A collage of four black and white photographs showing different Colorado River landscapes: a rocky waterfall, a forested lake reflecting a snow-capped mountain, a wide river valley under a cloudy sky, and a winding river through a dry, hilly landscape.

Colorado River Water Availability Study Colorado Water Conservation Board Meeting November 18, 2009

Consulting Team
AECOM Water
AMEC Earth & Environmental
Canyon Water Resources
Leonard Rice Engineers
Stratus Consulting

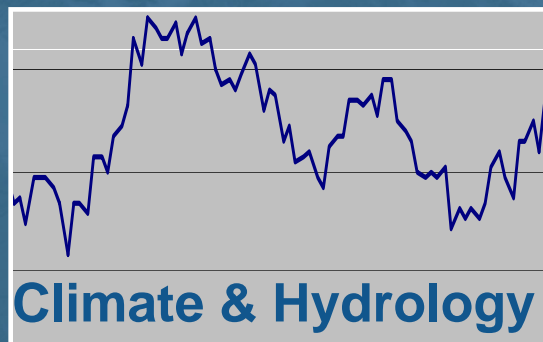
BOYLE | AECOM

Agenda



- Status report on in-state modeling results
- Builds on previous PRELIMINARY results:
 - Drought frequencies and durations
 - Hydrologic impacts of projected climate change
 - Climate change impacts on consumptive use
- Today's results
 - Water availability using CDSS/ StateMod for each basin for one of the hydrologic traces

Colorado Decision Support System

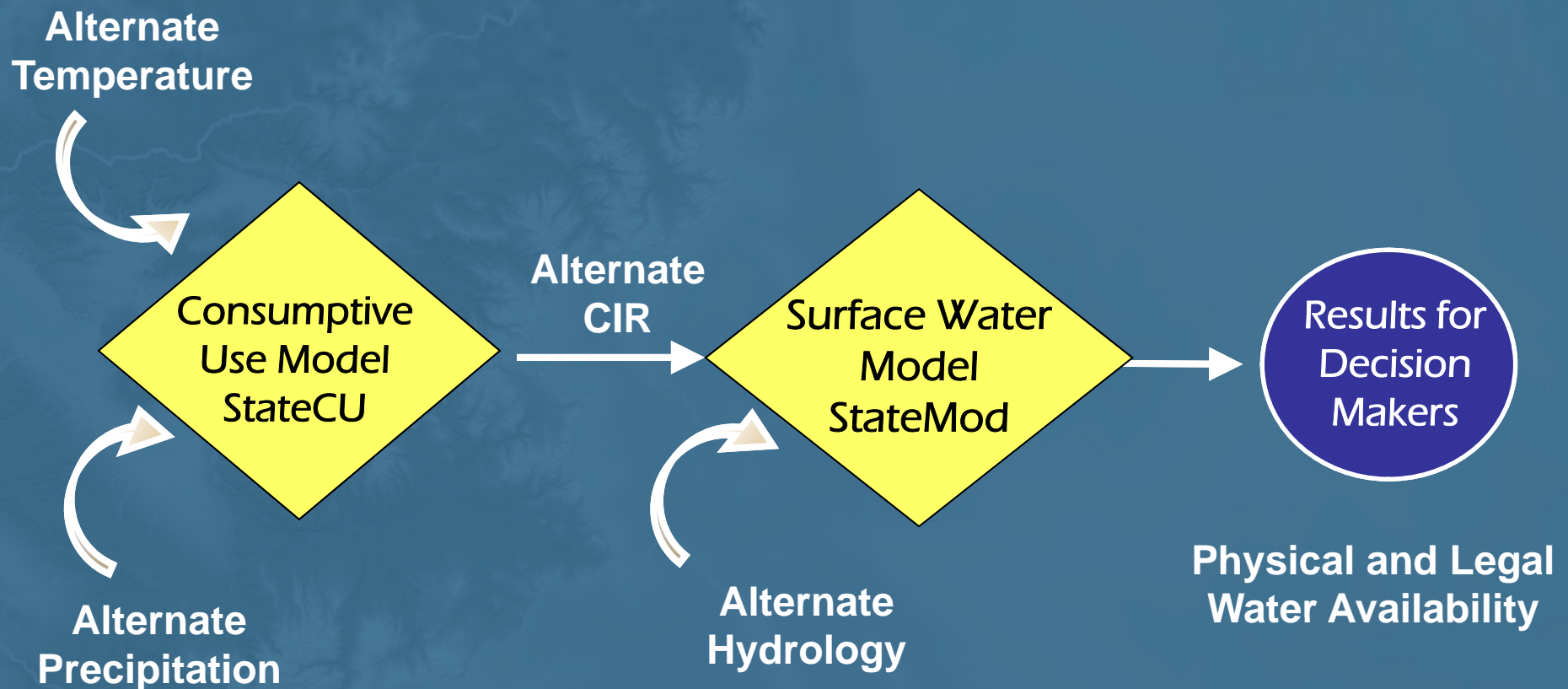


CDSS Models
StateCU
StateMOD

**Results for
Decision
Makers**

*Water Availability
Reservoir Conditions*

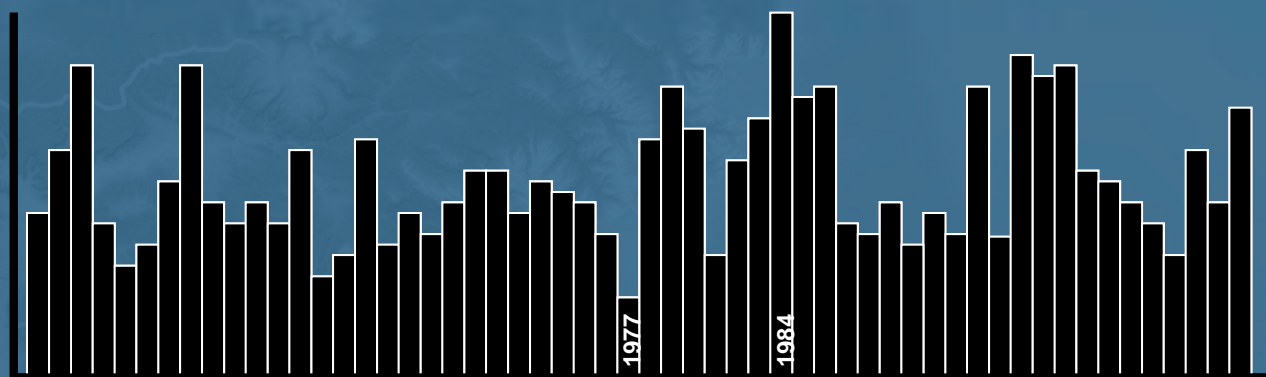
Last Step for Phase I - Water Availability



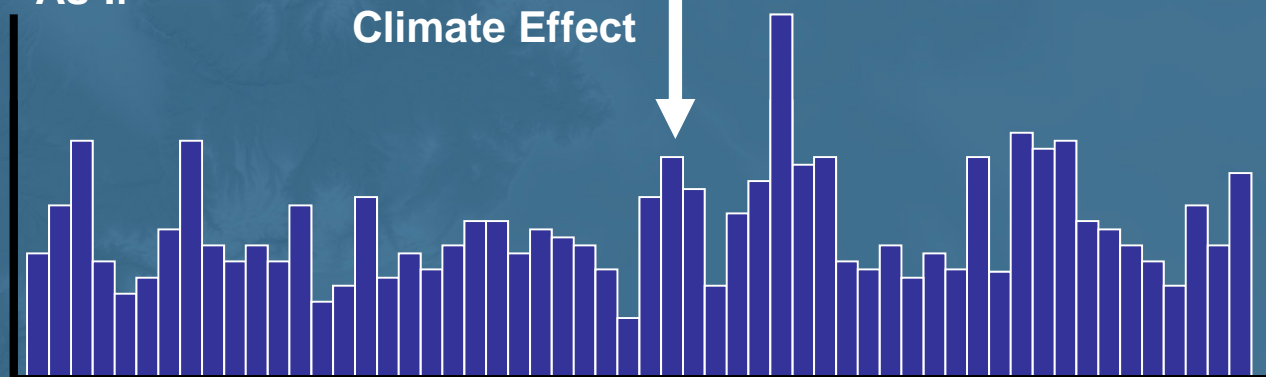
GCM's & Hydrology ~ Process



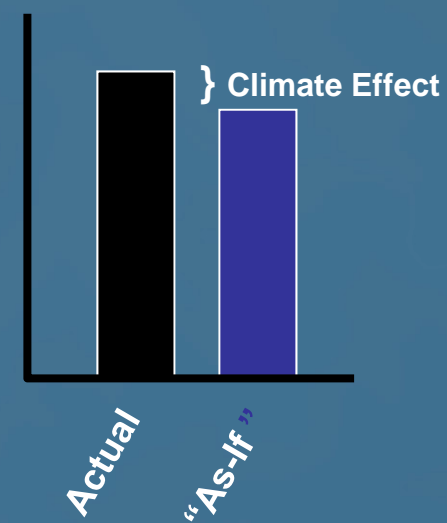
Actual



"As-If"



