

# RECLAMATION

*Managing Water in the West*

## **Water Storage & Salinity Control in the Colorado River Basin**

**Nick Williams**  
**2008 Salinity Summit**  
**January 16-18, 2008**  
**Las Vegas, Nevada**

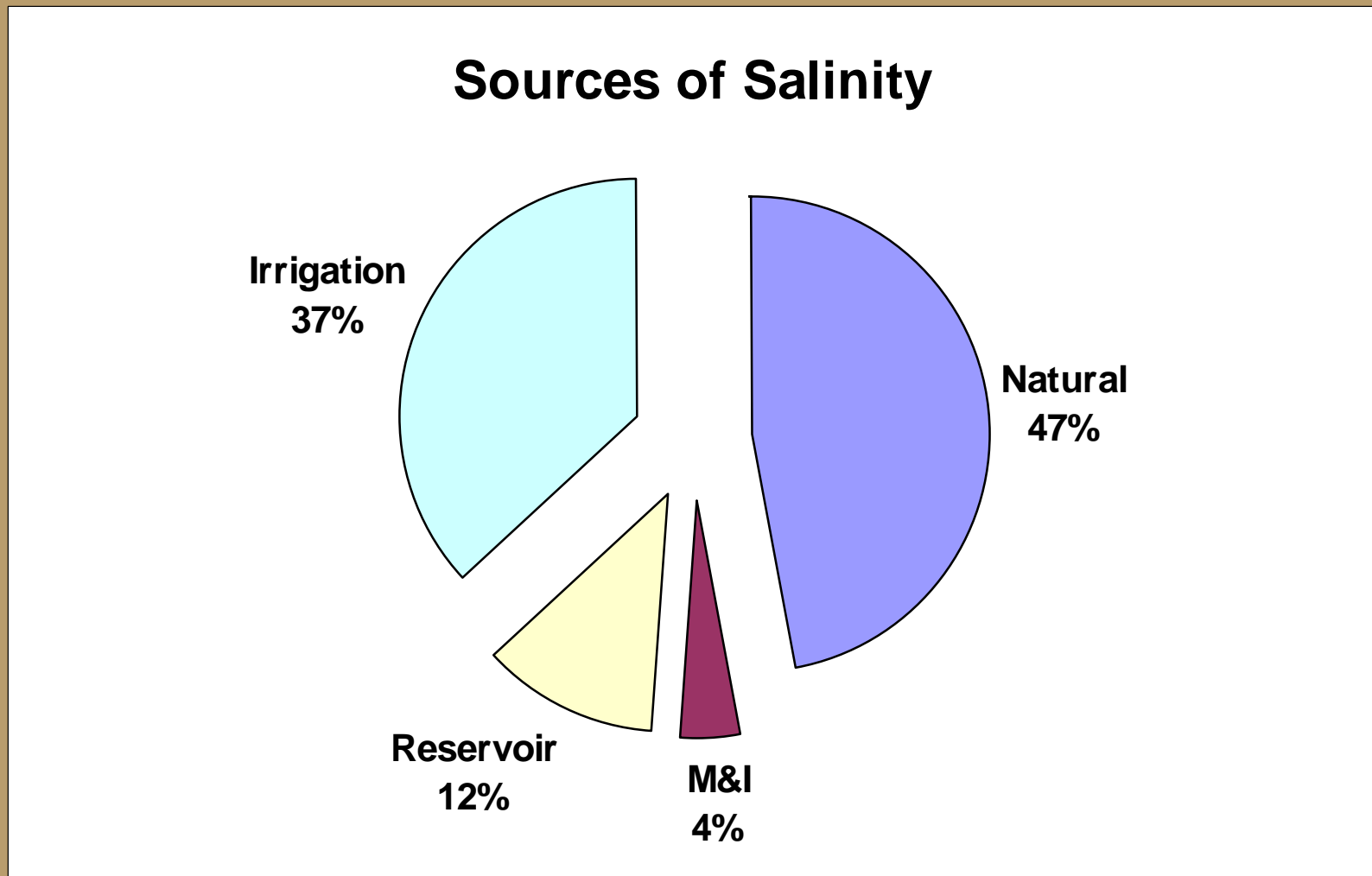


U.S. Department of the Interior  
Bureau of Reclamation

# History of salinity in the Colorado River Basin

- **Average annual salt load below Hoover Dam 1940-1972: 9.82 million tons or 688 mg/L**
- **Treaty between United States and Mexico**
- **Numeric Criteria**
  - Hoover Dam: 723 mg/L
  - Parker Dam: 747 mg/L
  - Imperial Dam: 879 mg/L
- **Economic Damages**
  - Over \$300 Million per year, quantified damages
  - Other significant unquantified damages

