



# PK-Granbury-Whitney Water Management Study

***Opening Remarks by:***

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***BRA Upper Basin Regional Manager***

***Presented by:***

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Manager***

**March 2011**





# Presentation Agenda

- Objective of the Study
- Why the Study?
- Study Methodology
- Study Results/Recommended Plan
- What Does This Mean for Me?
- Next Steps/Timeframe
- Questions





# Brazos River Authority Water Supply Reservoirs





# BRA Reservoir Facts



	Possum Kingdom	Lake Granbury
Impoundment Date	1941	1969
Conservation (full) pool (ft-msl)	999.0	692.7
Original Capacity (acre-feet)	724,739	153,500
Sediment Accumulation (acre-feet)	184,399	24,489
Current Capacity (acre-feet)*	540,340	129,011
Surface area (acres)*	16,716	7,945

**\*Full Pool Level – TWDB Current Volumetric Surveys  
1 acre-foot = 325,850 gallons**



Possum Kingdom

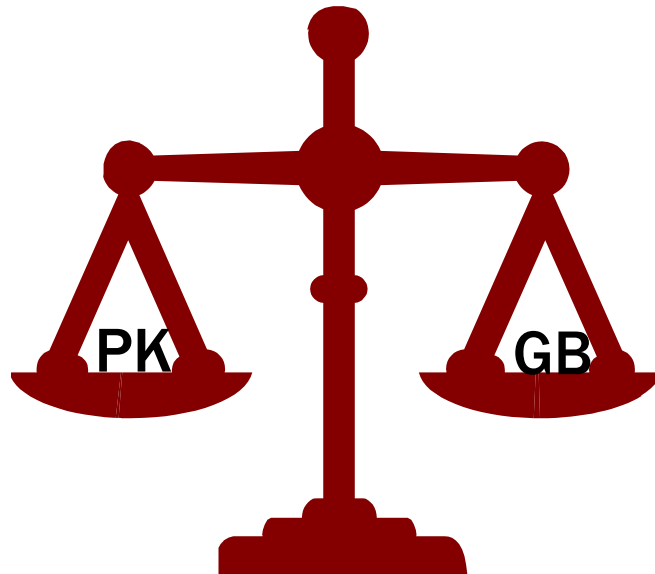


Lake Granbury



# Management Study Objective

Develop a lake management procedure for the Possum Kingdom/Granbury/Whitney system that meets water supply needs and considers major items/issues affected by lake levels and lake management.





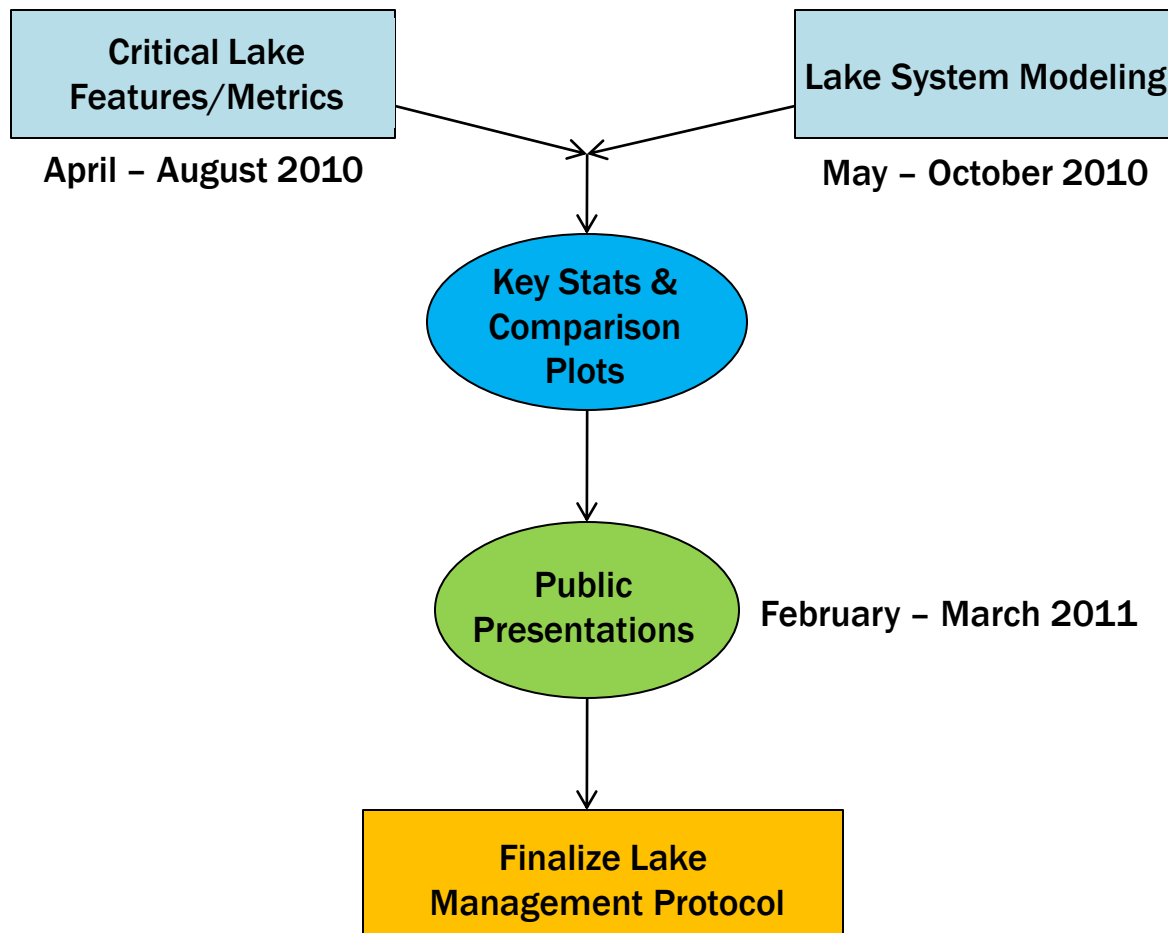
# Why the Study?

- PK hydropower units not in operation since Sept. 2007
- Current procedure balances drawdown between PK & Granbury  
(1:1 – Equal Drawdown)
- 2008 – 2009 Drought
- Potential Comanche Peak Nuclear Power Plant (CPNPP)  
Units 3 & 4
- Public comments and scrutiny from local interest groups
- Other options? - Began Management Study in Spring 2010
  - Joint effort – BRA Water Services Staff & Halff Associates, Inc.





# Study Methodology Overview





# Critical Lake Features/Metrics

- Location and lake bottom elevation
- Based on aerial photography, field measurements, BRA records, TWDB bathymetric survey



Critical Metric	Possum Kingdom	Lake Granbury
Fixed Residential Docks	87	2,948
Fixed Commercial Docks	3	31
Floating Residential Docks	1,383	253
Floating Commercial Docks	28	2
Group Residential Docks	10	6
Marina Facilities	41	19
Fuel Stations	10	6
Public Ramps	26	10
Other Ramps	18	45
<b>Total</b>	<b>1,606</b>	<b>3,320</b>





# Critical Features/Metrics

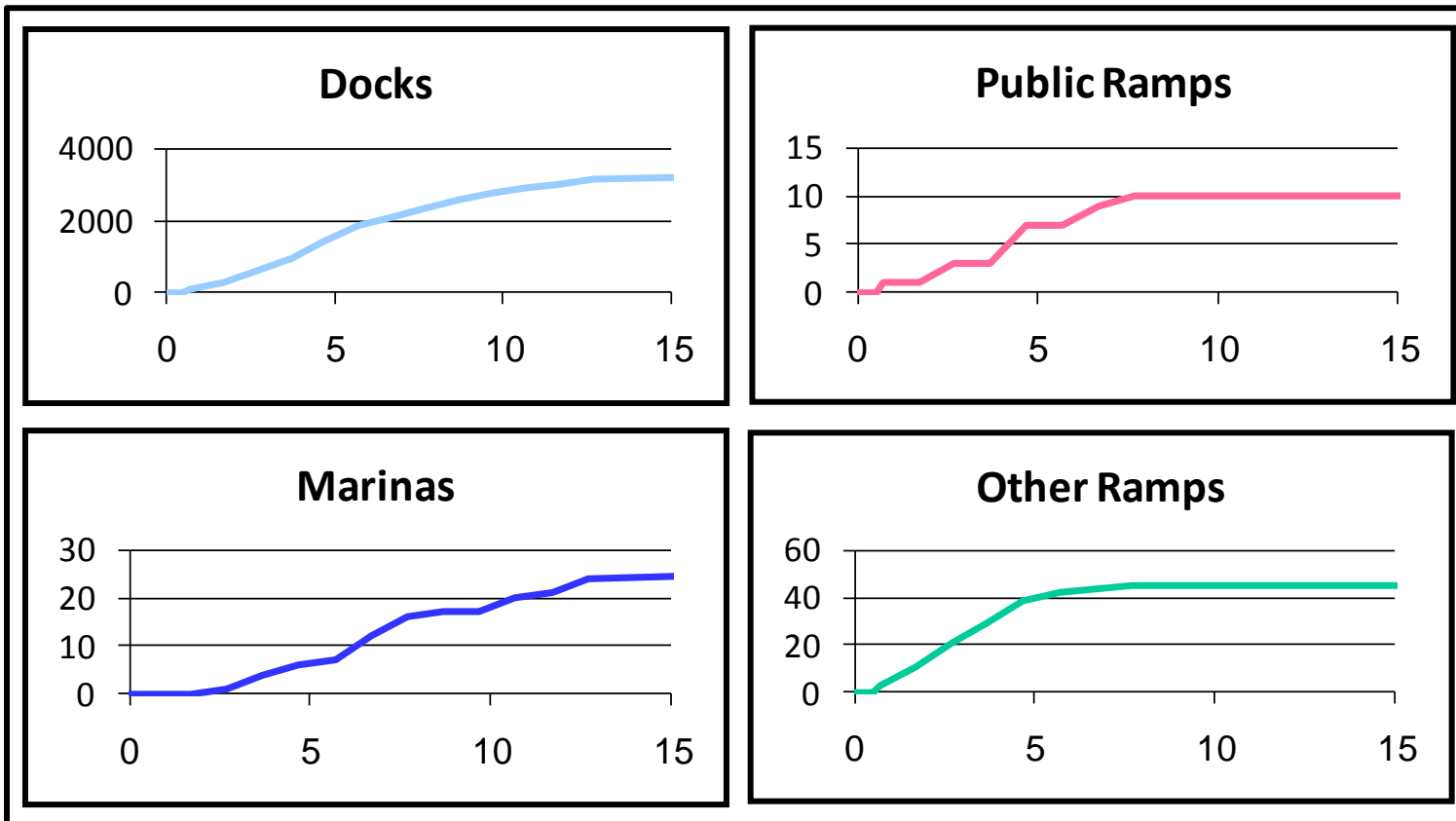
- Minimum 2' of water for feature to be in-service.
- Also digitized/classified:
  - Water supply intakes
  - Lake Granbury canals
  - Lakeside recreational features
  - Lakeside businesses
  - Lakeside properties
  - Downstream river businesses
  - Lake Whitney features