Climate Effect



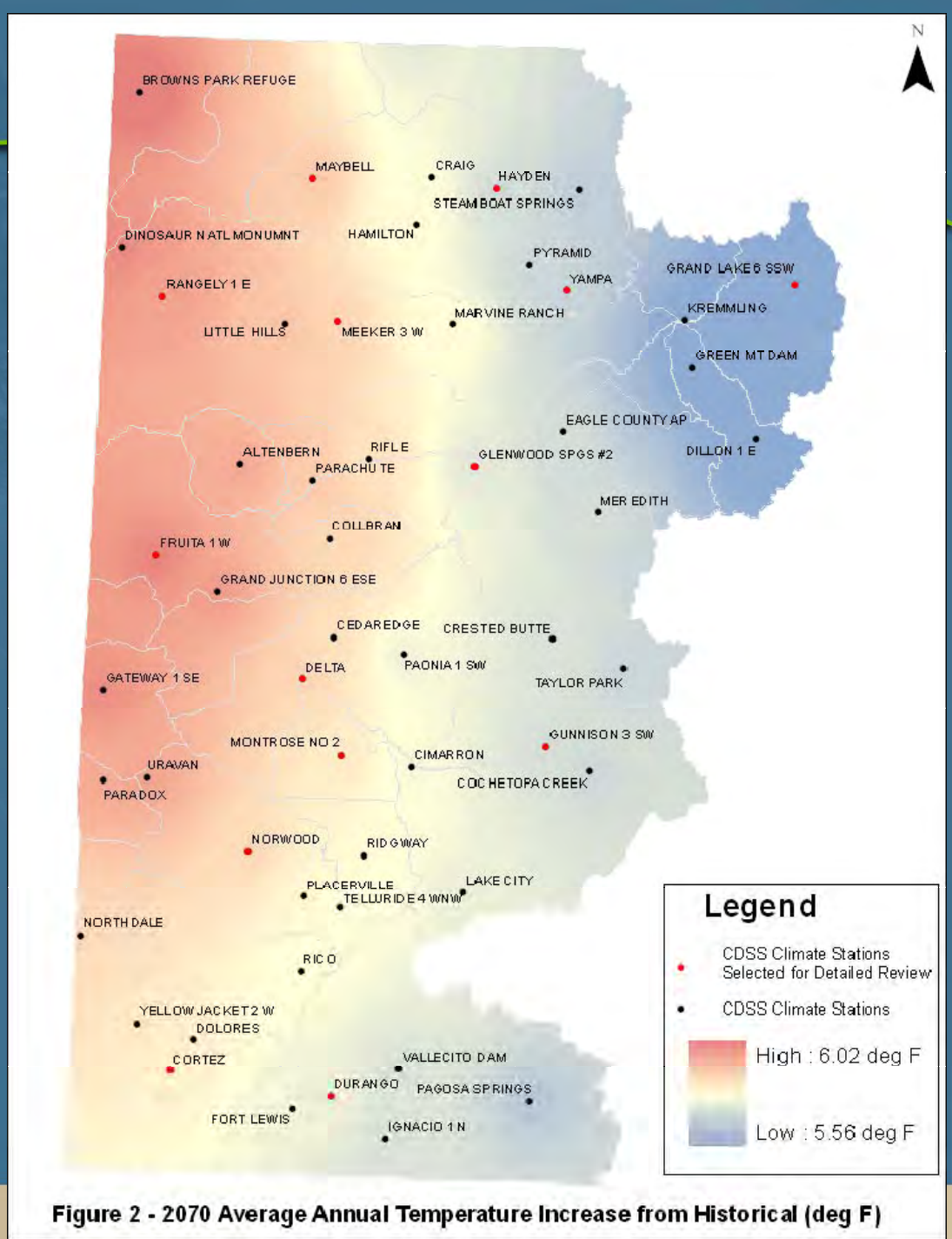
GCM's Effect On Temperature

Lower Elevations Show
Largest Increase

Basin Wide 2040 Average
Increase = 3.6 Deg F

Basin Wide 2070 Average
Increase = 5.8 Deg F

Increase is Consistent
Each Month



GCM's Effect On Winter Precipitation

Winter Precipitation
Increases Basin-Wide

Winter Precipitation
Increases More in
Northern CO

Winter Precipitation Increases
More at Higher Elevations

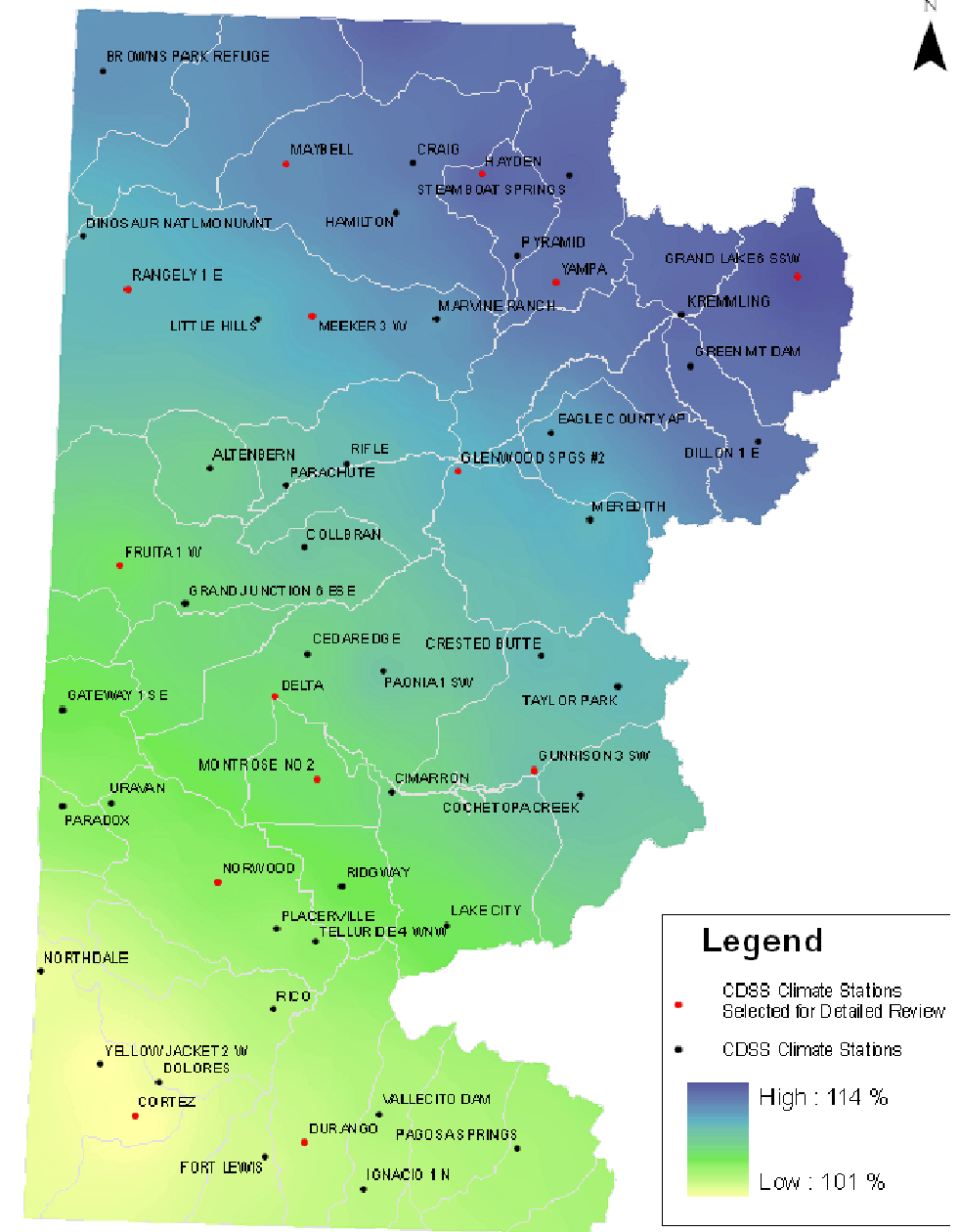


Figure 4 - 2070 Percent of Historical Winter (Nov - Mar) Precipitation

GCM's Effect On Irrigation Season Precipitation

Summer Precipitation
Decreases Basin-wide

Precipitation Decreases
More in Southern CO

Precipitation Decreases
Less at Higher
Elevations

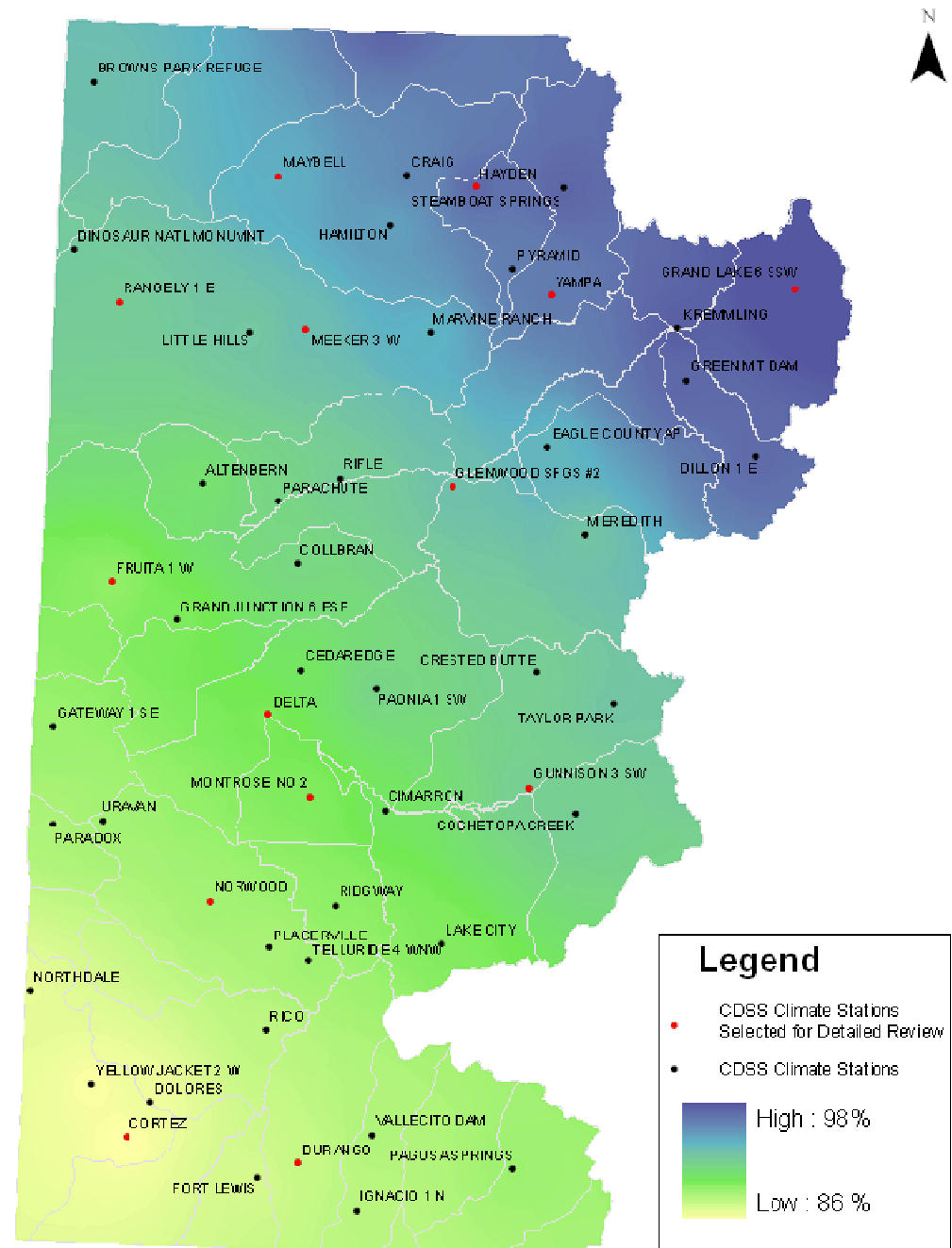


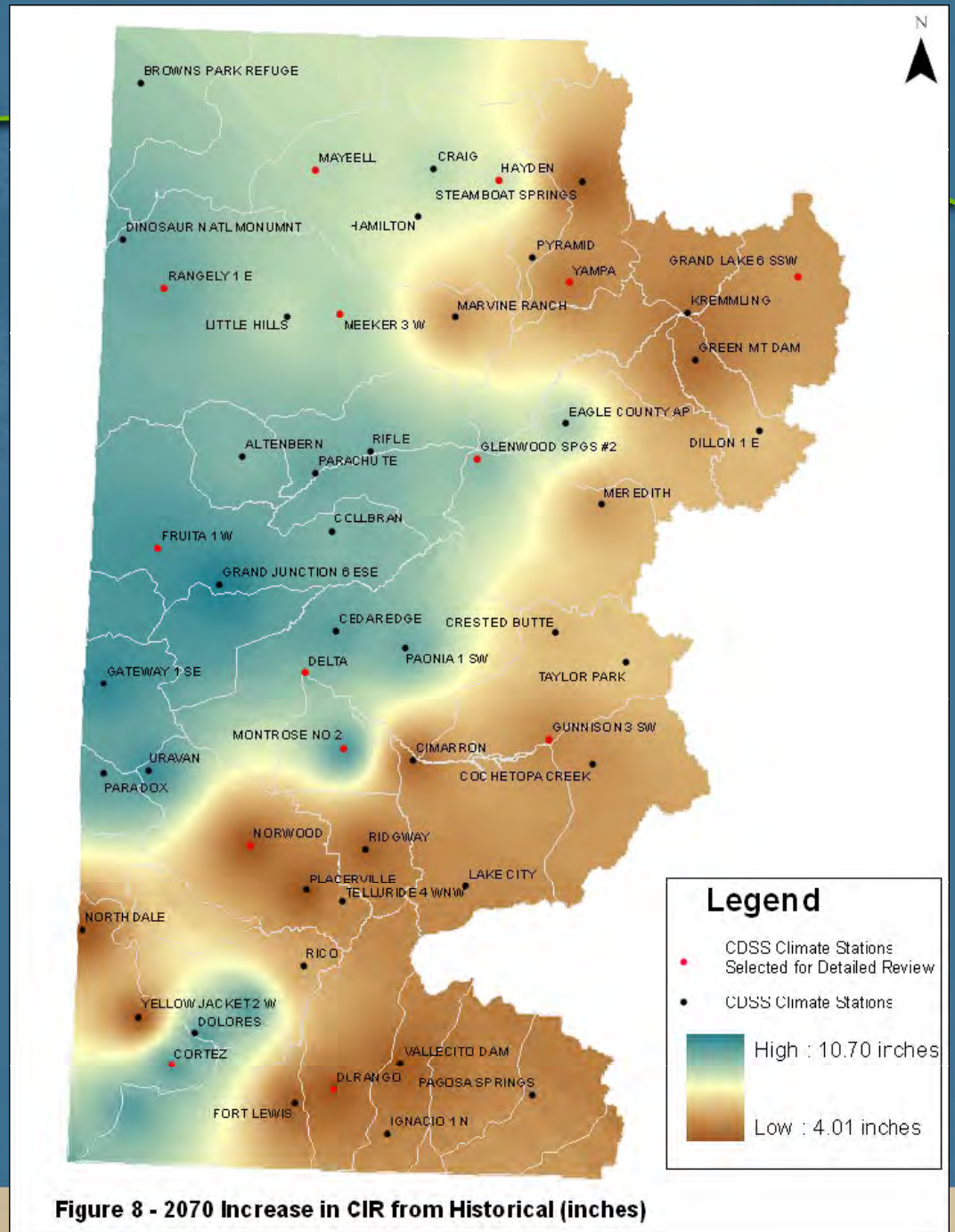
Figure 6 - 2070 Percent of Historical Irrigation Season (Apr-Oct) Precipitation

