Colorado River Water Availability Study

Four West Slope Roundtables Meeting

May 10, 2010

CWCB Project Manager

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Consulting Team

AECOM

AMEC Earth & Environmental

Canyon Water Resources

Leonard Rice Engineers

Stratus Consulting

BOYLE | AECOM

Objectives

"How much water from the Colorado River Basin is available to meet Colorado's water needs?"

- **Phase I**
  Water Availability under current infrastructure, currently perfected water rights, and current levels of consumptive and non-consumptive water demands

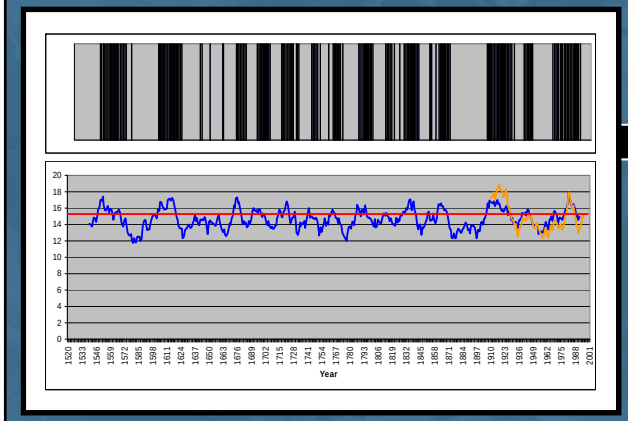
- **Phase II**
  Water Availability under projected demands from existing, conditional, and new water rights and for additional consumptive and non-consumptive water demands

Overall Hydrology Approach

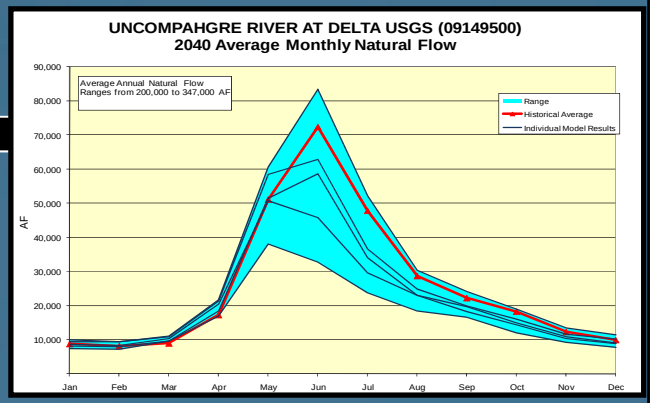
1500 1950 2005 2040 2070 2099

Observed Hydrology

Paleohydrology



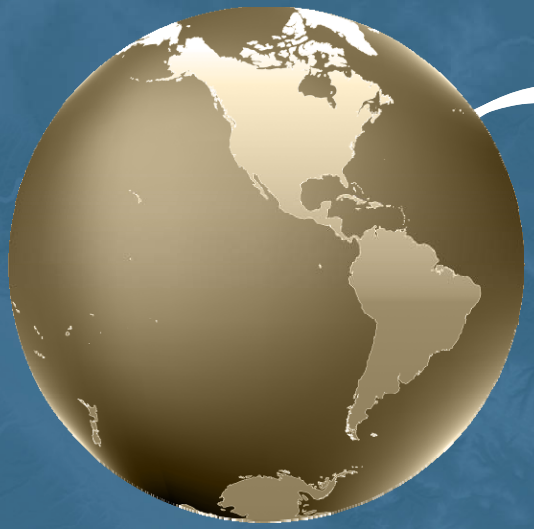
GCM's & Hydrology



Statistical Models

StateMod
StateCU

GCMs and Hydrology



Earth

- Emissions Scenarios
- Global Climate Models

Result: *Altered Temperature and Precipitation*

Colorado River Basin

- "Down-Scaled" Projections
- Revised Basin-Wide Hydrology

Result: *Altered Stream Flows*

State of Colorado

- CDSS Modeling

Result: *Water Availability*

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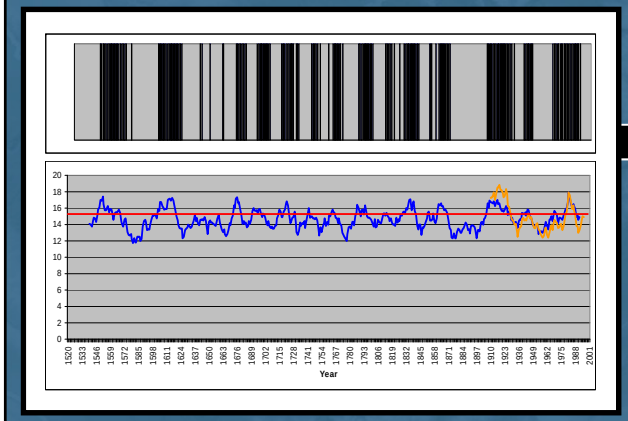

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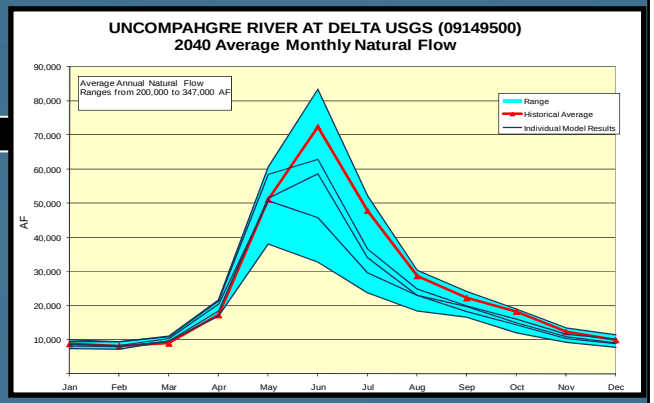

