE: Compact Minutes of the Sixth and Eighth Meeting

- Ave. gage flow Yuma assumed
17,300,000 af/yr (1901-1921 gage record)
- Commission assumed flow at Lee Ferry is 86% of flow at Yuma **14,964,000 af/yr**
- Reclamation Service estimate of depletions in the Upper Basin **2,267,000 af/yr**

Thus: Native Basin Flow Assumed

$$14,964,000 + 2,267,000 = 17,231,000 \text{ af/yr}$$



The Mexican Treaty of 1944

- Article X. guarantees an annual delivery of **1.5 maf** per annum.
- Provides for an additional **0.2 maf** per annum when there is a surplus.
- Allows the United States to reduce deliveries during an “extraordinary drought” by the same proportions as consumptive uses in the USA are reduced.



The 1948 Upper Colorado River Basin Compact

- Provides Arizona with **50,000 af** per annum, with the remainder as follows:
 - 51.75 % to Colorado
 - 23.00 % to Utah
 - 14.00 % to Wyoming
 - 11.25 % to New Mexico

“Consumptive use” is defined as man-made depletions to the native (virgin) flow at Lee Ferry.

NOTE: this definition includes CRSP Reservoir evaporation.



Two Major Unresolved Compact Issues that Impact Colorado's Available Colorado River Water Supply

- In the conflict between Articles III (a) and III (d)
 - which is controlling?

In other words:

Must the Upper Basin have to forgo a portion of its **7.5 maf** III(a) supply to deliver the **75 maf/10 years** as required by III(d)?

- Do the Lower Basin tributaries, especially the Gila River, have a share in the obligation to meet the Mexican Treaty deliveries?



How Much Water is Available for Colorado to Use?

- This depends ultimately on how the compact issues are resolved, AND
- The assumptions we make on how much water is available, where its diverted in the Upper Basin, AND
- The basic assumptions on inflow to Lake Powell, which is highly variable and subject to significant uncertainty.



How Much Colorado River Water is Colorado Currently Using?

Based on the *Consumptive Uses and Losses Reports*¹ and including Colorado's share of CRSP reservoir evaporation:

Colorado is consuming in the range of **2.5 to 2.8 maf** per annum.

Likewise;