# Lake Granbury Metrics

Number of Facilities Out-of-Service



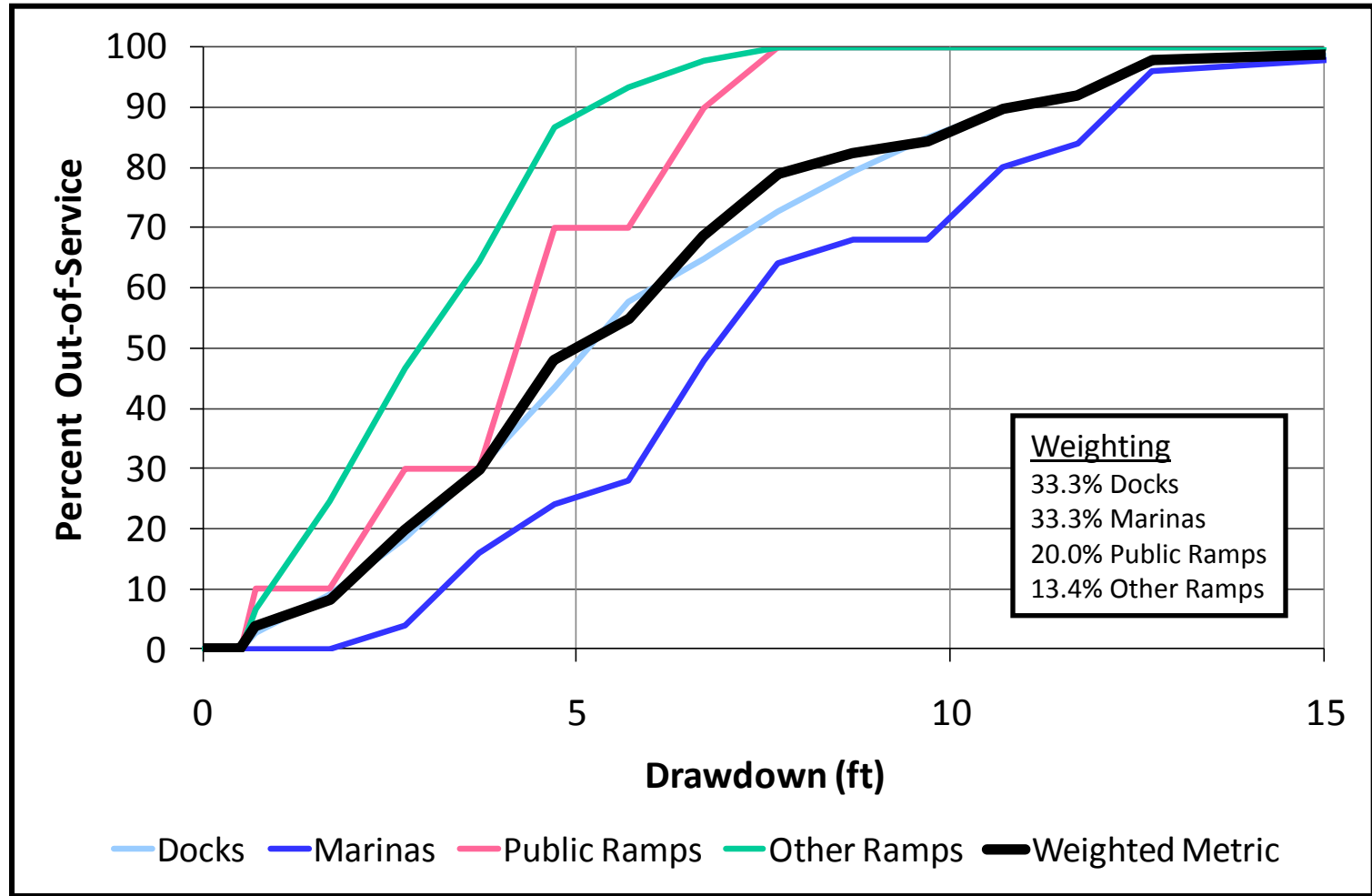
Drawdown (ft)





