

Lake Havasu City Water Supply

**A Small Fish in the Big Ocean of
Water Policy - At the Front Line of
Colorado River Shortages**

SKETCH PAD



...and lastly, how about a savory appetizer of bacon-wrapped Lake Havasu quagga mussels smothered in cheese??

Presentation Outline

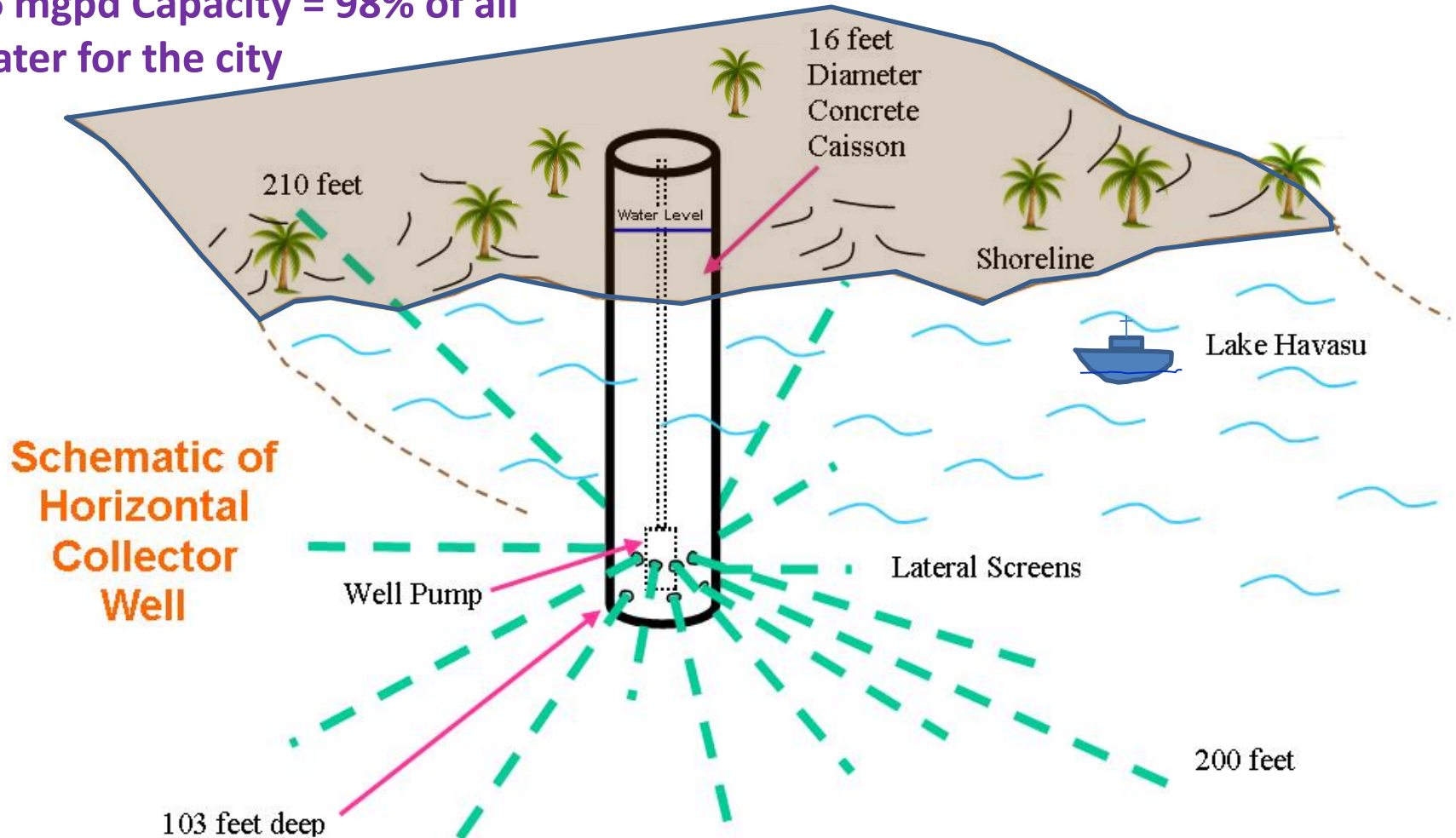
Lake Havasu City Water Diversion, Water & Wastewater Treatment, and Reuse

Current Colorado River Basin Conditions

How Shortages will Affect LHC?