GCM's Effect On Crop Irrigation Requirement

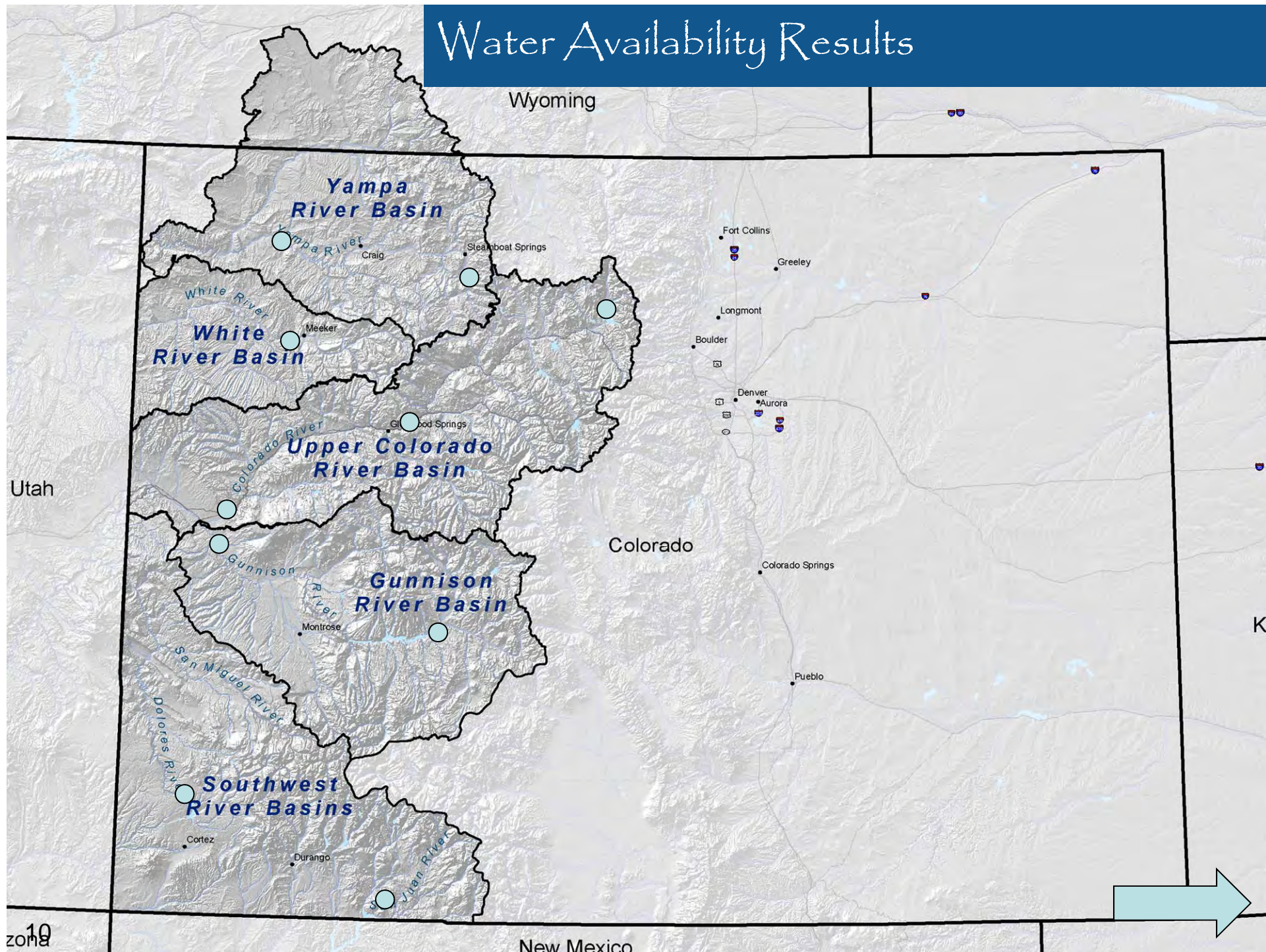
2040 Average Increase
= 20% (0.4 AF/Acre)
= 8 more growing days

2070 Average Increase
= 31% (0.64 AF/Acre)
= 29 more growing days

Lower Elevations Show
Largest Increase



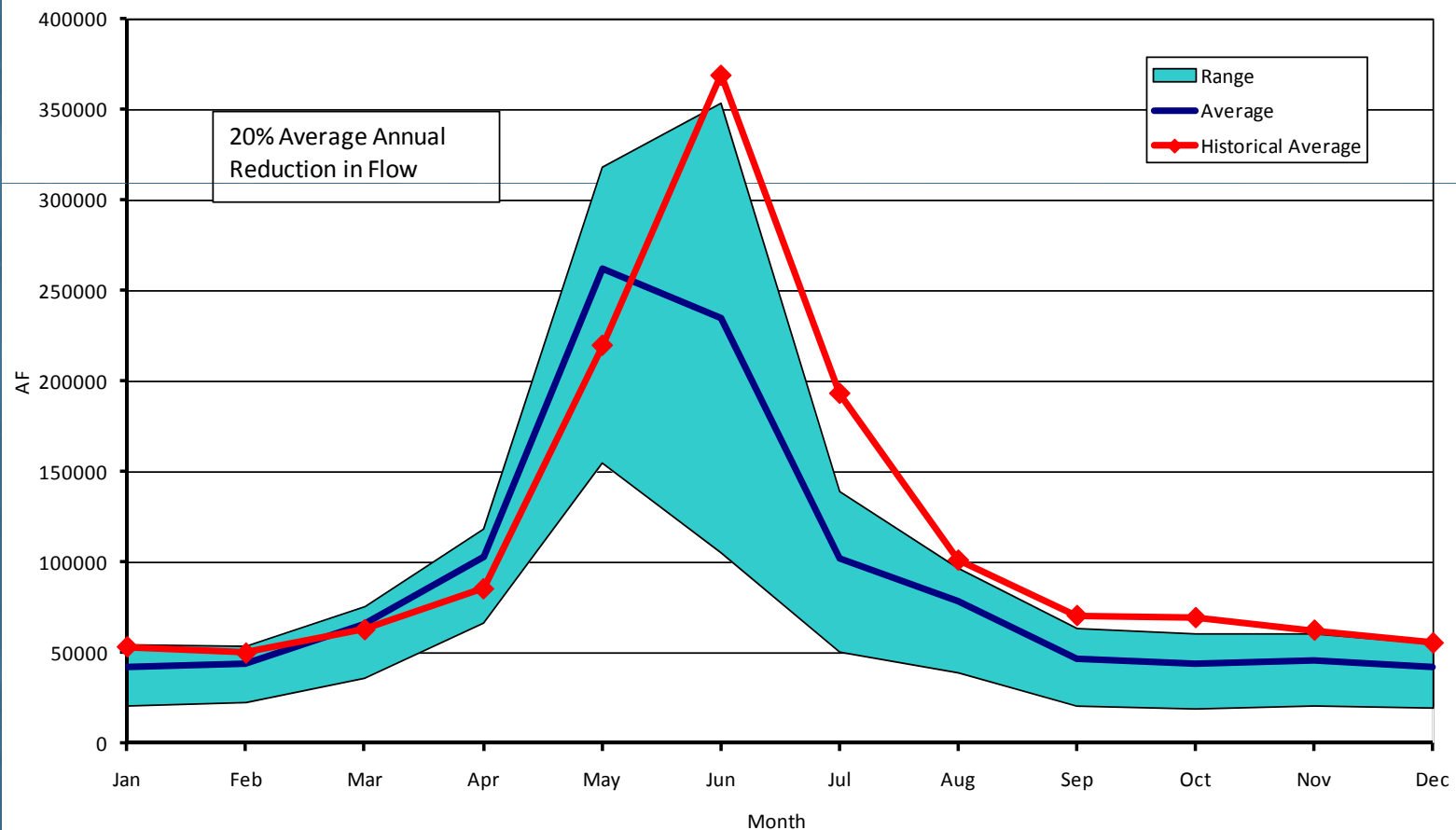
Water Availability Results



Water Availability Results



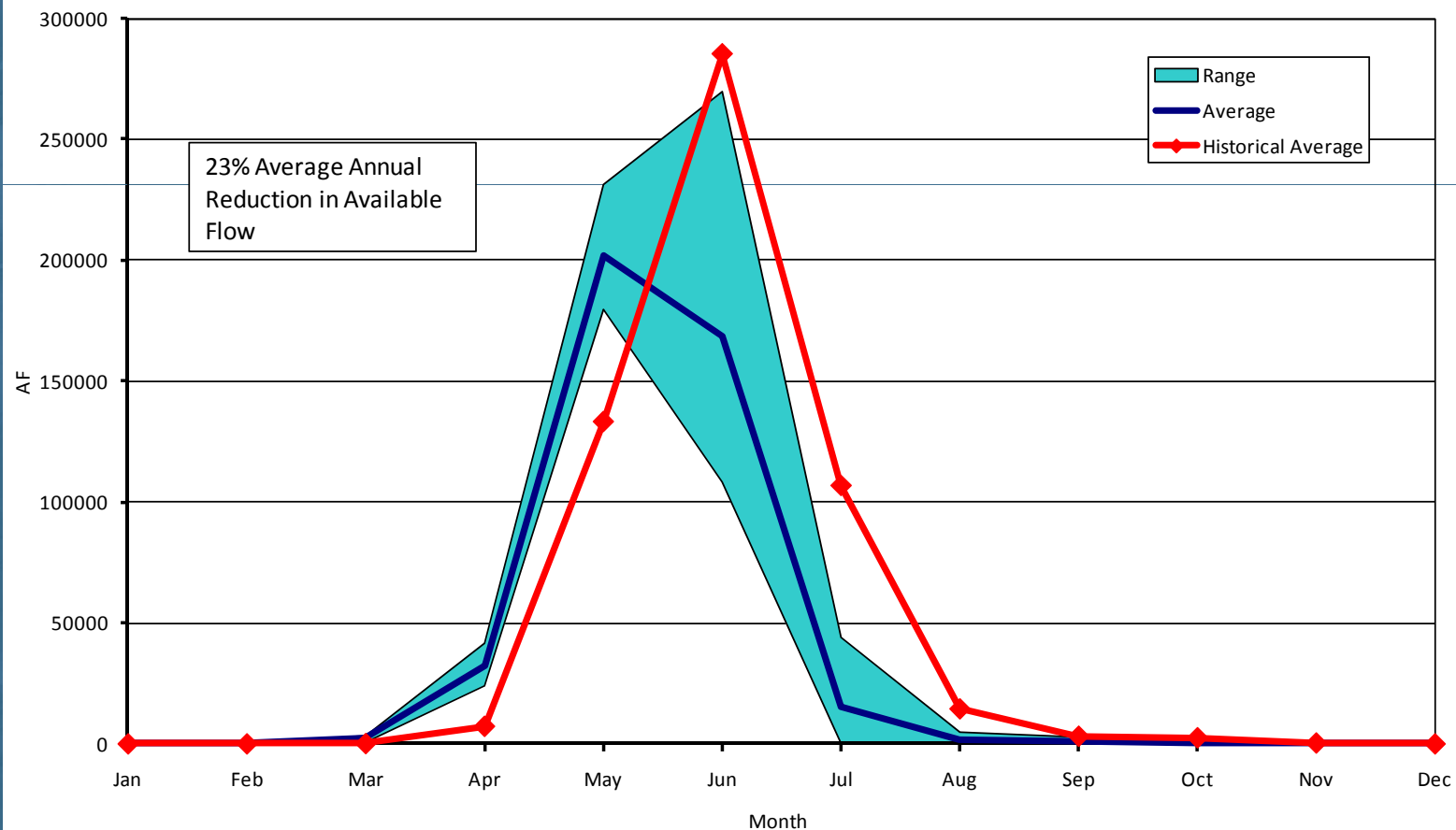
Colorado River At Dotsero (09070500)
2070 Average Monthly Modeled Physically Available Flow