# Lake Granbury Metrics

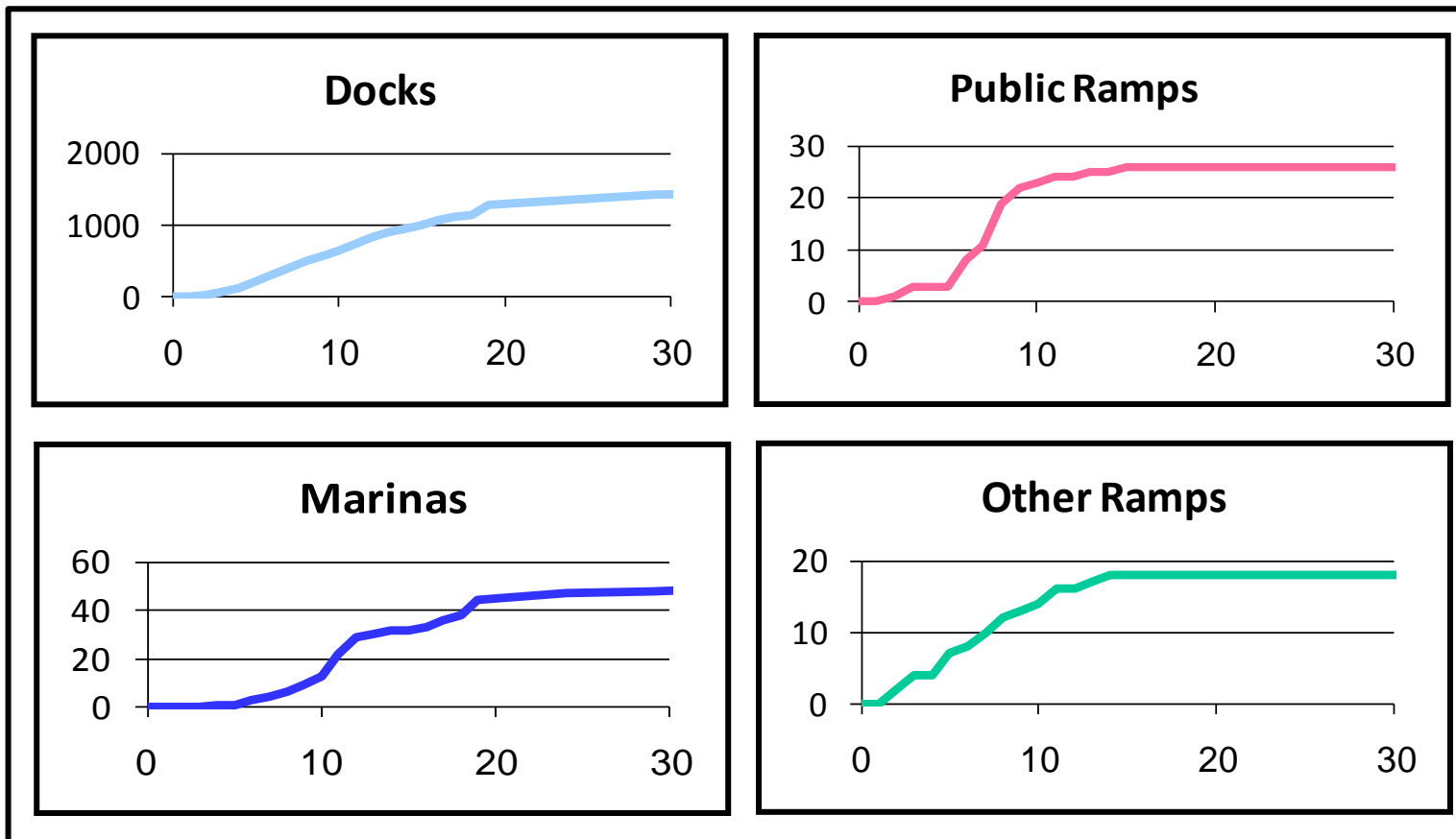
## Percent Out-of-Service





# Possum Kingdom Metrics

Number of Facilities Out-of-Service



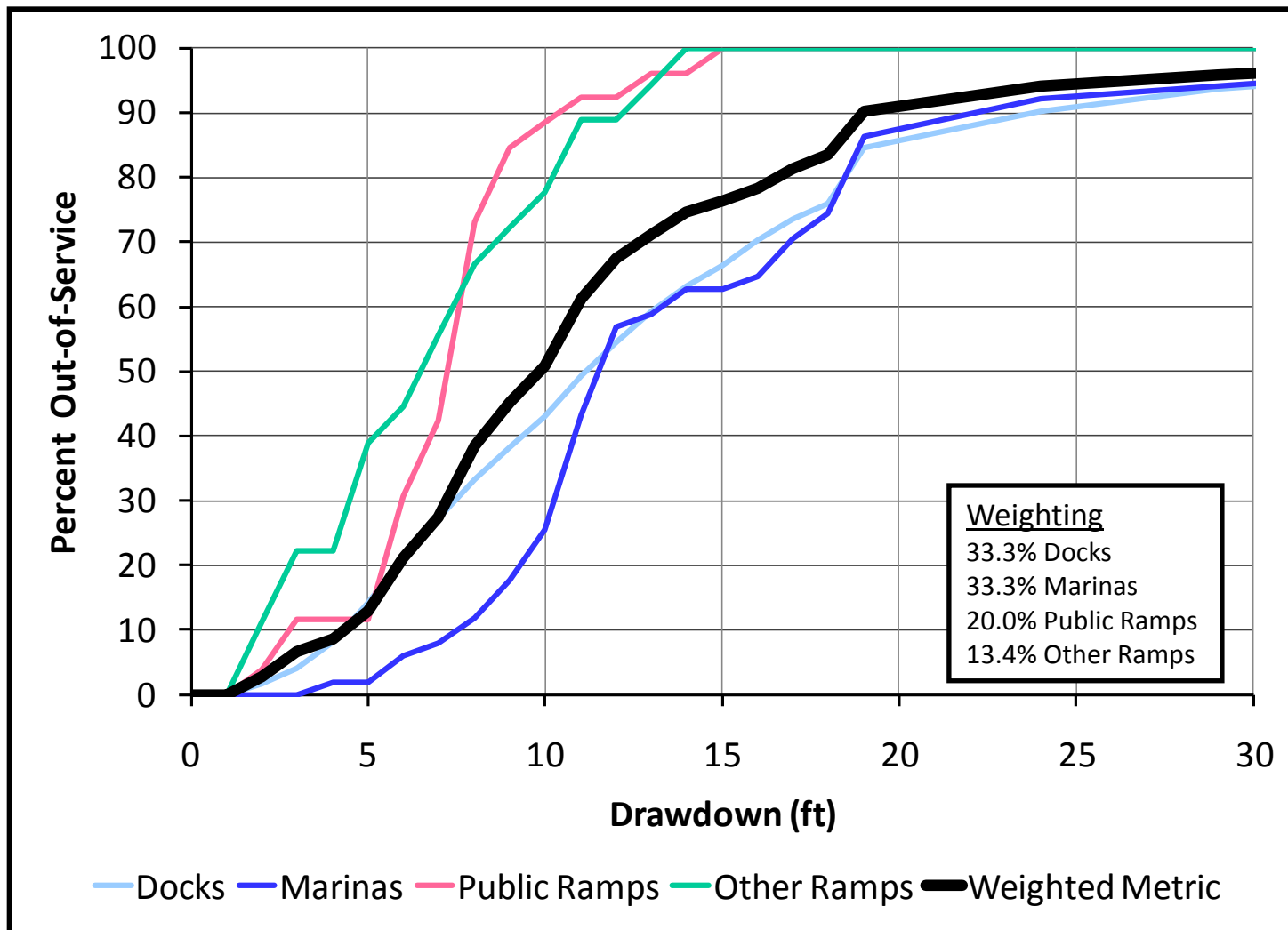
Drawdown (ft)