Horizontal Collector Well

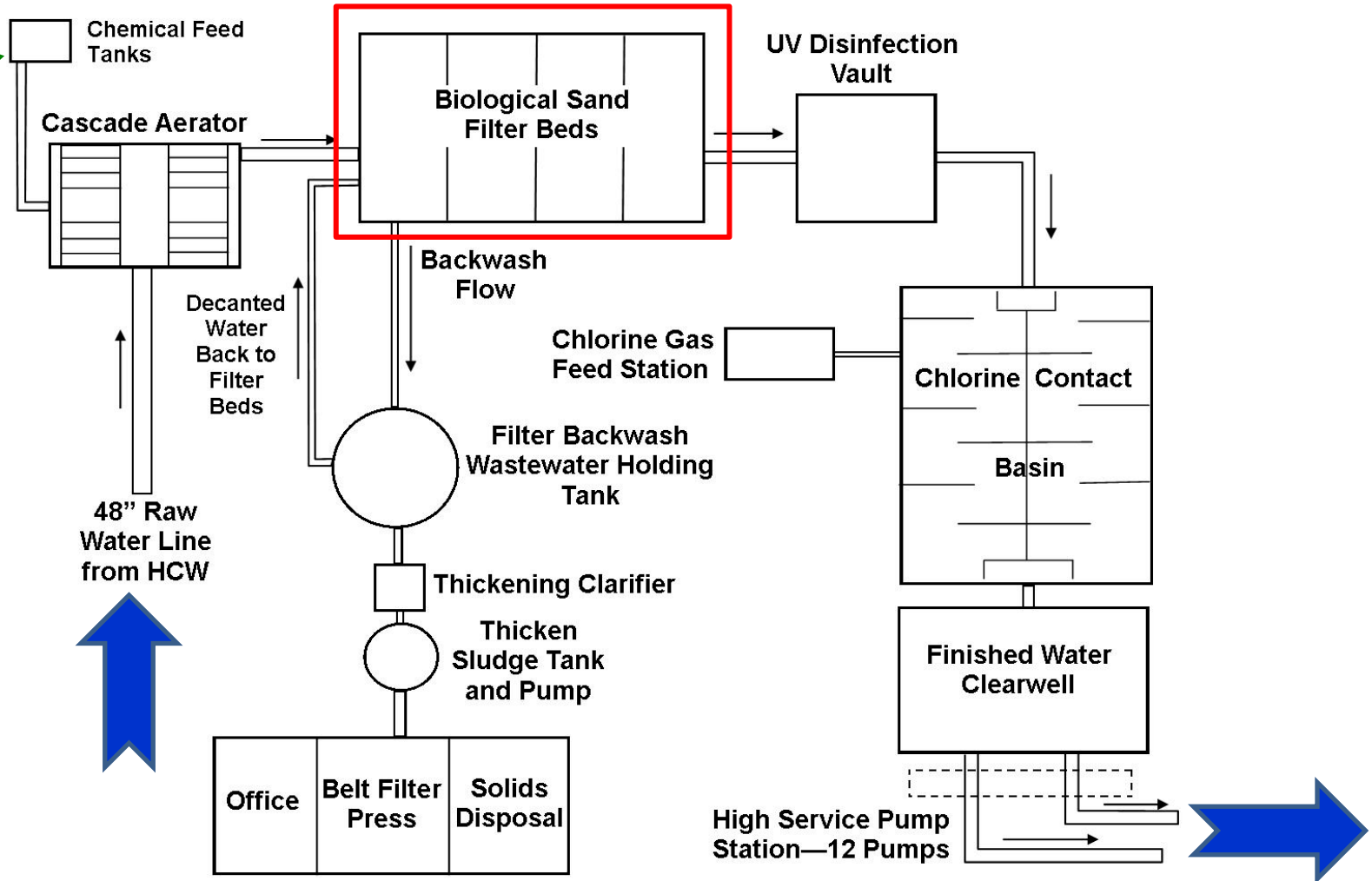
26 mgpd Capacity = 98% of all water for the city



Water Treatment Plant

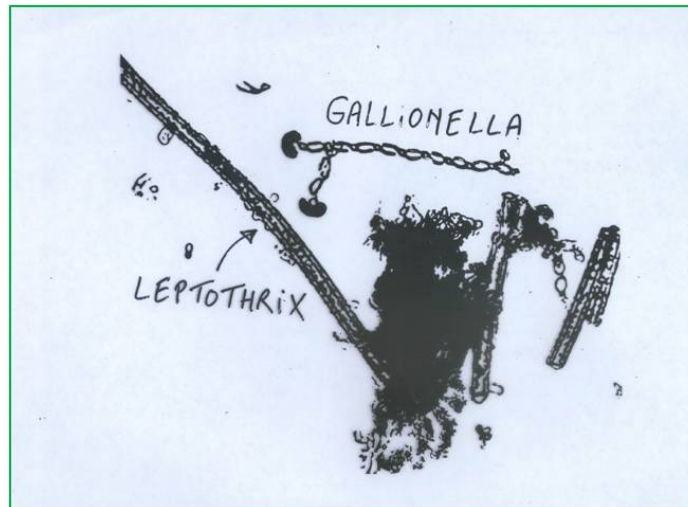
Capacity – 26 mgpd

FeCl_3 –
coagulation
and As
removal



Biological Filtration fo Manganese Removal

- Four filter bed basins that are 46' long x 31' wide x 18' deep carry seven feet deep of sand containing filamentous bacteria, such as those in genera of Leptothrix, Gallionelle, Crenothrix, Hyphomicrobium, Siderocapsacaes, Siderocystis, Metallagenium and Pseudomonas manganoxid.
- The bacteria metabolize manganese and iron to separate those elements from the water in the form of iron hydroxide and manganese dioxide, both that remain in the filter media until the filter is backwashed.
- The microbes need no special nutrients added to the water to help them grow, but need to have the water with a pH higher than 7.4 in order to best remove the manganese.
- Colorado River water is above this mark and it is oxygenated, which keeps compounds such as hydrogen sulfide and ammonia out of the water that could kill bacteria.