Statistical Models

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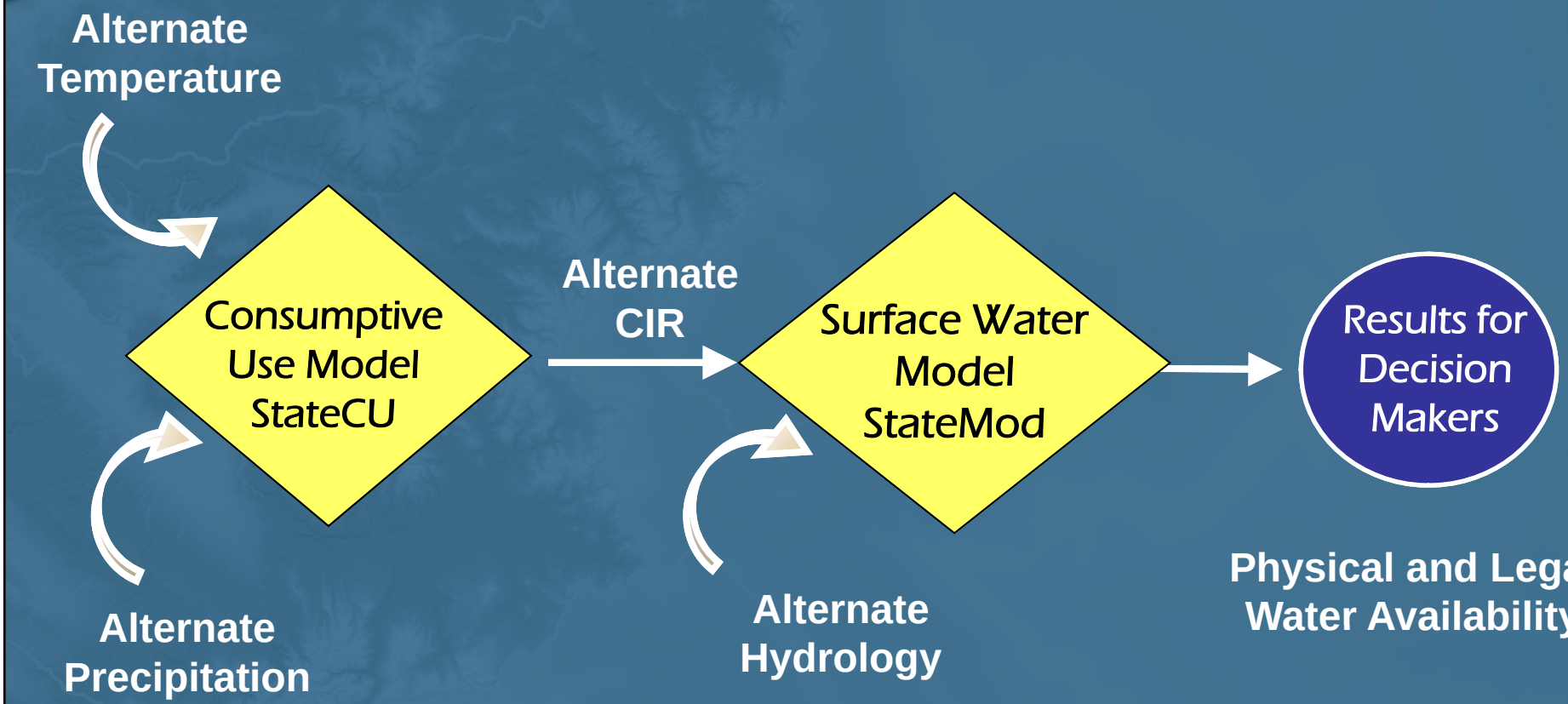
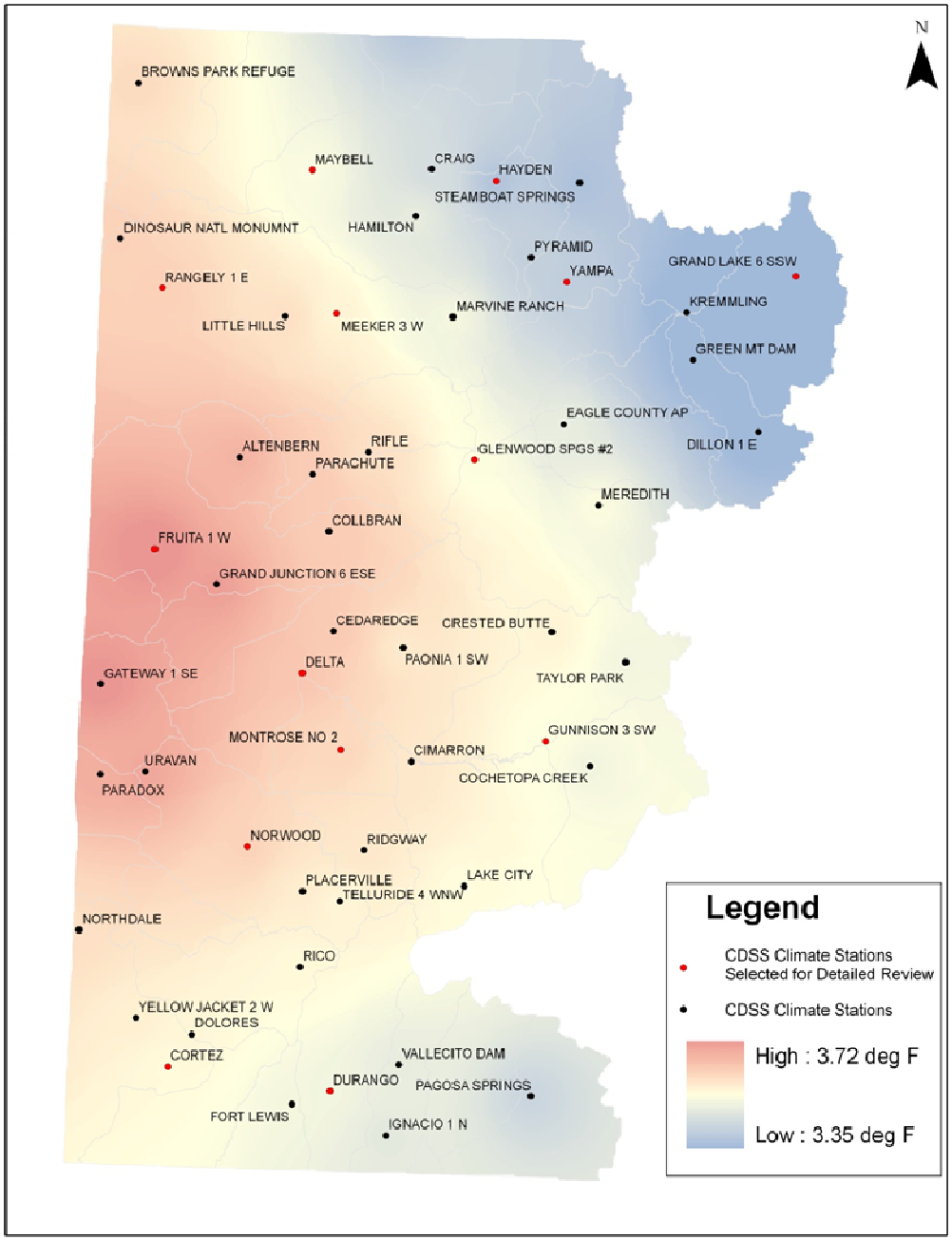
Estimating Water Availability

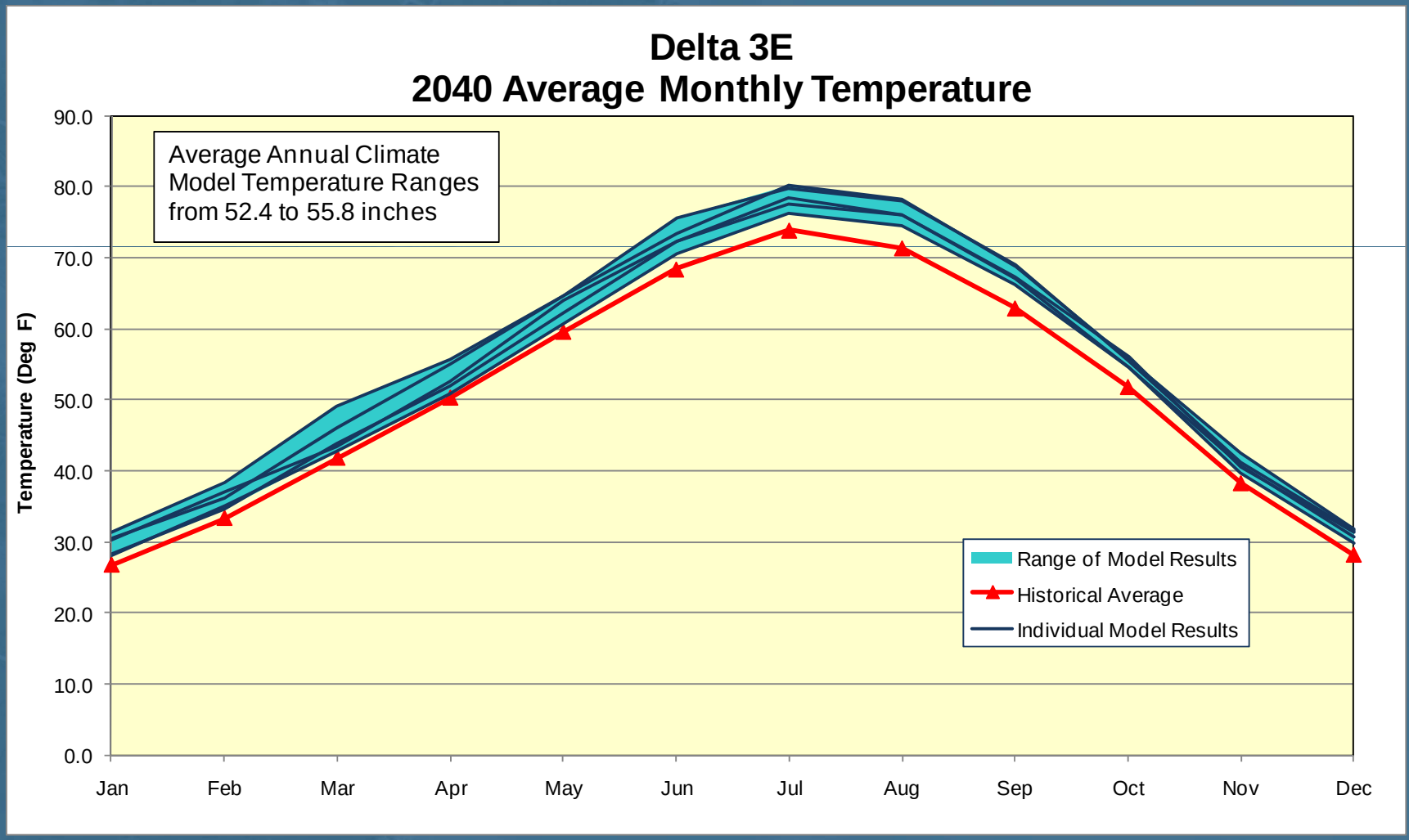


Findings - Temperature

- Increases basin-wide by 3.3 to 3.7 degrees F
- Lower elevations show largest increase
- Increase occurs each month of the year