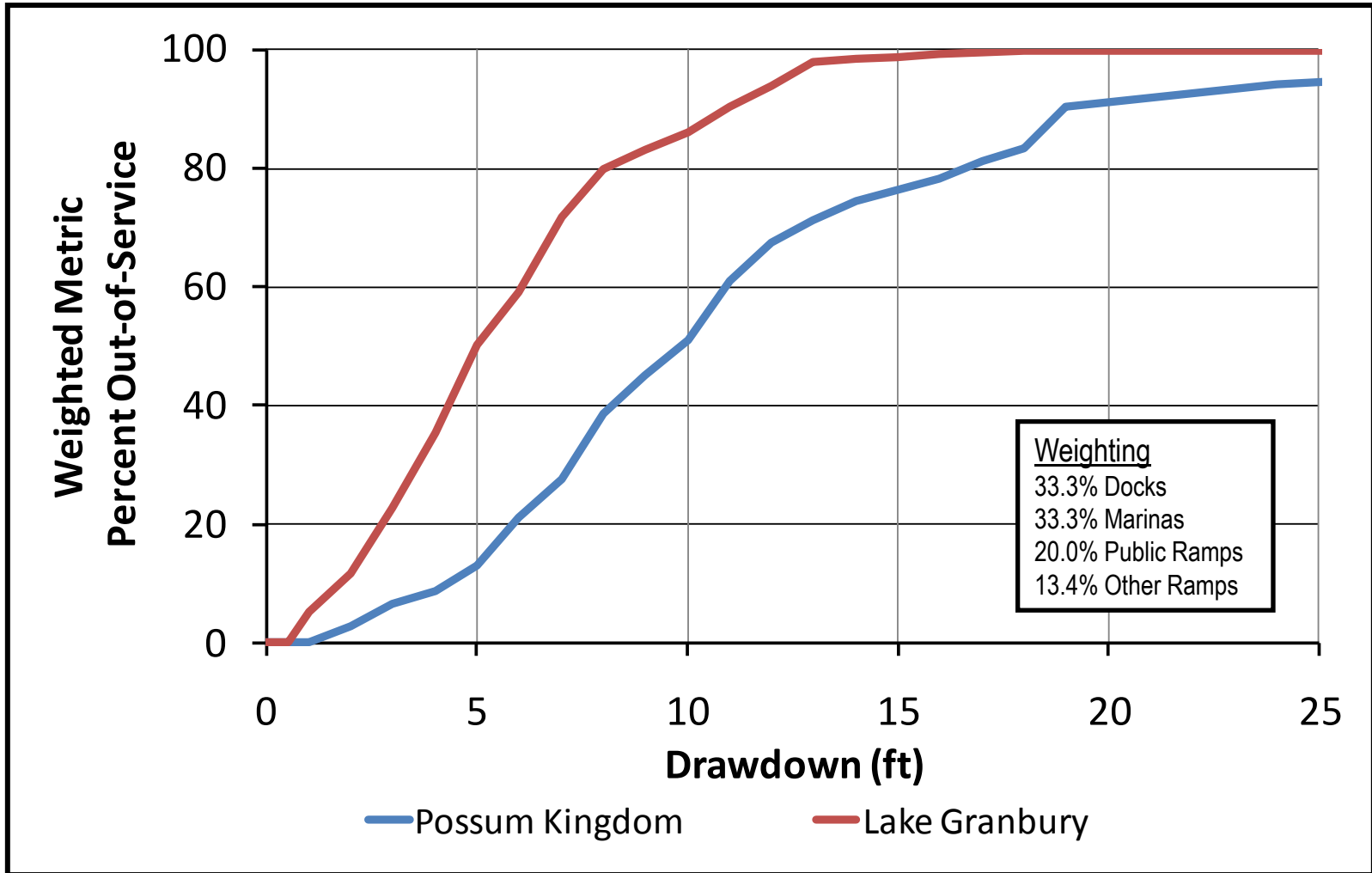


# Possum Kingdom Metrics

## Percent Out-of-Service

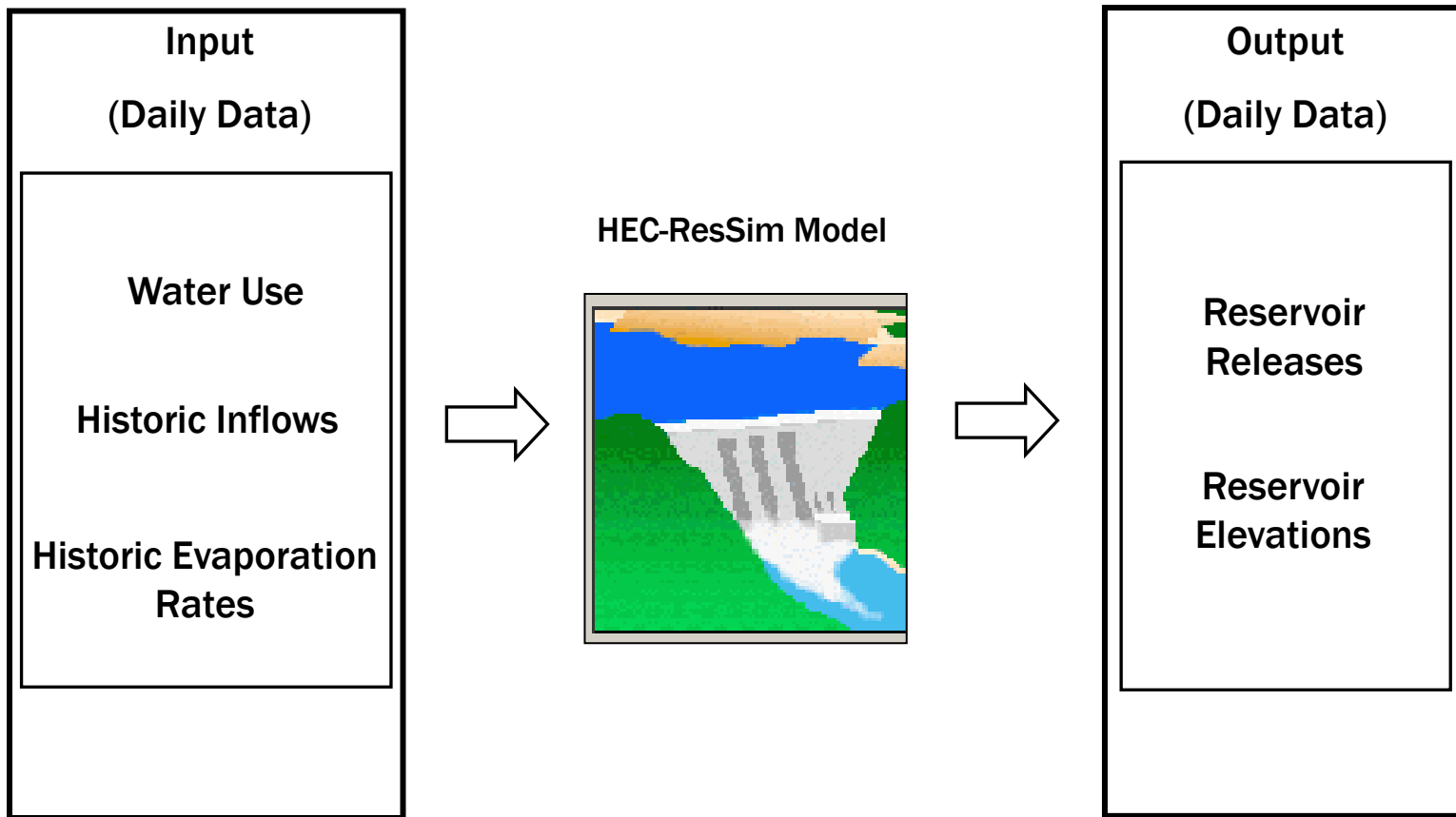


# Integrating Weighted Metric Impacts Into Model Results – Is Equal Drawdown “Equal”?





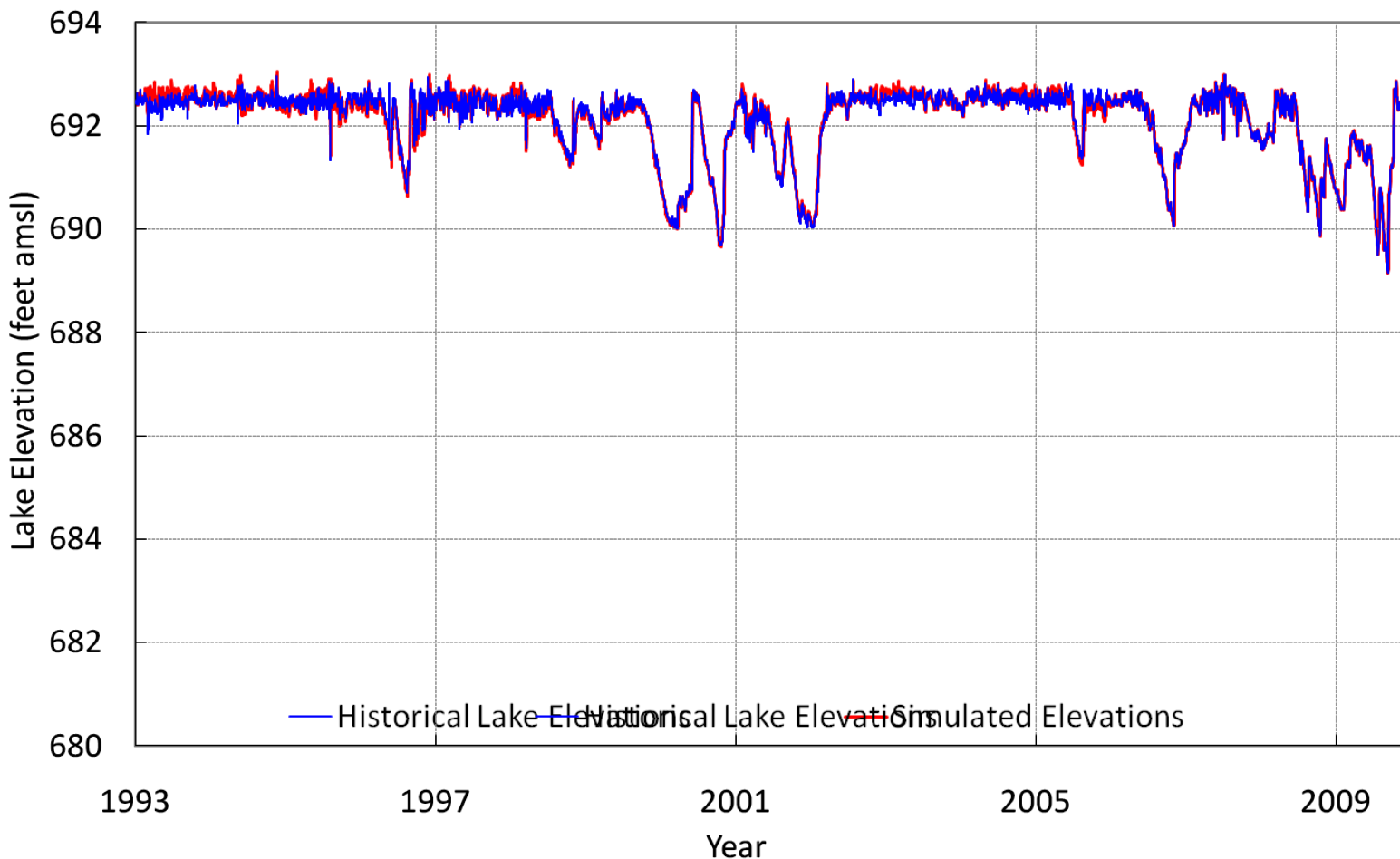
# Lake System Modeling





# Model Validation Results – Lake Granbury

Lake Granbury Observed and Simulated Lake Elevations Through Time  
Simulation Period: January 1993 - December 2009



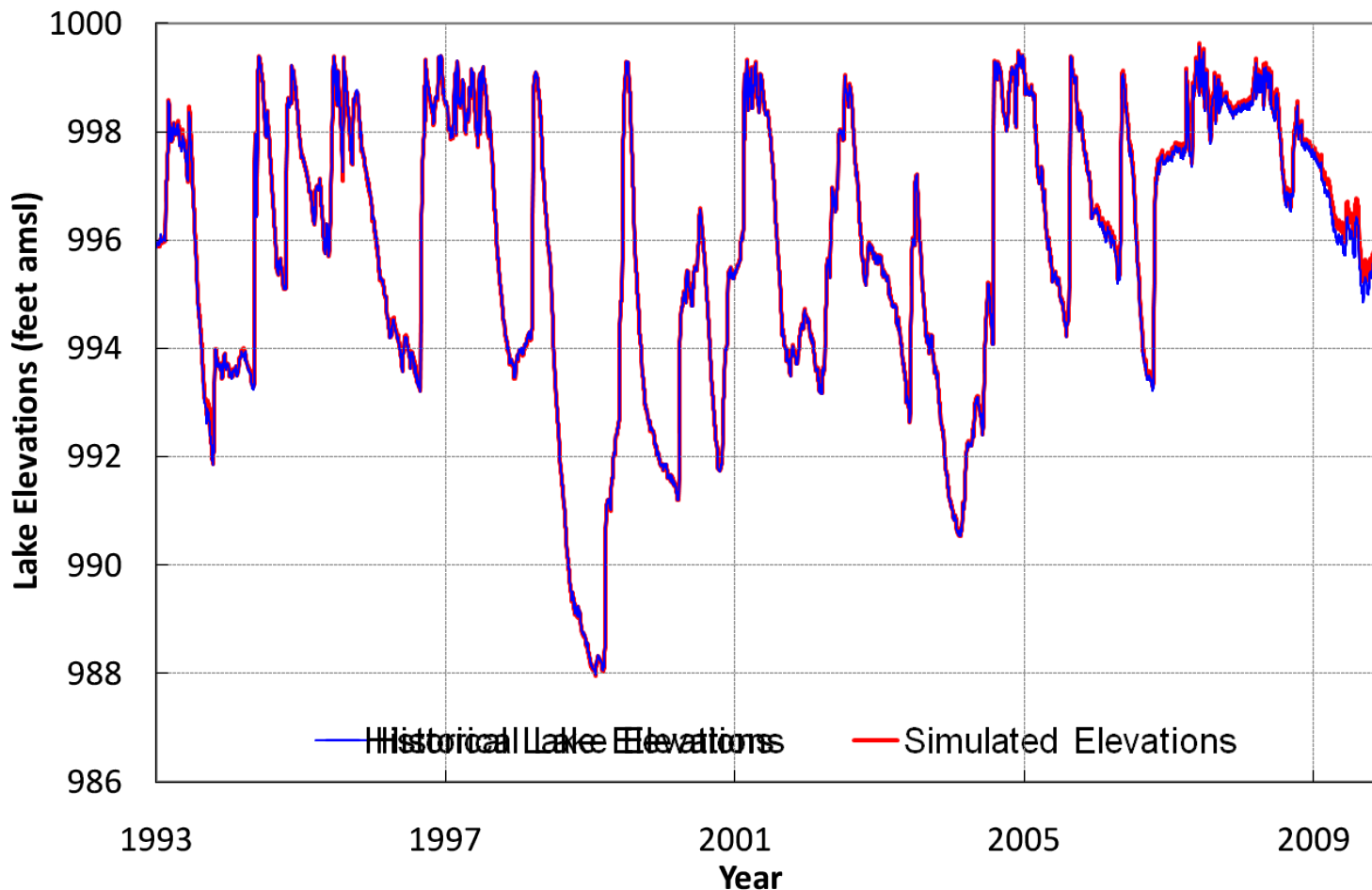
amsl – above mean sea level





# Model Validation Results – Possum Kingdom Lake

Possum Kingdom Lake Observed and Simulated Lake Elevations  
Simulation Period: January 1993 - December 2009



amsl – above mean sea level





# ***Lake Management Plan Scenarios***

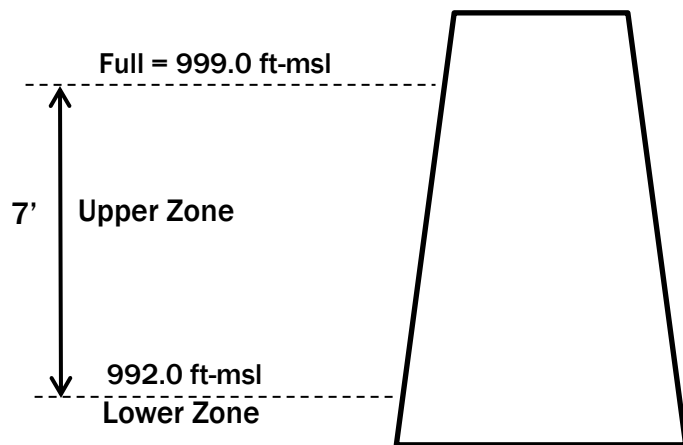
- **Equal Drawdown (1:1) – Current Operation**
- **Zonal Drawdown**
- **Granbury Used First to Meet Demands (GB 1<sup>st</sup>)**
- **Possum Kingdom Used First to Meet Demands (PK 1<sup>st</sup>)**
- **No Demand (No Water Use)**