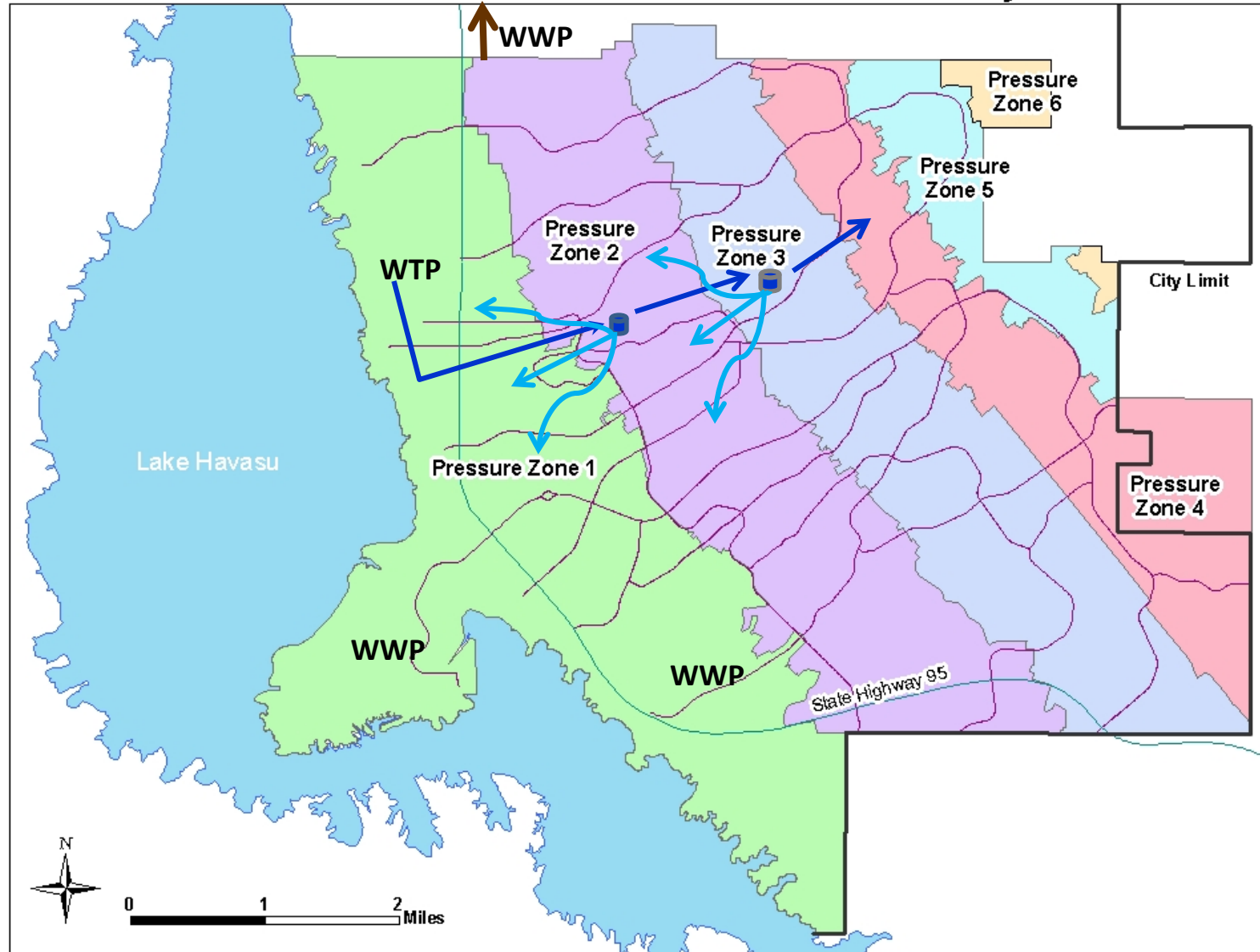


Solids
Assay
mg/kg
dry

As =	5,900
Ba =	860
Cr =	200
Co =	66
Cu =	89
Fe =	370,000
Mg =	3,600
Mn =	54,000
Ni =	70
Na =	1,000
Sr =	950
V =	1,000