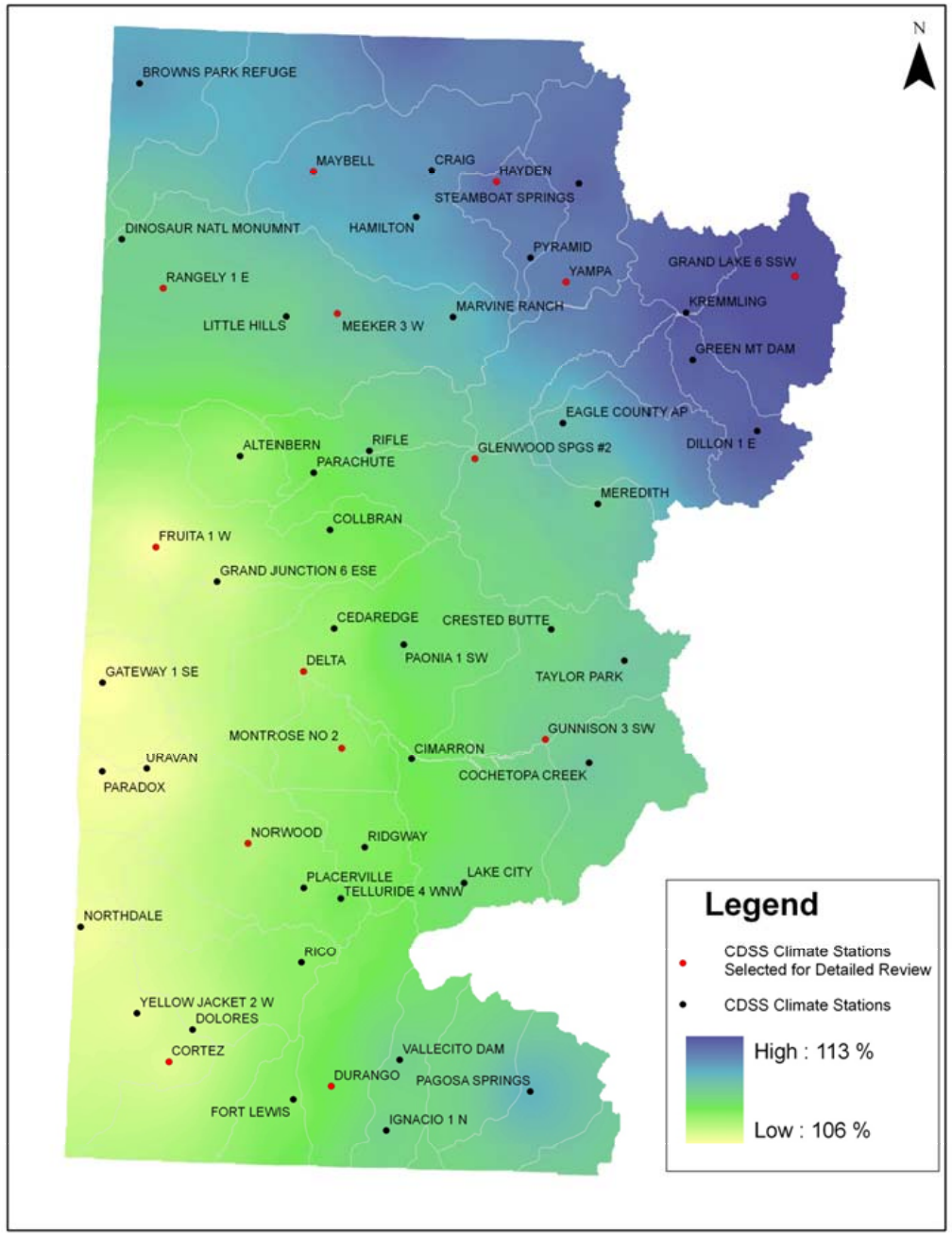


Findings - Temperature



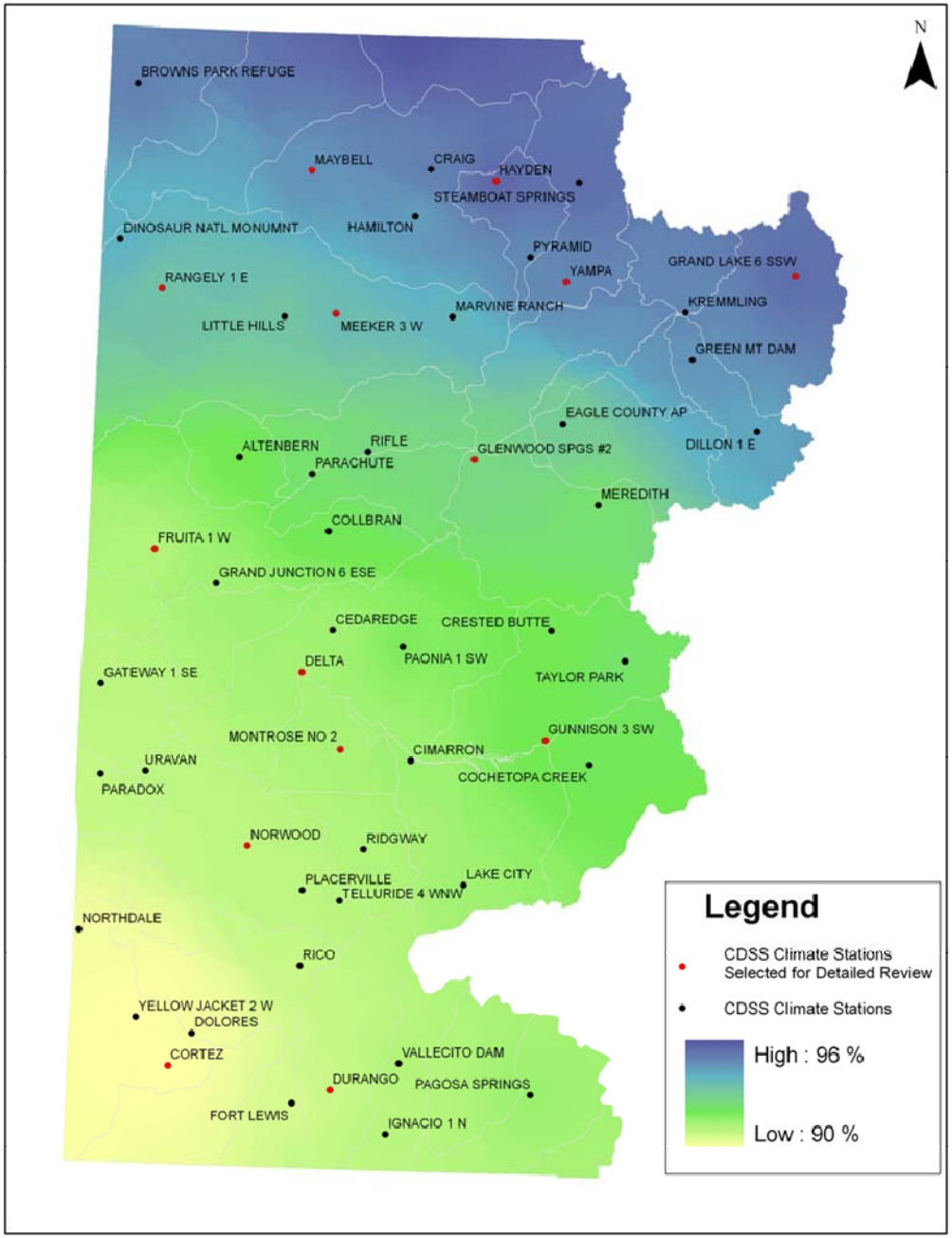
Findings - Winter Precipitation (Nov-Mar)

- Increases basin-wide by 6 to 13 percent
- Increases more in the northern part of the river basin
- Increases more at higher elevations
- Shifts from snow to rain in the shoulder months

