CENTRAL UTAH PROJECT – BONNEVILLE UNIT WATER SUPPLY VARIABILITY STUDY

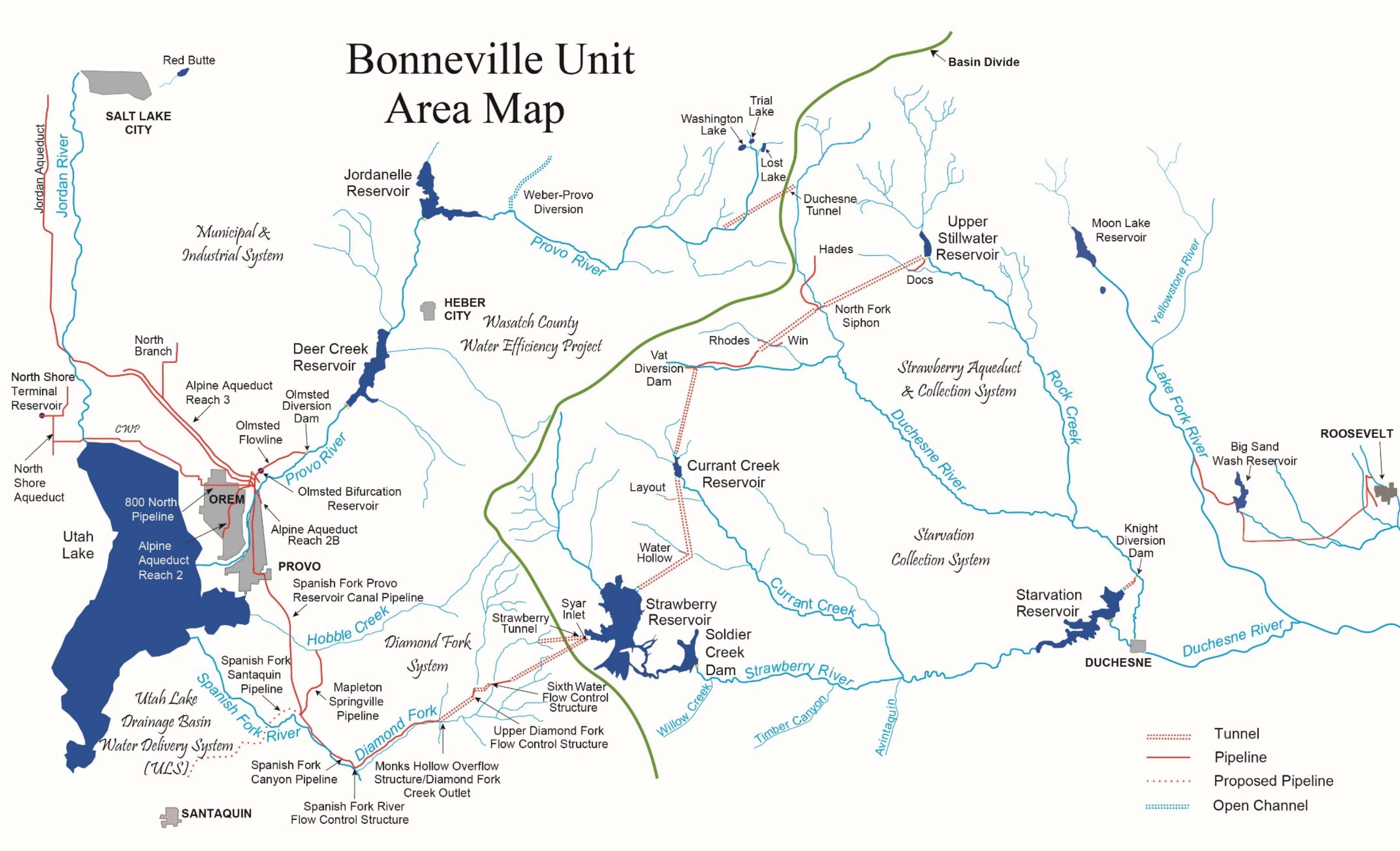
PREPARING FOR AN UNCERTAIN FUTURE

CENTRAL UTAH WATER
CONSERVANCY DISTRICT

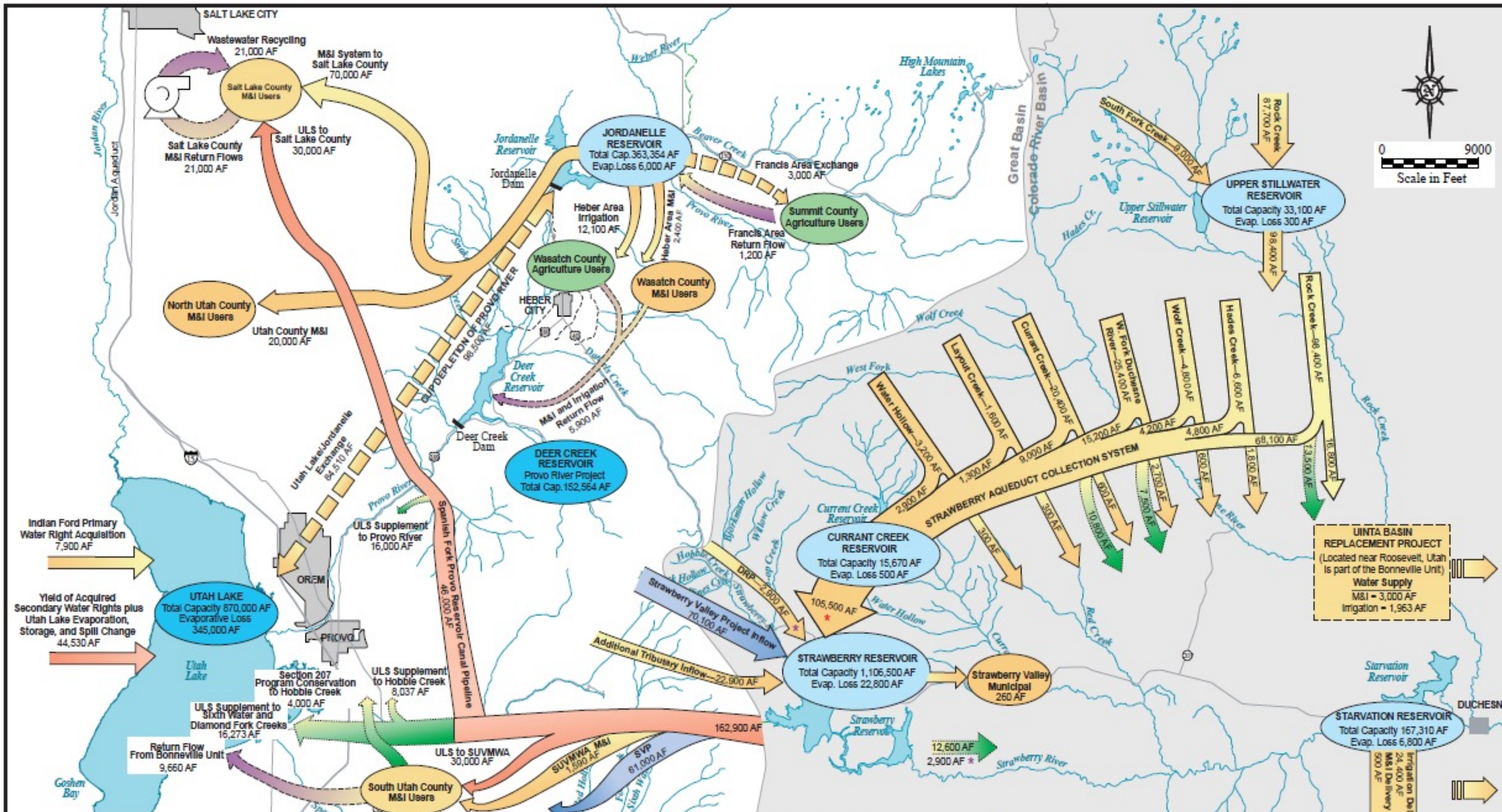
The CUP – Bonneville Unit Water Supply Variability Study is an opportunistic, proactive example of responsible water system management

PERSPECTIVE & BACKGROUND

- THE CENTRAL UTAH PROJECT IS COMPLEX & APPROACHING FULL DEMAND



THE CENTRAL UTAH PROJECT



Depletions to the Provo River

Description of Depletion	Average Annual Acre-Feet
M&I Salt Lake County	70,000
M&I North Utah County	20,000
Francis Area Agriculture	3,000
Wasatch County Agriculture	9,200
Daniels Replacement Project	2,900
M&I Wasatch County	2,400
Jordanelle Evaporation & Storage	6,000
Francis Area Return	-1,200
Wasatch County Agric. Return	-4,400
Wasatch County M&I Return	-1,500
Indian Ford/ Utah Lake Rights	-7,900
Total	**98,500**

Depletions to Utah Lake

Description of Depletion	Average Annual Acre-Feet
Provo River Depletion	98,500
Strawberry to Supplement Sixth Water and Diamond Fork	-16,273
Strawberry to Supplement Hobble Creek	-12,037
Strawberry to Supplement Provo River	-16,000
North Utah County M&I Return	
So Utah Return	-9,660
Yield of Utah Lake Rights, Plus Utah Lake Evaporation, Storage & Spill Change	-44,530
Total	**0**

Depletions to the Colorado River

Description of Depletion	Average Annual Acre-Feet
Strawberry Collection System Operation	
□ Bonneville Unit water released to the Basin	-101,900
□ Strawberry Valley M&I use	-260
□ Strawberry Reservoir evaporation (BU portion)	-17,700
□ Upper Stillwater Reservoir evaporation	-500
□ Current Creek Reservoir evaporation	-300
Starvation Collection System Operation	
□ Duchesne River area irrigation	-12,200
□ Duchesne River area M&I use	-250
□ Starvation Reservoir evaporation	-6,800
Uinta Basin Replacement Project	
□ Roosevelt area M&I use	-1,500
□ Upalco area irrigation use	-981
Offsetting gain from Daniel Replacement Project	+2,900
Total	**139,491**

Strawberry Reservoir

Project	Inflow	Outflow to Great Basin
Strawberry Valley Project	70,100 AF	61,000 AF
Central Utah Project	128,400 AF	101,900 AF
Daniel Replacement Project	2,900 AF	0 AF
Total	**201,400 AF**	**162,900 AF**

Project	Outflow to Uinta Basin
Strawberry Valley M&I	260 AF
Instream Flow	12,600 AF
Daniel Replacement Project	2,900 AF
Total	**15,760 AF**

Notes:

BONNEVILLE UNIT

CUP Transbasin diversion 101,900 AF

AF = acre-feet

Water deliveries and spills

Fishery flows

Return flows

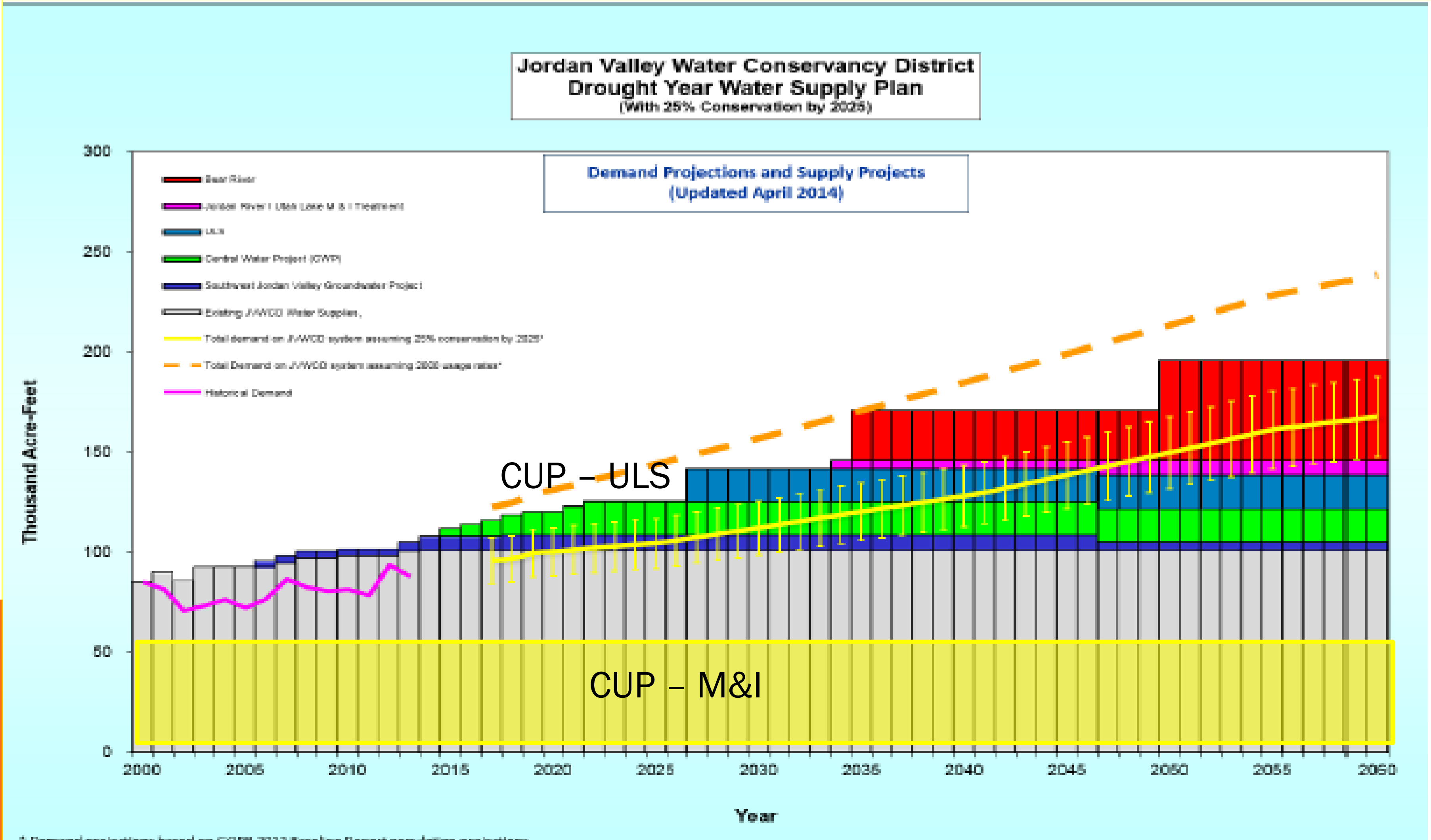
* Includes 4,000 AF Strawberry Valley Project Water