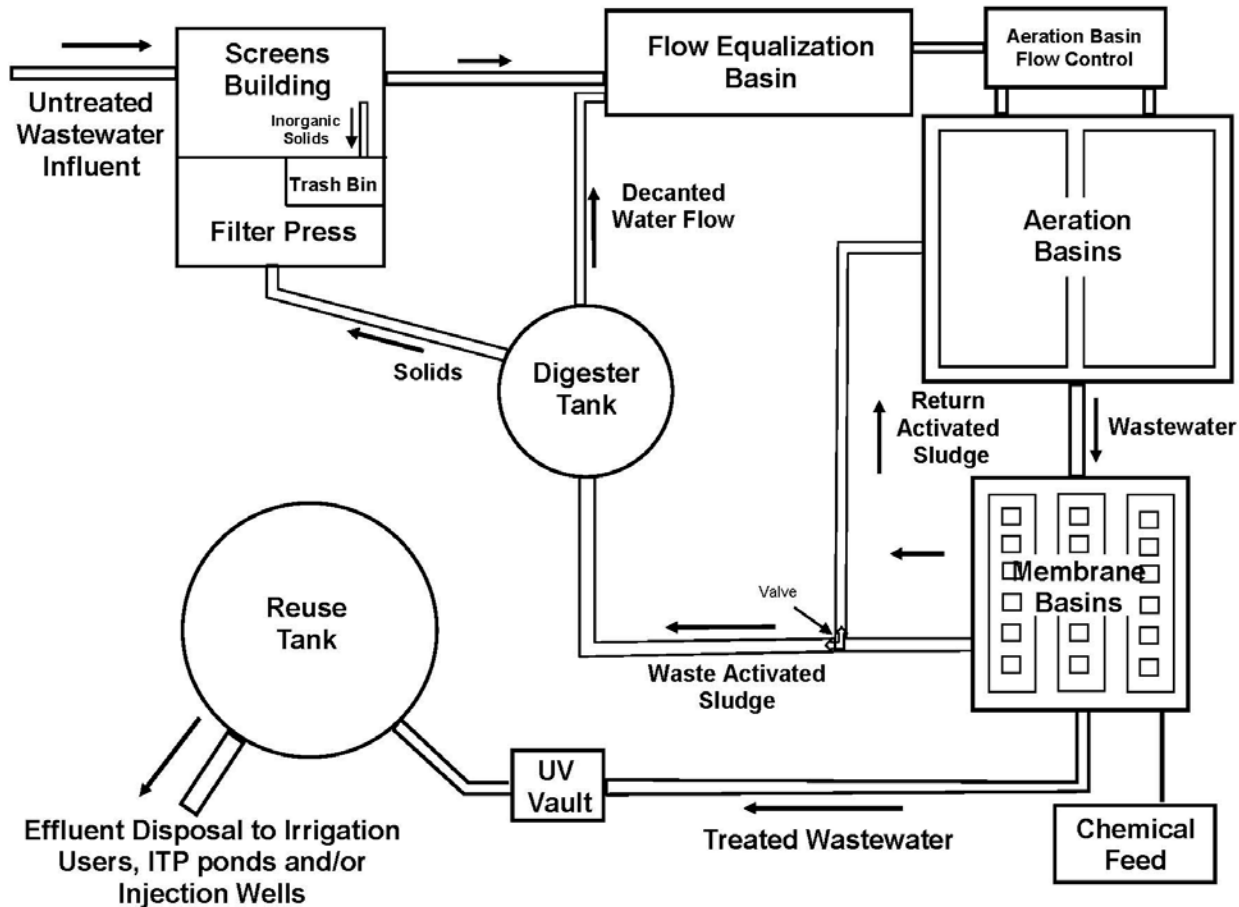
Water Distribution & Return

Water Pressures Zones in Lake Havasu City



Wastewater Treatment

Three total Plants – 2 are Standard Activated Sludge Aeration Plants and one that includes an ultra (0.04 μ m) Membrane Bioreactor After Aeration.



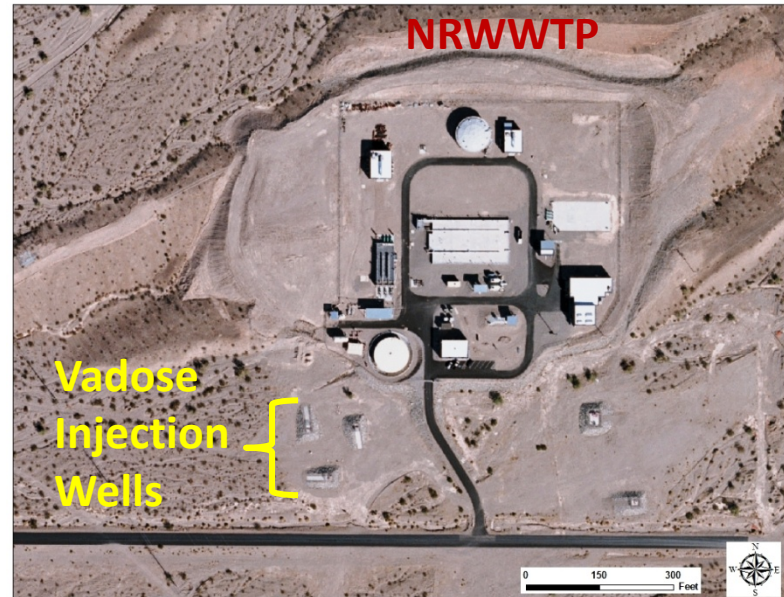
**North
Regional
WWTP**

Recently finished (2011) wastewater expansion program sewered ~85% of the City. ~3.5MGD ave.

Reclaimed Water Reuse

Close to ½ of Total Effluent Generated Goes to Irrigating 4 Golf Courses and a handful of smaller irrigators (~2,000 ac-ft/year).

The Rest is Either Currently Percolated and is Considered Return Flow to the River or is Injected into the Subsurface for Storage.



The City is Planning to Expand its Reclaimed Water Reuse for Irrigation to Replace at Least Another 1000 ac-ft of Colorado River Used Today.

Current Lower Colorado River Basin Conditions

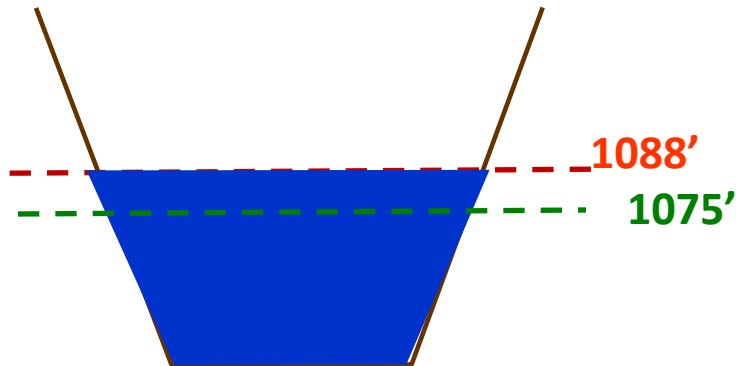
Current Lakes Mead and Powell Volumes

as of 3-10-2015

Lake Mead Level and % Capacity

	Capacity	Current
Elevation:	1219.6'	~1088'
Volume:	26.12 Mac-ft	10.83 Mac-ft

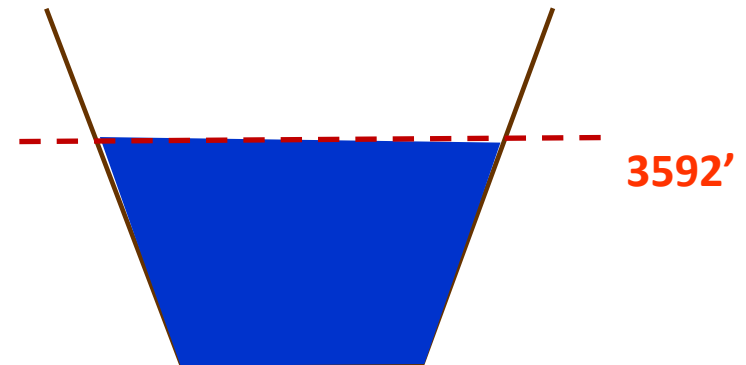
~41% full



Lake Powell Level and % Capacity

	Capacity	Current
Elevation:	3700'	3592'
Capacity:	24.322 Mac-ft	11.01 Mac-ft

~45% full



CR Interim Guidelines for Shortages and Coordinated Operations for Lakes Mead and Powell

Equalization of reservoir storage in Lake Mead and Lake Powell.

In effect to 2026 – negotiations to extend this strategy or develop a new plan will begin much sooner.

Shortage declaration tiers if the August forecast of Lake Mead elevation reaches a trigger elevation in **January**.