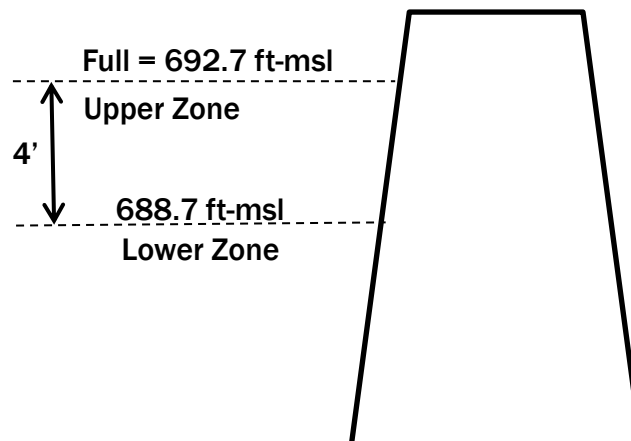


# Zonal Drawdown

Possum Kingdom



Granbury



1.75:1 (PK:Granbury) Drawdown Ratio in Upper Zone  
Drawdown Ratio Varies by Demand (Water Use) in Lower Zone





# Demand (Water Use) Scenarios

Scenario	System Demand (acre-feet/year)
Current	95,600
2020 w/o CPNPP Units 3 & 4	130,200
2020 w/ CPNPP Units 3 & 4*	184,300

\*Based on *October 2008, Lake Granbury Dissolved Minerals Study conducted by Freese and Nichols, Inc., and 2006 State Water Plan*

\* Scenario includes demand from CPNPP Units 3 & 4

**Combined Storage of PK and Granbury  $\approx$  650,615 acre-feet**  
**1 acre-foot = 325,850 gallons**





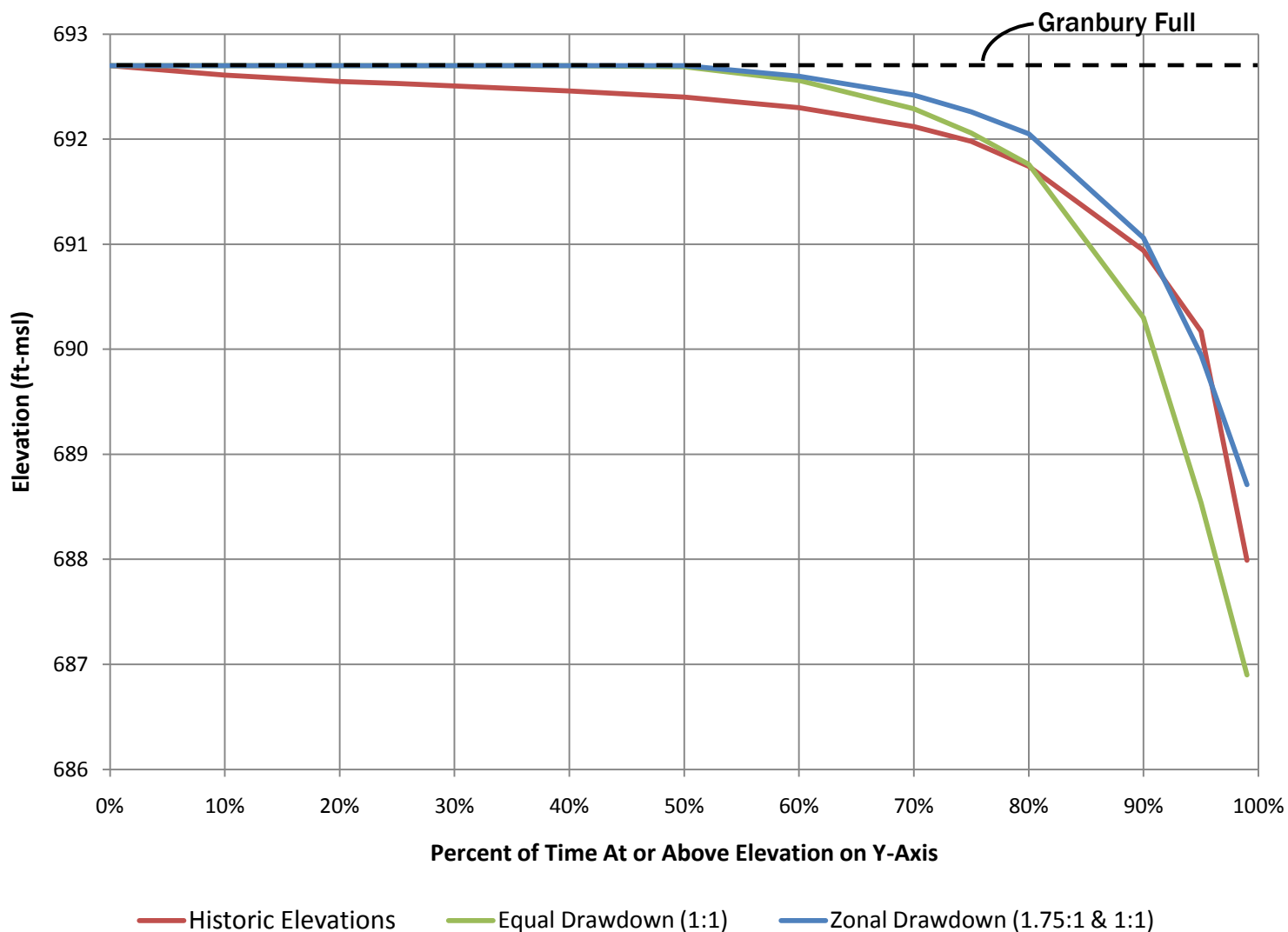
# Current Demand (Water Use) Results

95,600 acre-feet/year





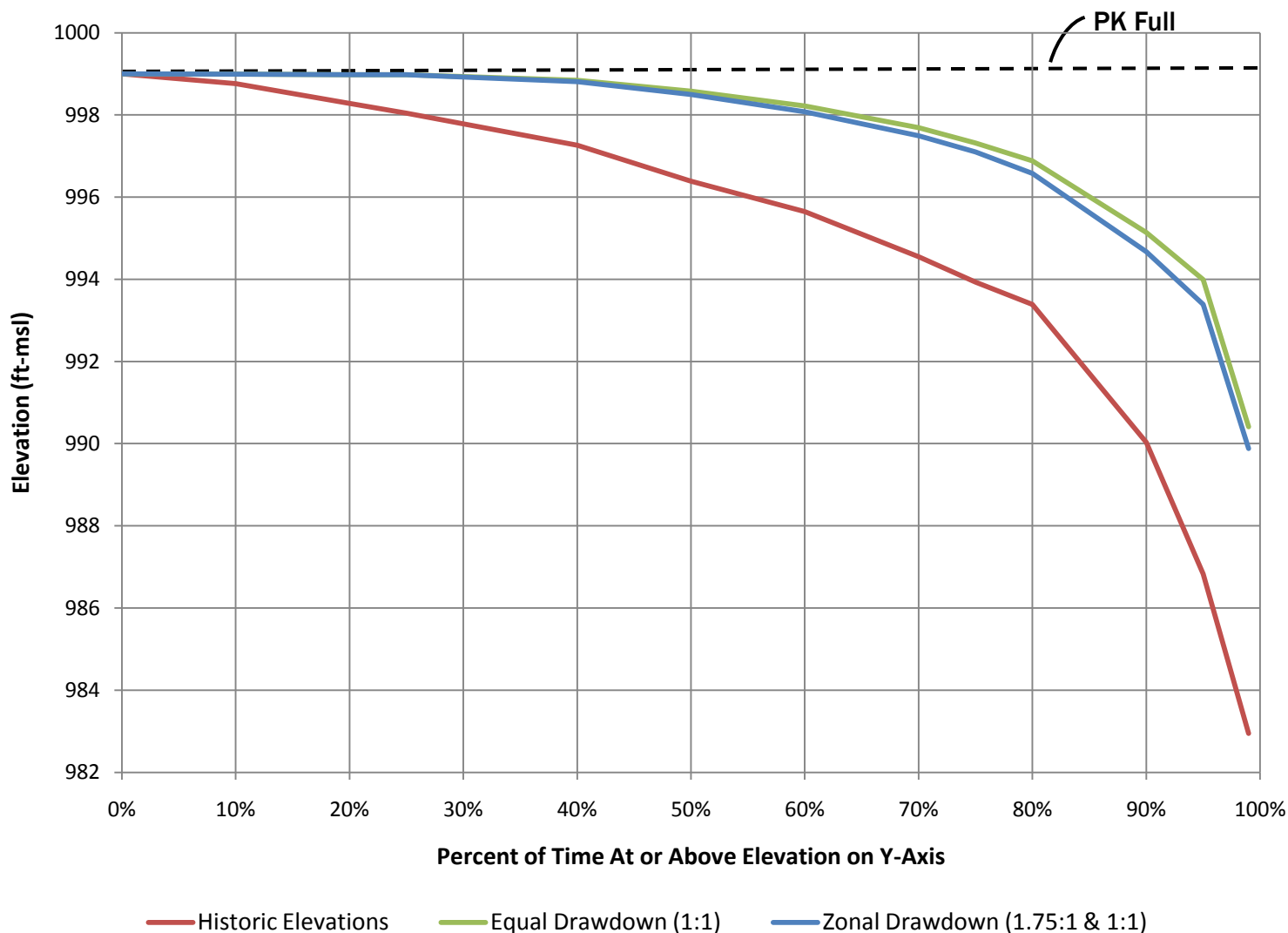
# Current Demands Granbury Frequency Plot