* Wasatch County Water Efficiency Project and Daniel Replacement Project

UTAH LAKE DRAINAGE BASIN
WATER DELIVERY SYSTEM
DISTRIBUTION OF
BONNEVILLE UNIT WATER
FIGURE 2-1

PERSPECTIVE & BACKGROUND

- **The CUP Supply was planned to have a multi-year carry-over. Customer agencies are planning on the CUP supplies to carry them through drought periods**



Source: 2014 Conservation Plan Update - JVWCD

PERSPECTIVE & BACKGROUND

CUWCD is one of Utah's water districts that established this center

PREPARE 60
SECURING UTAH'S ECONOMIC FUTURE

PROTECT — Protect What We Have

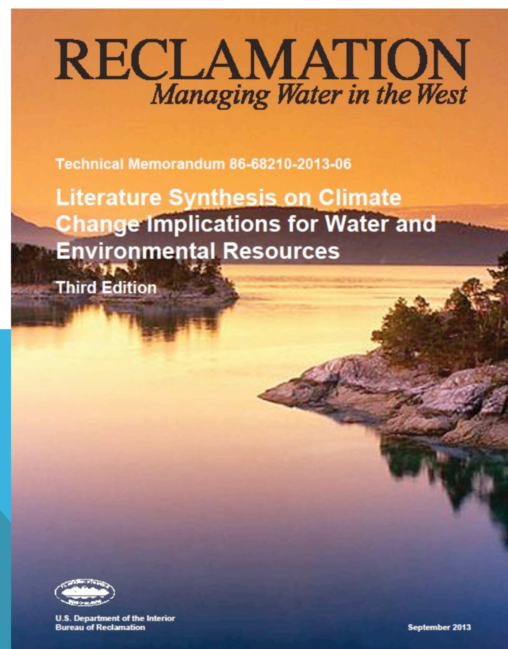
CONSERVE — Use It Wisely

PROVIDE — Provide For The Future

Source: www.prepare60.com

PERSPECTIVE & BACKGROUND

'Megadrought' could have catastrophic effects on California



Climate: Utah tree-ring study shows severity of historic megadroughts

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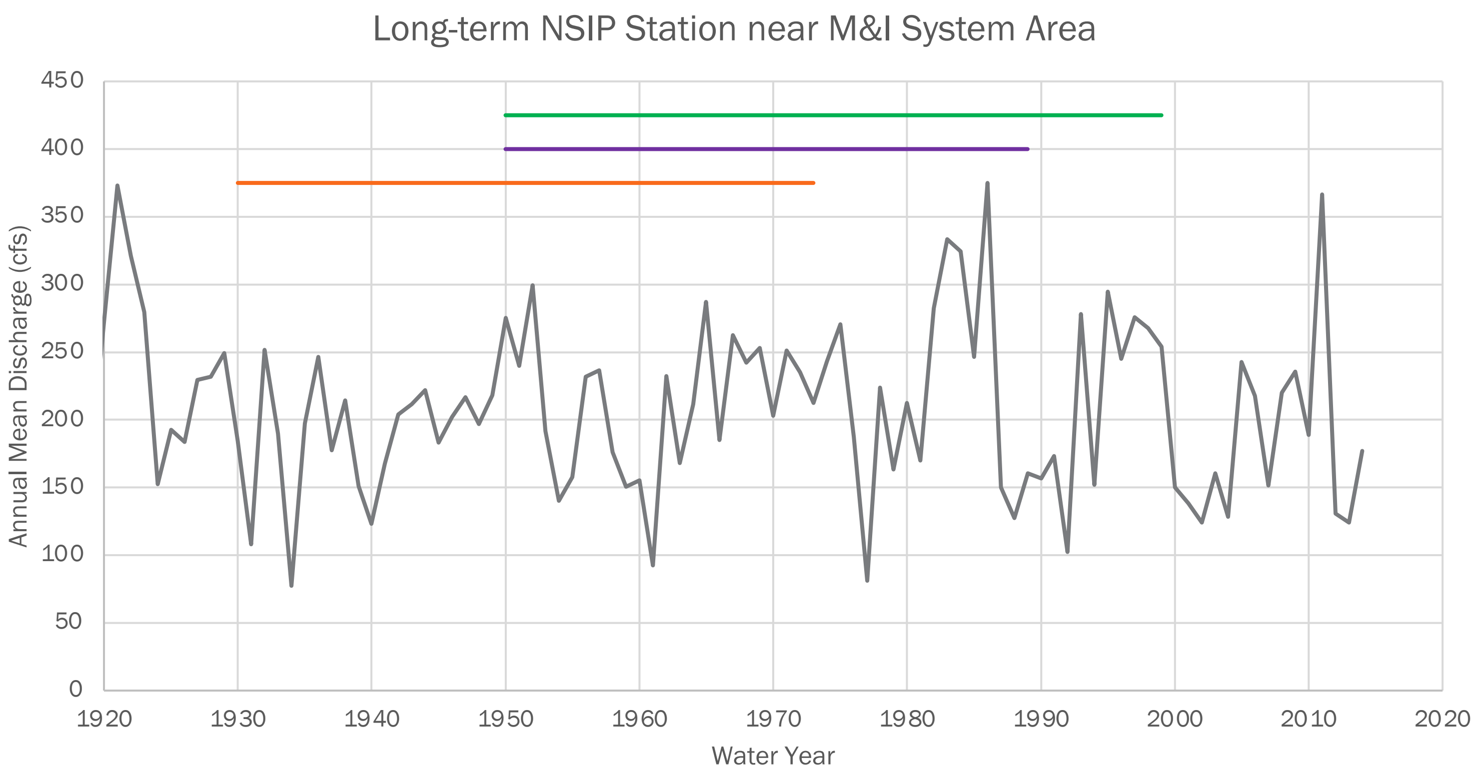
VARIABILITY IN HYDROLOGIC PERIOD OF RECORD

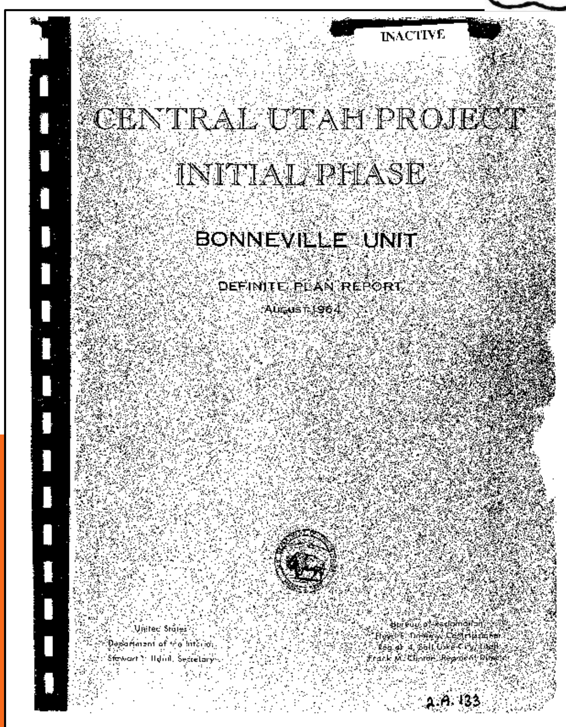
- 1979 Municipal & Industrial (M&I) System EIS: **1931 – 1973**
- 1987 Final Supplement to M&I System EIS: **1931 - 1973**
- 1998 CUPCA – Provo River Simulation Model (PROSIM): **1950-1989**
- 2004 Supplement to the 1988 Definite Plan Report for the Bonneville Unit: **1950-1999**

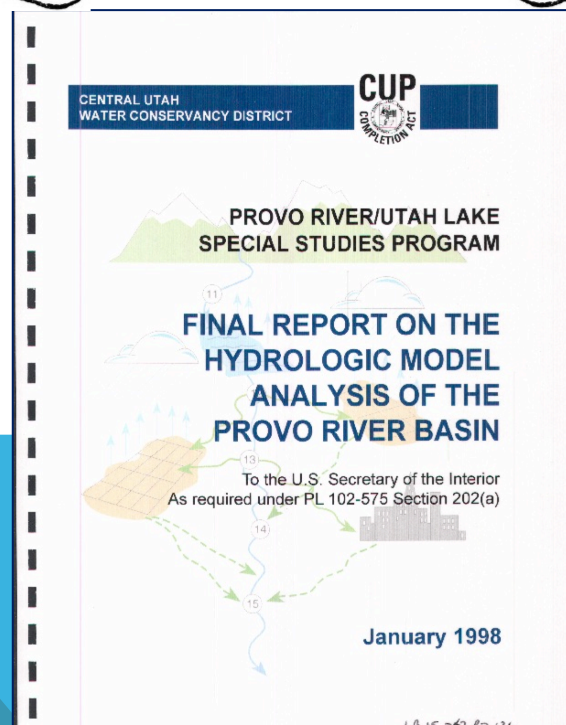


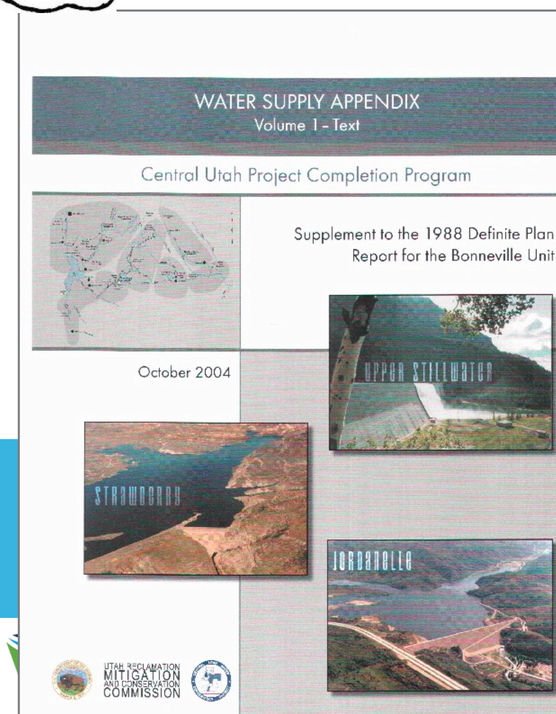
Source: USGS

“STANDING ON SHOULDERS”

CUP Bonneville Unit Water Supply Variability Model







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WHAT ARE THE GOALS OF THIS STUDY?

IMPROVE the reliability of the Central Utah Project water supply operations by:

1) **Evaluating the combinations of meteorological and operational conditions that stress the system.**

2) **Understanding the sensitivity to conditions that are more adverse than those that have been observed.**

3) **Developing a tool to aid in operating the system in advance of adverse conditions.**

CENTRAL UTAH WATER
CONSERVANCY DISTRICT

WHAT ARE THE GOALS OF THIS STUDY?

The goal is NOT to develop the perfect and ultimate DROUGHT Scenario that will please everyone and stress the system exactly as the future will! This is not likely to be possible.

Instead, the multiple scenarios that have and will be developed, will provide indications of the kinds of Droughts that might be experienced, and can be adjusted and tweaked in "What If" scenarios to estimate possible shortage situations.

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CENTRAL UTAH WATER CONSERVANCY DISTRICT

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PROJECT PURPOSE

1. **Improve understanding of severe drought conditions.**

2. **Examine the likelihood of future lower inflows**

3. **Aid in decision making**

4. **Educate the public about the potential for supply variability**

CENTRAL UTAH WATER
CONSERVANCY DISTRICT

FDR

PROJECT PURPOSE

1. **Improve understanding of severe drought conditions.**

   Develop tool and procedures to aid in recognizing and responding to potential adverse conditions.

2. **Examine the likelihood of future lower inflows**

3. **Aid in decision making**

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CENTRAL UTAH WATER
CONSERVANCY DISTRICT

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CENTRAL UTAH WATER CONSERVANCY DISTRICT

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2. **Examine the likelihood of future lower inflows**

   Estimate the kinds of extreme drought scenarios which could occur.

3. **Aid in decision making**

   Protect the reliability of water supplies by proactive response.

   Predict the magnitude of water supply impacts.