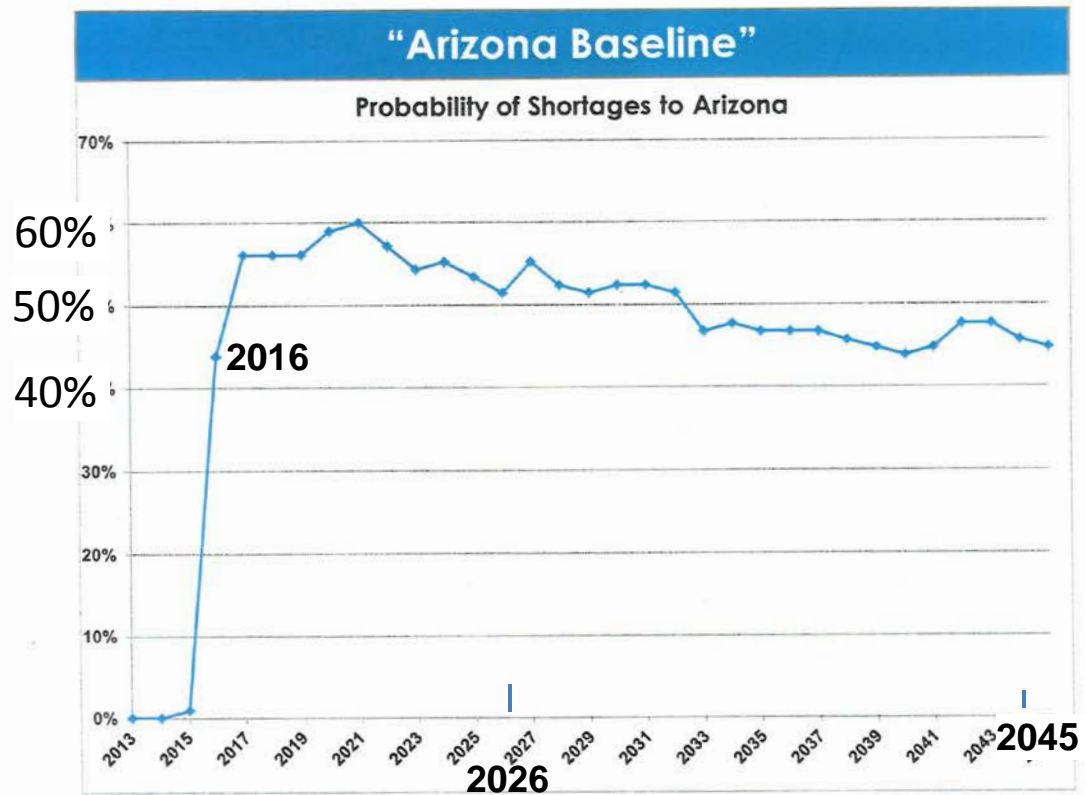
Shortage Stage	Lake Mead Trigger Elevation (feet amsl)	Volume of Total U.S. Shortage (ac-ft)	Arizona's Entitlement with Shortage (Mac-ft)	Nevada's Entitlement with Shortage (ac-ft)	Water Delivery Reduction to Mexico (ac-ft)*
Tier I	1075'	333,000	2.48	287,000	50,000
Tier II	1050'	417,000	2.40	283,000	75,000
Tier III	1025'	500,000	2.32	280,000	125,000

* Minute 319 with Mexico will expire at the end of 2017, if not extended to 2026.

If lake level falls below 1025 ft, then renegotiation with the Seven Basin states.

Central Arizona Project CR Shortage Declaration Probabilities

Shortages to Arizona

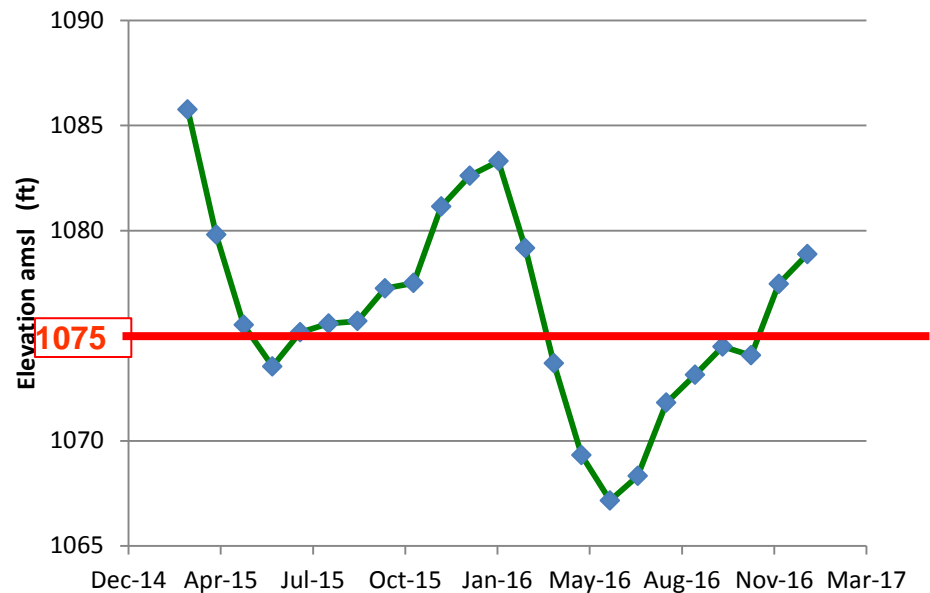


Bureau of Reclamation March 2015 24-Month Study

Bureau of Reclamation Operation Plan For Lake Mead - Most Probable Flows

Date End of Month	Lake Mead Elevations (feet amsl)
March 2015	1085.76
April 2015	1079.80
May 2015	1075.51
June 2015	1073.54
July 2015	1075.16
August 2015	1075.58
September 2015	1075.69
October 2015	1077.25
November 2015	1077.50
December 2015	1081.14
January 2016	1082.61
February 2016	1083.30
March 2016	1079.17
April 2016	1073.69
May 2016	1069.31
June 2016	1067.16
July 2015	1068.32
August 2016	1071.81
September 2016	1073.13
October 2016	1074.48
November 2016	1074.06
December 2016	1077.46
January 2017	1078.88