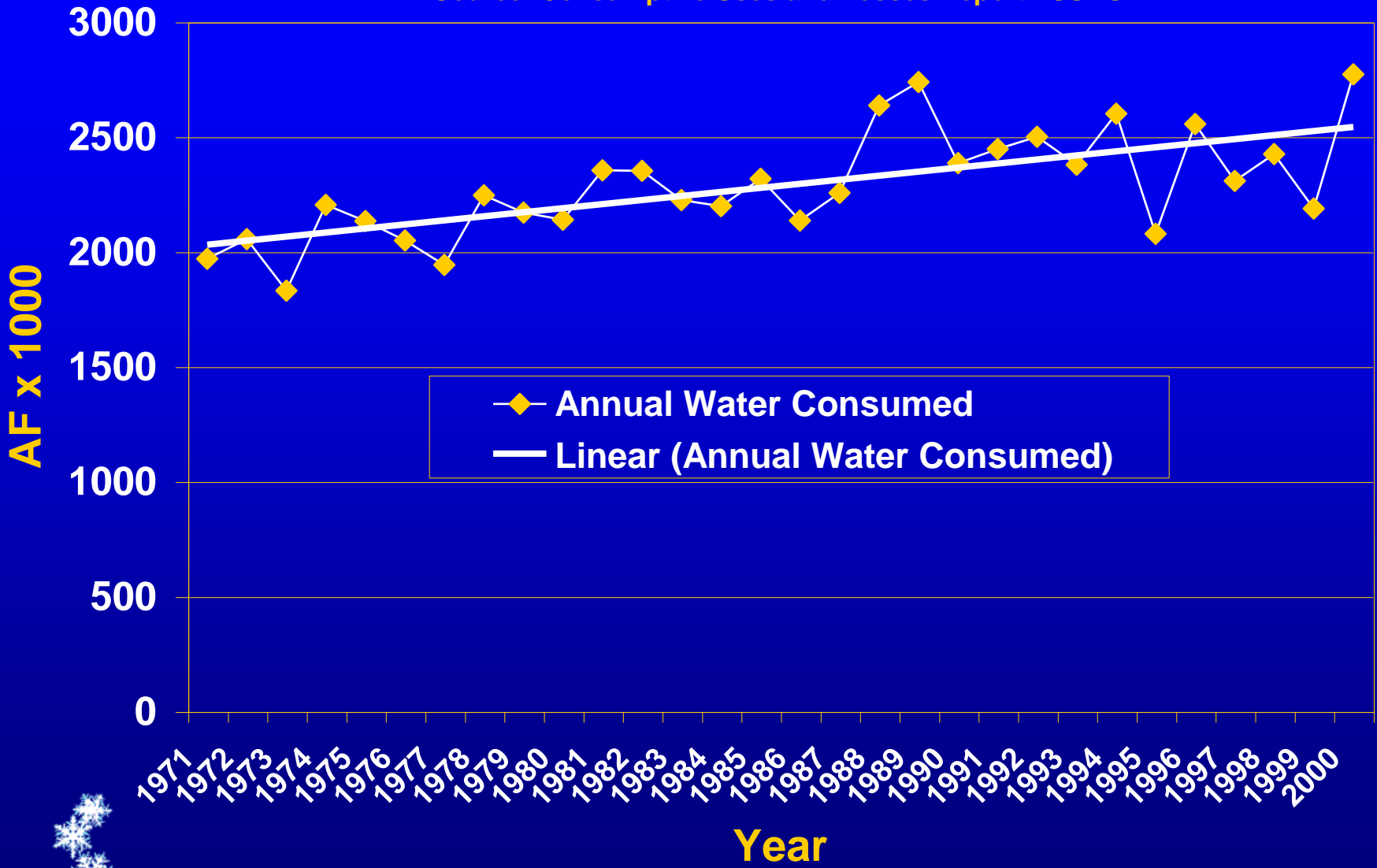
The Upper Basin States are using in the range of **4.5 to 5.0 maf** per annum.

¹ Published every five years (USDOI 1971-2000). May understate the Upper Basin irrigation uses.