Water Availability Results



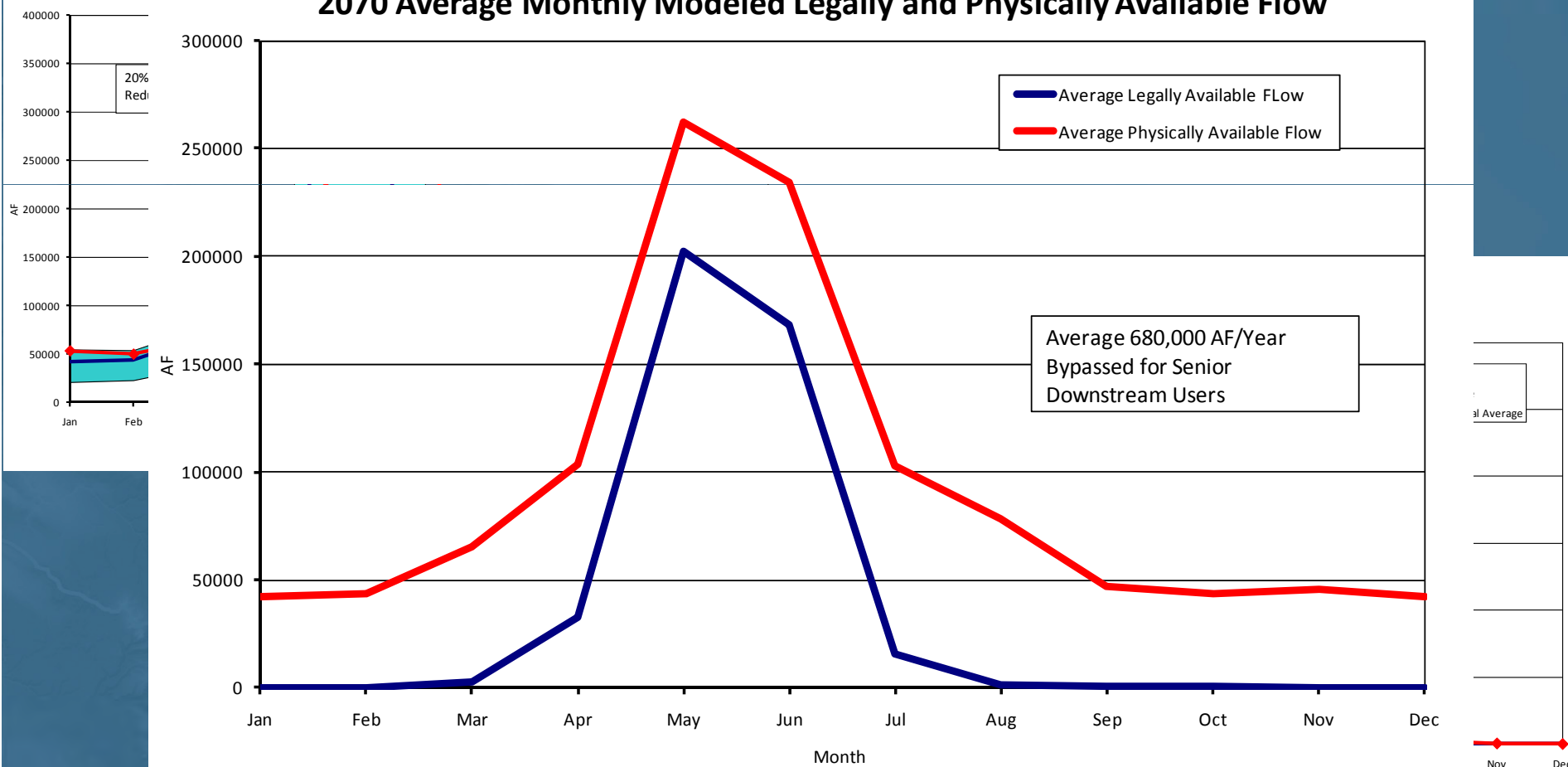
Colorado River At Dotsero (09070500)
2070 Average Monthly Modeled Legally Available Flow



Water Availability Results



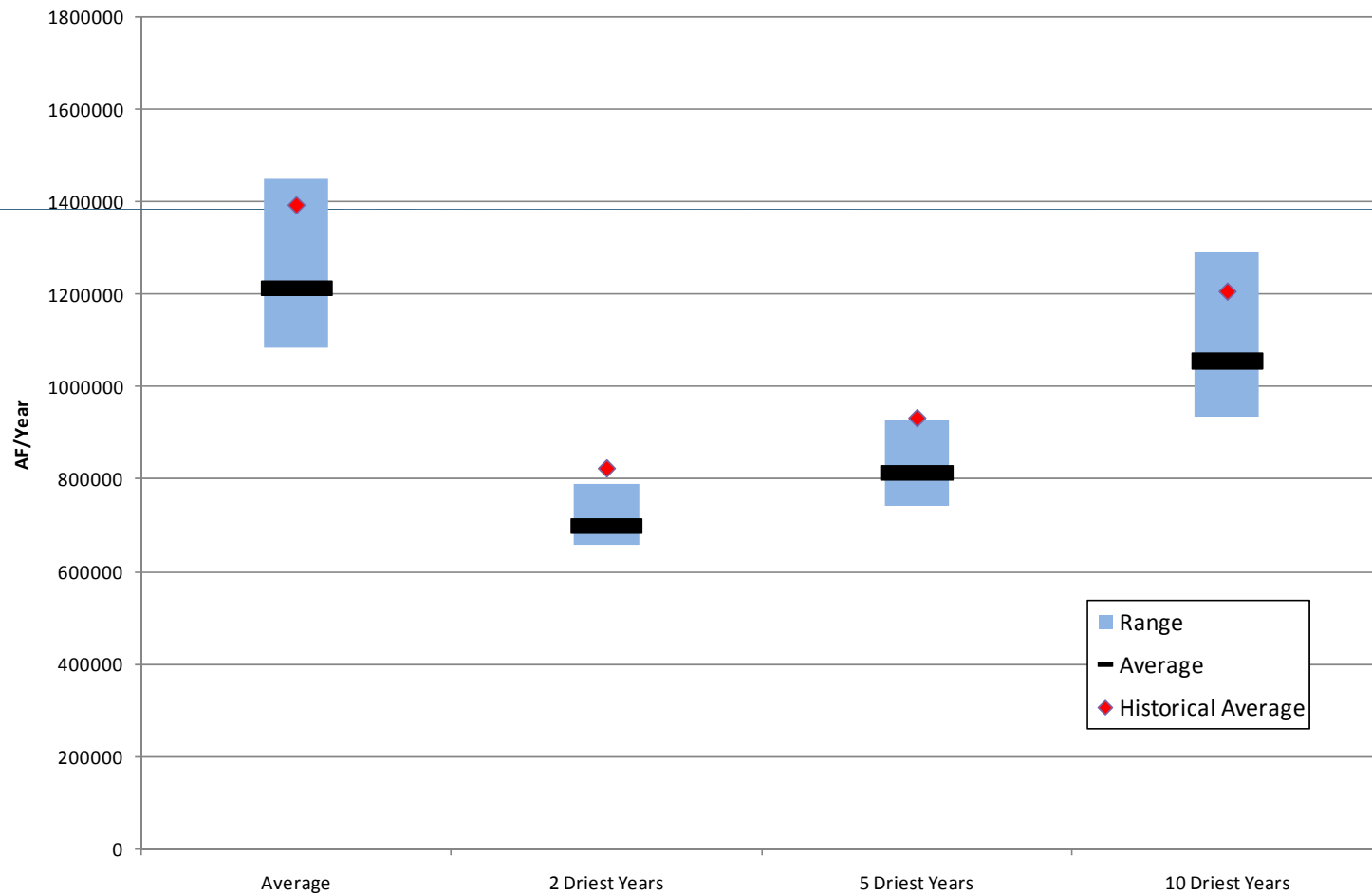
Colorado River At Dotsero (09070500)
2070 Average Monthly Modeled Legally and Physically Available Flow



Water Availability Results



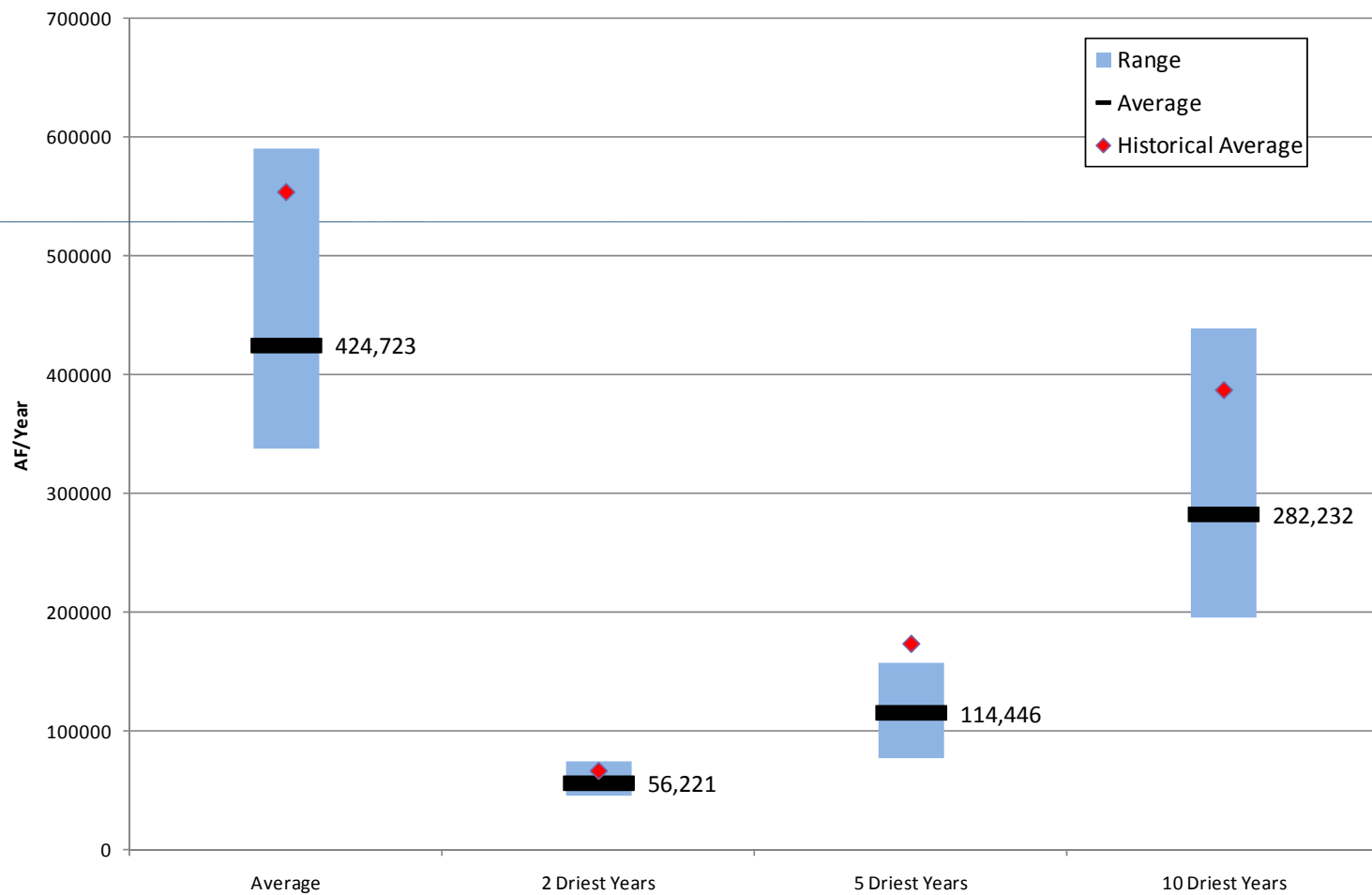
**Colorado River At Dotsero (09070500)
2070 Modeled Physically Available Flow**