Projected Lake Mead Elevations

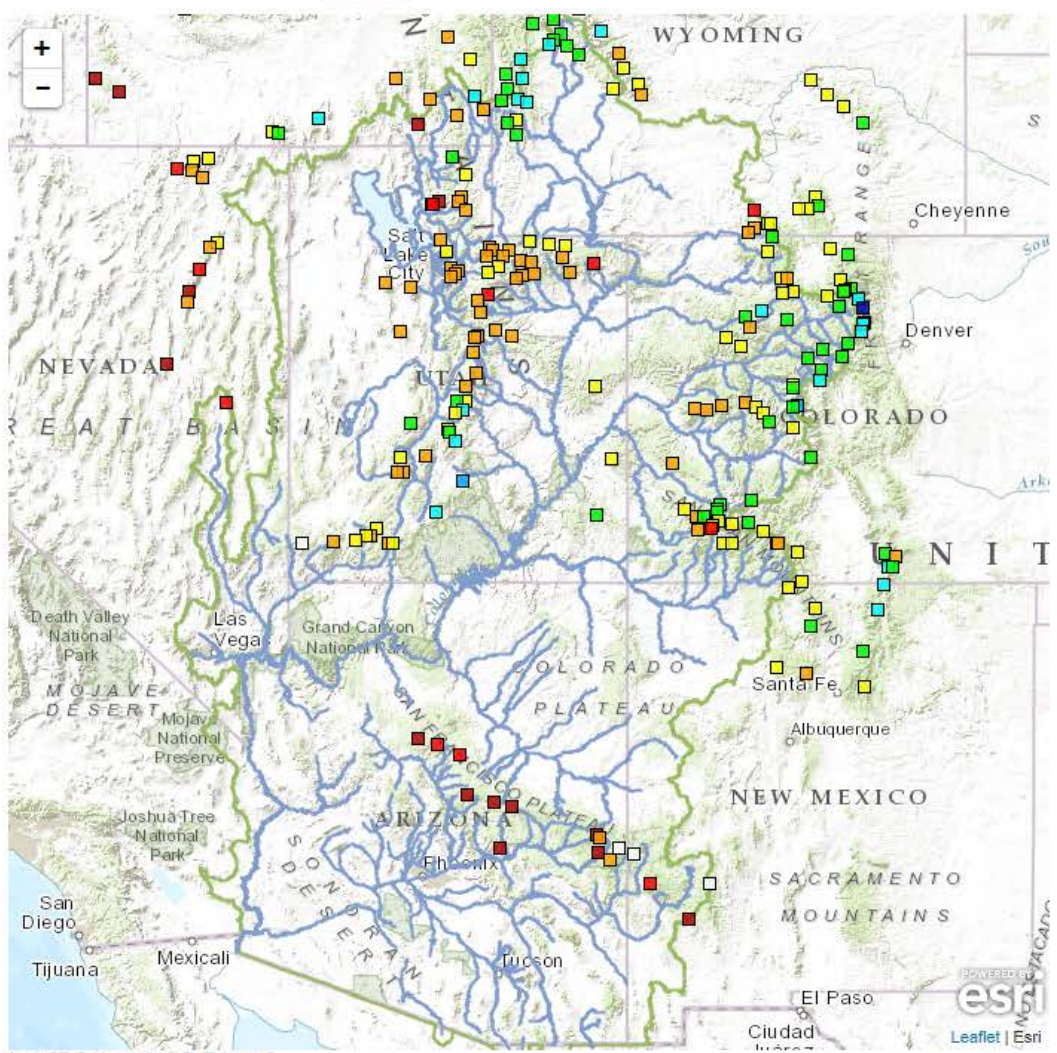


Next water supply webinar April 7, 11am MST. [Read More...](#)
CBRFC presentation are posted here. [Read More...](#)
CBRFC Webinars are posted here. [Read More...](#)

Snow Conditions March 11th 2014

Conditions Map

[Help](#)



Lat: 37.6 Lng: -110.5, Zoom: 6

[River Conditions](#)

Snow Conditions

Points **Grids**

Data Updated: Wed, 11 Mar 2015 17:40:01 - [Help](#)
0600

Show [Hide Other Types](#)

- No Data
- No Average
- < 7000 ft
- 7000-8000 ft
- 8000-9000 ft
- 9000-10000 ft
- > 10000 ft

- Percentiles
- Percent Average
- Percent Median

- No Data
- < 25%
- 25-50%
- 50-75%
- 75-90%
- 90-110%
- 110-125%
- 125-150%
- 150-175%
- >175%

[Water Supply Forecasts](#)

[Peak Flood Probability](#)

[Reservoir Conditions](#)