4. **Educate the public about the potential for supply variability**

CENTRAL UTAH WATER CONSERVANCY DISTRICT

STUDY COMPONENTS

Evaluate and Select Model Platform

Develop Conceptual Model

Implement on Selected Platform

Develop Historical Hydrology

Develop Adverse Hydrology

Develop Predictive Model Capabilities

RiverWare© was Selected

General purpose river system simulator

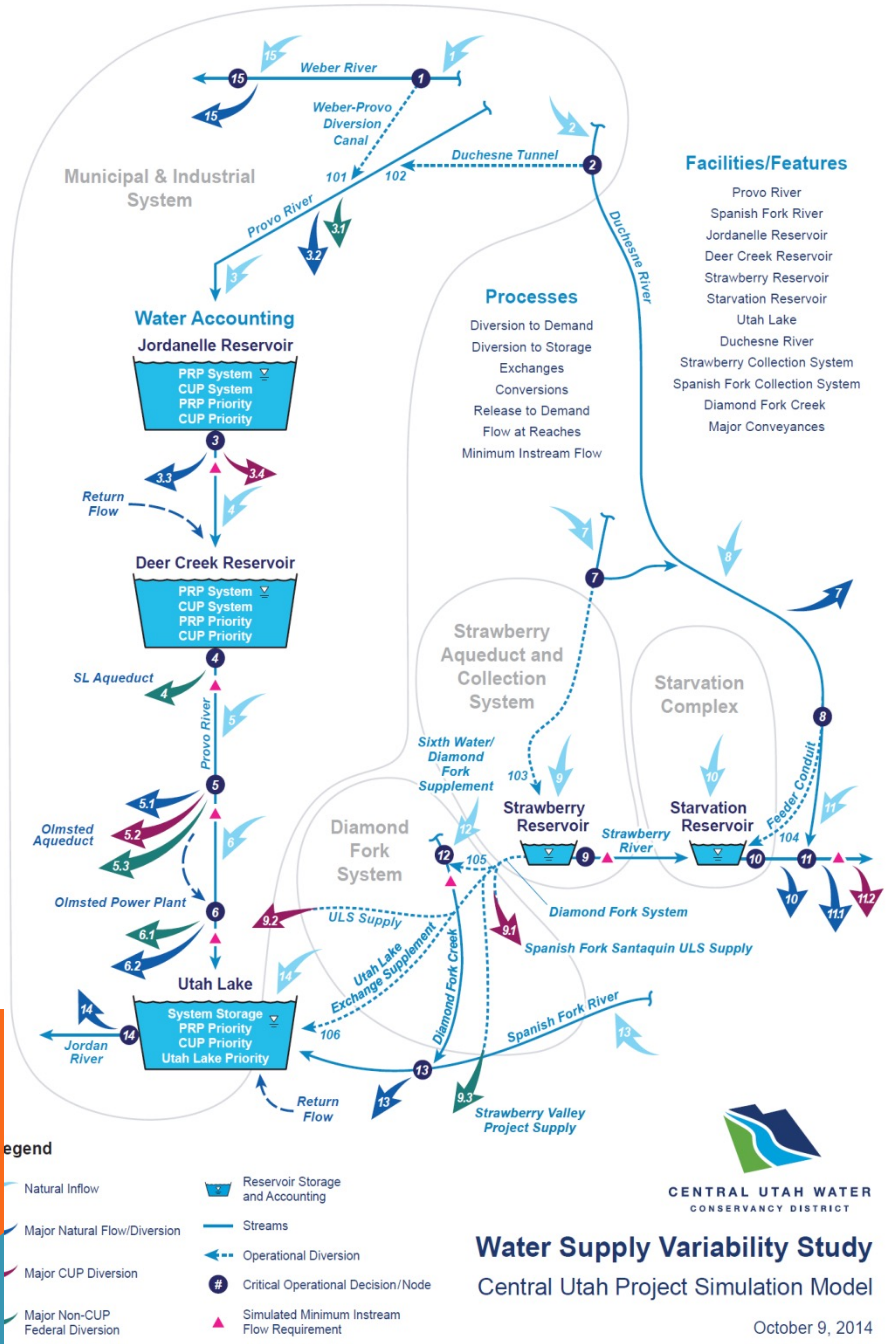
Widely used and accepted

Fully maintained and supported

Allows inclusion of detailed policies

Relatively easy to use

System Overview and CUPSIM Model Schematic



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HISTORICAL HYDROLOGY

Inflows and Demands taken from PROSIM Model plus Bonneville Unit Definite Plan Report, which extensively verified the M&I System supply

Data Extended to 1950 – 2009 by correlation

15 Inflow Nodes, 20 Demands, 5 Reservoirs (with up to four accounts each)

ADVERSE HYDROLOGY DEVELOPMENT

Three Datasets Developed – 60 years of ADVERSE Hydrology:

- Observed Resampled Approach
- Paleo Sampled Approach
- Downscaled GCM Projected Approach

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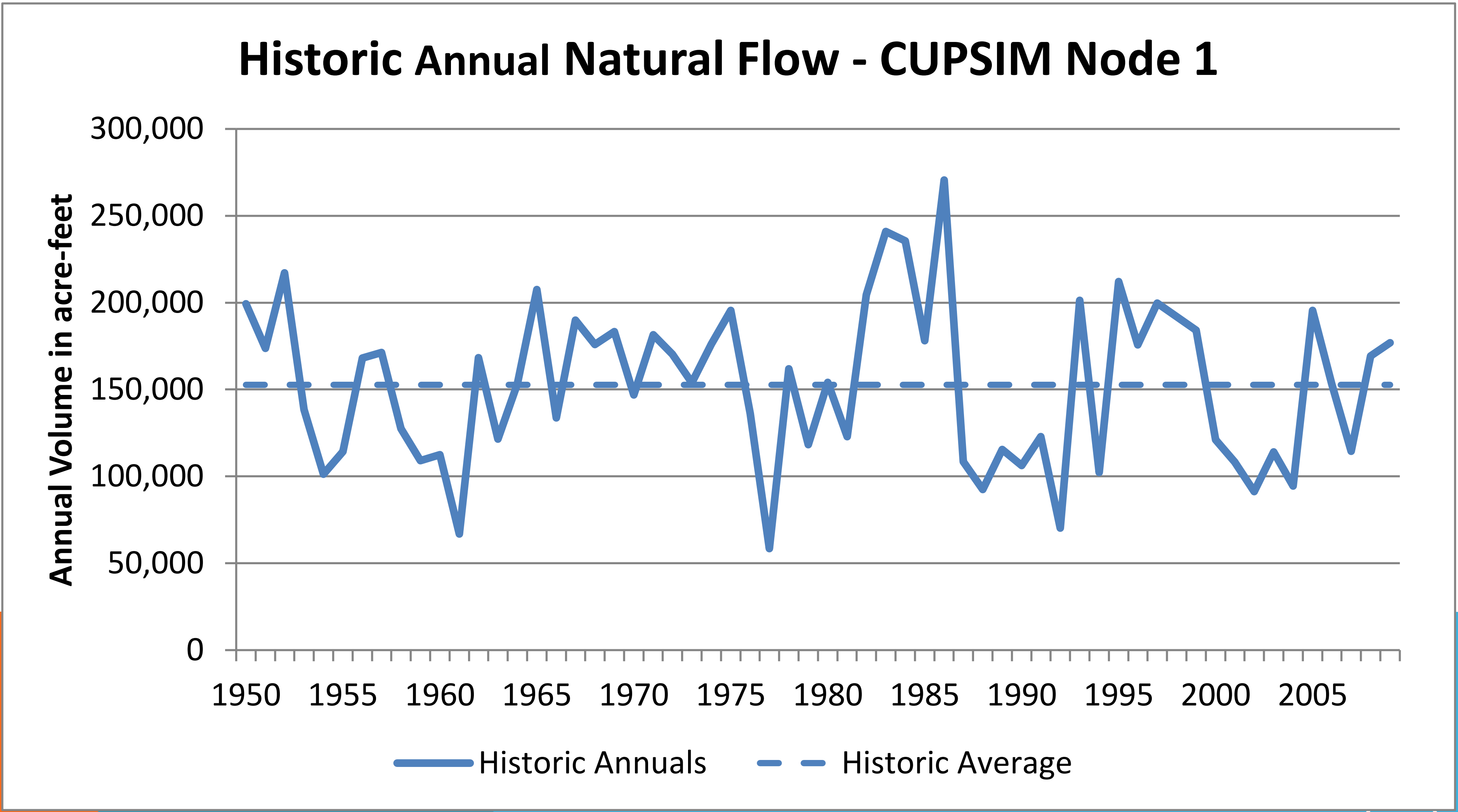
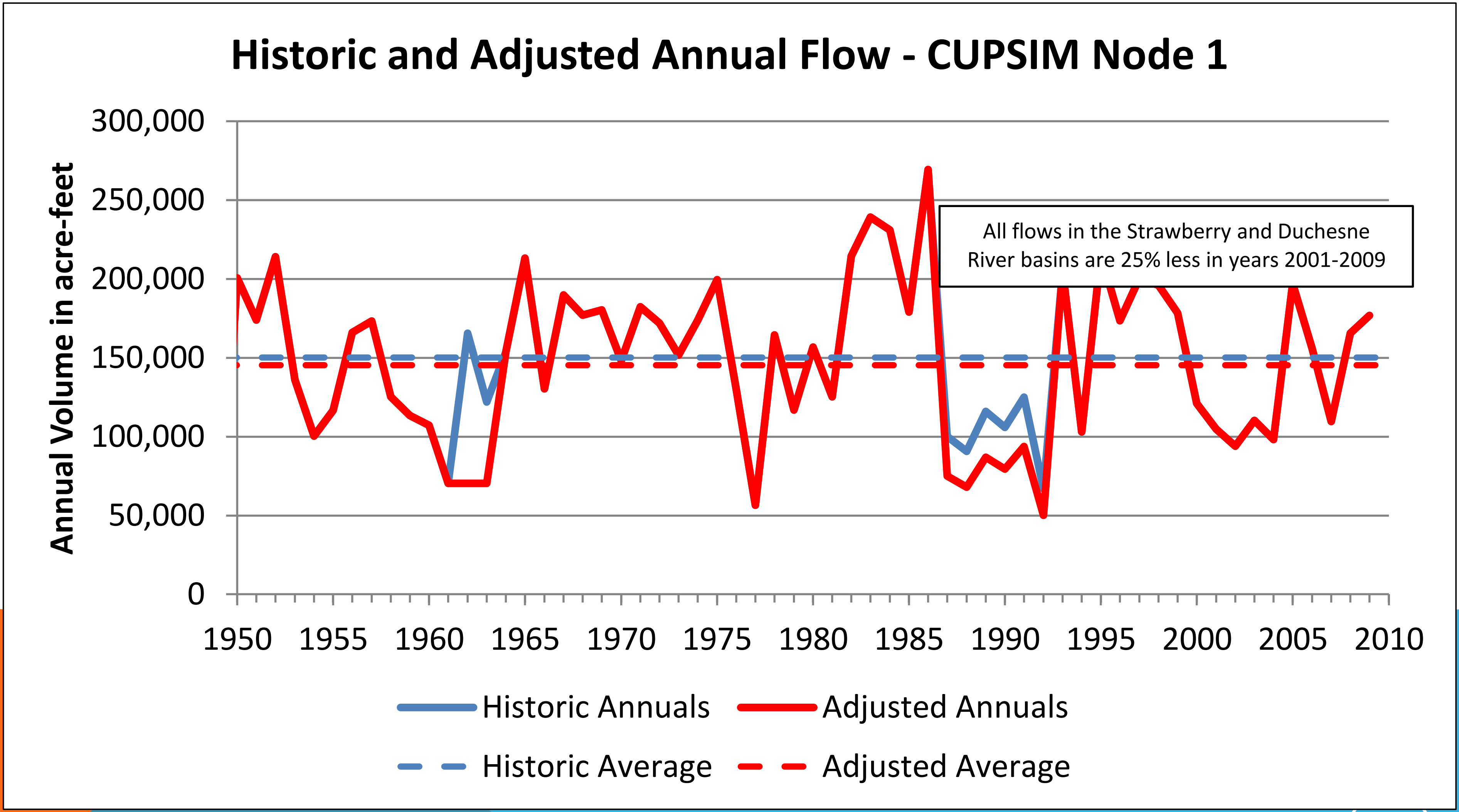
OBSERVED HYDROLOGY