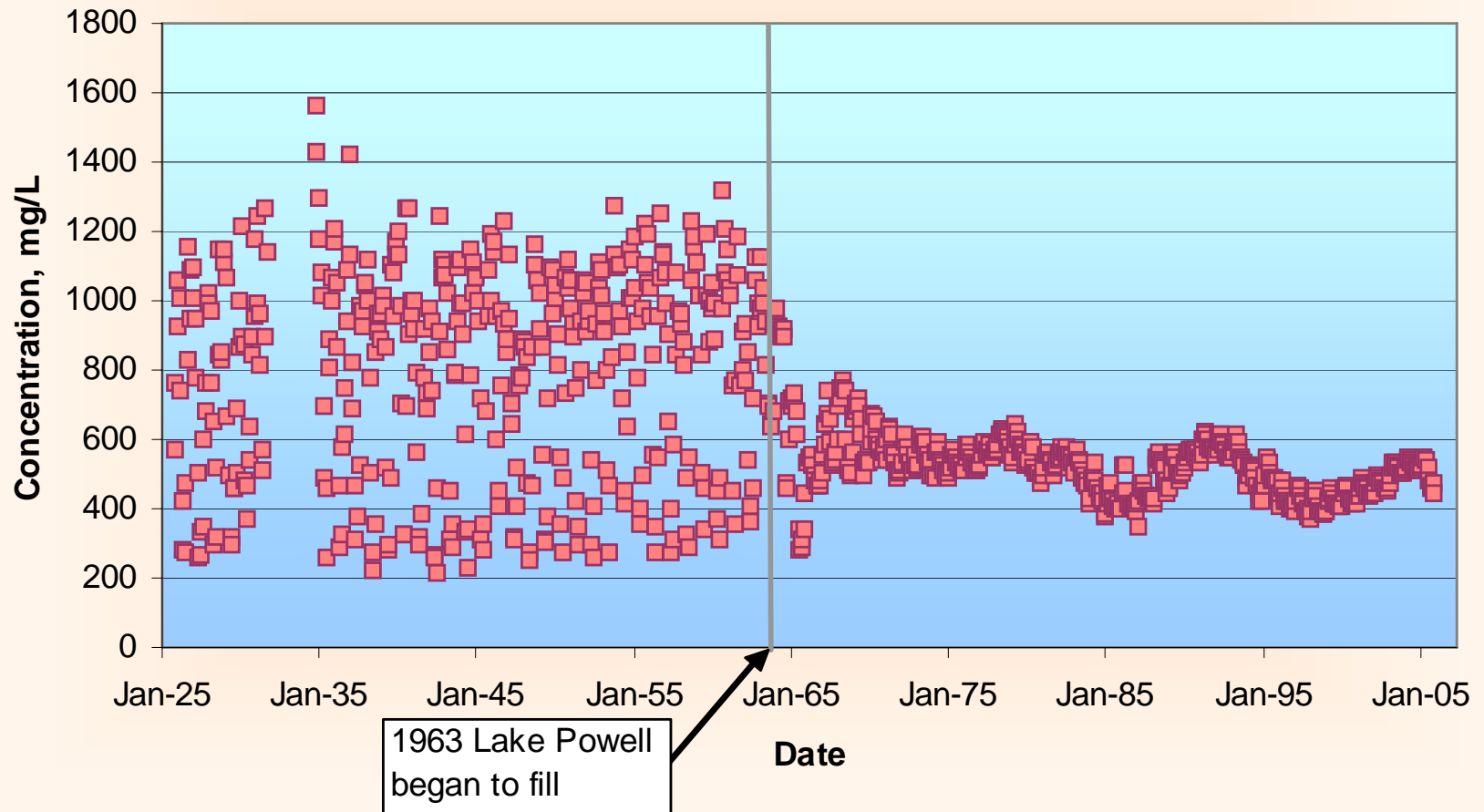
# Salinity sources



From US DOI, 2005

# Water storage impacts: salt fluctuations

Colorado River at Lee's Ferry  
TDS Concentration



Iptn079W1-1

1140

DAY: 3656.5

4 January 2000

1120

1100

1080

1060

1040

1020

1000

980

960

Elevation (Meters)

