

# CHATFIELD LAKE, CO COST OF STORAGE FOR M&I WATER SUPPLY

Corps WS Workshop

2-4 June 2009

Tulsa, OK



# Issues on Chatfield Cost for WS

- High Updated Storage Costs
- Low Reliability, e.g. Low yield to storage
- High Modification Costs to reallocate Storage (Mitigation and Recreation Modifications)
- We cannot effect the latter two issues, but can effect the price charged for use of storage space and therefore the cost per unit of water



# Chatfield Modification Costs

- Environmental Mitigation = \$ 45M
- Recreation Modifications = \$ 44M
- Updated Cost of Storage = \$ 34M
- Total = \$ 123M
- \$5,790 per acre-ft of storage



# Costs for Reallocated Storage in Corps Reservoirs since 1977

- 1977 is when the “highest of four methods” policy for determining price to charge for reallocated storage for M&I came in to effect.
- Updated Cost of Storage (UCS) is most common method, and applies to Chatfield.
- Examined 82 reallocations at 29 Lakes which used highest of four methods.
- Average Cost per acre-ft of storage is \$470, with a range of \$100 to \$4,500.
- Chatfield Updated Storage Cost is about \$34M for 20,600 ac-ft, or \$1,650 per ac-ft.



# Cost for Water Provided

The bigger issue at Chatfield is not so much the cost per acre-ft of storage space, but rather the cost per acre-ft of water provided on a reliable, yearly basis, and over time.



# Yield to Storage Relationships for Corps WS

- Most Corps WS reservoirs provide a firm or dependable yield.
- Common terms for dependable yield include: drought of record, 50-yr low flow, 2% chance.
- Yield to Storage relationships for Corps WS reallocations generally range from about .35 ac-ft/yr to 20 ac-ft/yr for 1 ac-ft of storage when using a "dependable" yield evaluation with an average of 2.5 and a median value of 1.2.
- Chatfield would have 0 ac-ft/yr for 1 ac-ft of storage based on natural inflows, and .11 ac-ft/yr based on total inflows (all "man-made" inflows)