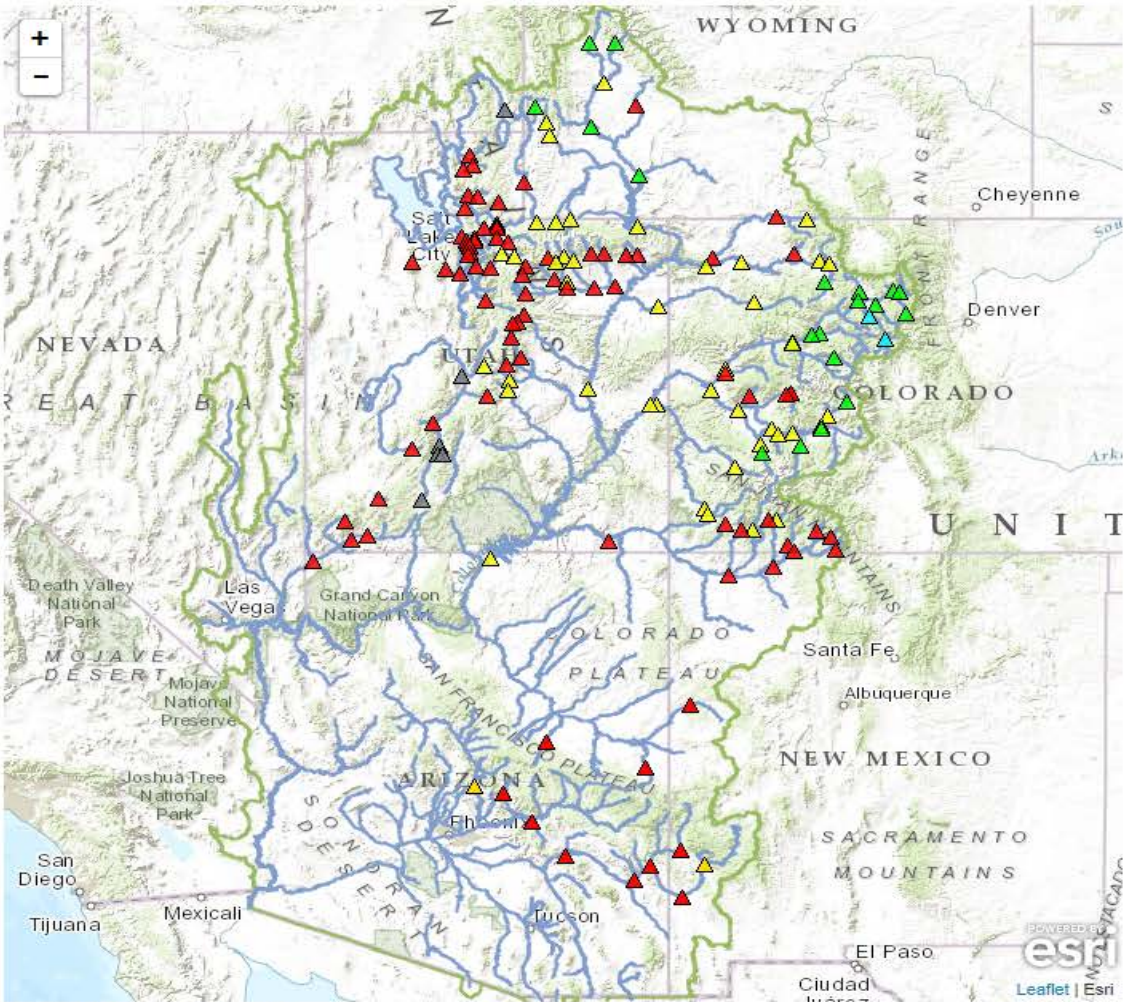
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Water Supply Conditions