0

50

100

150

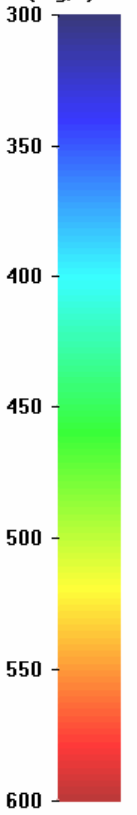
200

250

300

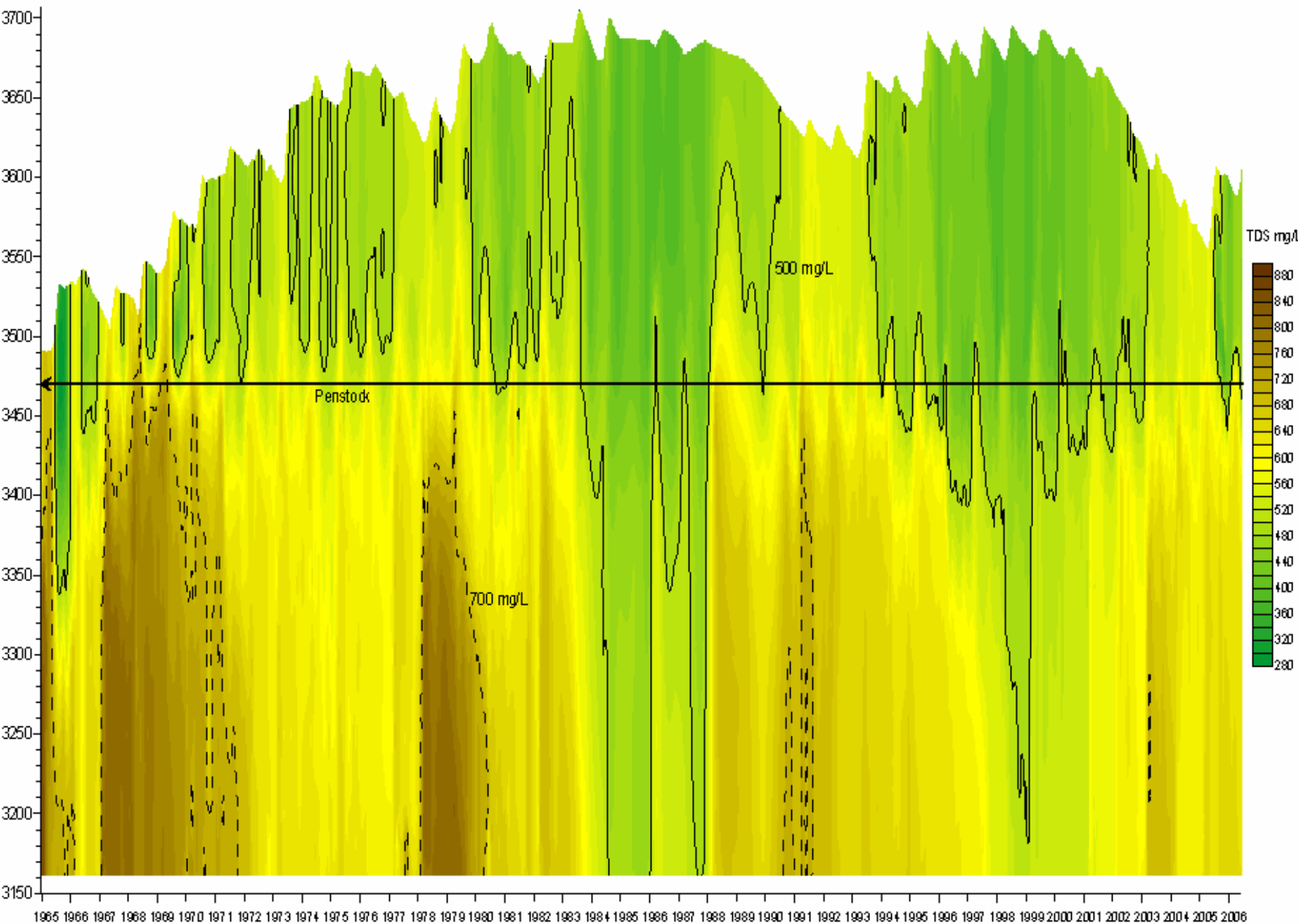
Kilometers

Dissolved Solids (mg/L)