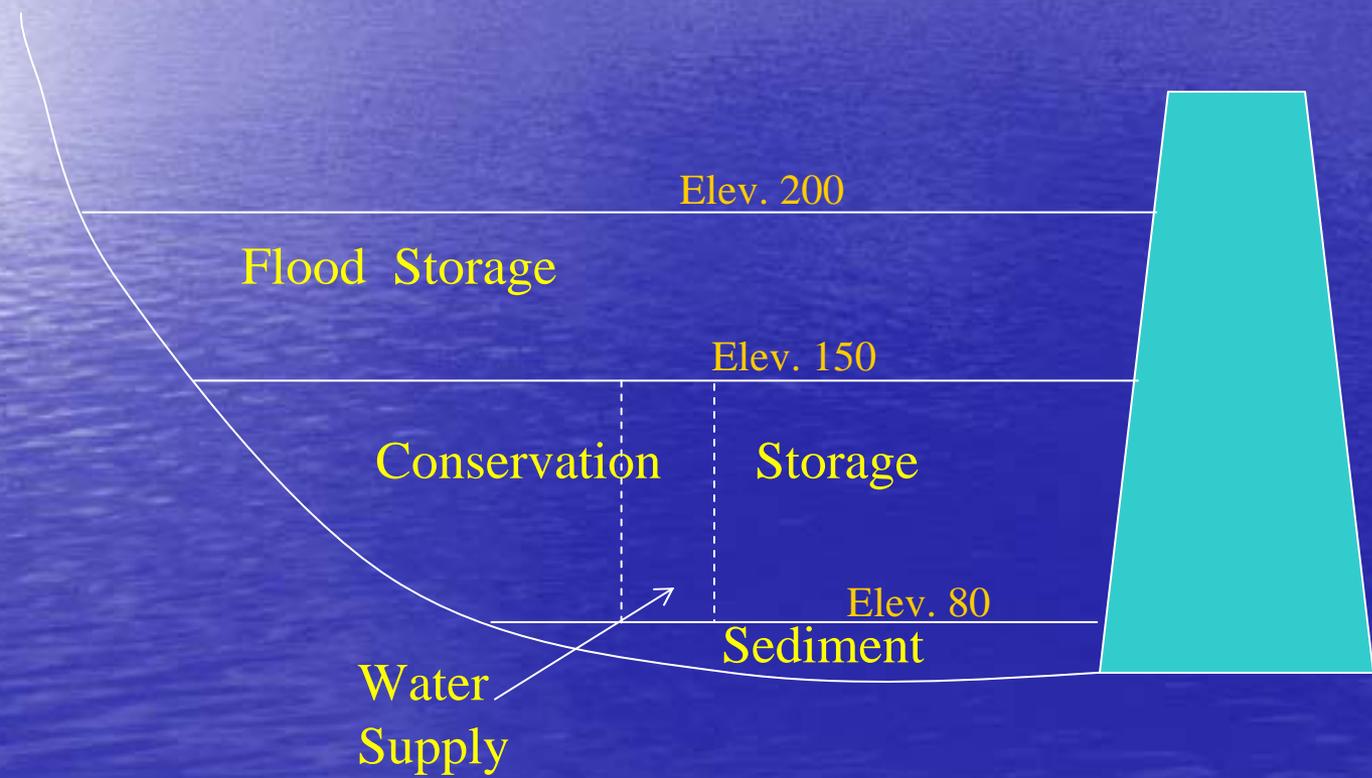


# Reasons for Low Yield to Storage at Chatfield

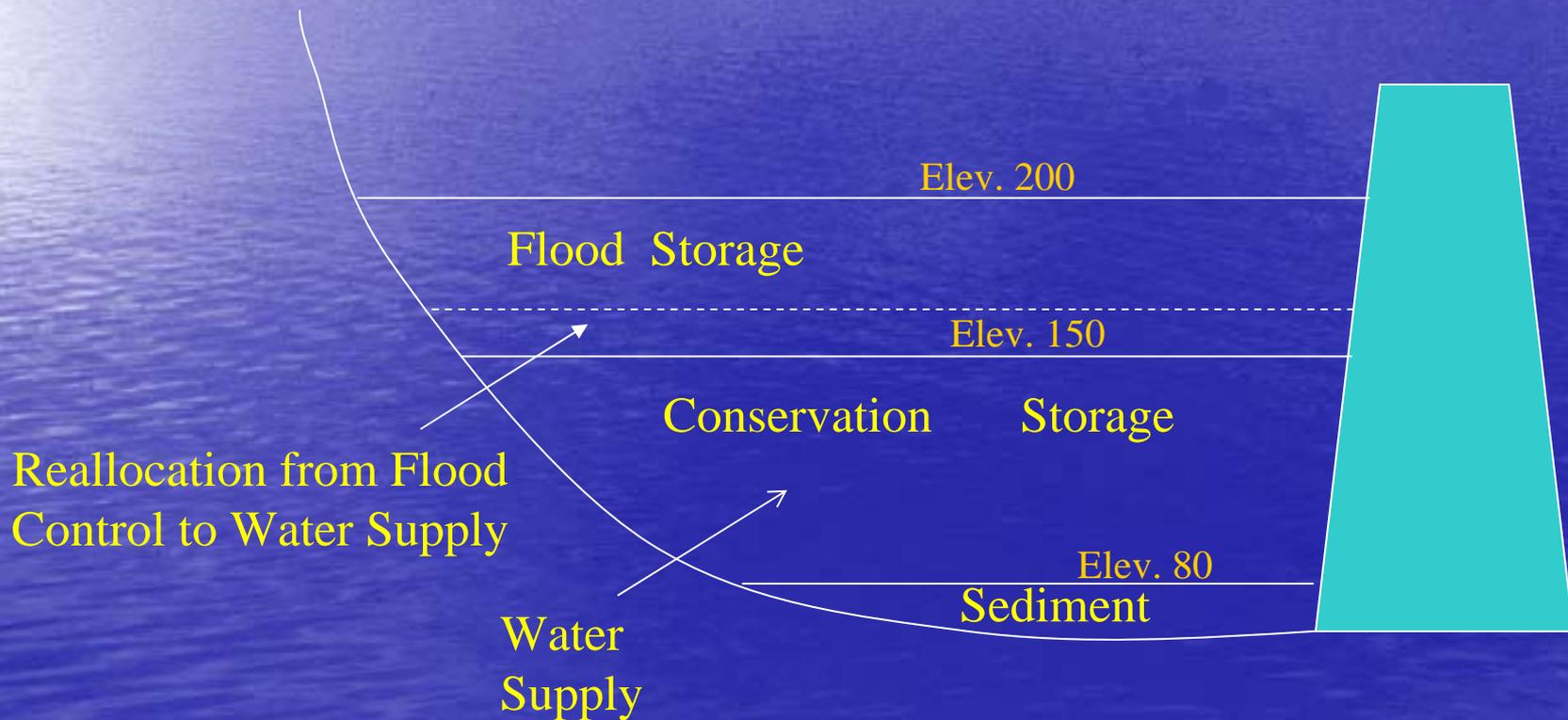
- Basin has 14 inches of average annual rainfall
- Pool (below 5432 msl) is dedicated to Recreation, Fish and Wildlife, and prior water rights. Lower pool cannot be reallocated.
- New WS attains only “incremental” yield of storage between 5444 and 5432 msl.