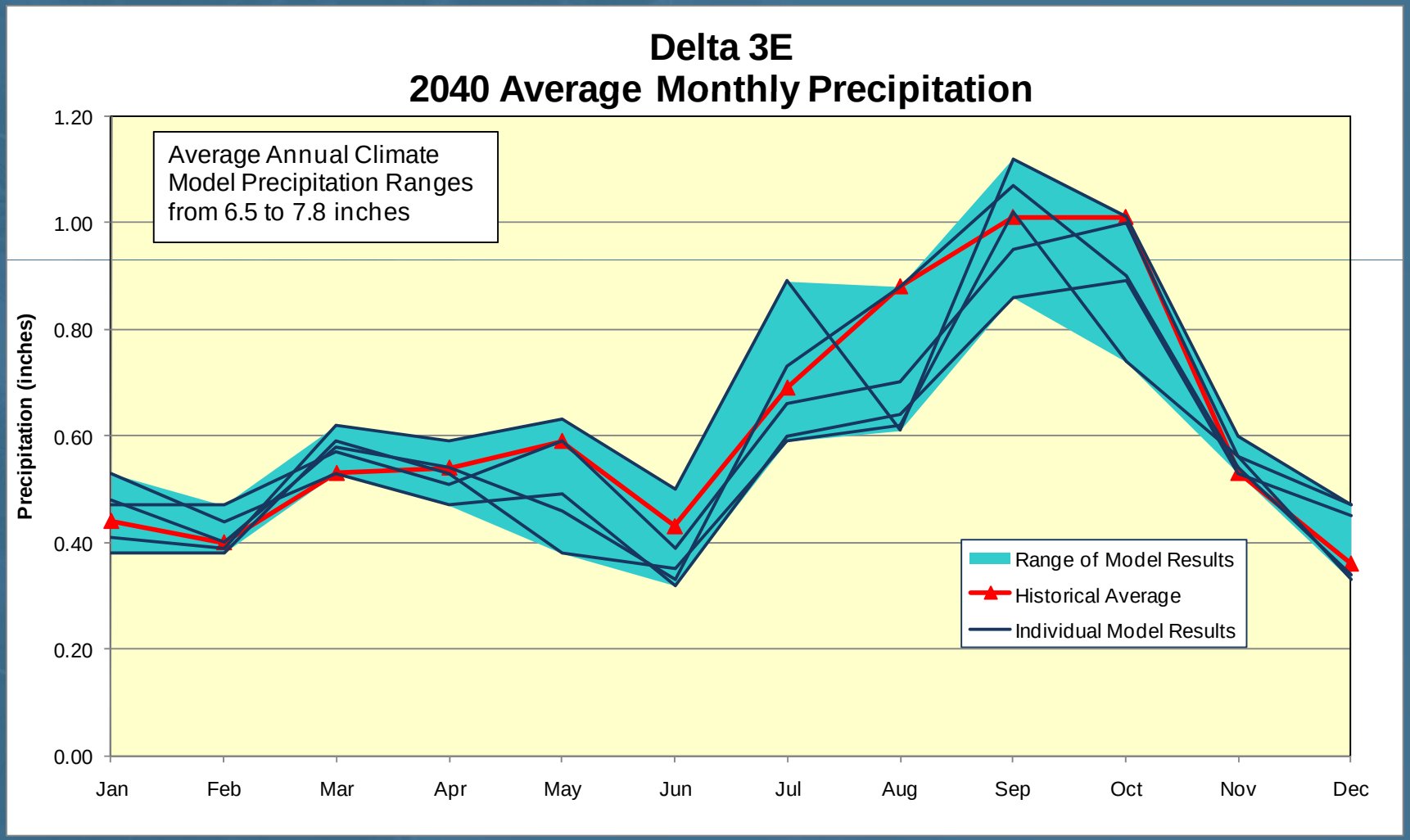


Findings - Summer Precipitation (Apr-Oct)

- Decreases basin-wide by 4 to 10 percent
- Decreases more in the southern part of the basin
- Decreases less at higher elevations

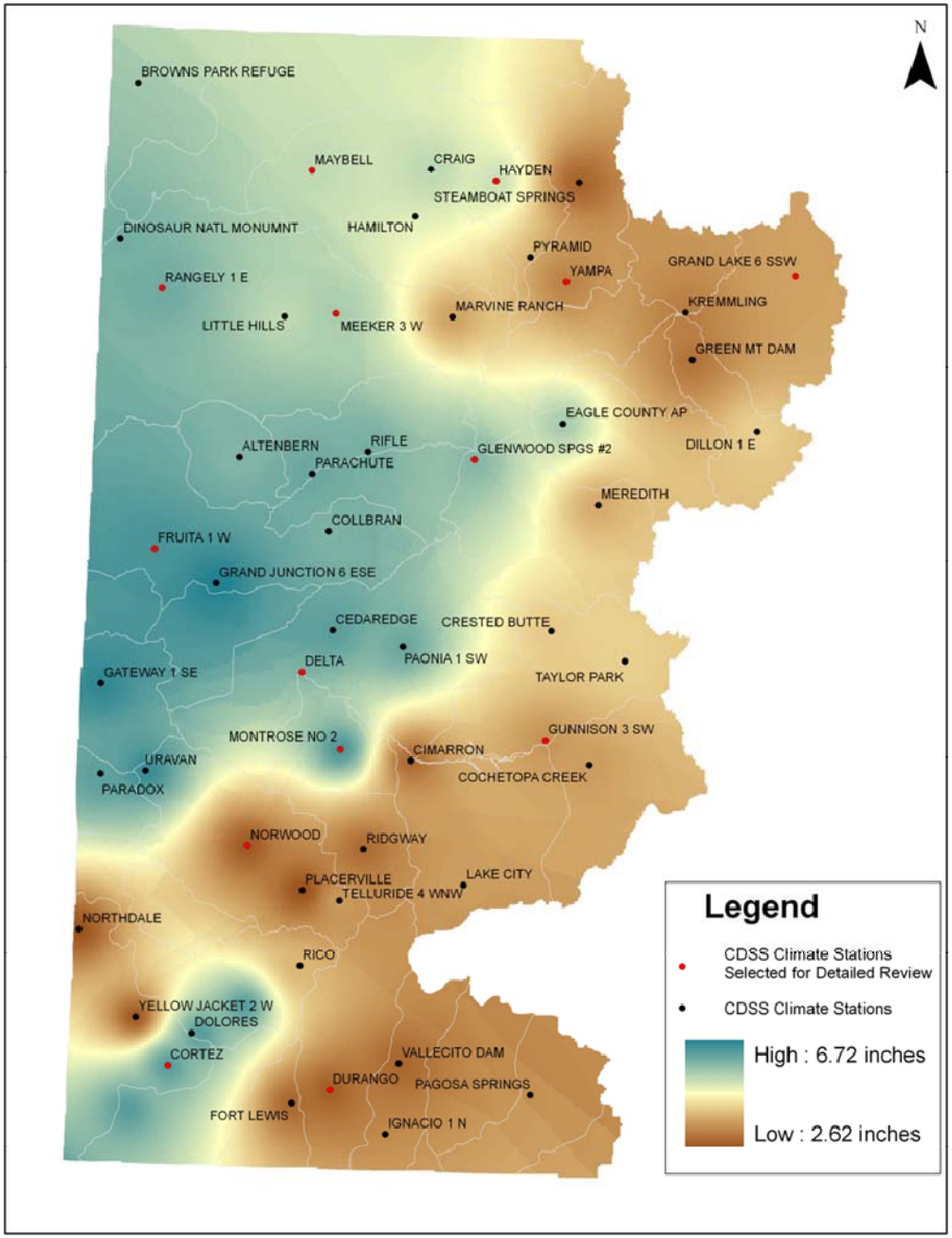


Findings - Precipitation



Findings - Crop Irrigation Requirement

- Increases basin-wide 2.6 to 6.7 in/yr for pasture grass
- Increases basin-wide by 20 %
- Growing season increases basin-wide by 15 to 22 days
- Increases more at lower elevations