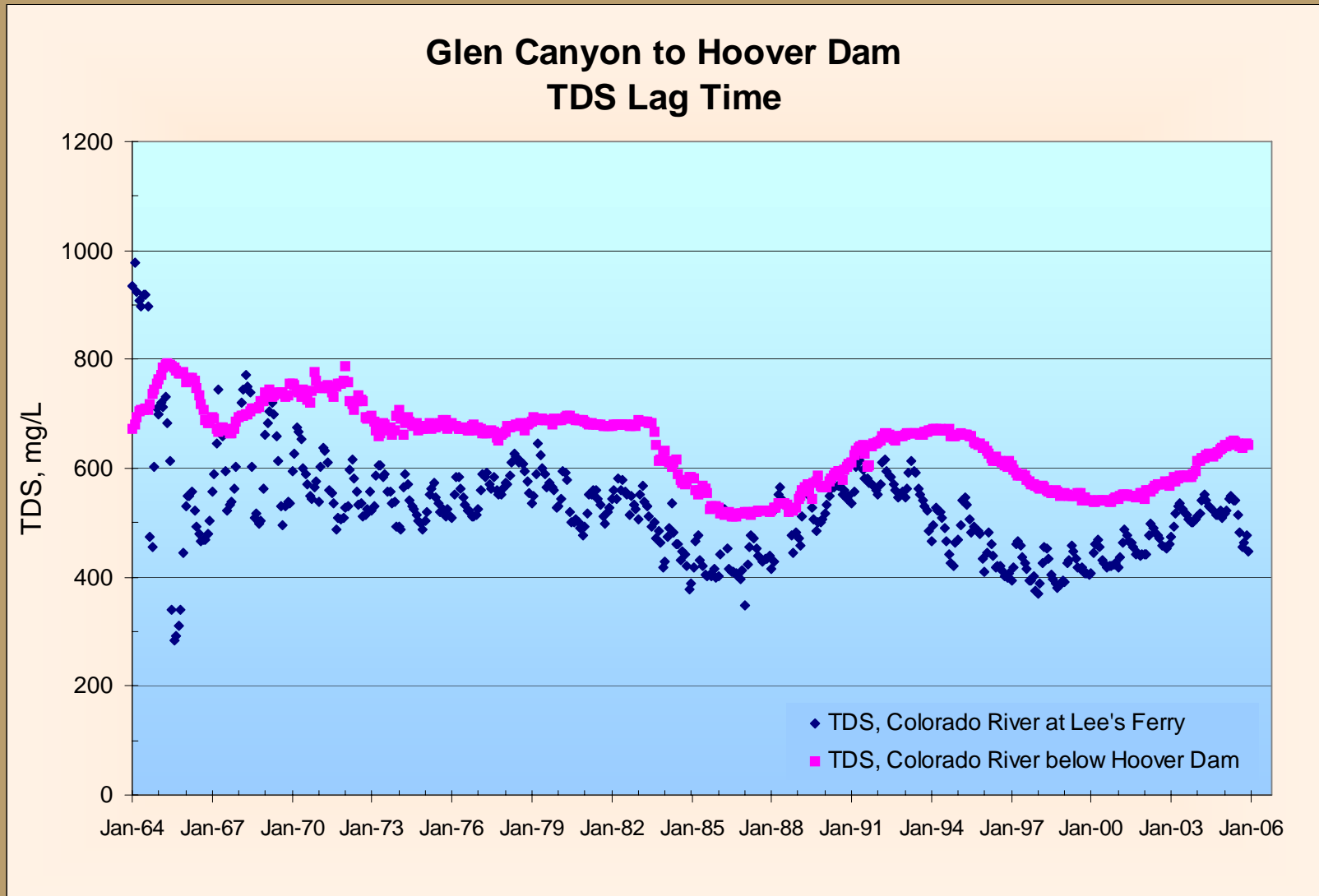


# Wahweap TDS 1964 to 2006

Elevation (Ft) above Sea Level



# Water storage impacts: lag time



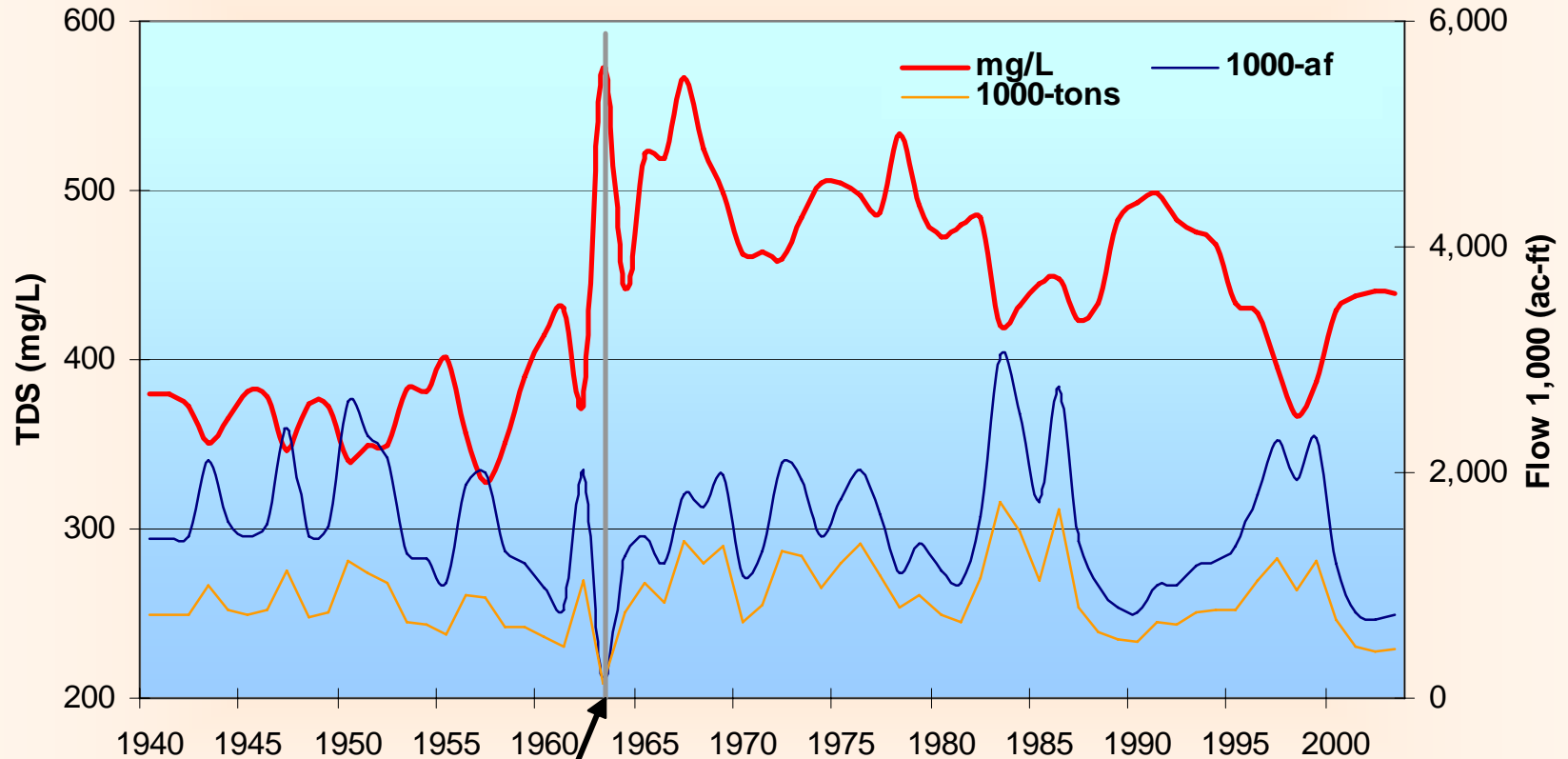
# **Water storage impact: reservoir initial filling**