Water Availability Results



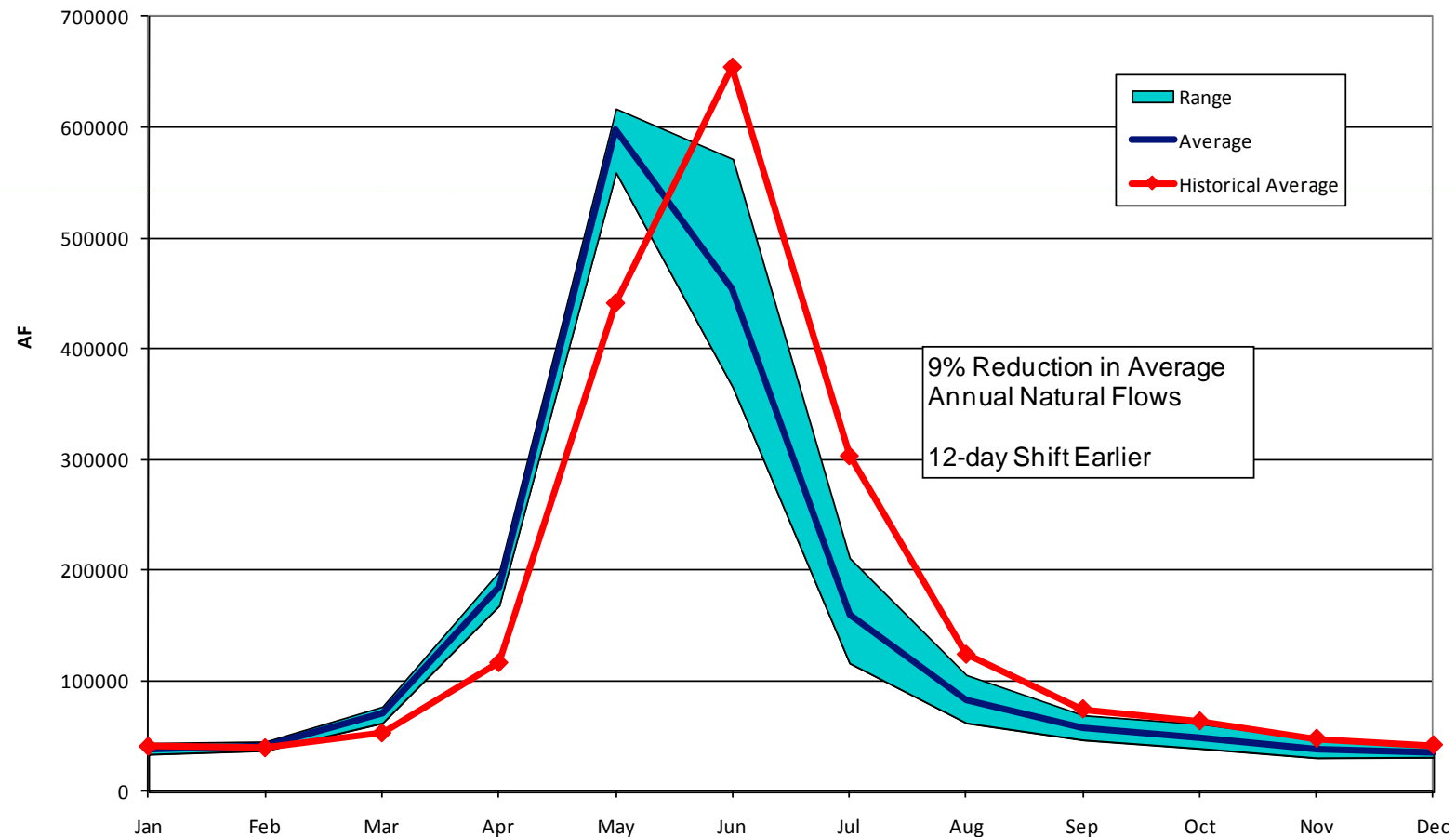
**Colorado River At Dotsero (09070500)
2070 Modeled Legally Available Flow**



Water Availability Results



Colorado River at Dotsero (09070500)
2070 Average Monthly Natural Flow



Colorado River at Dotsero ~ Breakdown

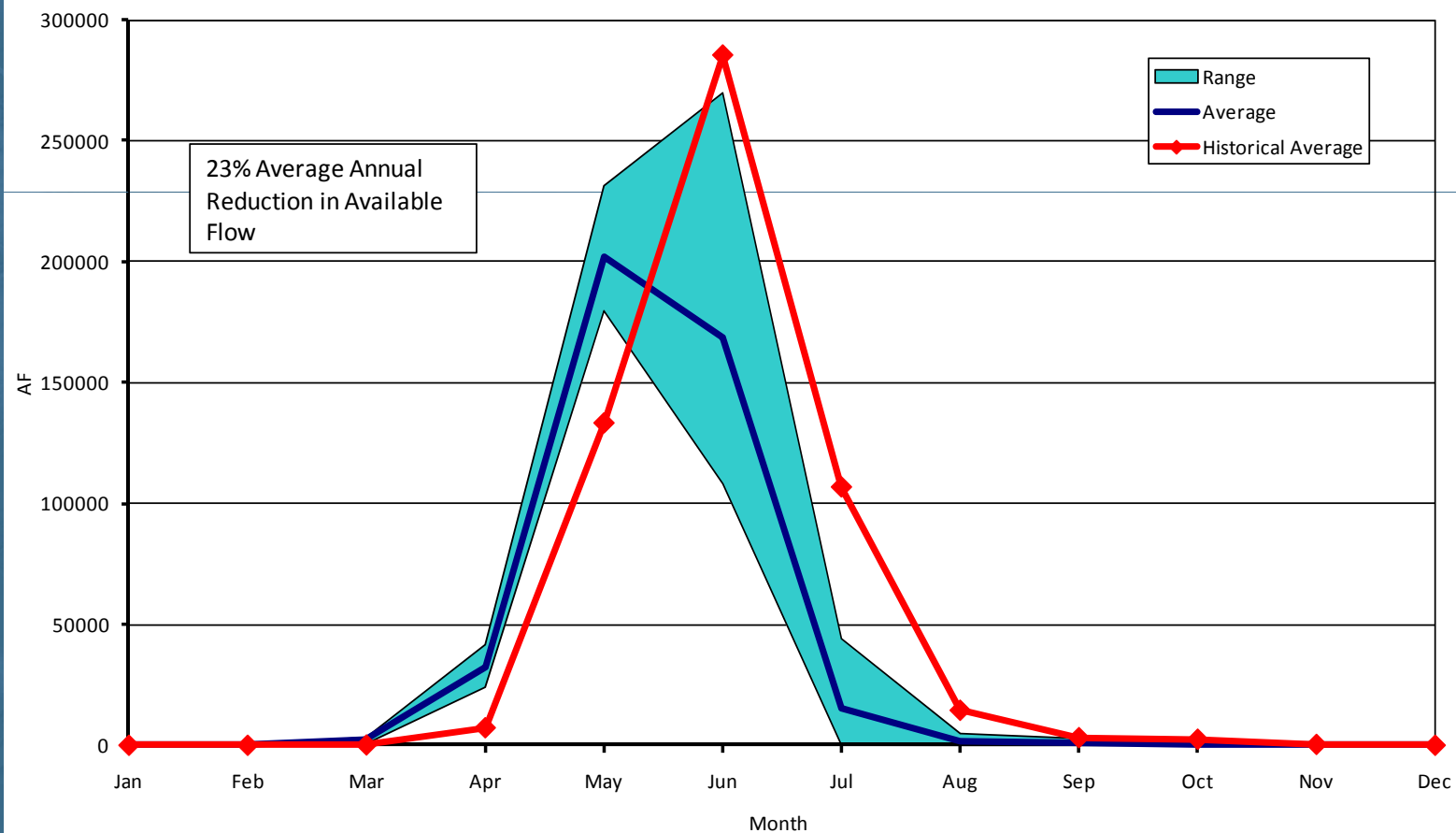


- Average Historical Natural Flow= 2.0 MAF/Year
- Average 2070 Climate Natural Flow = 1.82 MAF/Year
Decrease of 9 % (180,000 AF/Year)
- Downstream Grand Valley Area AG Demand
Increases by 34% (**~55,000 AF/Year**)
- Legally Available Flow
Decreases by ~**130,000 AF/Year**

Water Availability Results



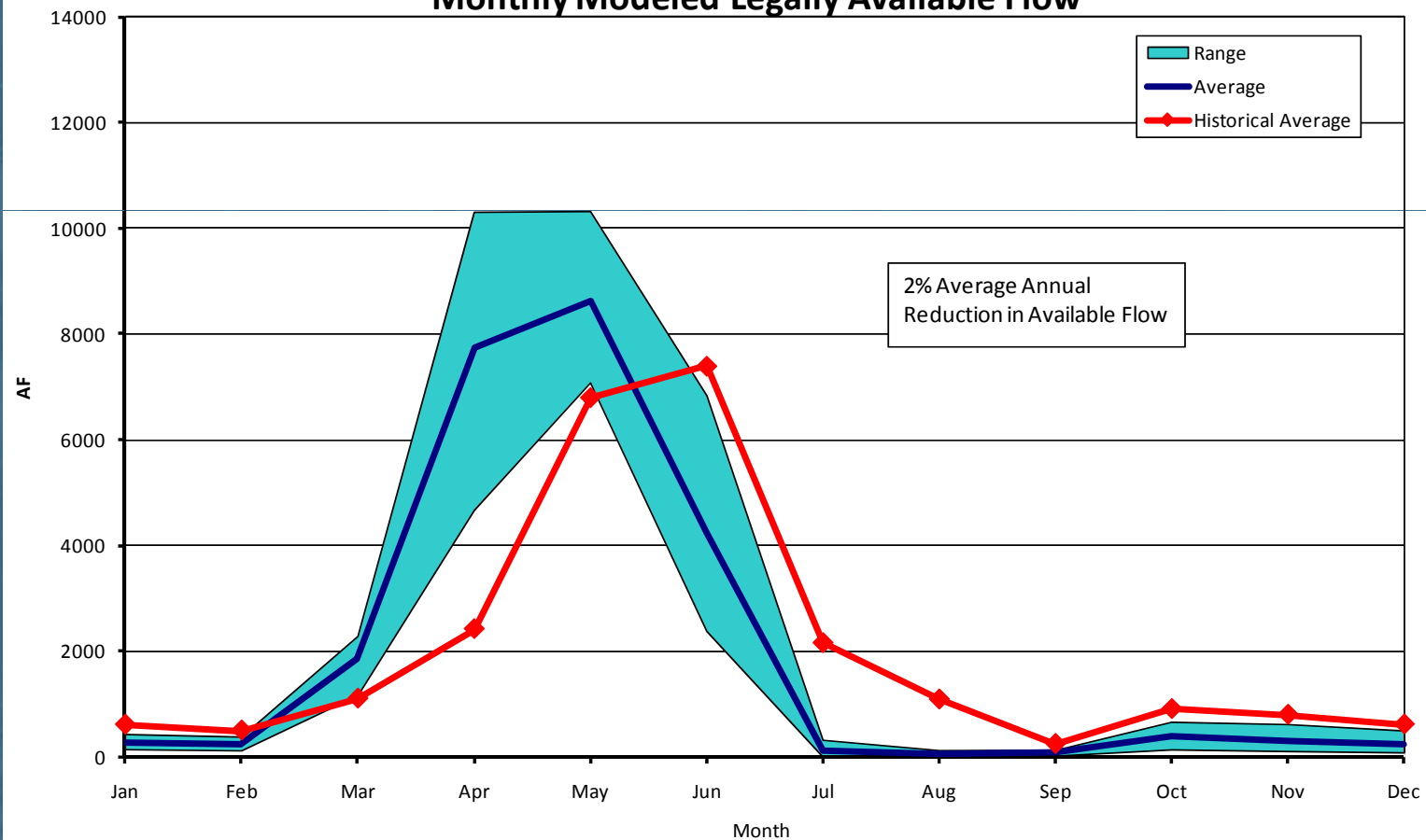
Colorado River At Dotsero (09070500)
2070 Average Monthly Modeled Legally Available Flow