March 11th 2014

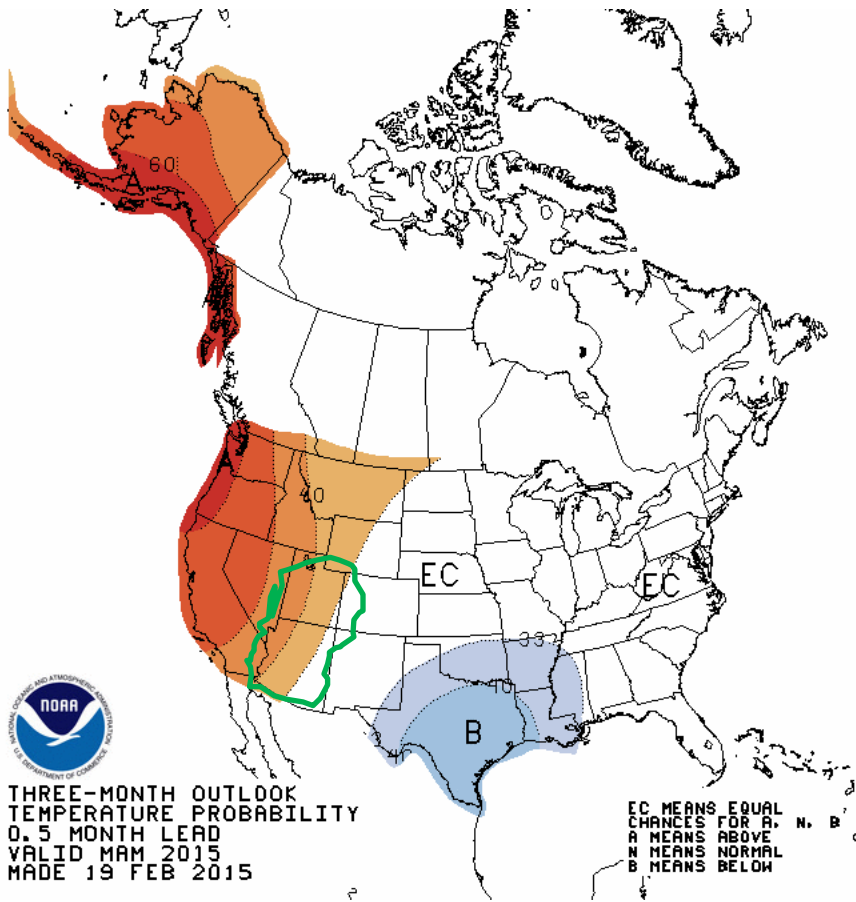
Conditions Map

Help

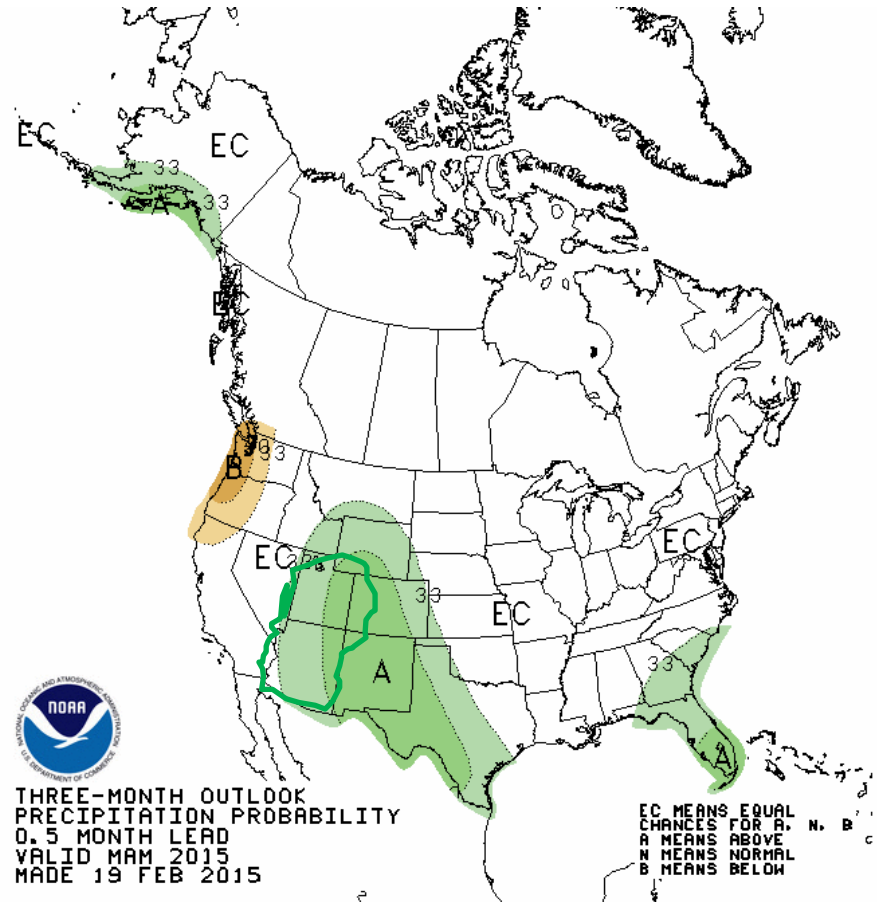


- ▶ River Conditions
- ▶ Snow Conditions
- ▼ Water Supply Forecasts
 - Official Forecast Date: 2015-3-1
 - ESP Run Date: 2015-03-11
 - Show [Hide Other Types](#)
 - Official Percent Average
 - Official Percent Median
 - ESP Percent Average
 - ESP Percent Median
 - ▲ < 70%
 - ▲ 70-90%
 - ▲ 90-110%
 - ▲ 110-130%
 - ▲ >130%
 - ▲ Regulated
 - △ No Forecast
 - Offices
 - CBRFC
 - WGRFC
 - ABRFC
- ▶ Peak Flood Probability
- ▶ Reservoir Conditions
- ▶ Weather Conditions
- ▶ Map Options
- ▶ Search Points

March through May 2015



Temperature Chances



Precipitation Chances

What Declared Shortages mean to One Little Fish on the River

Lake Havasu City Colorado River Water Supply and Demand

Entitlement = 28,331 ac-ft – all 4th Priority

Firmed water banked through the Arizona Water Banking Authority =

~126,000 ac-ft – good for withdrawal until 2096

Approximate Consumption Demand in 2014 =

12,332 ac-ft. LHC was at ~18,000 ac-ft/year in 2006.

Intrastate Shortage Sharing Agreement that Reductions will come from the Contract Entitlement

How Will Reductions to 4th Priority Entitlements be Determined?

ADWR outlined to Reclamation, a five step Recommendation:

- 1) 2.8 Mac-ft - AZ P1-3 demand = P4 Availability for AZ
- 2) P4 Availability - AZ Shortage Reduction = P4 Available after Shortage Reduction
- 3) 164,652 ac-ft / P4 Availability = P4 Mainstream Shortage %
- 4) P4 Available after Shortage Reduction x P4 Mainstream Shortage % = P4 Mainstream Shortage Reduced Supply
- 5) Remainder of P4 Available after Shortage Reduction goes to CAP.

Exact water allocated to P4 contracts depends on the P1-3 demand at the time and discretion of the Interior Secretary.

Estimated Range of Reductions to LHC Entitlement

<u>Arizona Reduction</u>	<u>Lake Havasu City Reduction¹</u>	<u>Resulting Entitlement</u>
320 KAF	~5300 - 6200 AF <i>18.7% - 21.8%</i>	~23,031 - 22,131 AF
400 KAF	~6700 - 7700 AF <i>23.6% - 24.7%</i>	~21,631 - 20,631 AF
480 KAF	~8000 - 9200 AF <i>28.2% - 32.3%</i>	~20,331 - 19,131 AF

¹Based on calculations given in the last slide and given 1.3 to 1.1 Mac-ft P1-3 demand.

These Calculations are Dependent on Several Factors – There are Wild Cards to Consider

Mexico's shortage share could disappear very soon (2017). – w/o Mexico's contribution, the tier 3 shortage could lower to **16,710 ac-ft.**

“...the Secretary will have considerable discretion to distribute Colorado River water during shortage.” - from BOR

Reclamation's interim management period is only guaranteed for another **12 years.**

Same is true for the intrastate shortage agreement between Mohave County Water Authority and central Arizona.

PLUS: How quickly will the succession of shortages take place?

The weather is at best a question mark and Lake Mead has been known to drop by more than 20 feet in one year. (i.e. 2001, 2002)

Some Famous Water Quotes

"When the well is dry, we learn the worth of water."

--Benjamin Franklin

I never drink water because of the disgusting things that fish do in it.

-- W. C. Fields

Water, taken in moderation, cannot hurt anybody.

--Mark Twain

You don't drown by falling in the water; you drown by staying there.

--Edwin Louis Cole

Whiskey is for drinking, water is for fighting over.

-- Anonymous

You can't trust water: Even a straight stick turns crooked in it.

--W. C. Fields

Microcystis