# Water Supply in a Multipurpose Project (Typical)



# Water Supply in a Multipurpose Project (Chatfield)





# Costs Per Acre-Foot Per Year of Dependable Yield

- Examined 82 reallocations at 29 Lakes which used highest of four methods.
- Average Cost per acre-ft/yr is \$230, with a range of \$50 to \$980.
- Chatfield Updated Storage Cost per acre-ft/yr \$14,300.



# Alternatives Considered for Adjusting UCS

1. Percent Time (in years) WS Storage is used based on Natural Inflows
2. Percent Storage used based on Total Inflows
3. Percent Storage used based on Natural Inflows
4. Dependable Yield based on Total Inflows



# Alternatives Considered

## Factual "givens"

- 59 year period of record – 1942 – 2000
- 20,600 ac-ft of storage each year
- 1,215,400 ac-ft of storage over the period of record
- Water Rights and Priorities of 15 Users
- Some users have ability to "make flows"
- Updated Cost of Storage = \$34M



# Alternatives Considered Results in Percent of UCS

1. Percent Time in years - Natural Inflows = 83%
2. Percent Storage Used - Total Inflows = 41%
3. Percent Storage Used - Natural Inflows = 33%
4. Dependable Yield for Total Inflows = 11%



# Alternatives Considered

Results expressed in

## Adjusted Updated Cost of Storage

1. Percent Time Used Natural Inflows =  
\$28M
2. Percent Storage Used - Total Inflows =  
\$14M
3. Percent Storage Used - Natural Inflows =  
\$11M
4. Dependable Yield for Total Inflows =  
\$4M



# Alternatives Considered

## Results expressed in Cost Per Acre-Ft/Year Yield

1. Percent Time Used Natural Inflows =  
\$ 11,760
2. Percent Storage Used - Total Inflows =  
\$ 5,880
3. Percent Storage Used - Natural Inflows =  
\$ 4,620
4. Dependable Yield for Total Inflows =  
\$ 1,680



# Recommended Alternative

Recommend Alternative 2 – Updated Cost of Storage adjusted by Percent Storage used based on Total Inflows

- > 41% of UCS = \$14 Million
- > \$680 per acre-ft of storage space
- > \$1,640 per acre-ft/yr of average yield
- > \$5,880 per acre-ft/yr of dependable yield

# Rationale for Recommended Adjustment in UCS

- No Federal Costs for Implementation
- Accounts for all inflows
- Helps make WS more affordable for Users
- “Price” for storage is more in line with other reallocations
- Considers the reliability and utility of the storage space.
- Maintains policy of selling storage, not water

# ASA Approval Memo

## 22 Jan 2009

My staff has reviewed the memorandum, background information, options paper and recommendations by the Omaha District and Northwestern Division Commanders and the assessment by Corps Headquarters. In accordance with their recommendations, I find the analysis to be presented clearly and reasonably, and that it represents a proposed valuation method that more accurately reflects uncertainty of the water storage yield at Chatfield Lake when placing a value on the UCS. The requested policy exception is approved because of the special conditions at Chatfield Reservoir. The exception will provide a more equitable rate for the UCS, bringing the UCS in line with other Corps reservoirs.

# ASA Memo to DCW

## 27 Jan 2009

I would like your staff to further examine the UCS method used in the Chatfield Reservoir reallocation policy exception; consider its potential for use on future reallocation studies, and make a recommendation to me as to whether the method should be formally adopted and added as an optional method of calculating UCS, and if so, the best vehicle to accomplish that (e.g., new or revised guidance or policy).