## **Colorado River Storage Project (CRSP)**

- **Authorized in 1956**
- **Four units**
  - **Glen Canyon**
  - **Flaming Gorge**
  - **Navajo**
  - **Curecanti (Aspinall)**
- **Total storage capacity = 34 million acre-feet**
- **Built between 1957 & 1966**

# Water storage impacts: salt gains

## Green River near Greendale, Utah



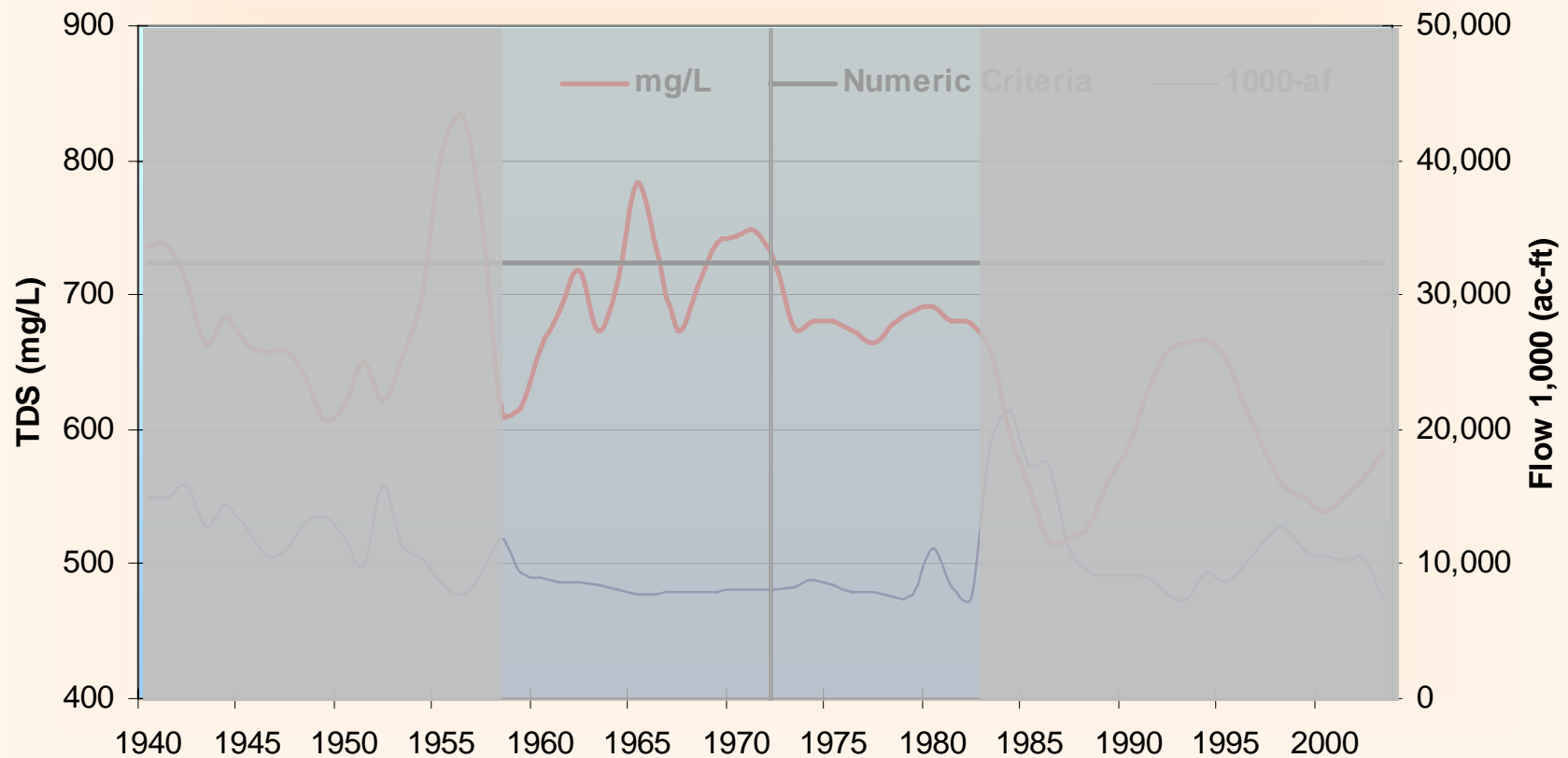
1963 - Flaming Gorge Res.  
began to fill

# Colorado River Salinity

- **Numeric criteria established using 1972 salinity levels**
- **Numeric criteria for Colorado River below Hoover Dam = 723 mg/L**
- **Projected salinity levels at Hoover Dam without salinity control measures:**
  - 1980 = 681-782 mg/L
  - 1985 = 692-871 mg/L
  - 1990 = 716-978 mg/L