OBSERVED RESAMPLED HYDROLOGY

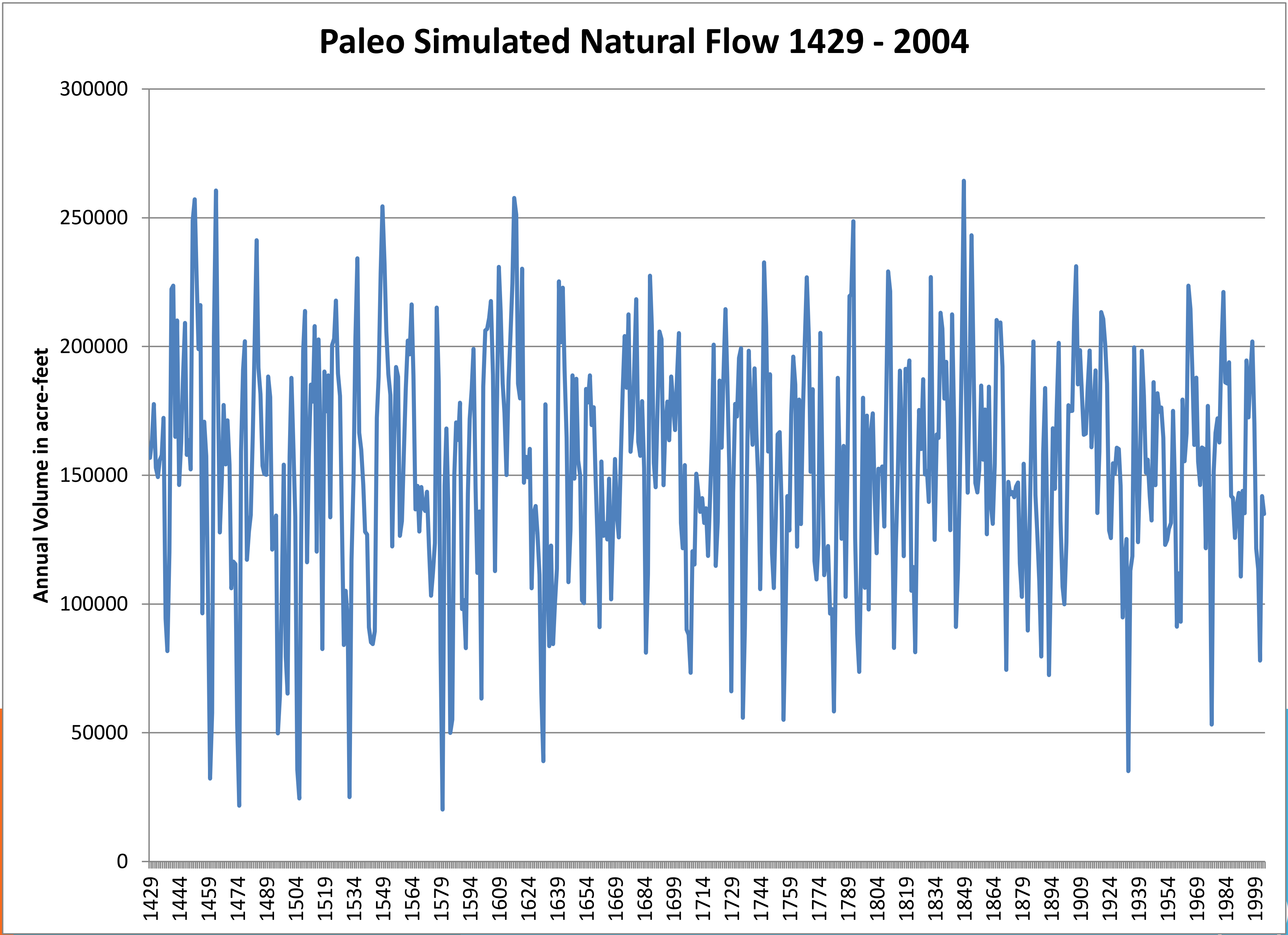


PALEO HYDROLOGY

Weber River Study developed 576 years of naturalized data.

A subsequent Bear River study developed 1,200 years. This has not yet been incorporated

A study of the upper Provo River is expected soon.


Paleo Simulated Natural Flow 1429 - 2004
Annual Volume in acre-feet
300000
250000
200000
150000
100000
50000
0
1429
1444
1459
1474
1489
1504
1519
1534
1549
1564
1579
1594
1609
1624
1639
1654
1669
1684
1699
1714
1729
1744
1759
1774
1789
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1819
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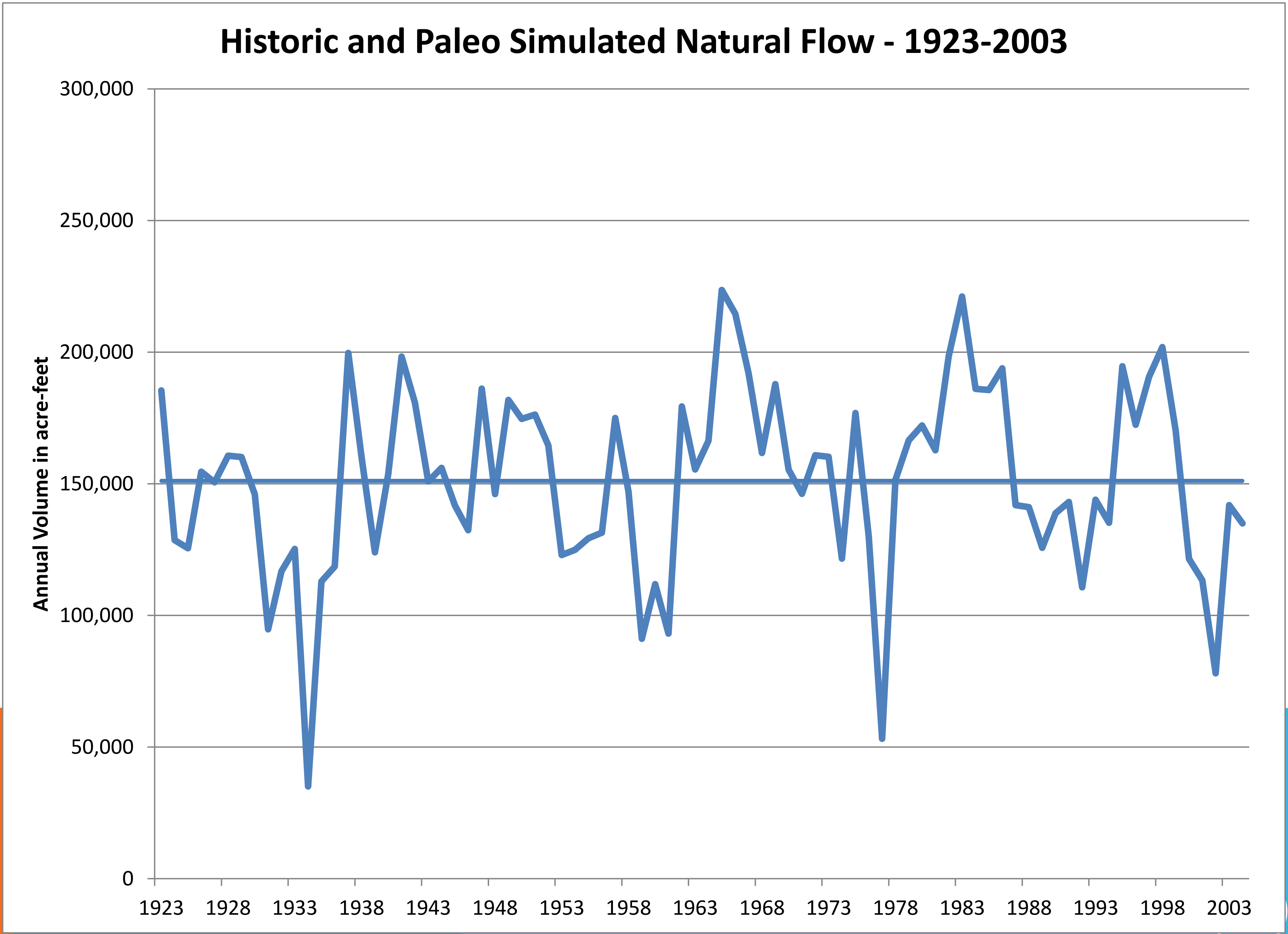
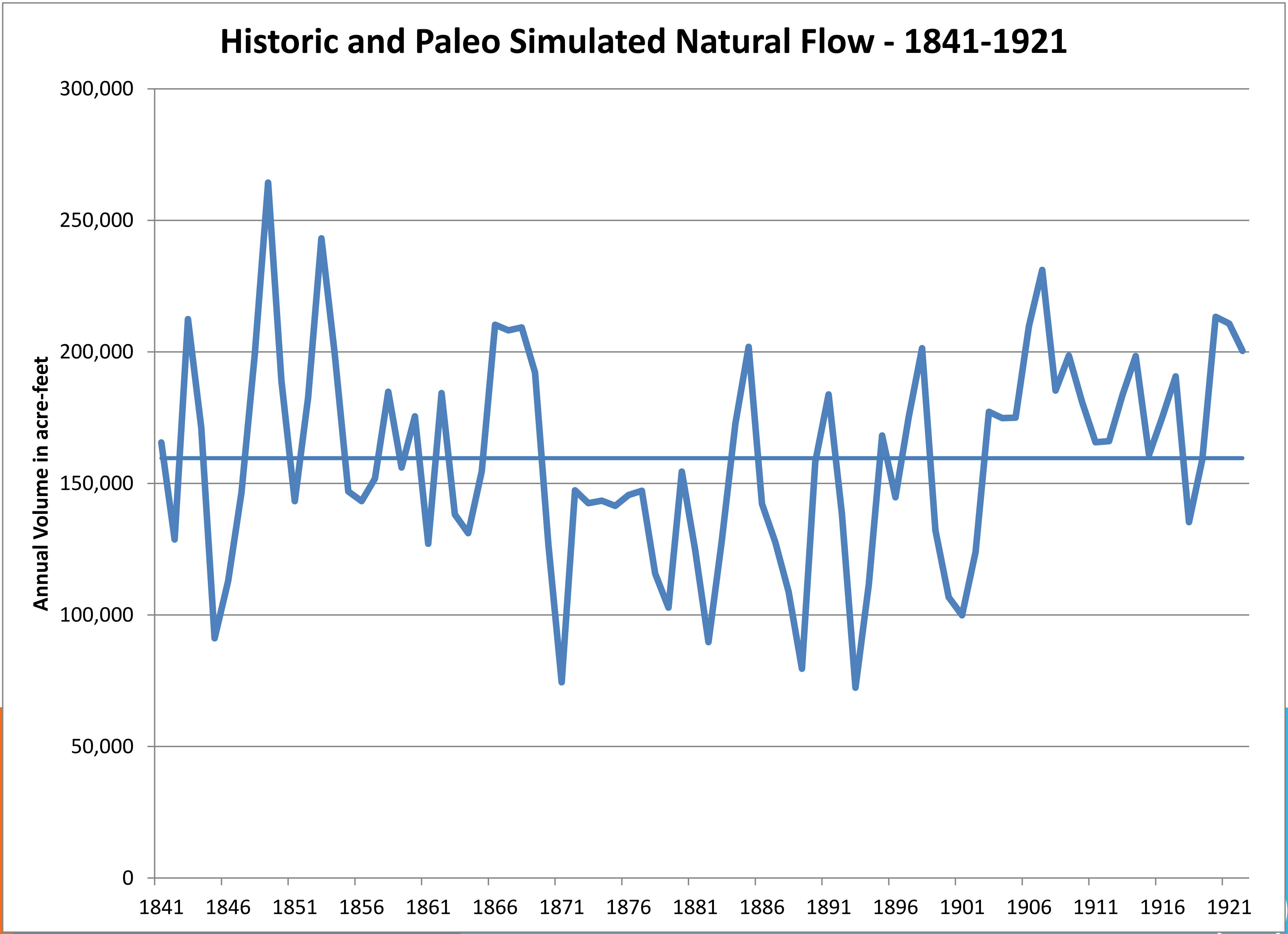
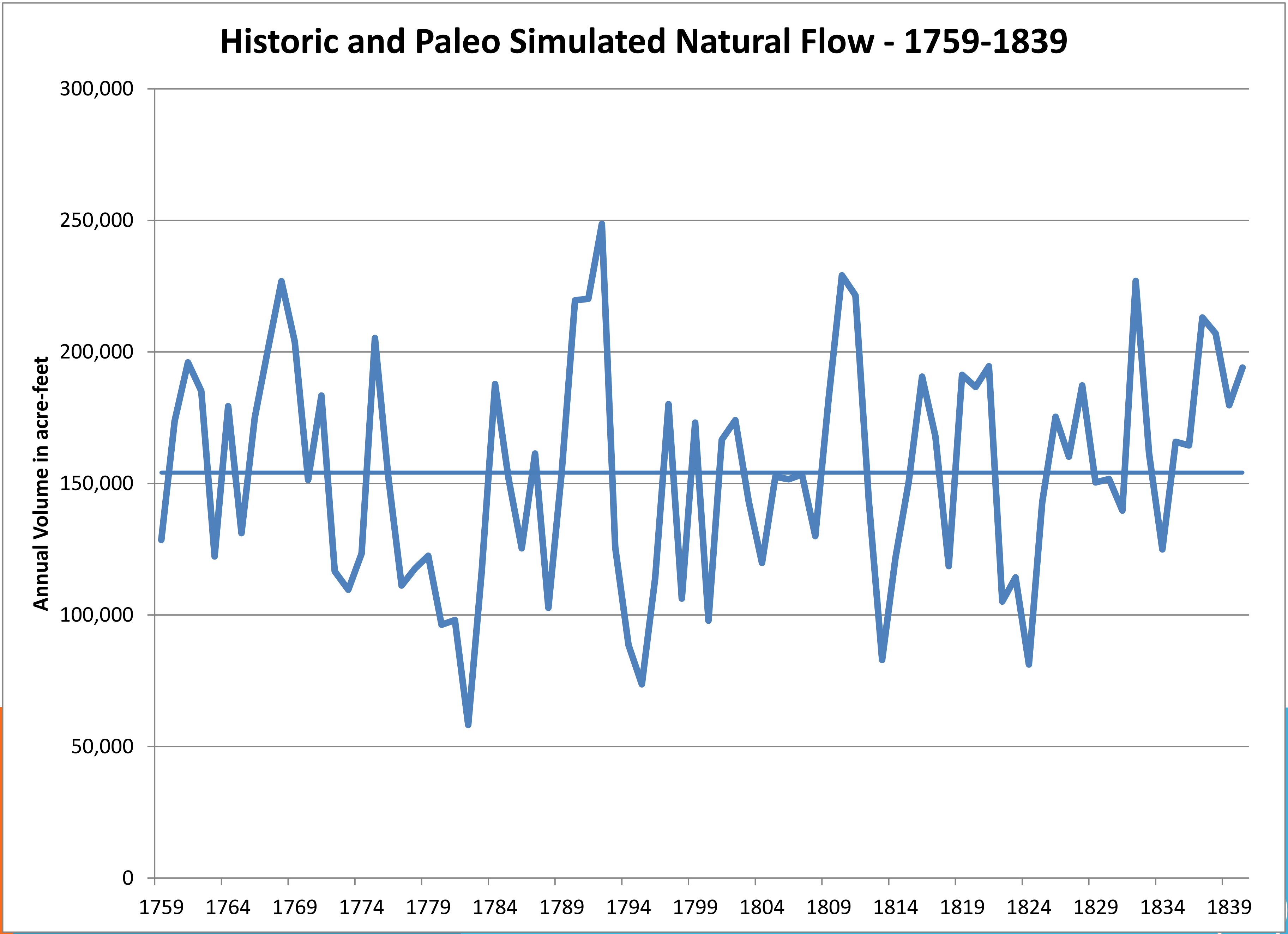
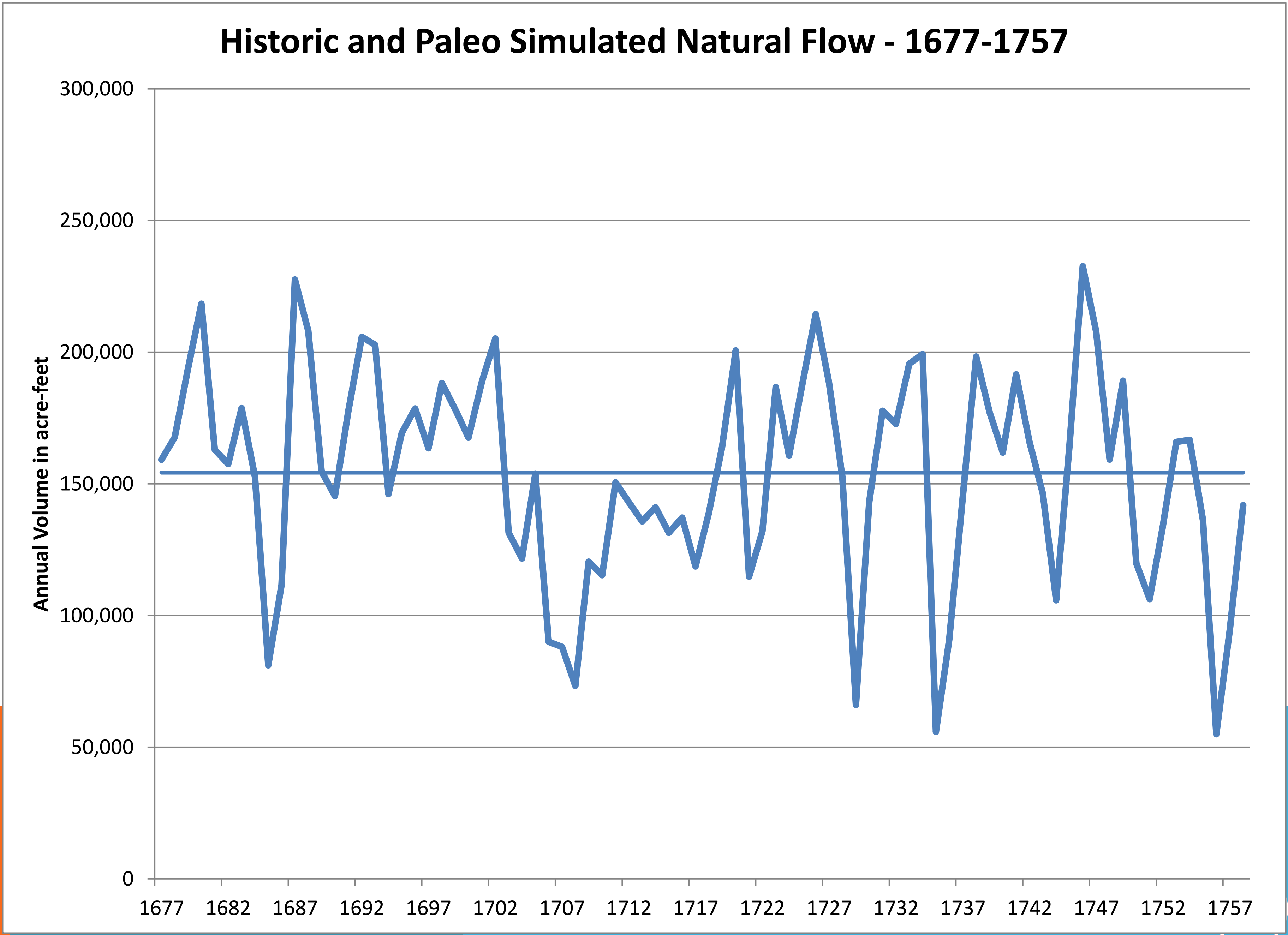
1939
1954
1969
1984
1999