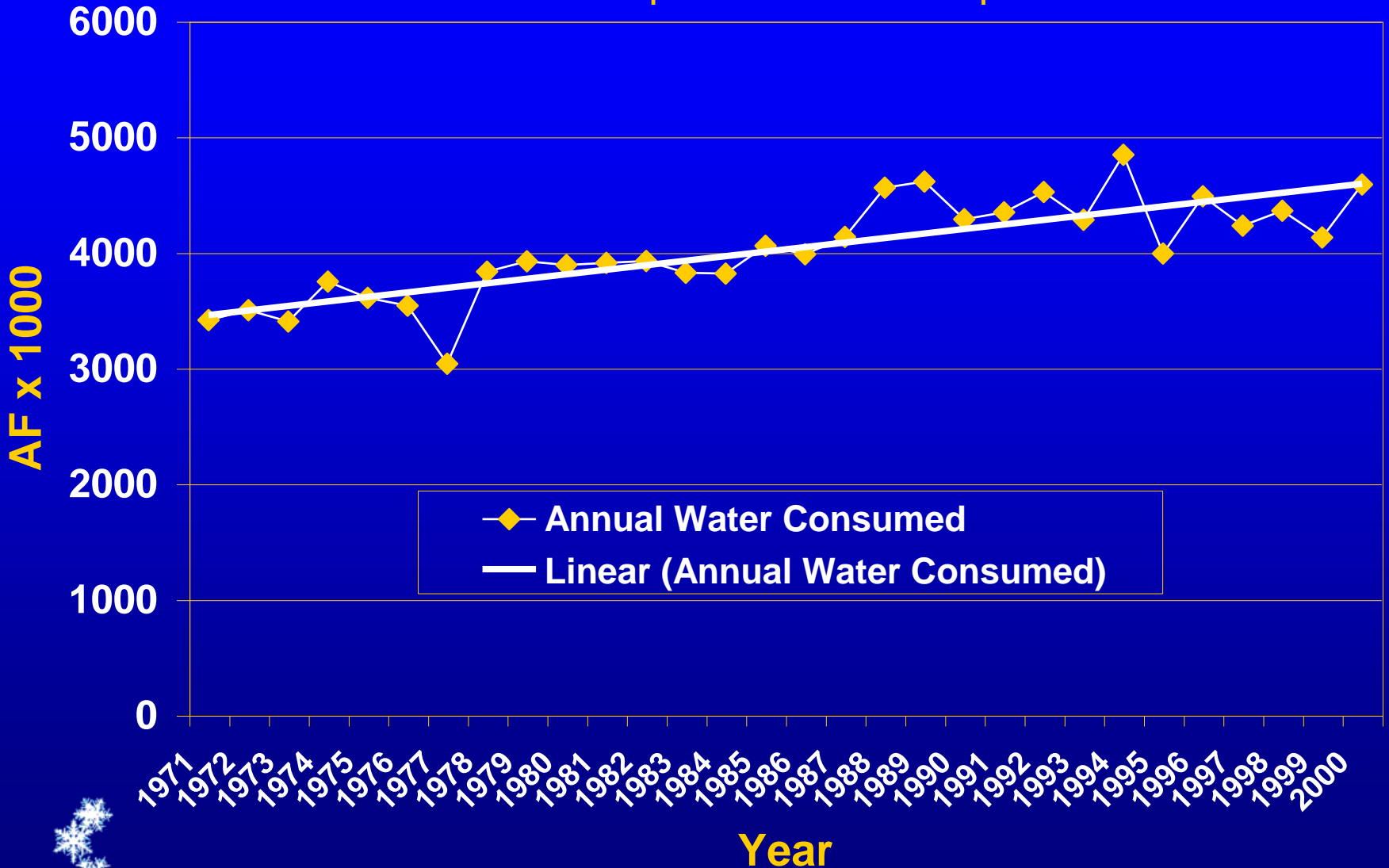
Total Colorado Consumptive Use

Source: Consumptive Uses and Losses Report - USDOI



Upper Basin Consumptive Use

Source: Consumptive Uses and Losses Report - USDOI



Different Scenarios

1) Noah's estimate:

$$0.5175 \times (7,500,000 - 50,000) = 3,855,000 \text{ af}$$

2) Reclamation's hydrologic determination:

- Based on the 1954-1965 hydrology (Reclamation assumes a **11.6 maf** ave. undepleted inflow to Lake Powell)
- Assumes a Lee Ferry delivery of **8.25 maf/annum** (**7.5 maf** for the Lower Basin + **750kaf** for Mexico).

$$0.5175 \times (6,000,000 - 50,000) = 3,079,000 \text{ af}$$

3) The 1965 hydrology with no deliveries from Upper Basin to Mexico – approximately **3,450,000 af.**



Bottom Line:

- **Colorado has either a lot of water to develop – upwards of another million acre feet,**
- OR -**
- **Colorado may already be at or above full development of its Colorado River supplies at certain periods.**



Sobering Thoughts

Can you imagine the impacts to Colorado if a compact call curtailed projects such as the C-BT, Dillon Reservoir, Fry-Ark, Moffat Tunnel Collection System, Homestake, Twin Lakes, Wolford, Dallas Creek, Dolores and Central Utah Project, San Juan-Chama, etc., and they could not legally divert a drop of water?!



Uncertainty: Climate

Can we rely on past hydrology to describe the future with sufficient reliability to make reasonable plans?

What are the policy implications of changing conditions on the Colorado River?



Uncertainty: Management

The Bureau of Reclamation, Denver Water, Aurora, the CWCB, and almost every other major basin water provider uses modeling based on the historical record.

Is this a wise process?

If not, what are the alternatives?