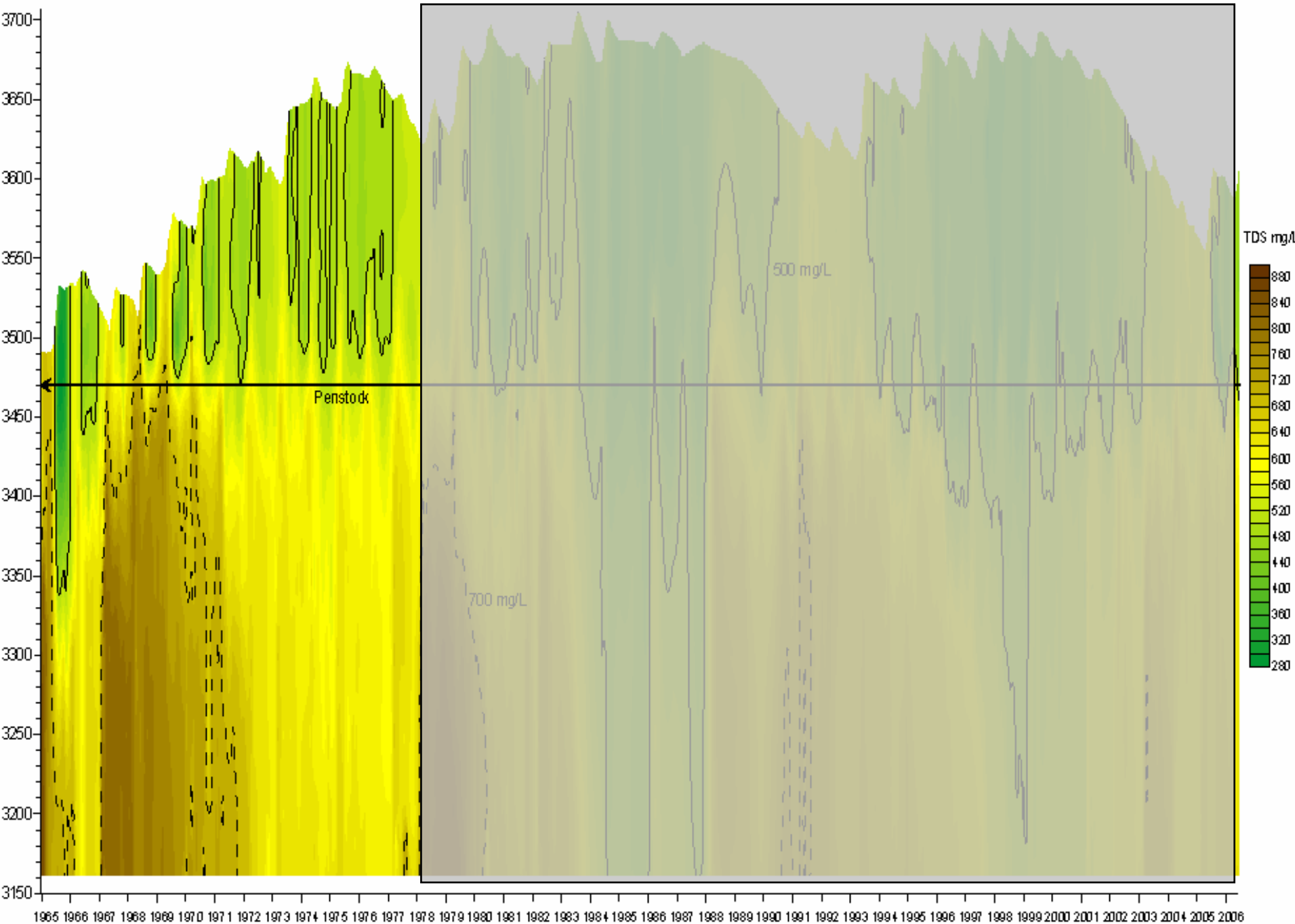
# Colorado River salinity: below Hoover Dam