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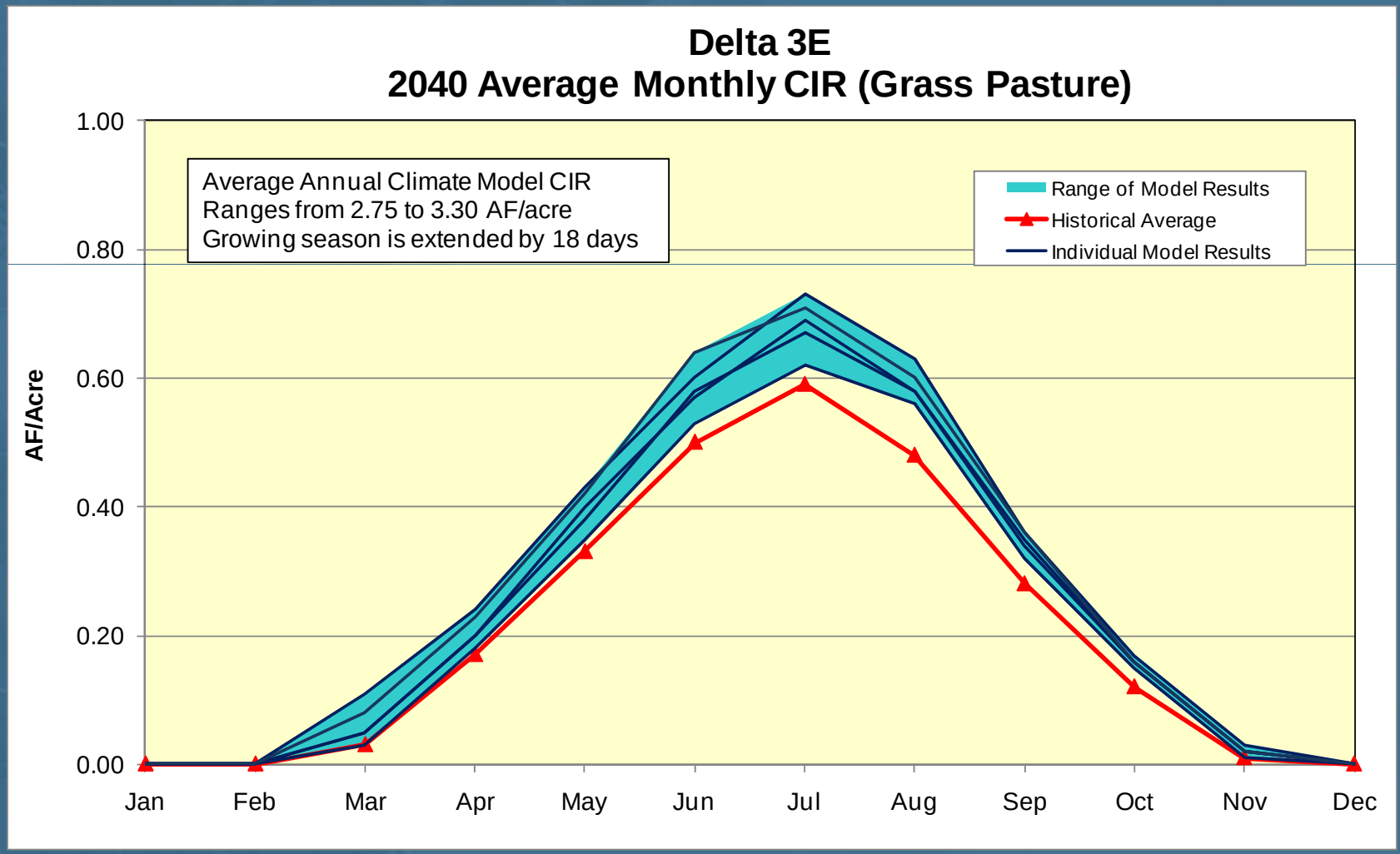
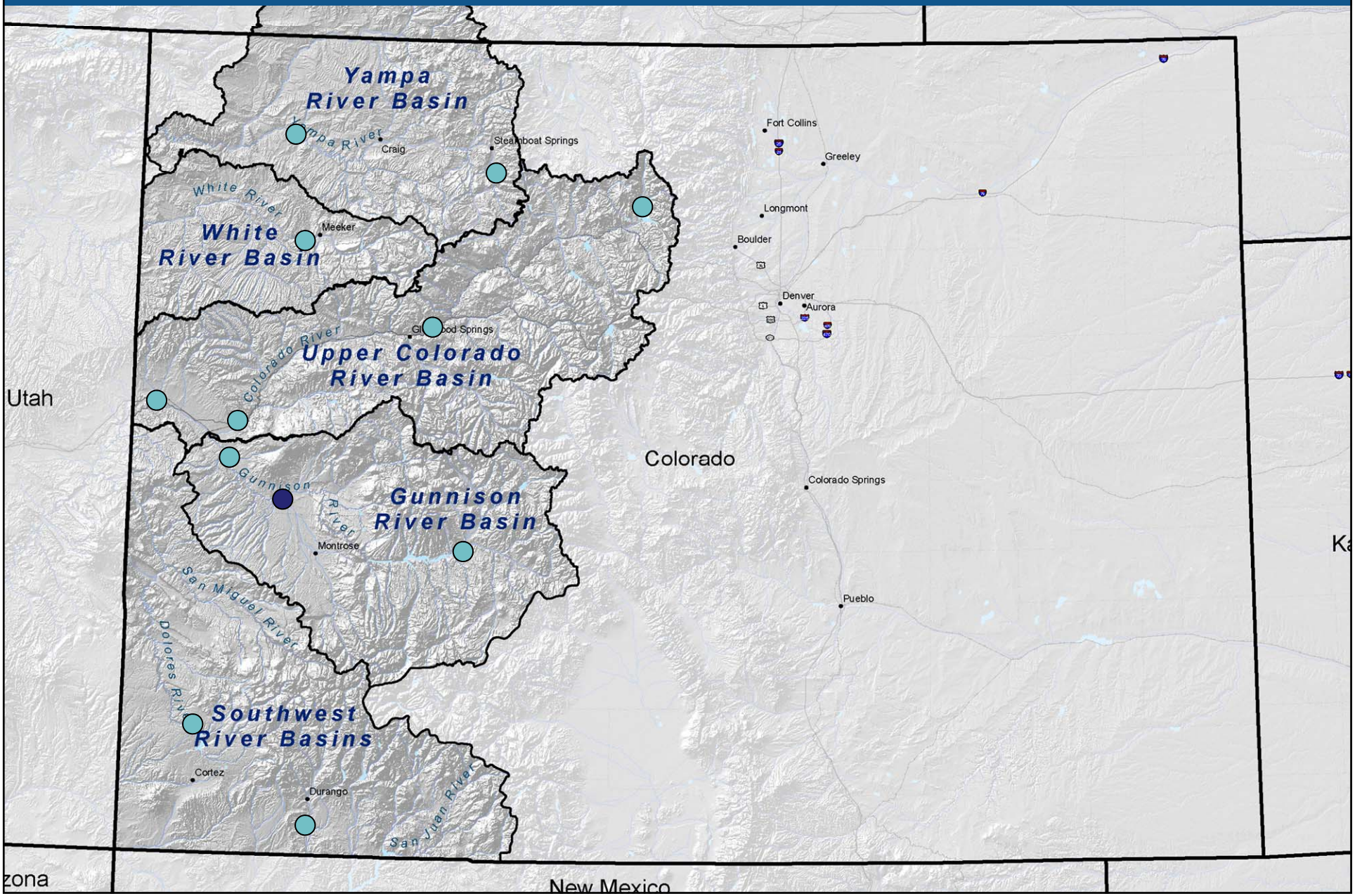
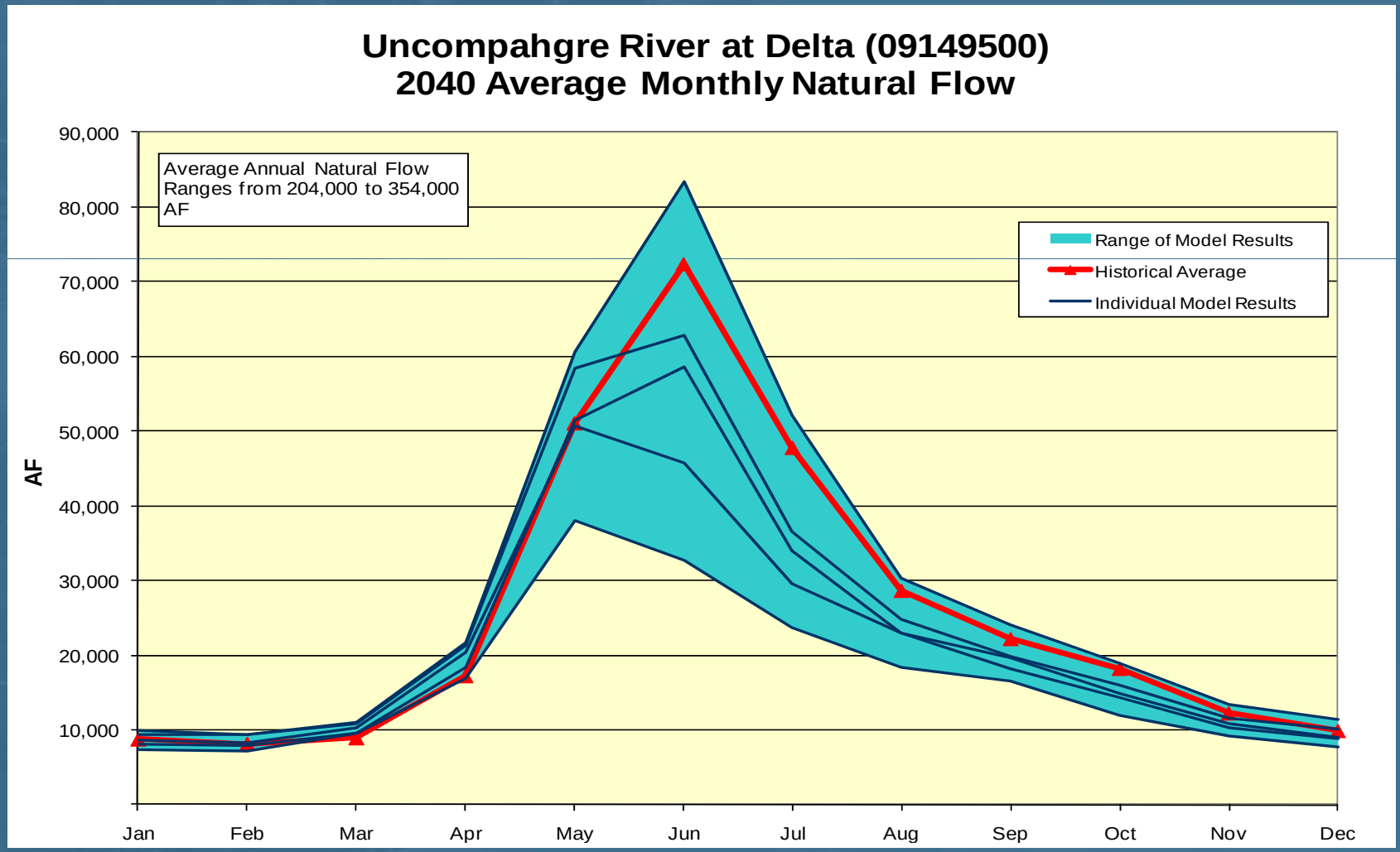