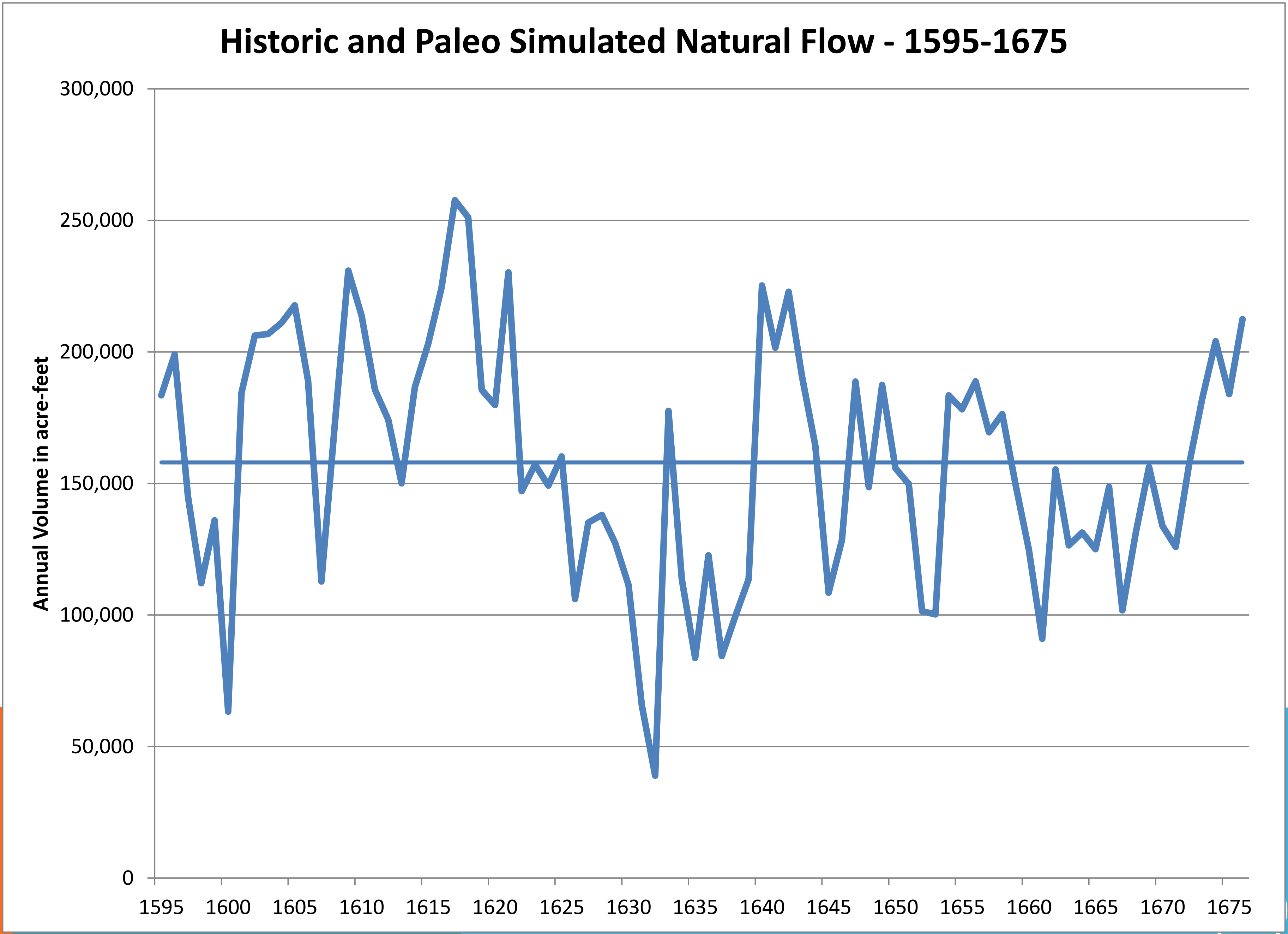

Historic and Paleo Simulated Natural Flow - 1923-2003
Annual Volume in acre-feet
300,000
250,000
200,000
150,000
100,000
50,000
0
1923
1928
1933
1938
1943
1948
1953
1958
1963
1968
1973
1978
1983
1988
1993
1998
2003

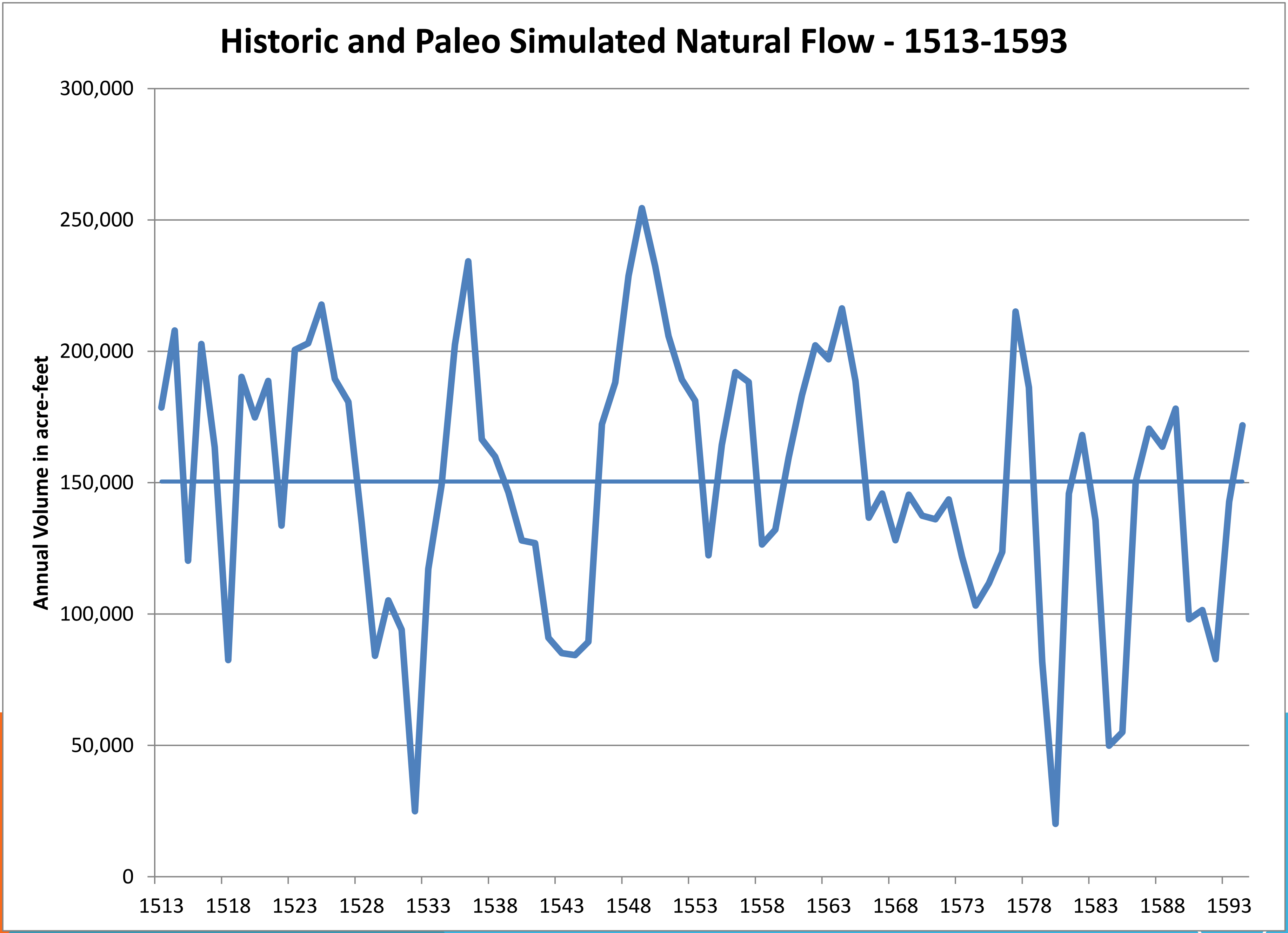

Historic and Paleo Simulated Natural Flow - 1841-1921
Annual Volume in acre-feet
300,000
250,000
200,000
150,000
100,000
50,000
0
1841
1846
1851
1856
1861
1866
1871
1876
1881
1886
1891
1896
1901
1906
1911
1916
1921