# Current Demands

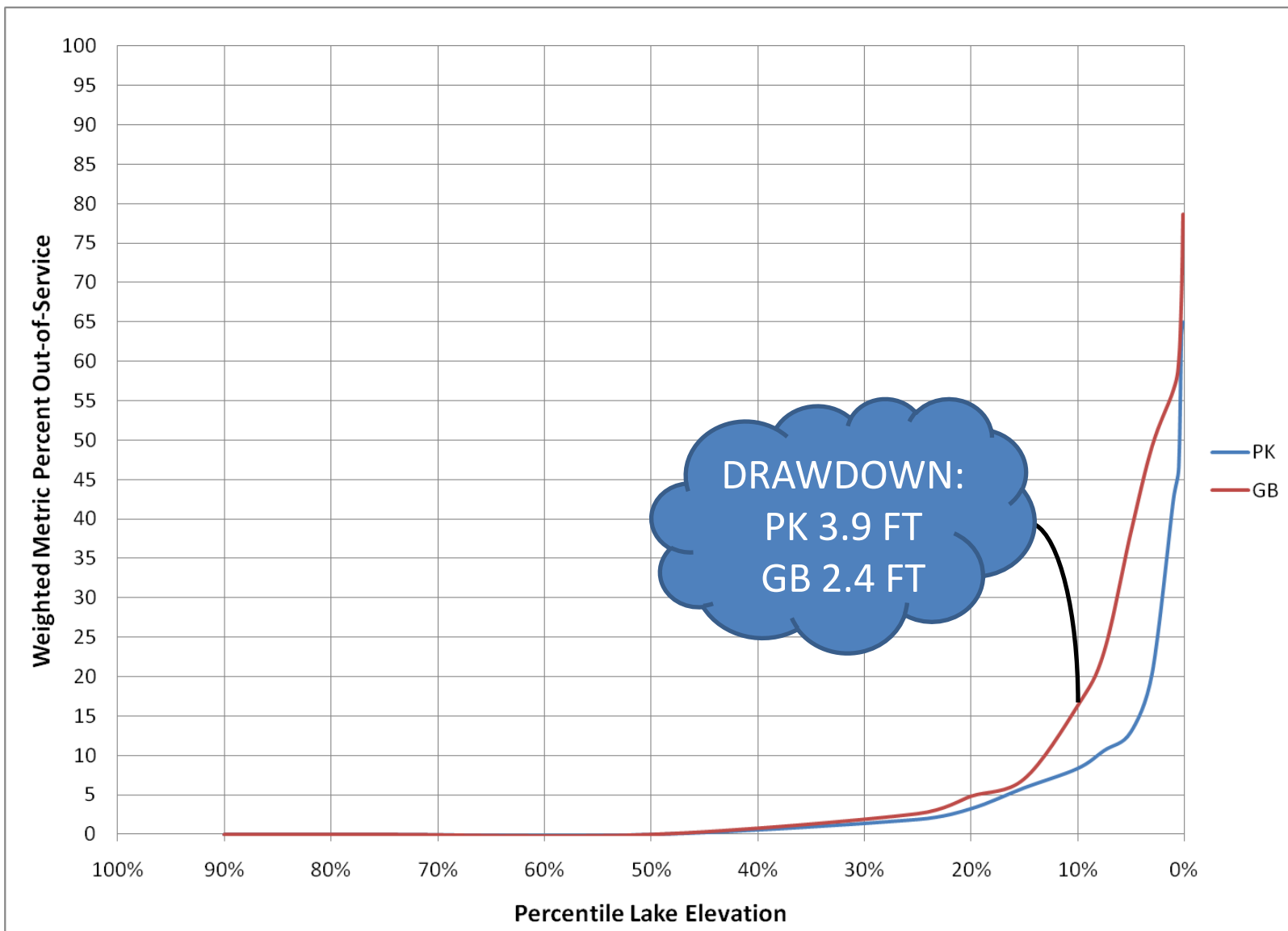
## Possum Kingdom Frequency Plot





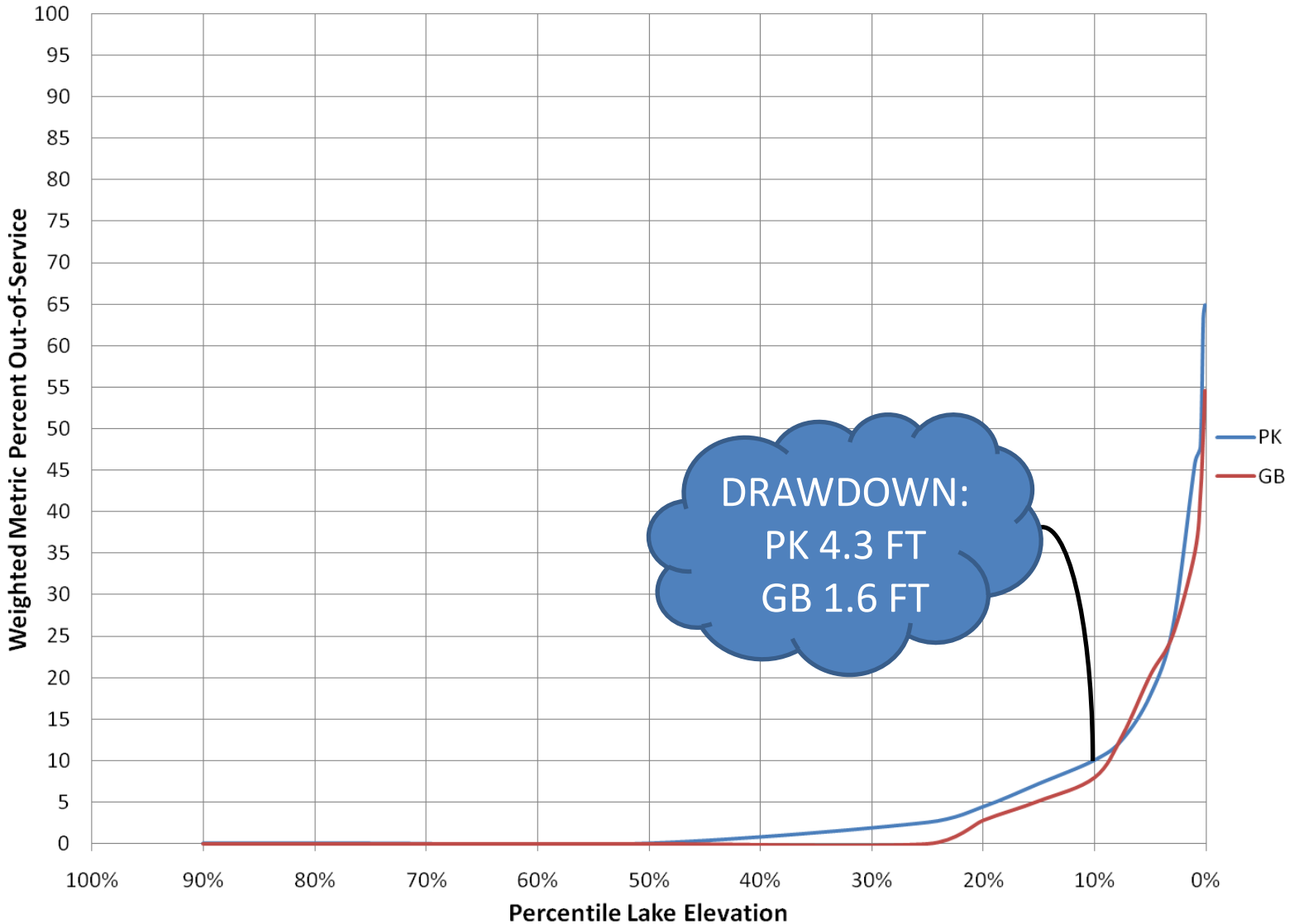
# Current Demands

Equal Drawdown (1:1 Both Zones)



# Current Demands

Zonal Drawdown (1.75:1 Upper and 1:1 Lower)





# 2020 Demand (Water Use) Results

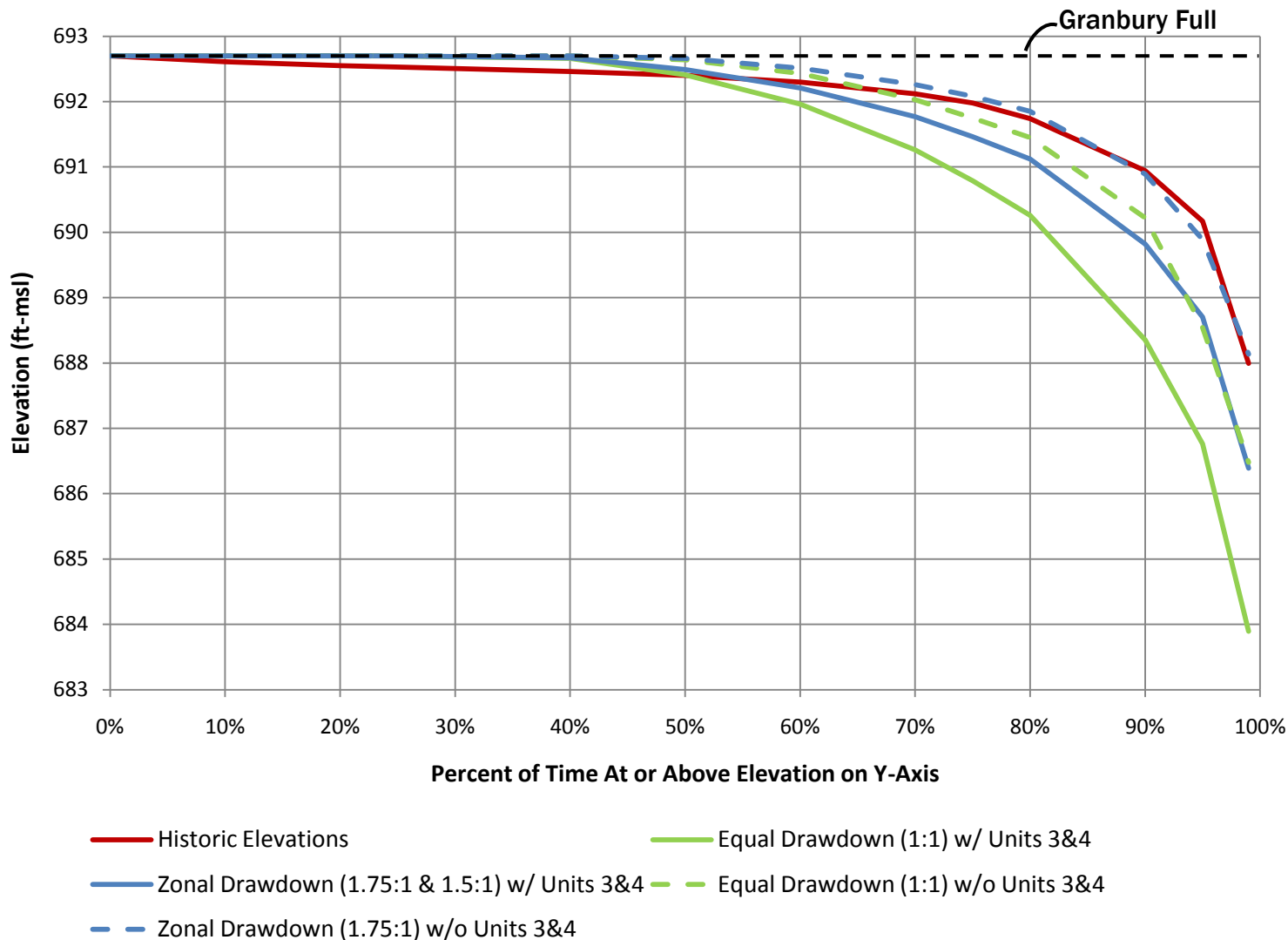
130,200 acre-feet/year w/o CPNPP Units 3 & 4