## Colorado River below Hoover Dam, Ariz-Nev



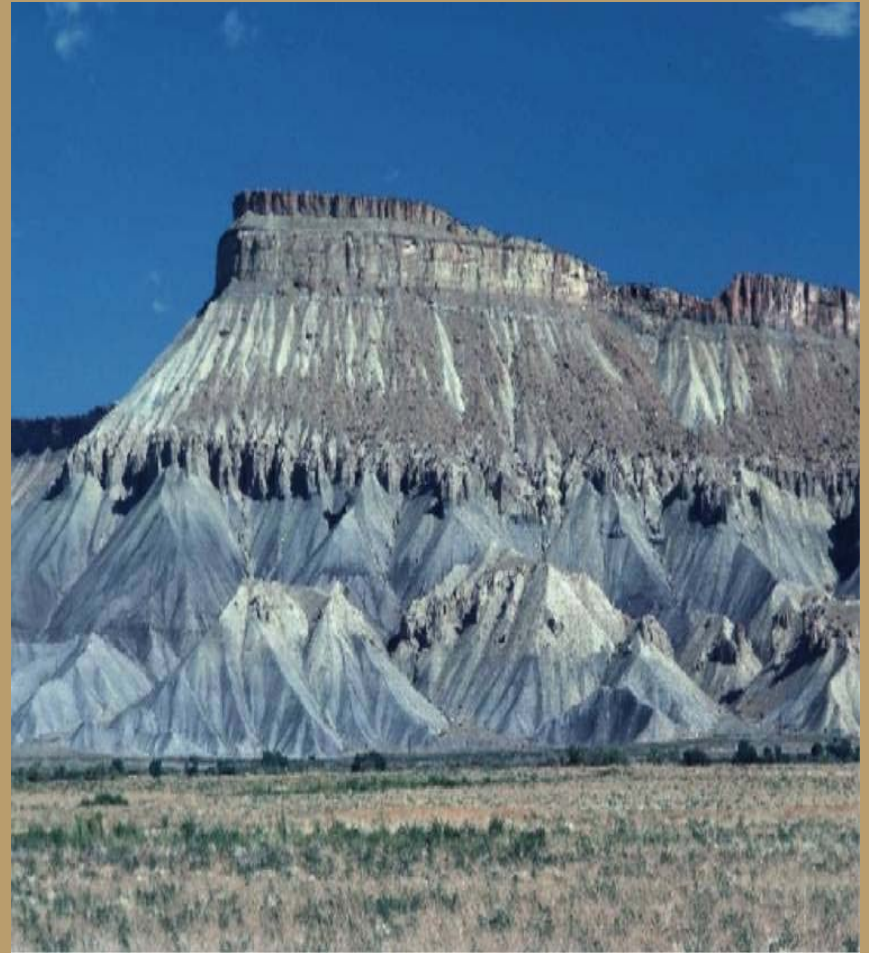
# Wahweap TDS 1964 to 2006

Elevation (Ft) above Sea Level



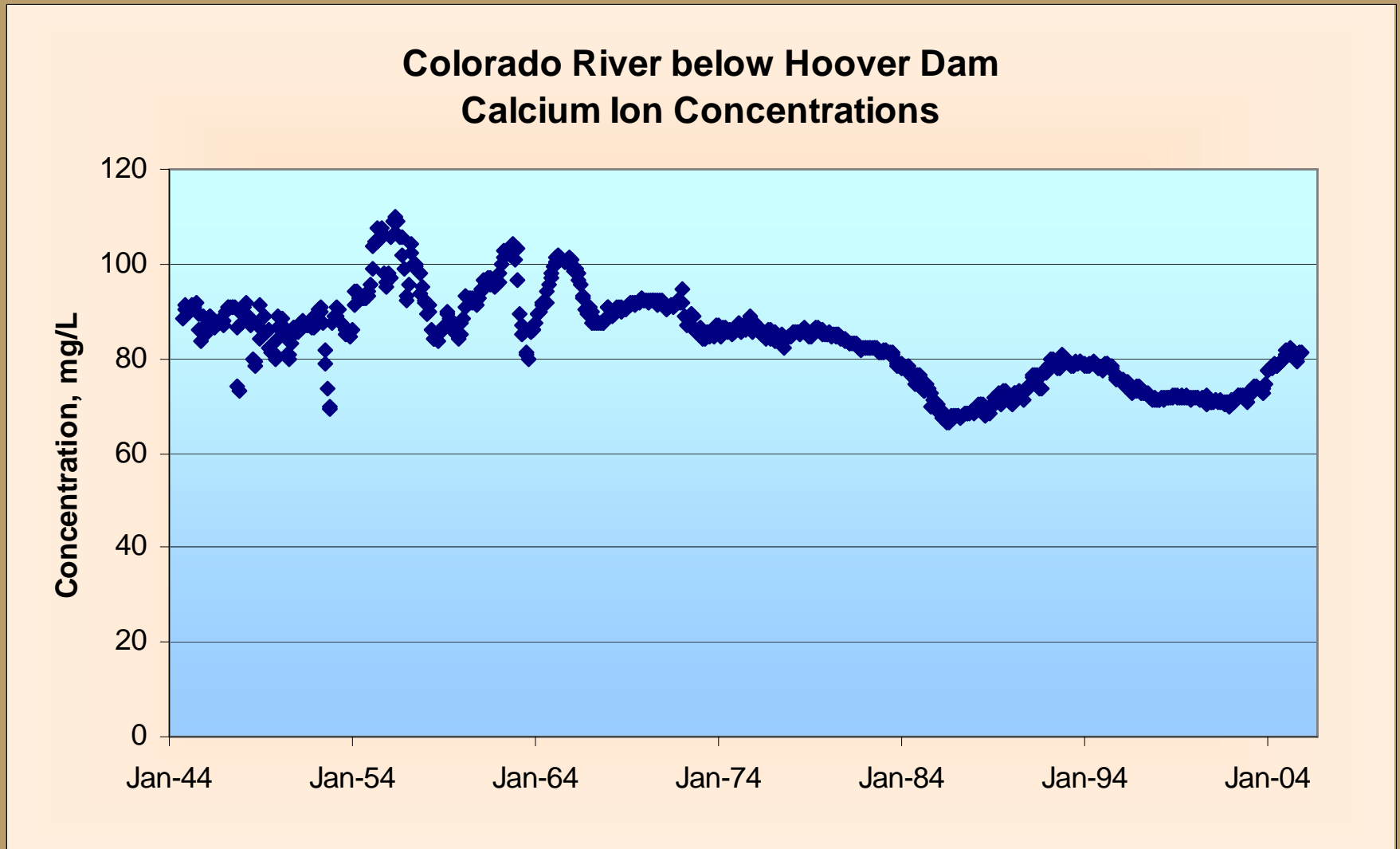
# Salinity Control Program

- Through 2005 1.1 million tons reported controlled
- Majority of projects are irrigation improvement
- Reduce seepage and percolation through Mancos Shale and other marine shales
- Major source of salt is gypsum (calcium-sulfate)