Historic and Paleo Simulated Natural Flow - 1759-1839
Annual Volume in acre-feet
300,000
250,000
200,000
150,000
100,000
50,000
0
1759
1764
1769
1774
1779
1784
1789
1794
1799
1804
1809
1814
1819
1824
1829
1834
1839



Historic and Paleo Simulated Natural Flow - 1677-1757
Annual Volume in acre-feet
300,000
250,000
200,000
150,000
100,000
50,000
0
1677
1682
1687
1692
1697
1702
1707
1712
1717
1722
1727
1732
1737
1742
1747
1752
1757


Historic and Paleo Simulated Natural Flow - 1595-1675
Annual Volume in acre-feet
300,000
250,000
200,000
150,000
100,000
50,000
0
1595
1600
1605
1610
1615
1620
1625
1630
1635
1640
1645
1650
1655
1660
1665
1670
1675



Historic and Paleo Simulated Natural Flow - 1513-1593
Annual Volume in acre-feet
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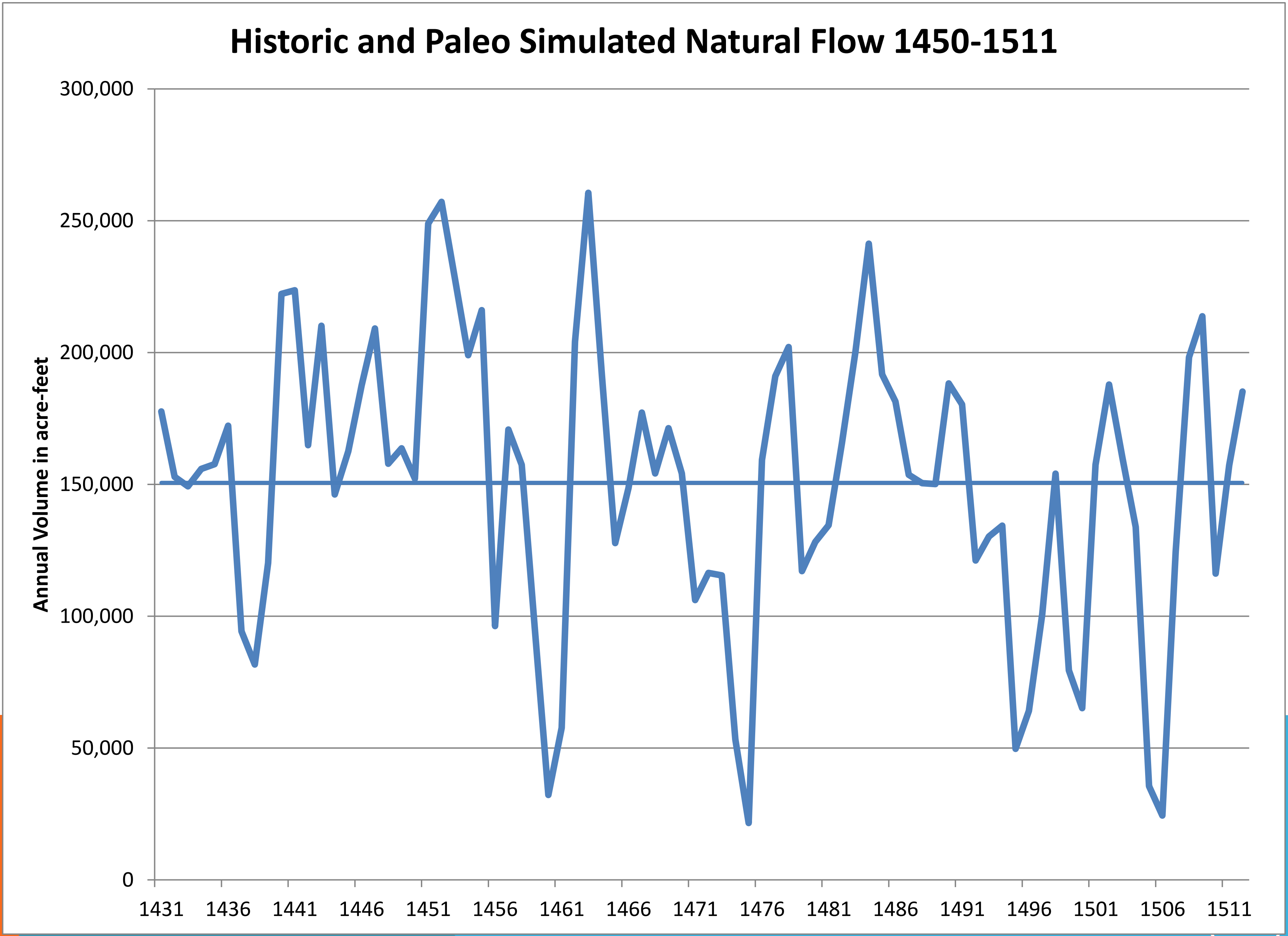
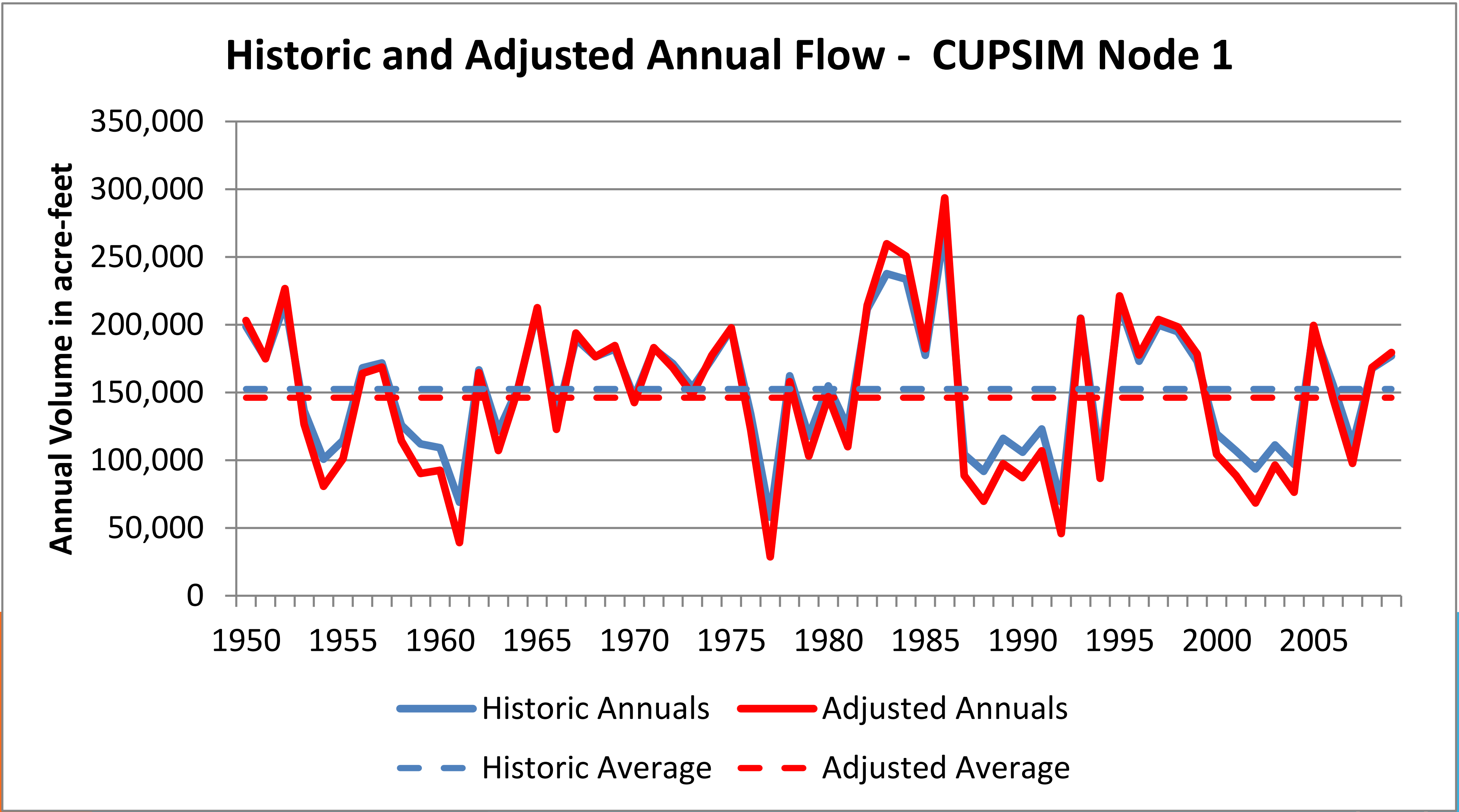
250,000
200,000
150,000
100,000
50,000
0
1513
1518
1523
1528
1533
1538
1543
1548
1553
1558
1563
1568
1573
1578
1583
1588
1593

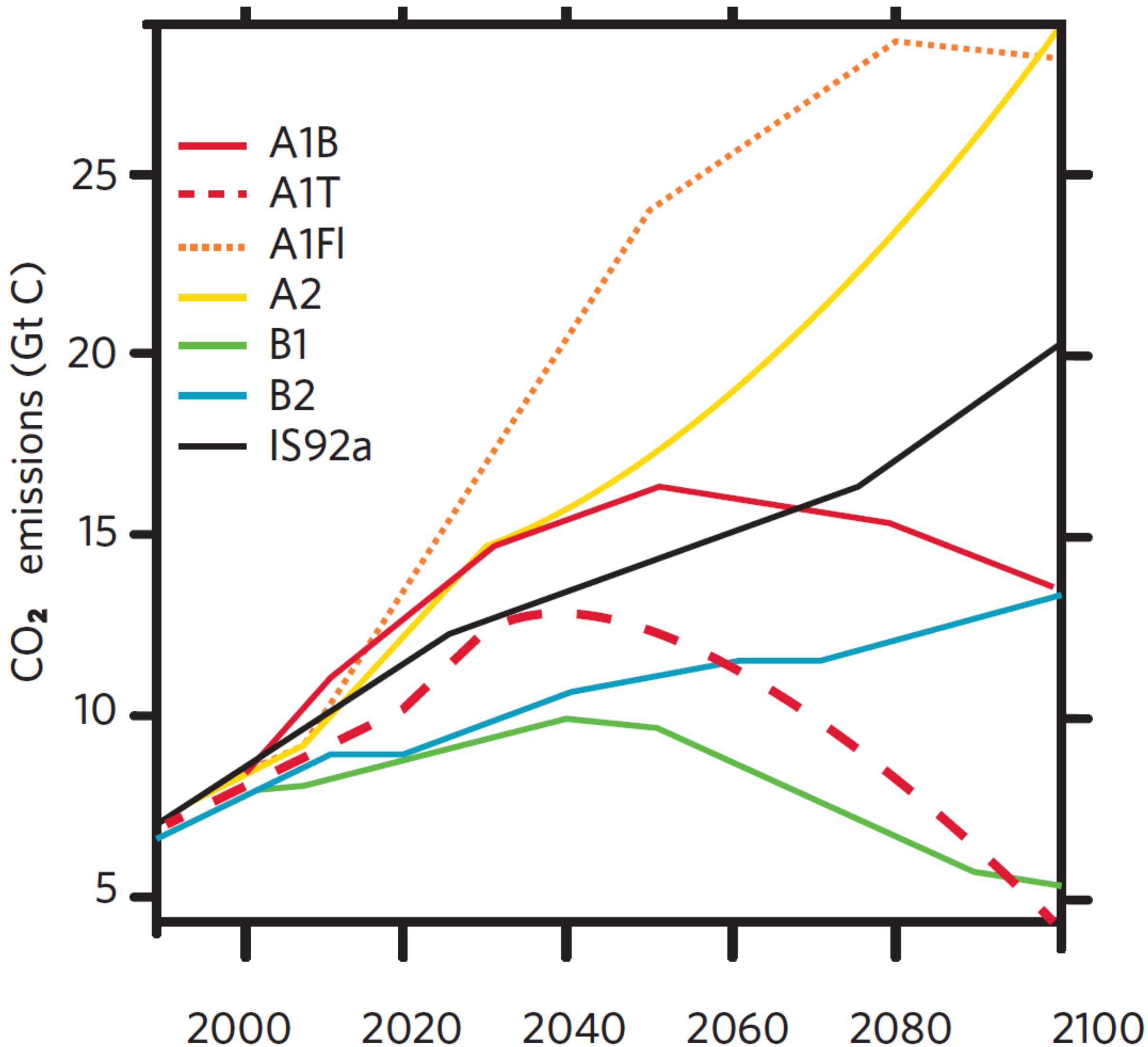


Historic and Paleo Simulated Natural Flow 1450-1511
Annual Volume in acre-feet
300,000
250,000
200,000
150,000
100,000
50,000
0
1431
1436
1441
1446
1451
1456
1461
1466
1471
1476
1481
1486
1491
1496
1501
1506
1511