Water Availability Results



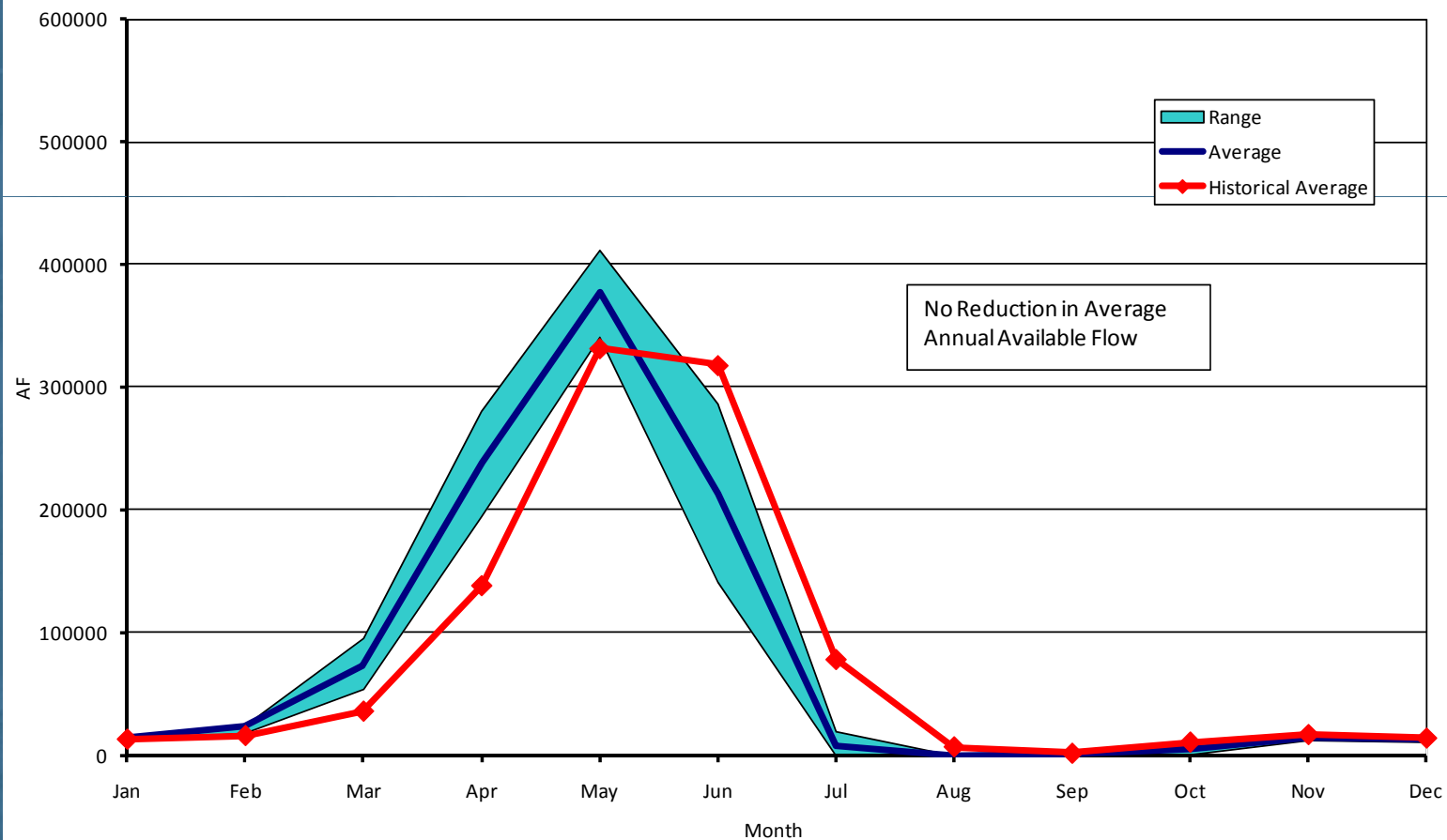
**Yampa River Below Stagecoach Reservoir (09237500) 2070 Average
Monthly Modeled Legally Available Flow**



Water Availability Results



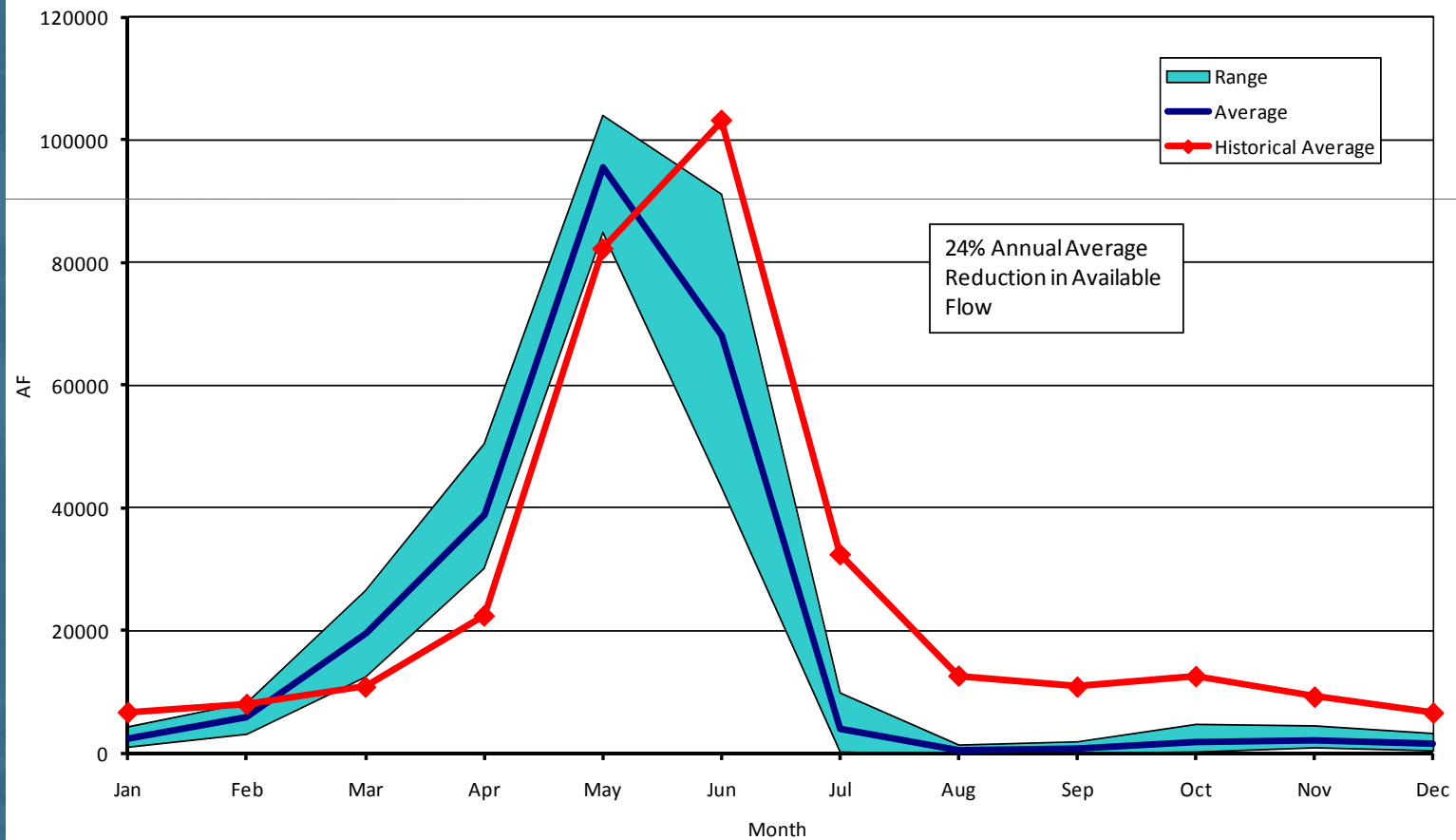
Yampa River Near Maybell (09251000)
2070 Average Monthly Modeled Legally Available Flow



Water Availability Results



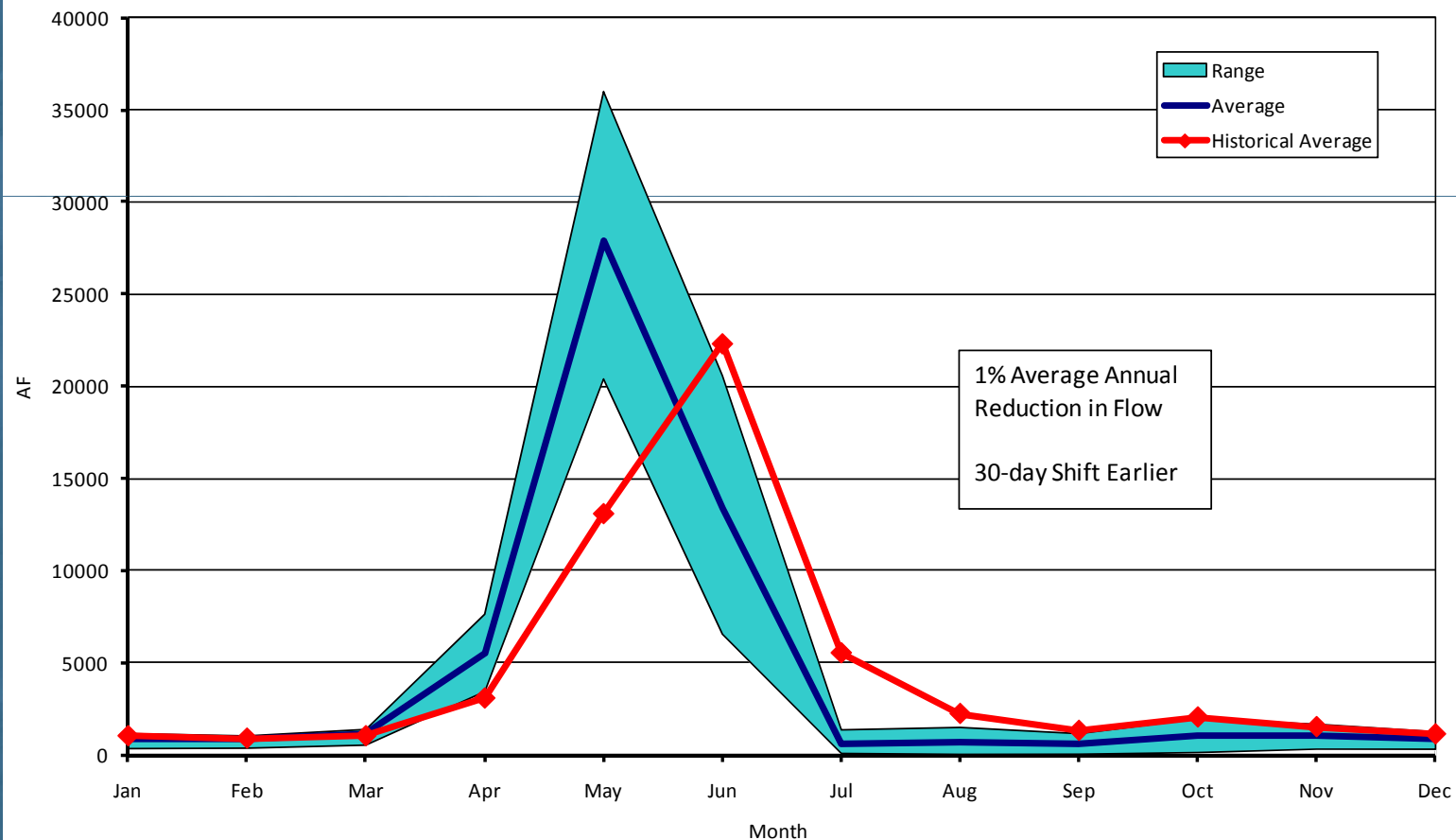
White River Below Meeker (09304800)
2070 Average Monthly Modeled Legally Available Flow