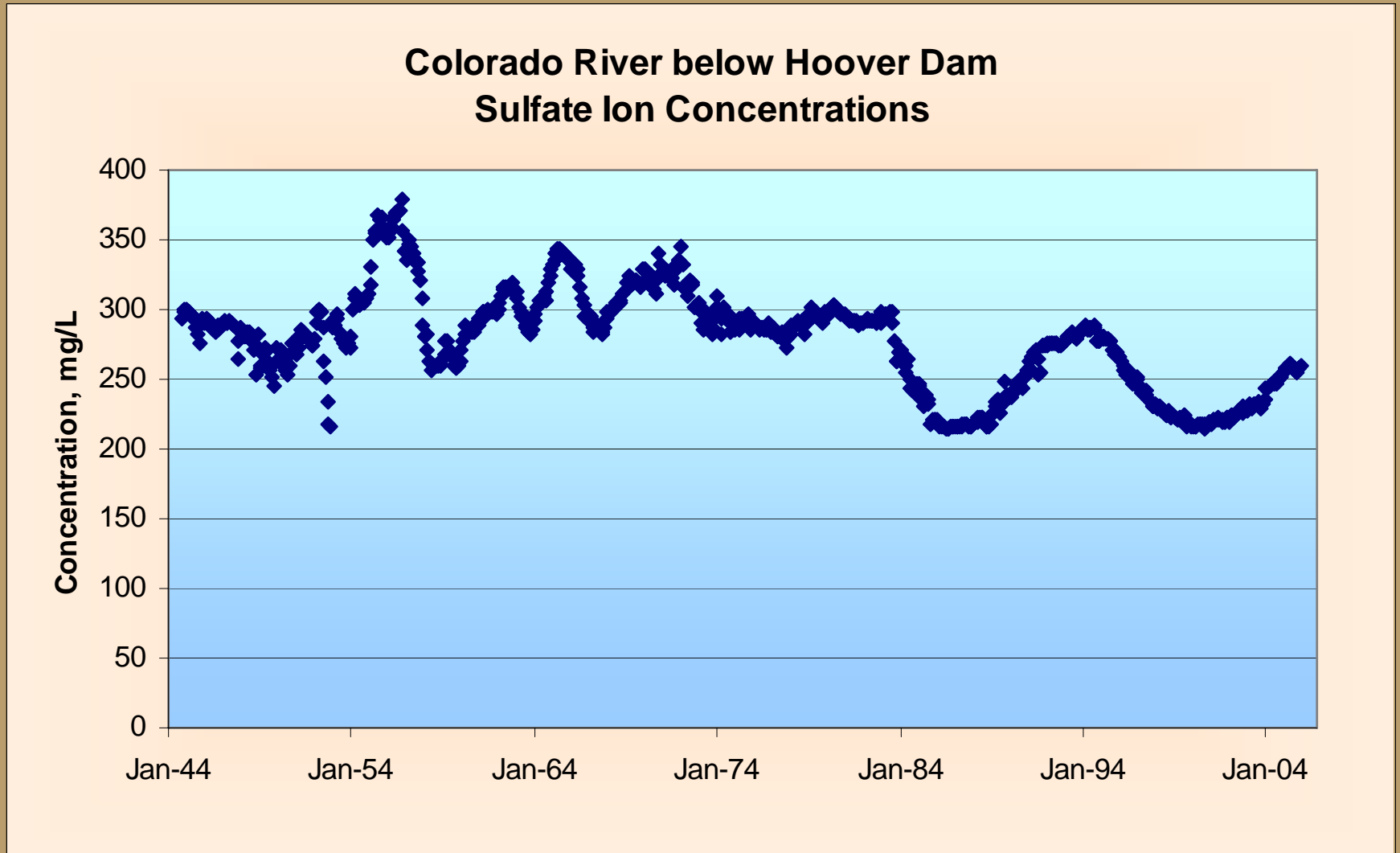


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# Salinity Control: calcium concentrations



# Salinity Control: sulfate concentrations



# Salinity Control Program

- **Verifying tons of salt controlled?**
  - New projects implemented each year
  - Full benefits may not be realized for years
  - Varying hydrology complicates analysis and comparisons
  
- **Average salt load (tons) at Colorado River below Hoover Dam comparison (flow adjusted):**
  - 1940-1988: 9.5 million tons
  - 1989-2003: 8.5 million tons

# Summary

- **Water storage:**
  - Altered seasonal salinity fluctuations
  - Created lag time in the system
  - Reduced dilution flows during initial filling
  - Leached salt from reservoir basins
  - Coincided with numeric criteria
- **Salinity control:**
  - Chemistry trends and load reduction estimates verify effectiveness