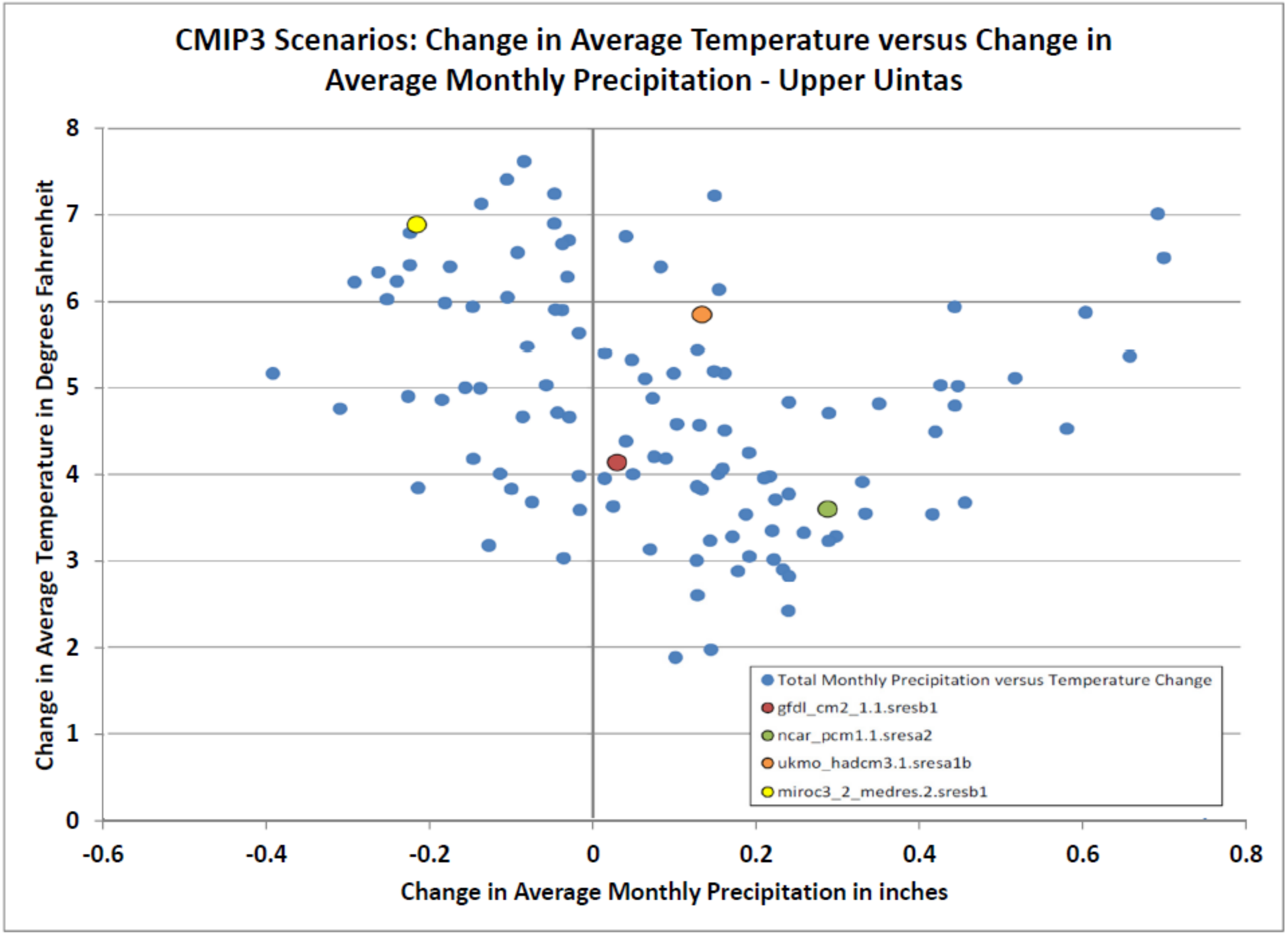
PALEO SAMPLED HYDROLOGY



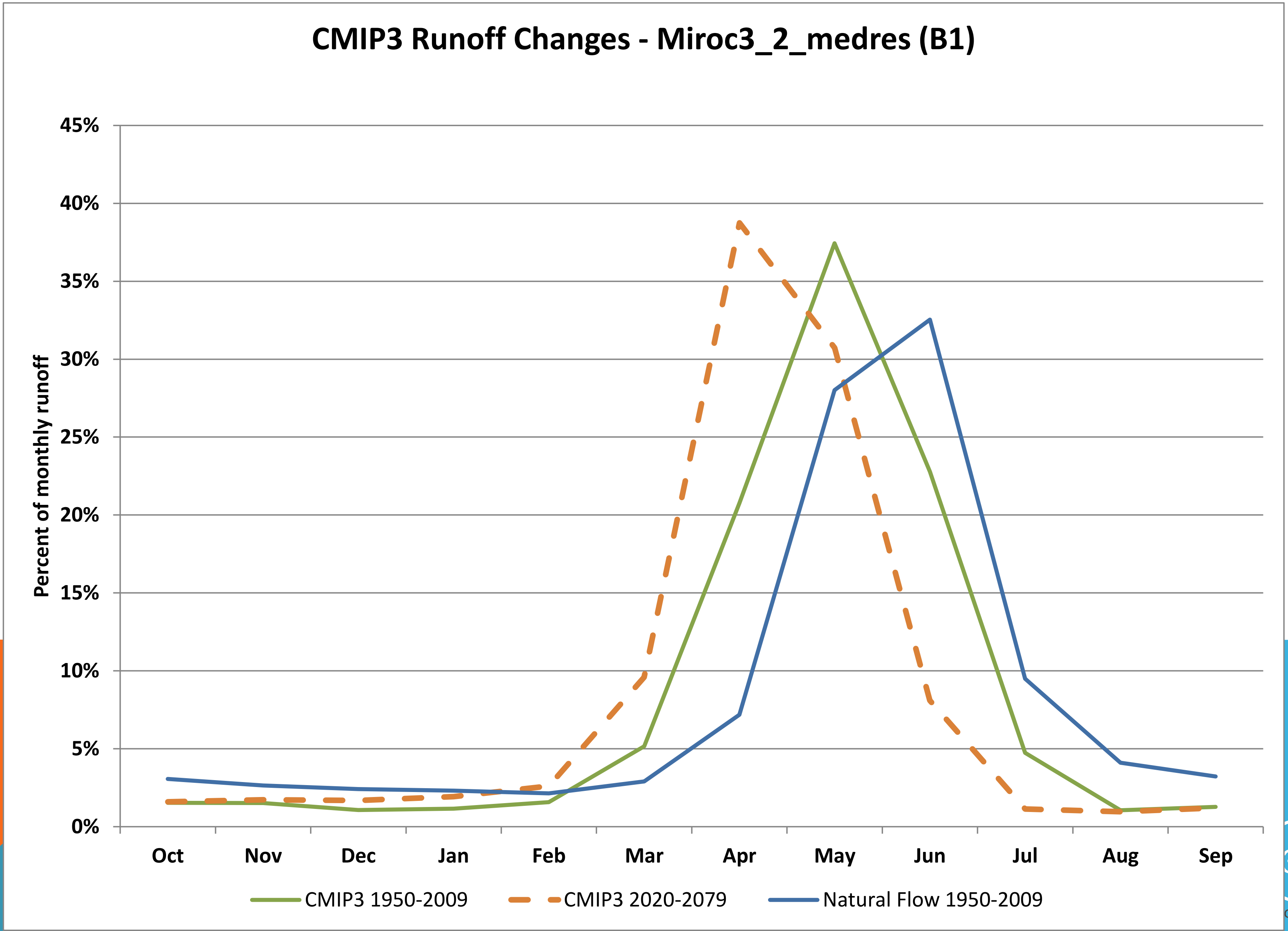
GCM PROJECTED FUTURE SCENARIOS



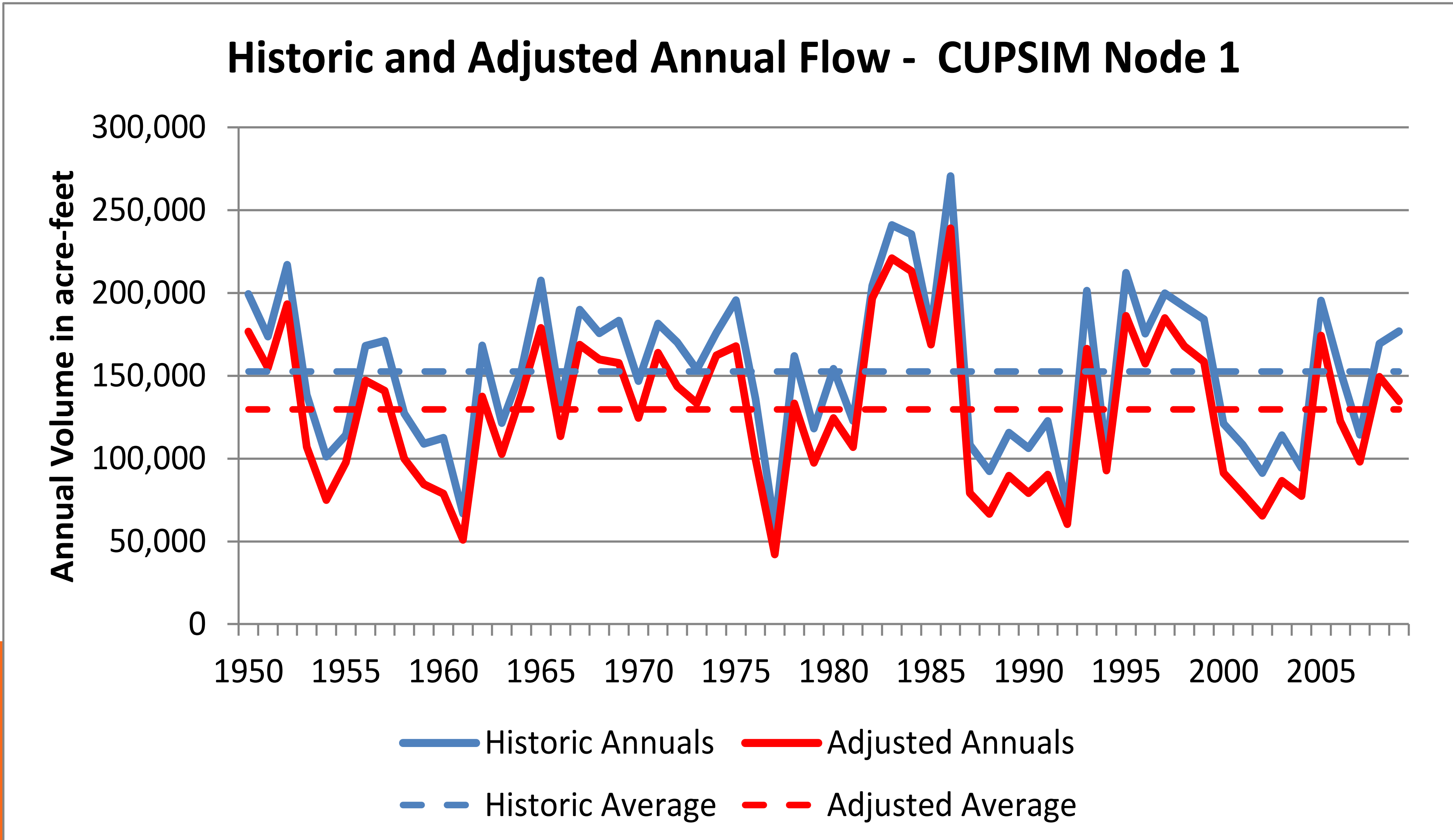
GCM PROJECTED FUTURE SCENARIOS



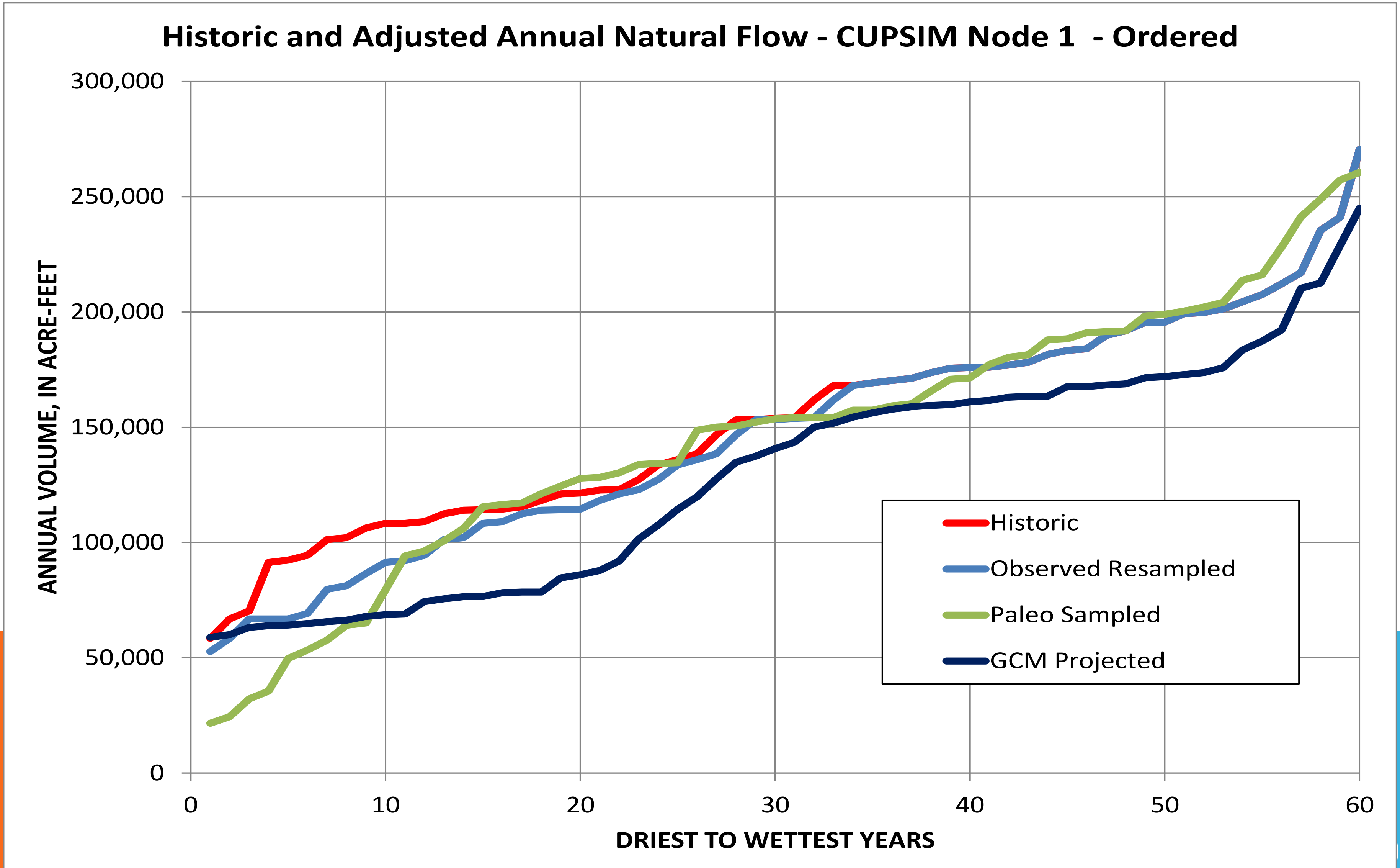
GCM PROJECTED HYDROLOGY



GCM PROJECTED HYDROLOGY



SUMMARY OF ADVERSE HYDROLOGY



CUPSIM MODEL RESULTS