184,300 acre-feet/year w/ CPNPP Units 3 & 4





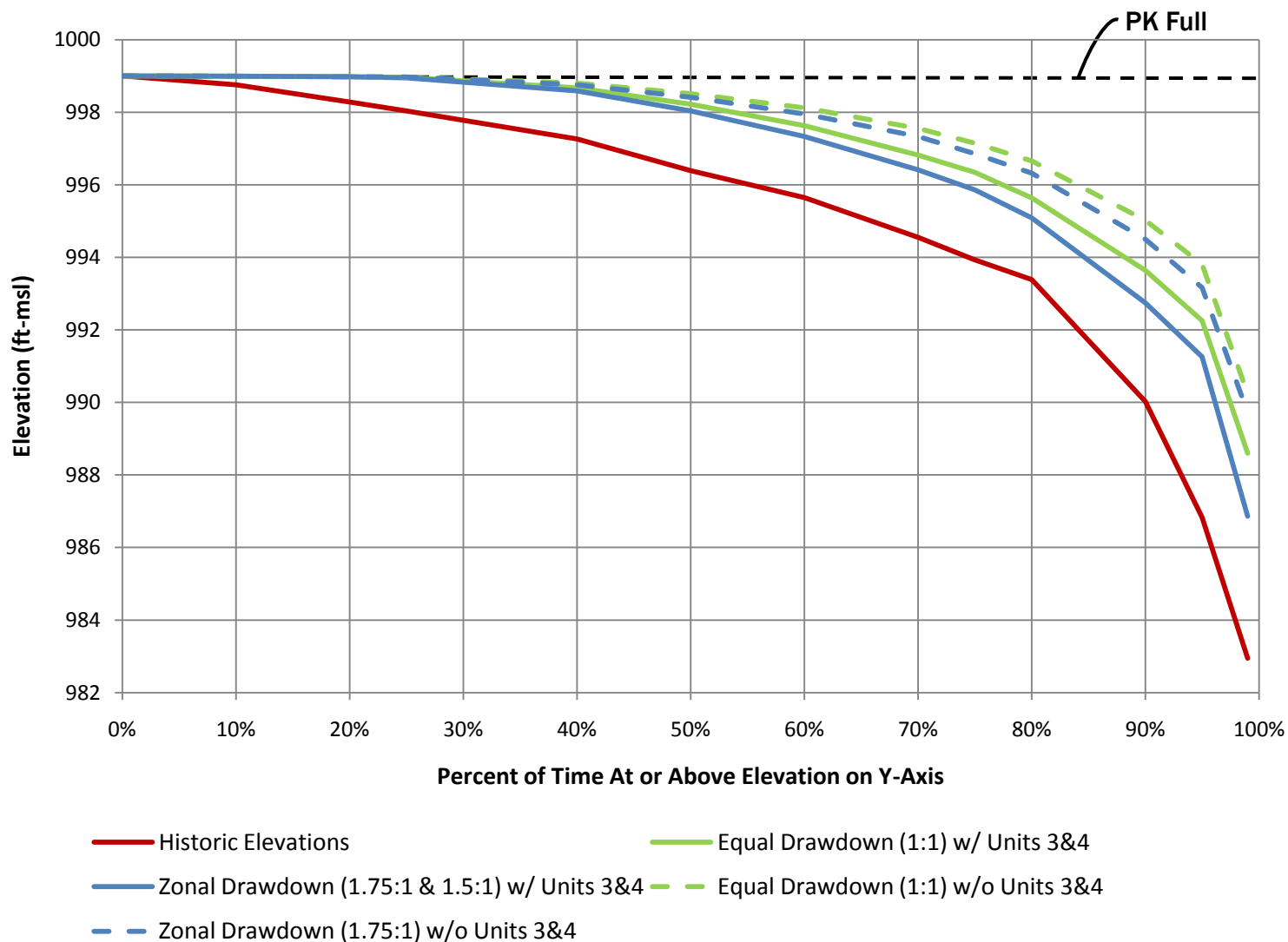
# 2020 Demands Granbury Frequency Plot





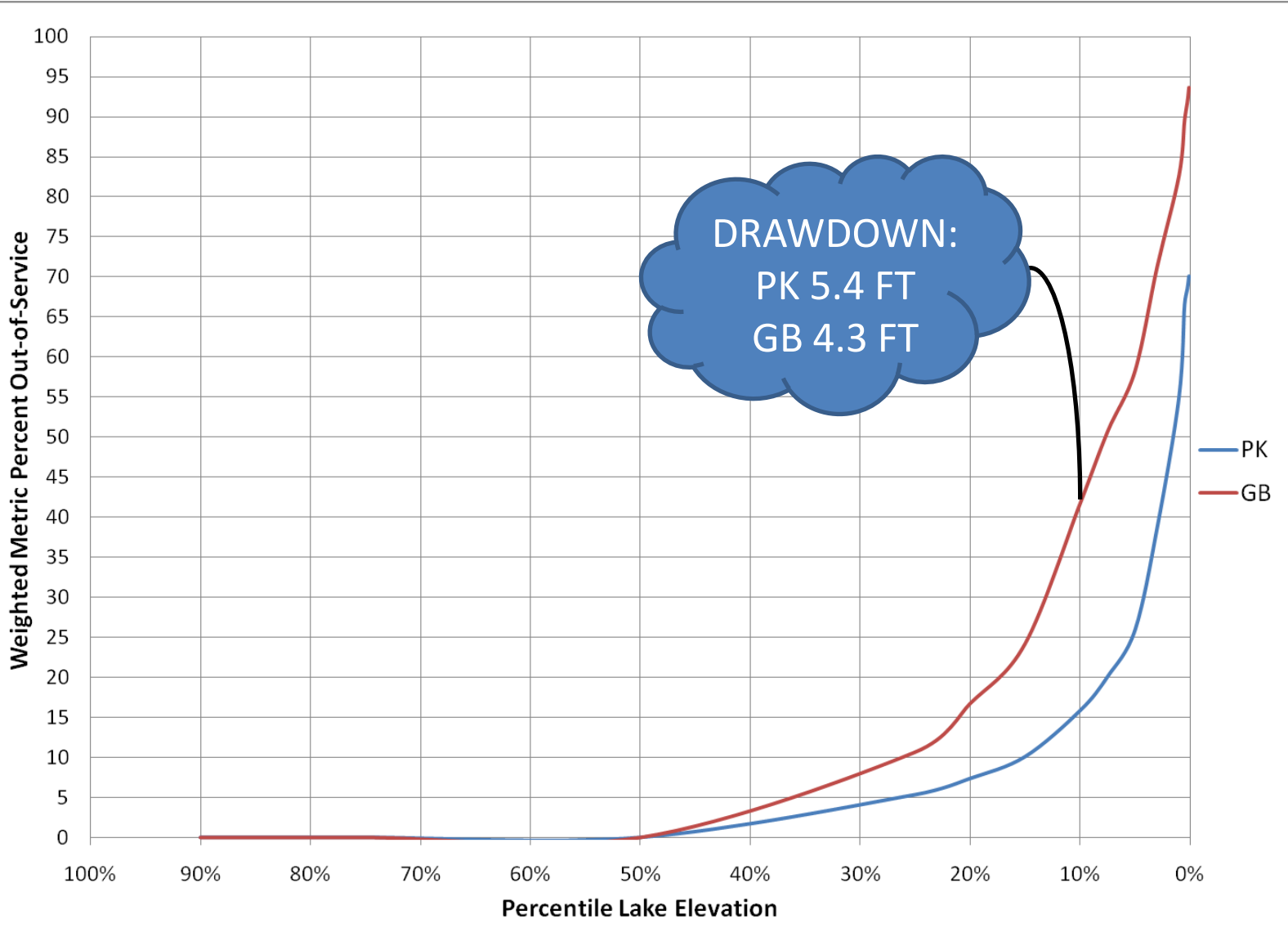
# 2020 Demands

## Possum Kingdom Frequency Plot



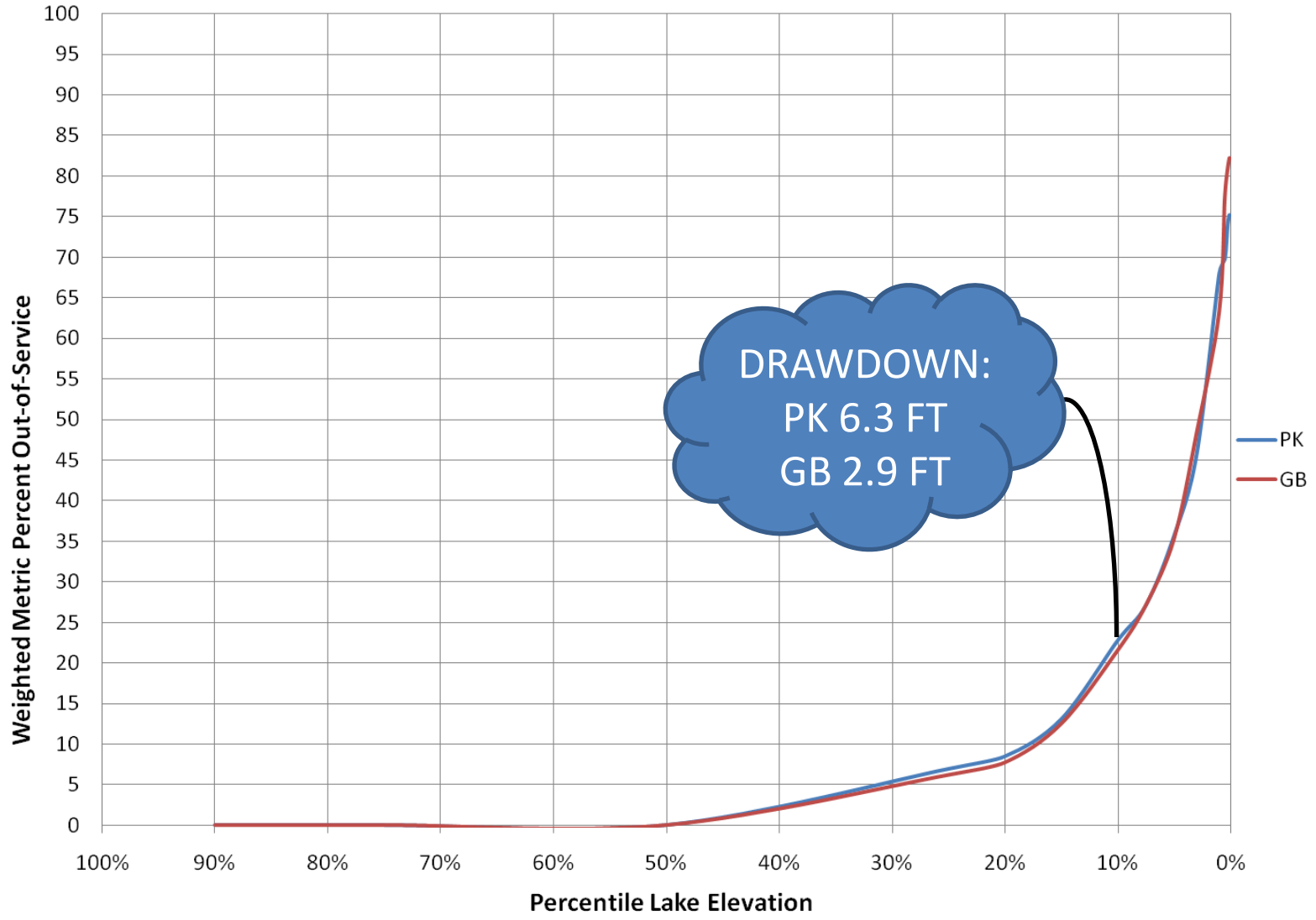
# 2020 Demands w/Units 3 & 4

Equal Drawdown (1:1 Both Zones)



# 2020 Demands w/Units 3 & 4

Zonal Drawdown (1.75:1 Upper and 1.5:1 Lower)



**DRAWDOWN:**  
PK 6.3 FT  
GB 2.9 FT





# What Does the Zonal Drawdown Mean to Me?

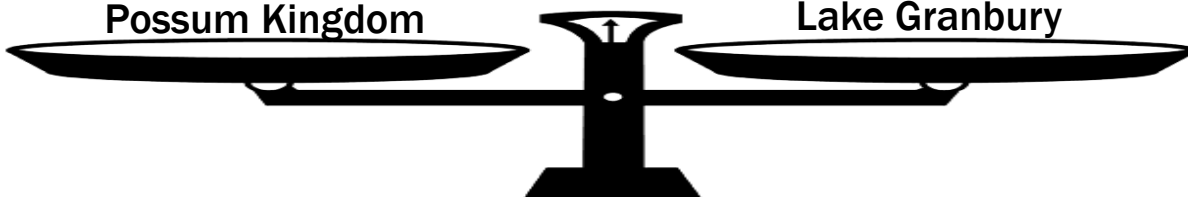
- Current Demands:
  - Granbury
    - Approximately equal to historic levels on average.
    - 1'-2' higher than Equal Drawdown during droughts.
  - PK
    - Over 2.2' higher than historic levels on average
- 2020 Demands w/ CPNPP Units 3&4:
  - Granbury
    - On average nearly 0.5' higher than Equal Drawdown.
    - 1.5'-2.5' higher than Equal Drawdown during droughts.