Water Availability Results



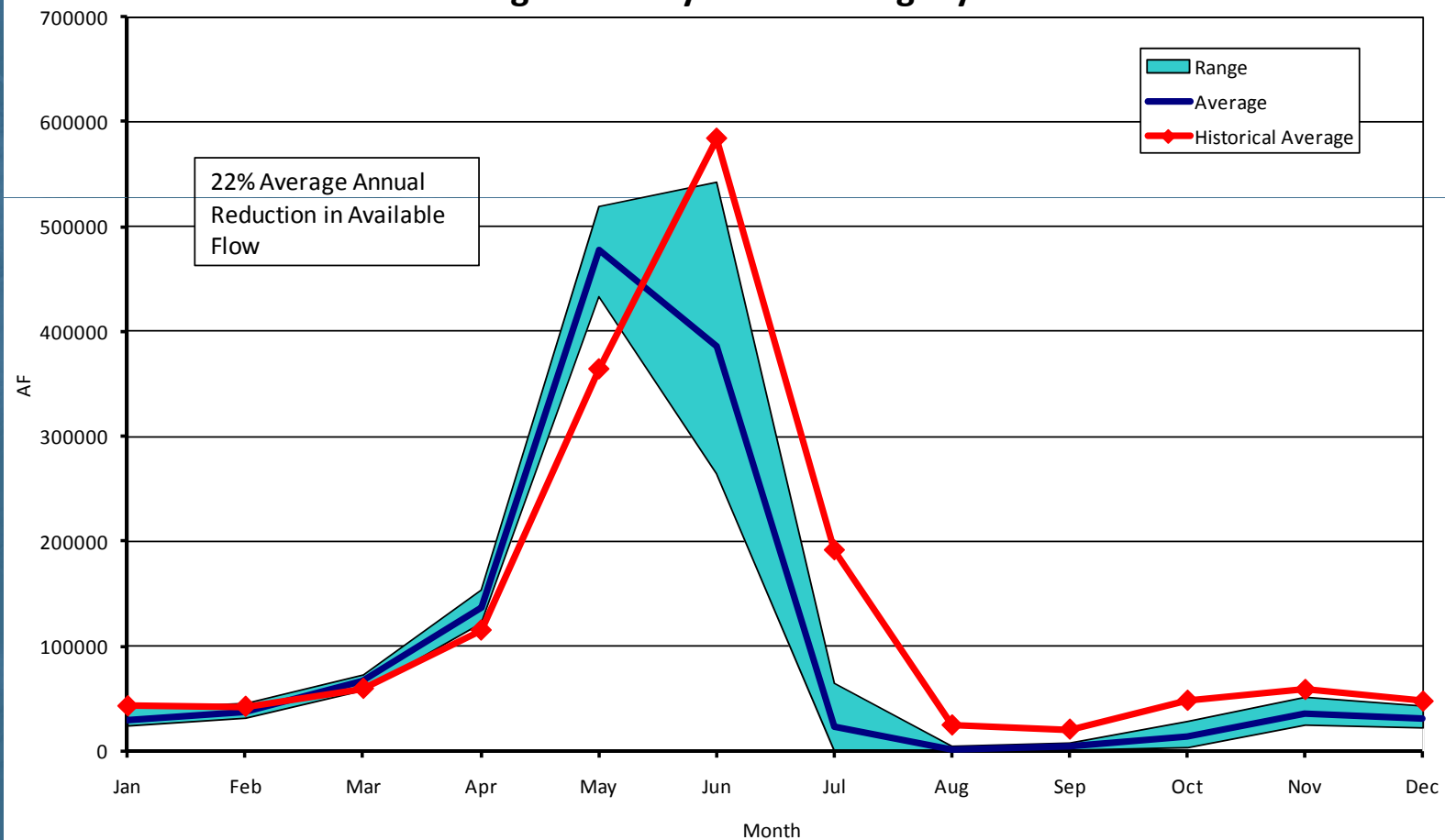
Colorado River Near Grand Lake (09011000)
2070 Average Monthly Modeled Physically Available Flow



Water Availability Results



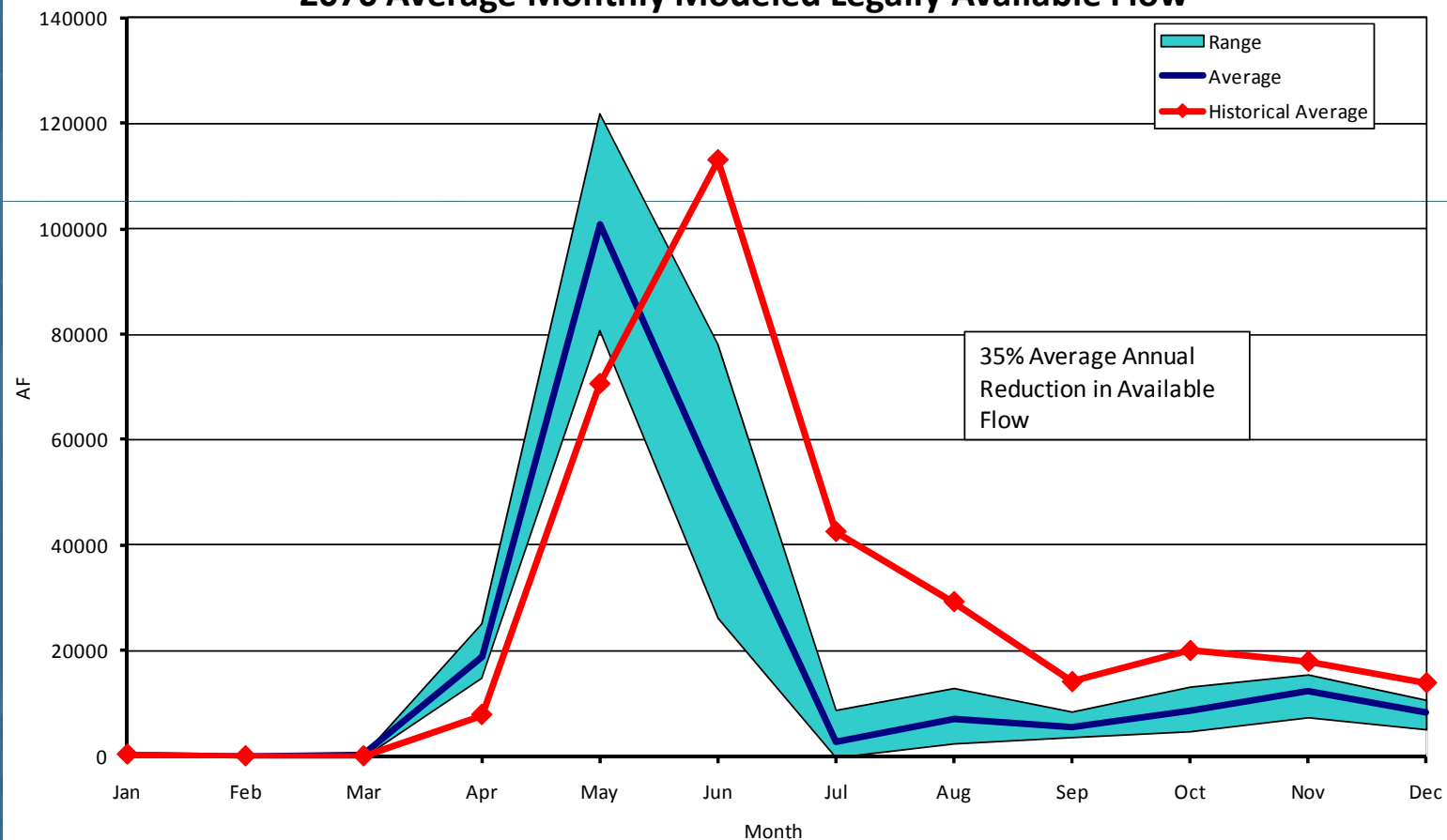
Colorado River Near Cameo (09095500)
2070 Average Monthly Modeled Legally Available Flow



Water Availability Results



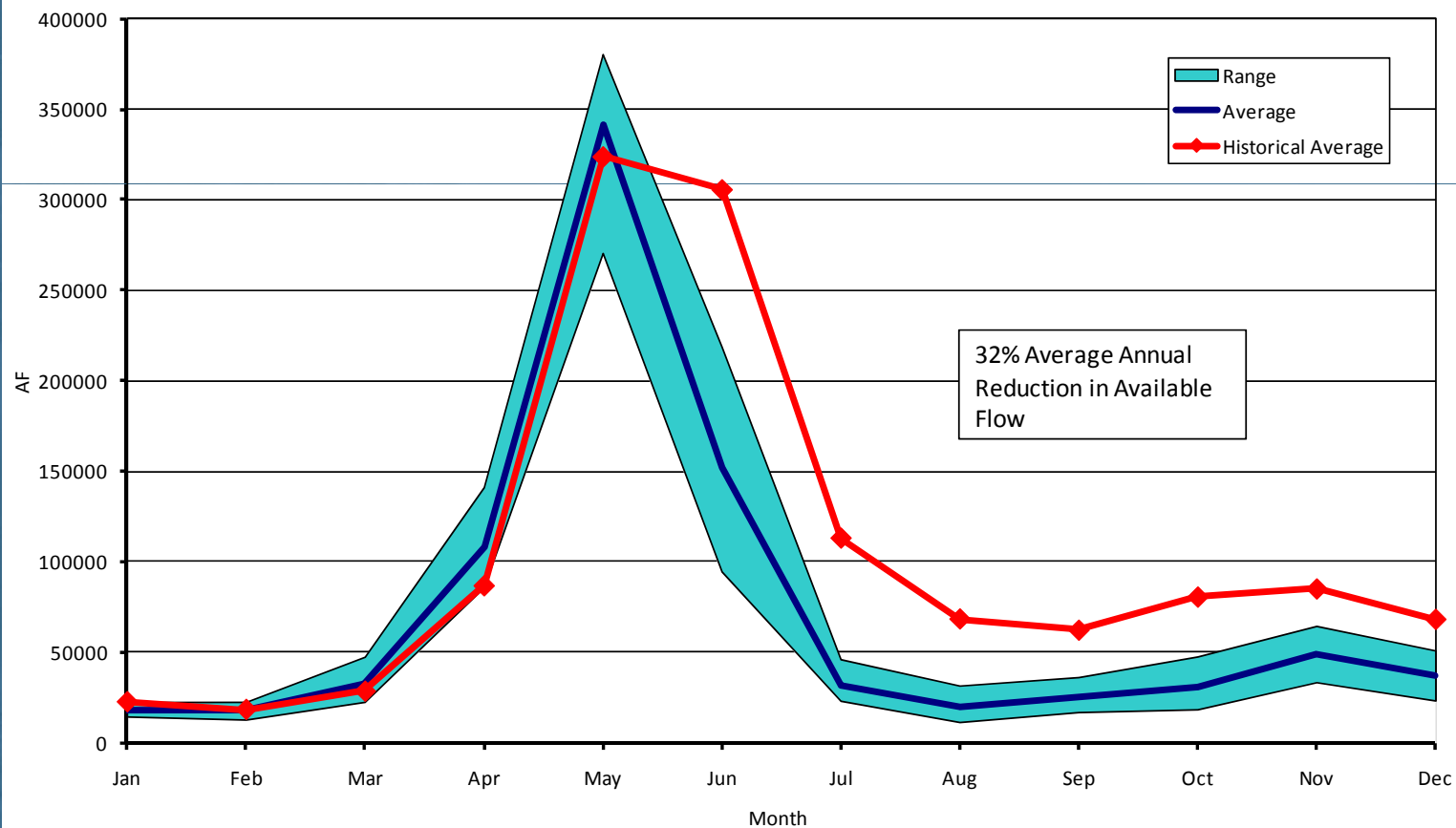
Gunnison River Near Gunnison (09114500)
2070 Average Monthly Modeled Legally Available Flow