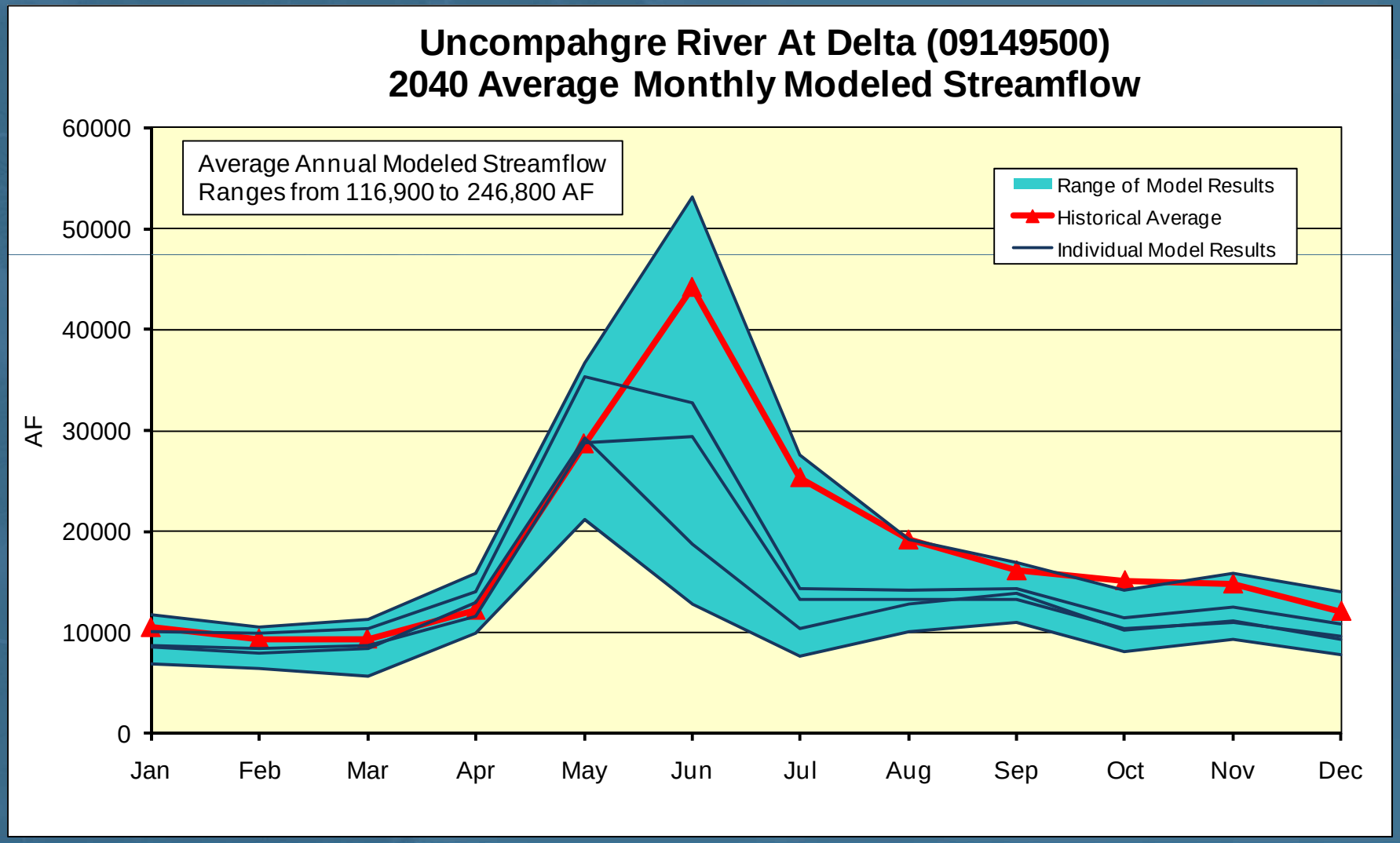
Sequence of Results: Uncompahgre River at Delta and Gunnison River Basin