  - PK
    - Over 1.4' higher than historic levels on average



Possum Kingdom

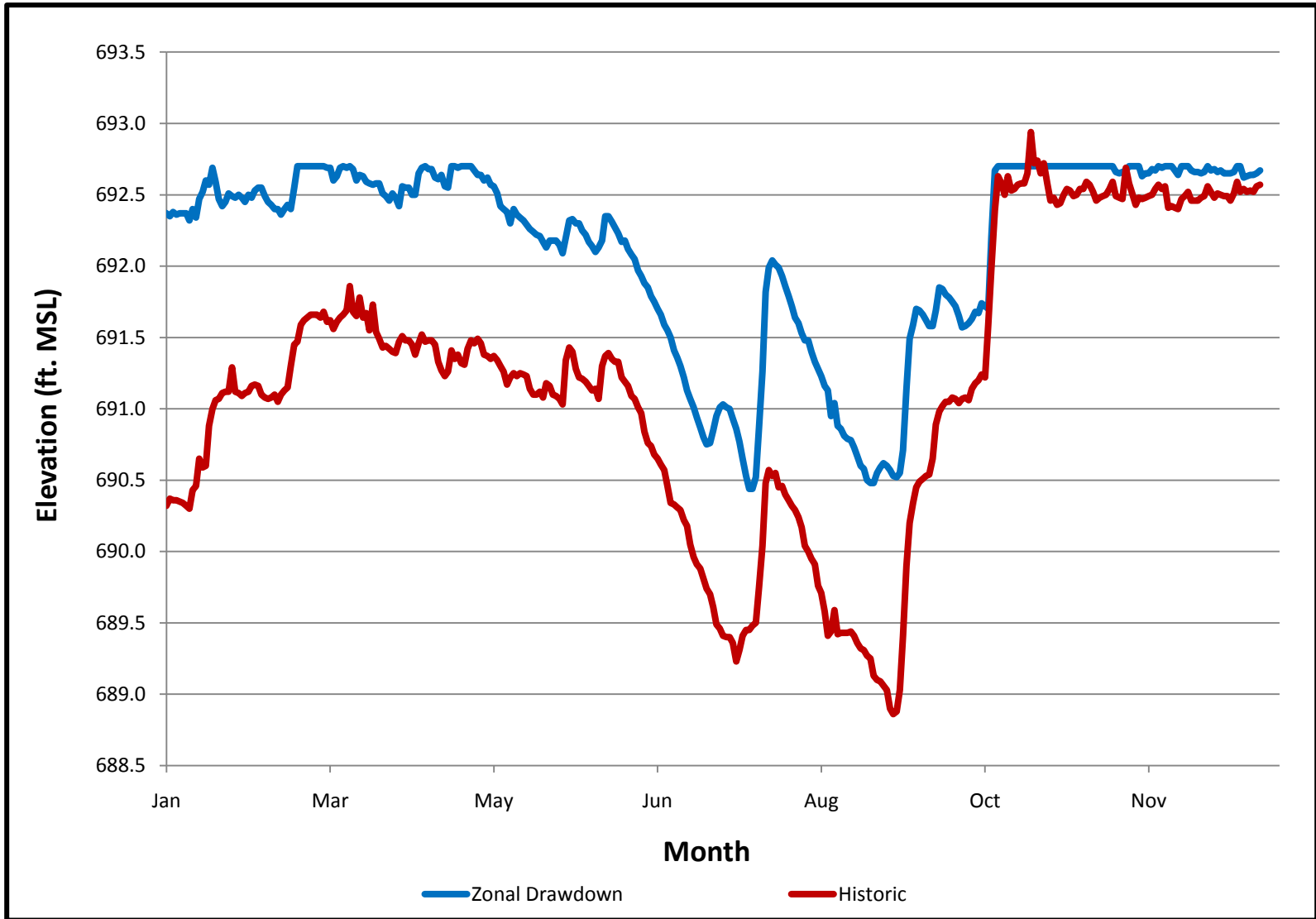


Lake Granbury



# What About the Drought of 2009?

## Lake Granbury





# Conclusions

- Recommend Mgmt. based on Zonal Drawdown
- Zonal Drawdown balances impacts in dry times
- Zonal Drawdown Ratios will need to be adjusted over time as demands increase:
  - Near-term Conditions (Before Addition of Comanche Peak Units 3 & 4)
    - 1.75:1 drawdown ratio (PK:Granbury) when PK above elev. 992
    - 1:1 drawdown ratio when PK below elev. 992
  - Future Conditions
    - 1.75:1 drawdown ratio when PK above elev. 992
    - 1.5:1 to 1.75:1 drawdown ratio when PK below elev. 992 (dependent upon level and location of future demand)





# Next Steps/Timeframe

- April - Evaluate public feedback & comments
- April – BRA Board
- May or June – Implement plan