Water Availability Results



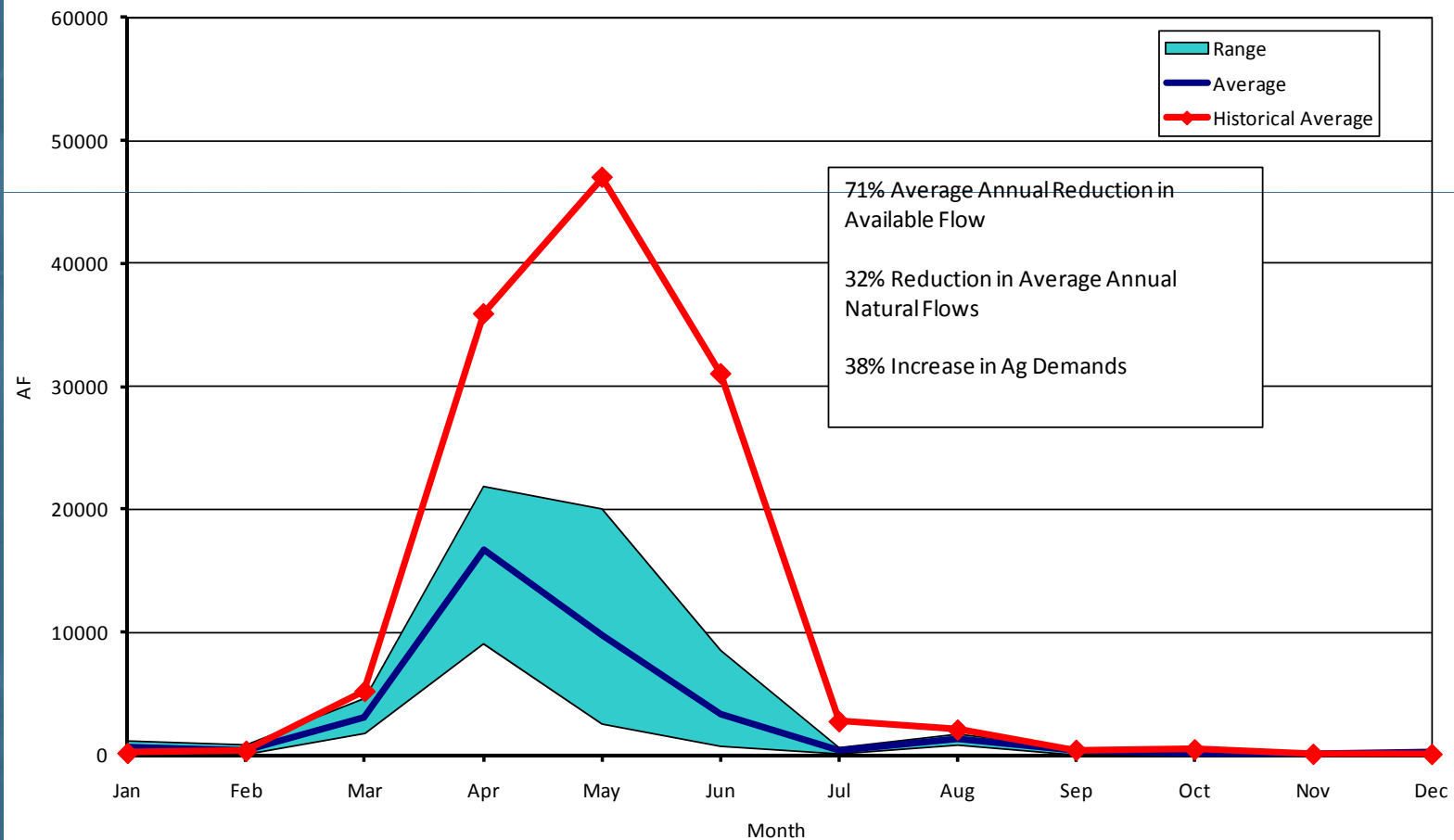
Gunnison River Near Grand Junction (09152500)
2070 Average Monthly Modeled Legally Available Flow



Water Availability Results



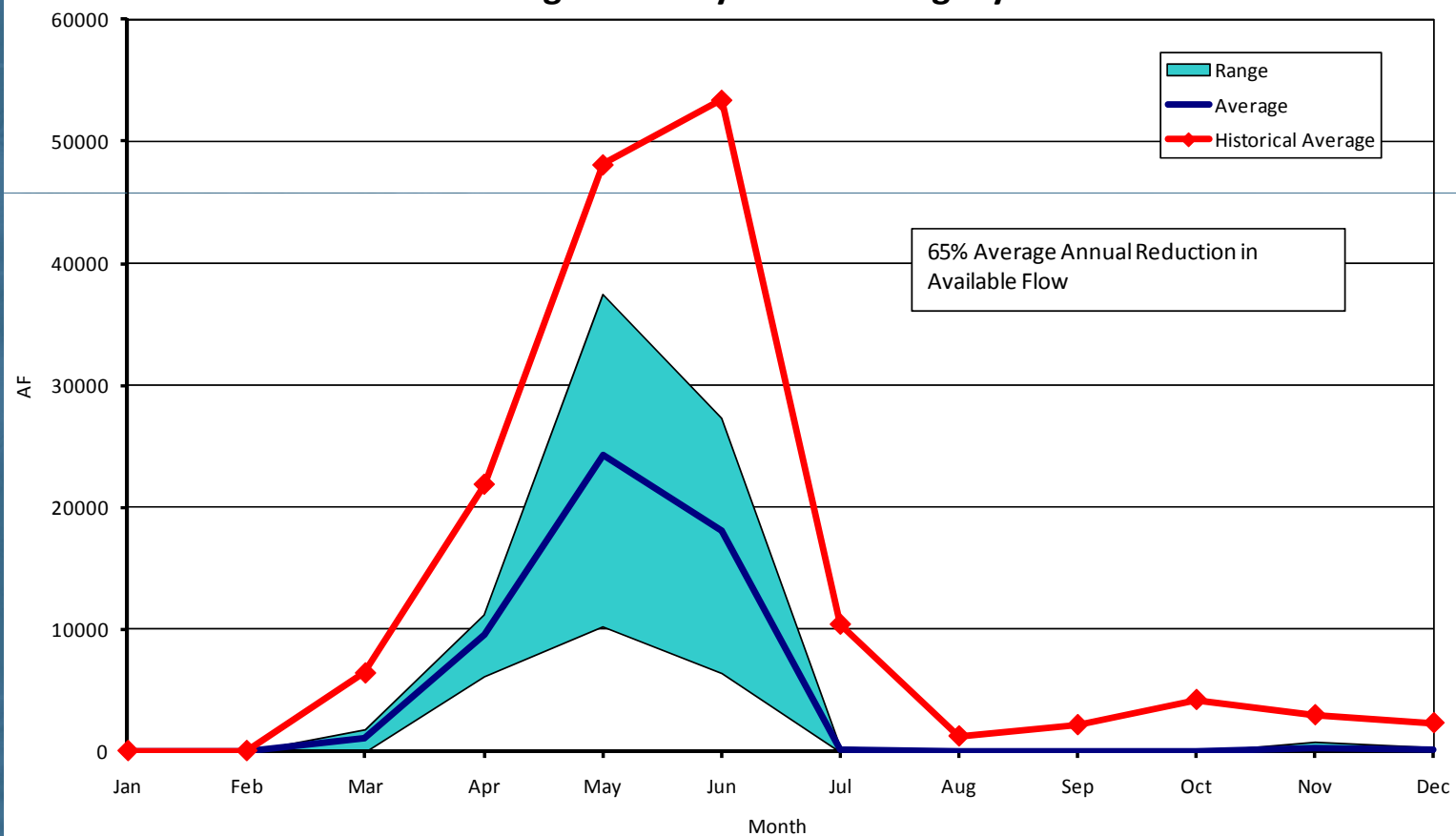
Dolores River Near Bedrock (09171100)
2070 Average Monthly Modeled Legally Available Flow



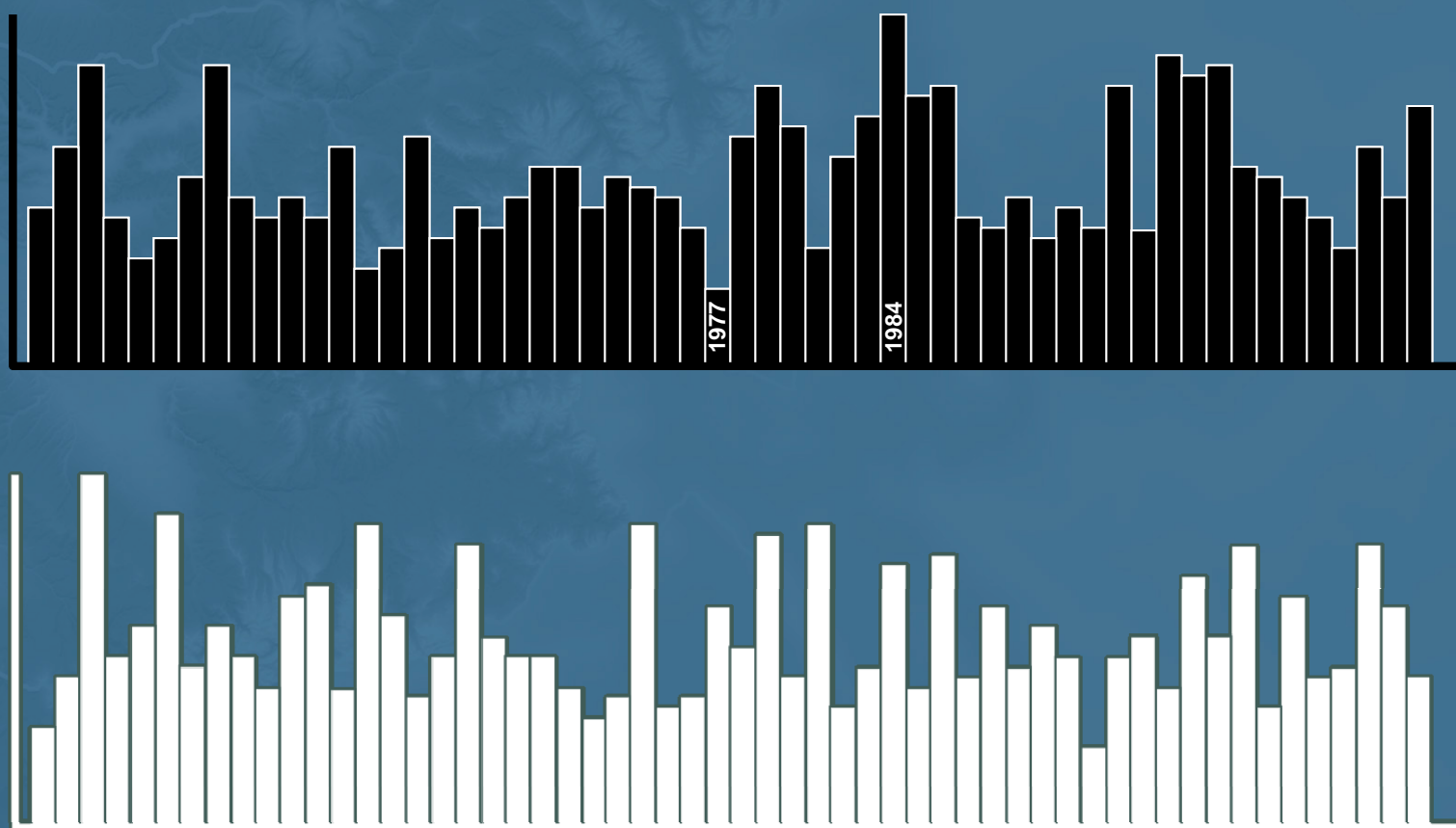
Water Availability Results



San Juan River Near Carracas (09346400)
2070 Average Monthly Modeled Legally Available Flow



Resequencing ~ Alternate Historical Hydrology



1.

Repeat
100x

Phases



- **Phase I**
Water Availability under current water supply 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

Comments and Questions?



Contact Information:

Ray Alvarado:	303.866.3441	ray.alvarado@state.co.us
Blaine Dwyer:	303.987.3443	blaine.dwyer@aecom.com
Matt Brown:	303.987.3443	matthew.brown@aecom.com
Ben Harding:	303.443.7839	ben.harding@amec.com
Erin Wilson:	303.455.9589	erin.wilson@lrcwe.com

Website:

<http://cwcb.state.co.us/WaterInfo/CRWAS>