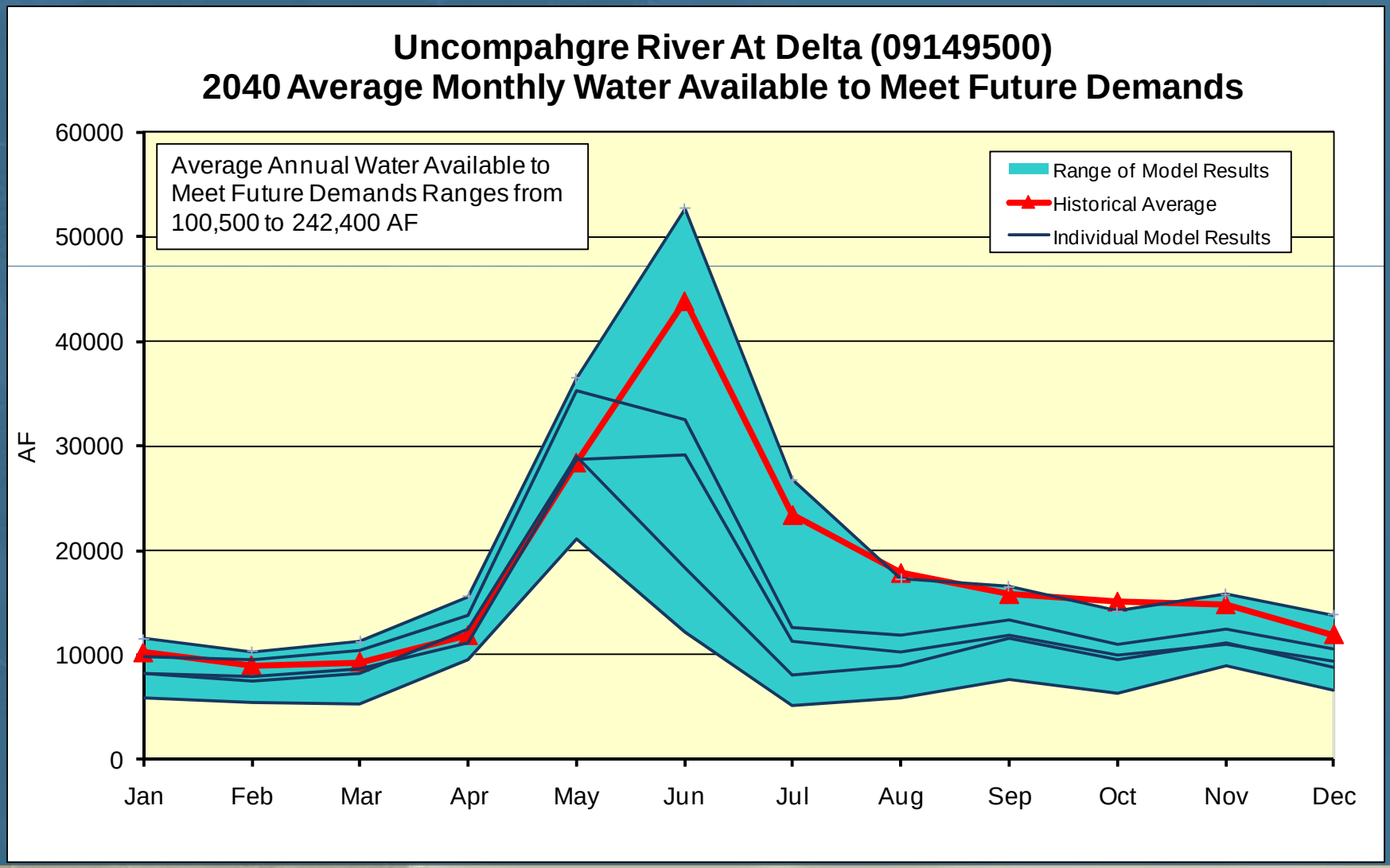
Natural Flow



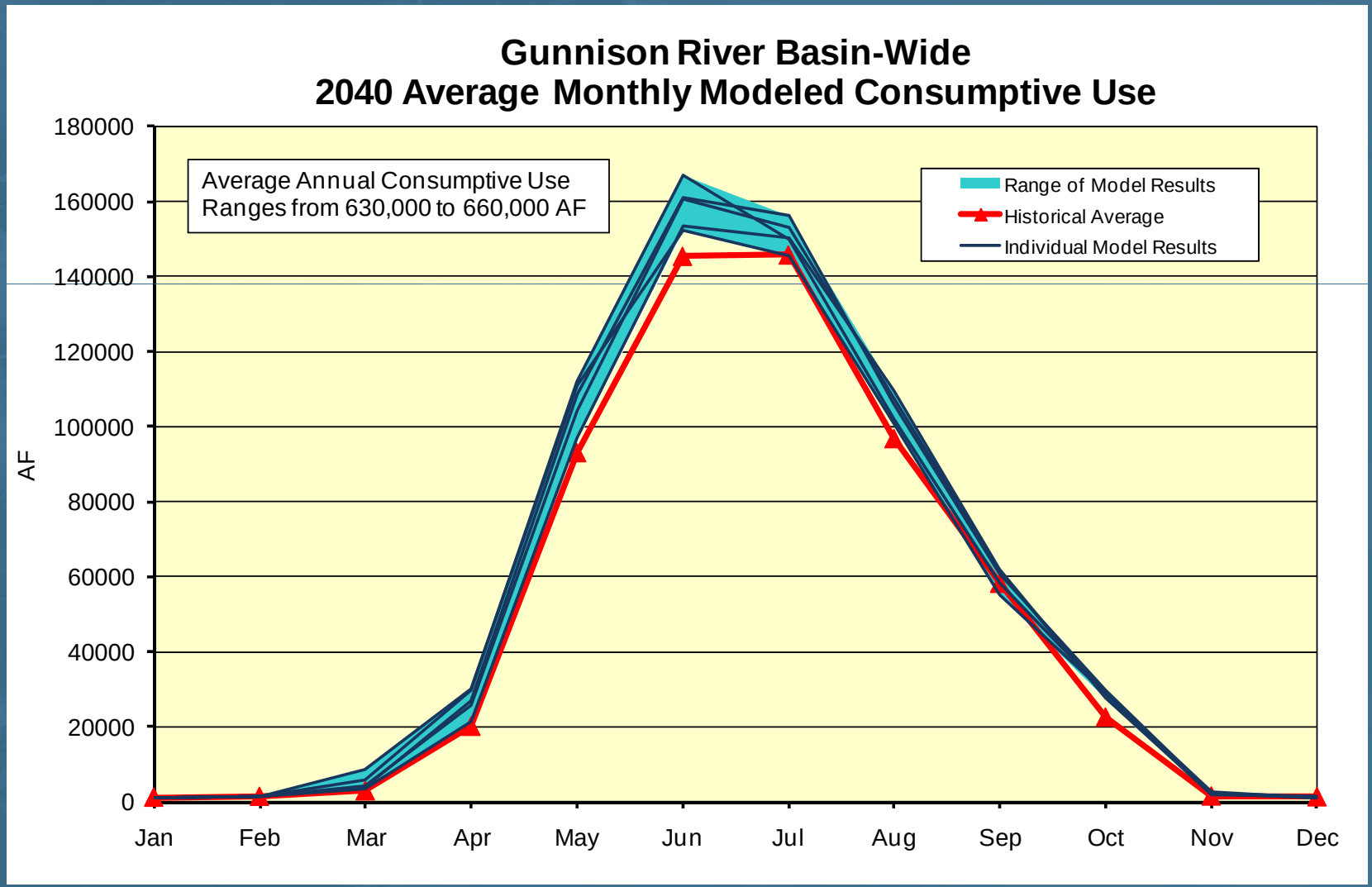
Modeled Streamflow



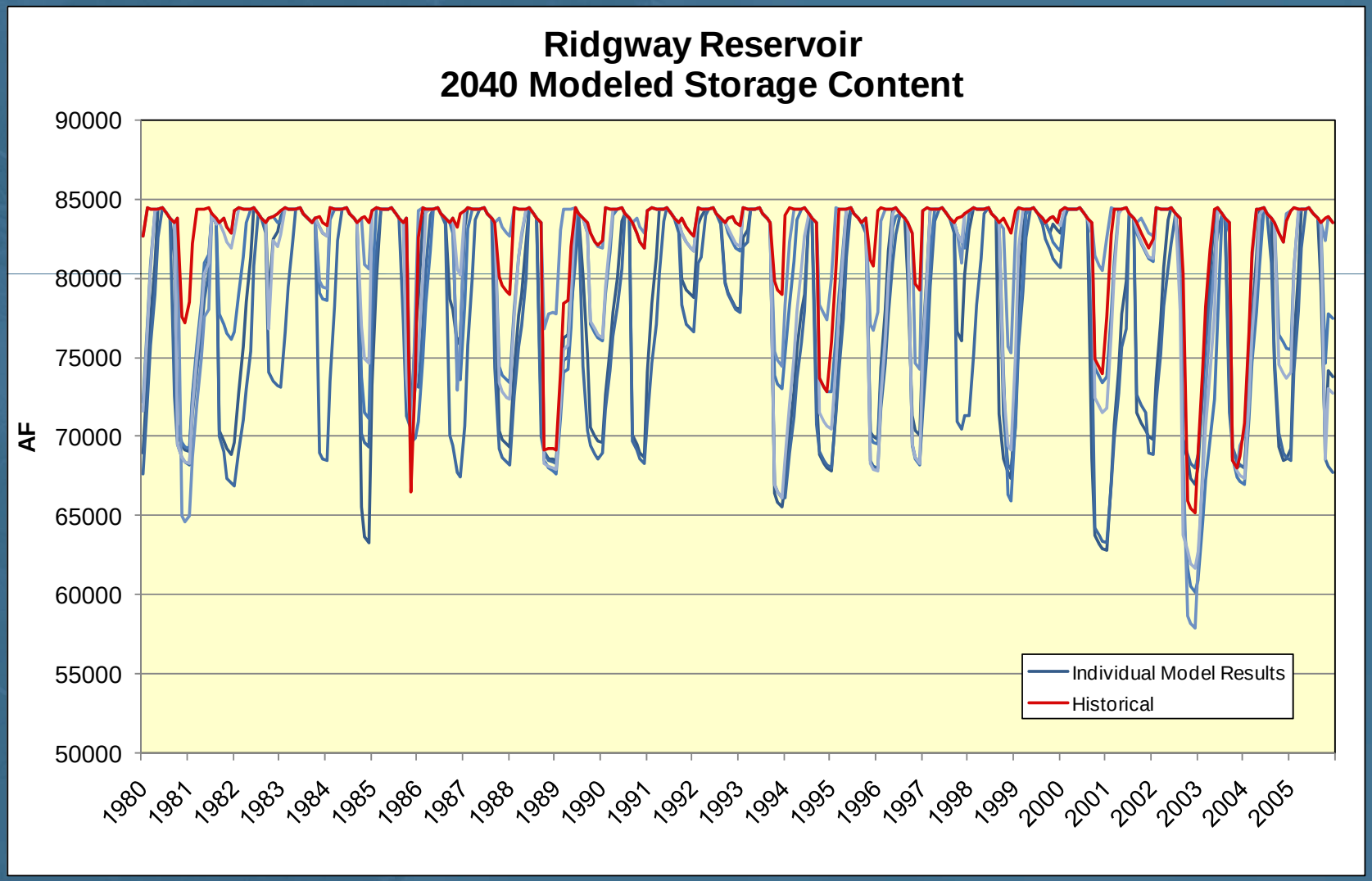
Water Availability



Modeled Consumptive Use



Modeled Reservoir Storage



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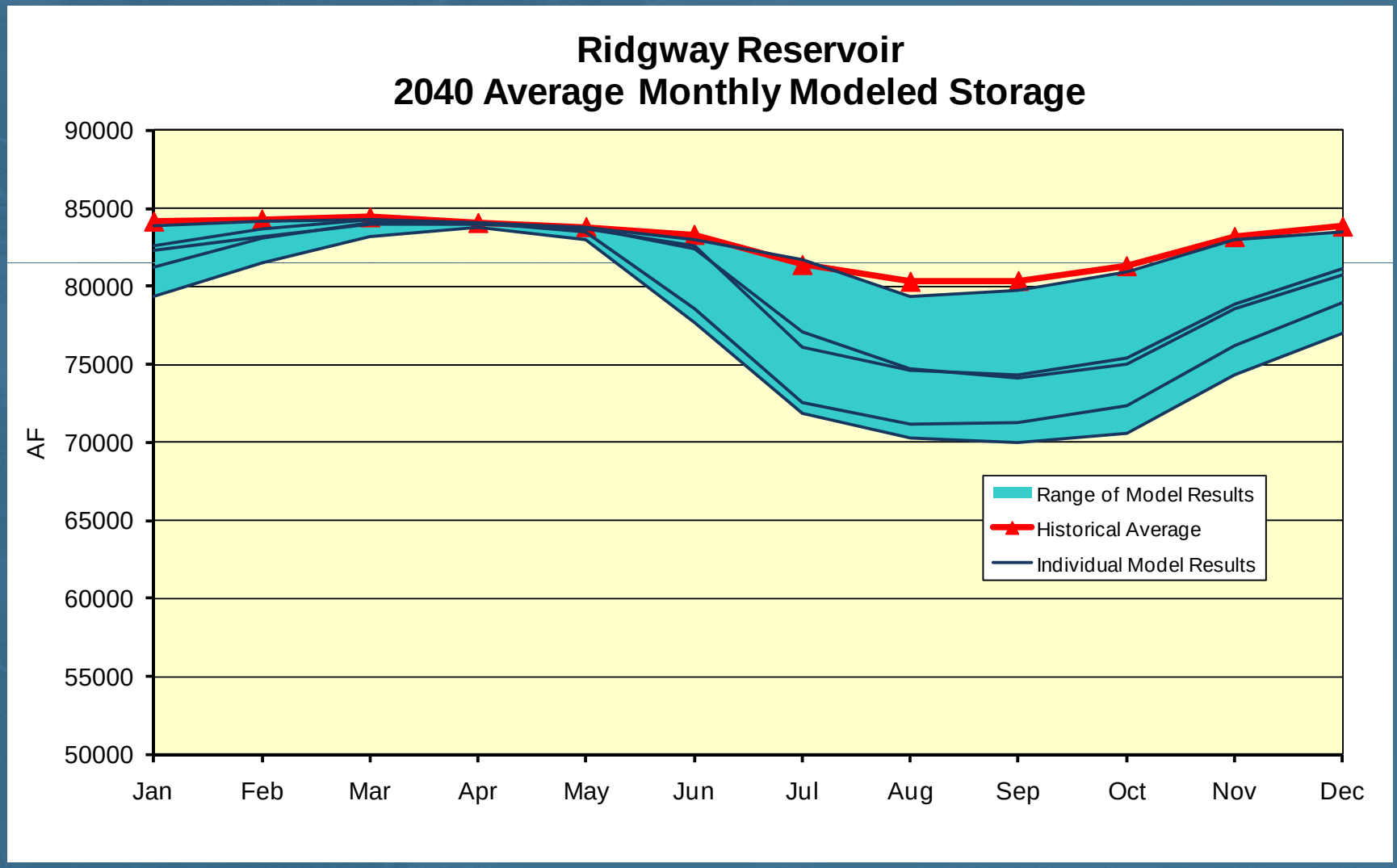


Water Available based on Compact Assumptions – Approach

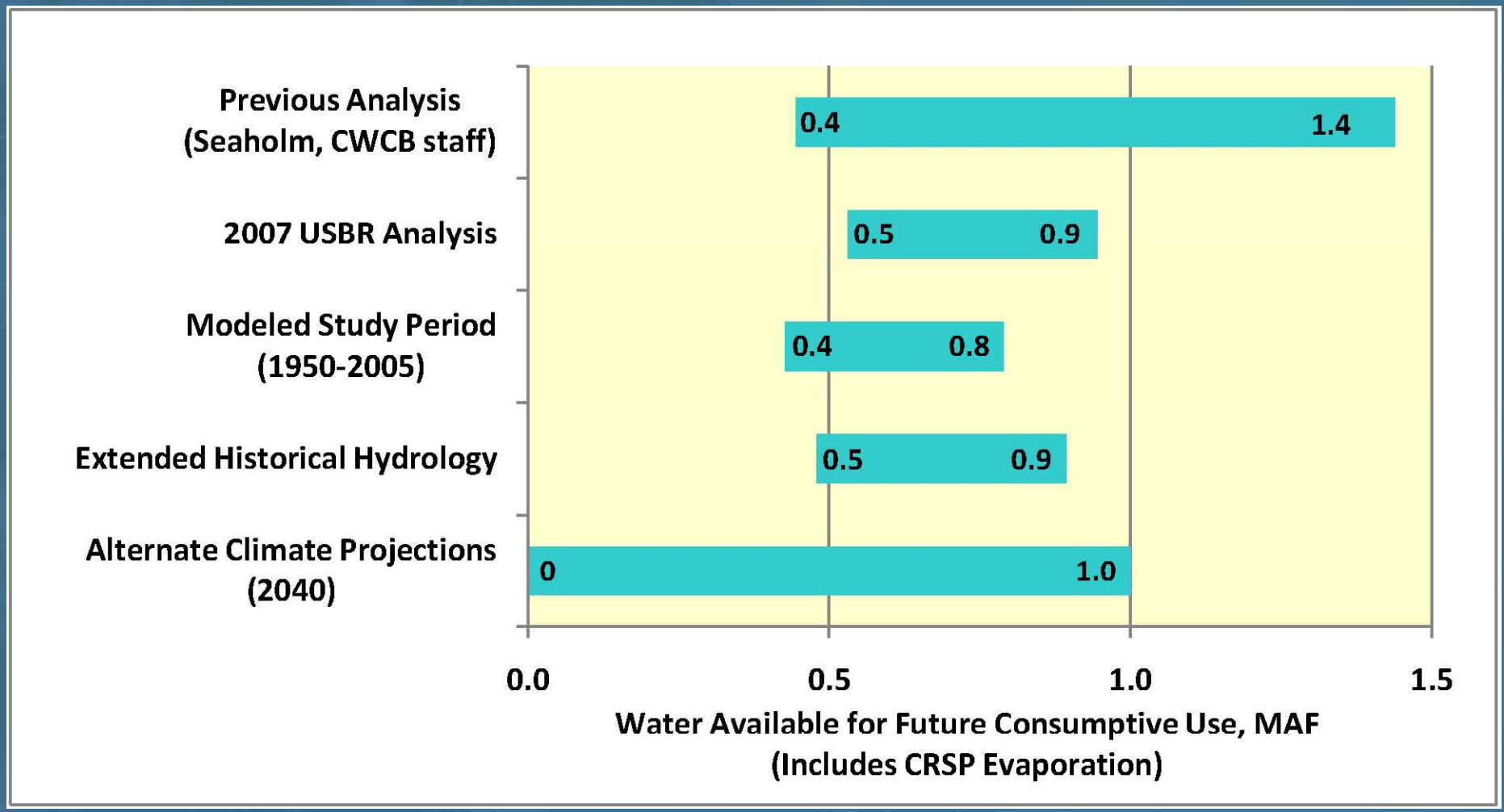
- Used mass-balance analysis at Lee Ferry (2007 HD)
- Simulated full-development water use requests in upper basin
- Calculated 10-year cumulative flow at Lee Ferry
- Calculated upper basin consumptive use that could be maintained considering Compact provisions
- Hydrology adjusted for climate change
- NM, UT, WY fully developed
- All Upper Basin storage capacity fully used

Water Available based on Compact Assumptions – Approach

- Applied Upper Basin water use requests used in 2007 Hydrologic Determination:

Potential Lee Ferry Obligation	Upper Basin Water Use
75 MAF	6.76 MAF
82.5 MAF	5.98 MAF

Water Available based on Compact Assumptions – Findings



CRWAS Conclusions

- BRT interaction provided essential information to update and refine CDSS
- Computer models proved appropriate for Phase I objectives

CRWAS Conclusions

- Phase I demonstrates broad range of water availability results
  - Inherent uncertainties in GCMs
  - Complexity of modeling atmospheric circulation
  - Down-scaling effects of changed temperature and precipitation on natural flows in Colorado River basin

CRWAS Conclusions

- Phase I results based on current water demands
  - Stakeholders demonstrated strong interest to expand analysis to future demands / operating conditions

CRWAS Recommendations

- Continue CDSS refinements
  - Baseflows in Plateau Creek
  - Aspinall Unit reservoir operations
  - Current release rules for flood control reservoirs
  - Alternative transbasin demands affected by climate change
  - Alternatives to representing USFWS fish flow recommendations
  - Remove New Mexico structures from San Juan / Dolores model

CRWAS Recommendations

- Use CRWAS to support other CWCB / IBCC programs
- Incorporate new water management strategies
- Stakeholders to interpret findings:
  - from their own perspective
  - considering their assessment of possible future conditions
  - considering the resources they have available to adapt
  - considering their role in water management
  - considering their tolerance for risk

Comments and Questions?

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