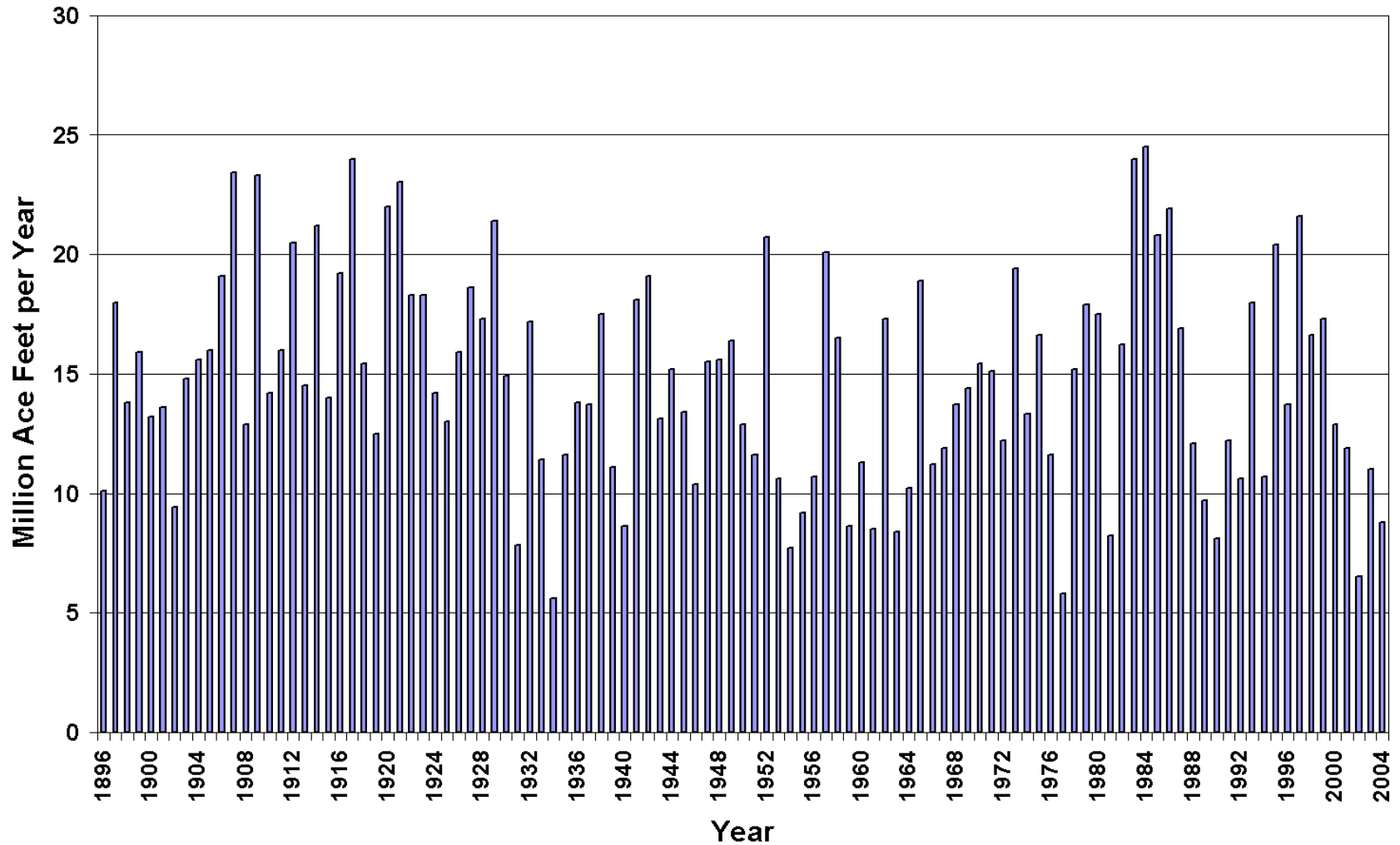


Concerns

- The model results Reclamation has provided the Basin States uses the 1906-1995 period. Is this period representative of the long term hydrology? This period looks very wet.
- Are hydrologic and climatic conditions changing faster than our ability to recognize these changes and develop near modeling and planning tools?
- What are the alternatives to using the gage record?



Estimated Virgin Flow at Lee Ferry



Tree Ring Inflow (with UCRC data 1962-2004) Hydrology at Lee Ferry AZ
90 Year Running Average



Bottom Line

- If flow at Lee Ferry (undepleted) for the next 10-30 yrs. averages about 15 maf/yr – we're probably **ok**.
- If flow at Lee Ferry (undepleted) for the next 10-30 yrs. averages about 13 maf/yr – could be **big trouble**.





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