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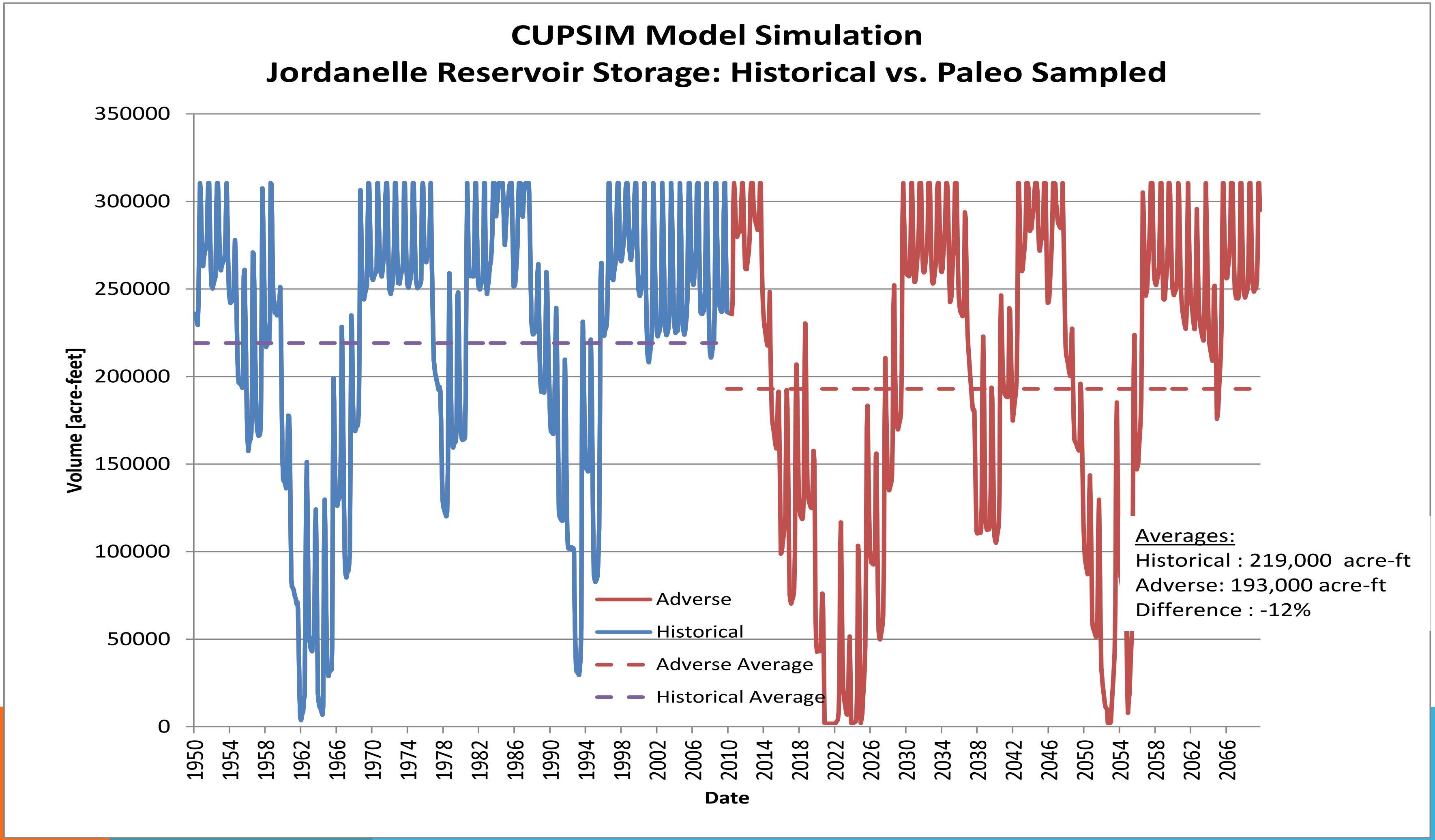

CENTRAL UTAH WATER CONSERVANCY DISTRICT

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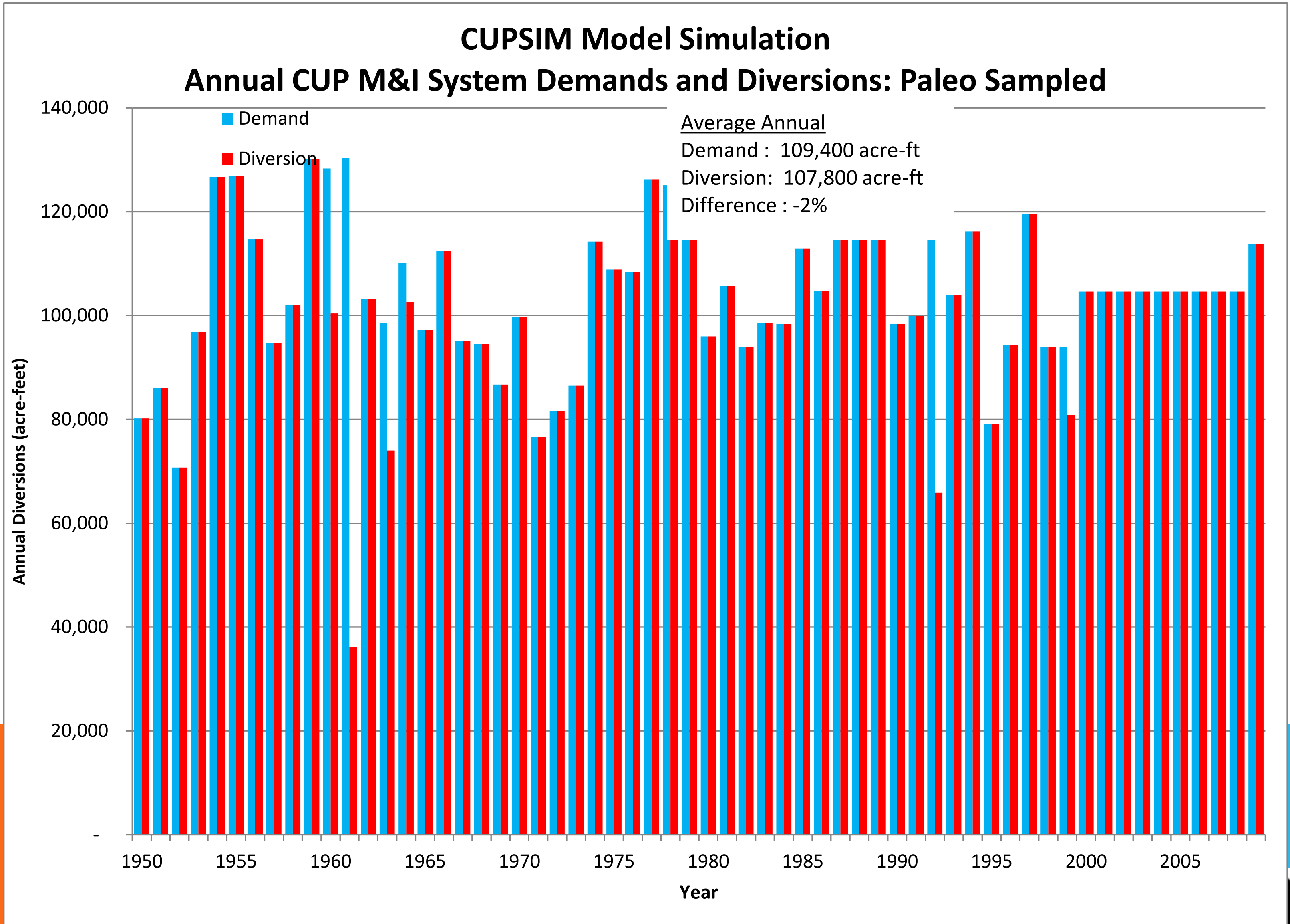
CUPSIM MODEL RESULTS



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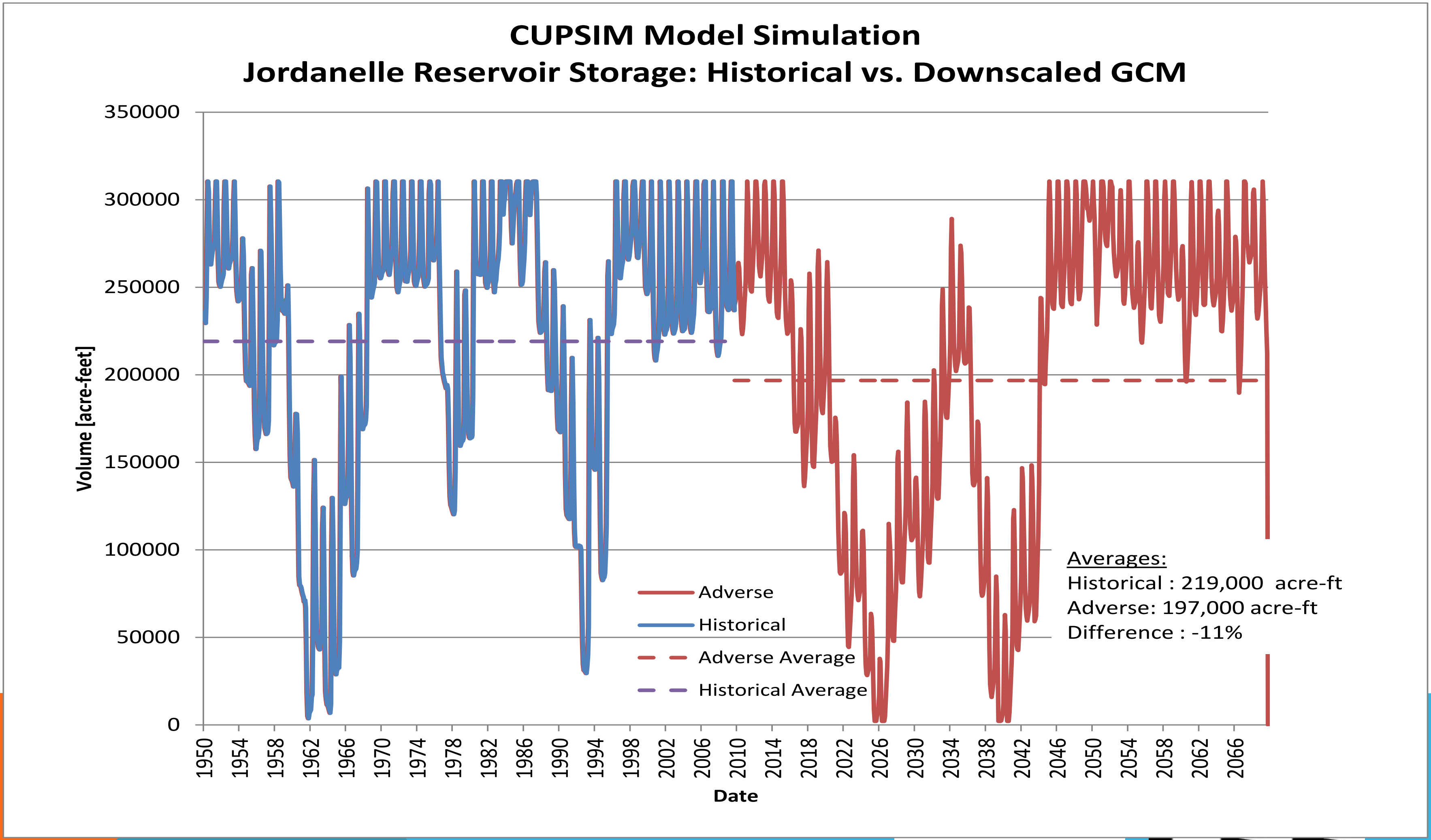
CUPSIM MODEL RESULTS



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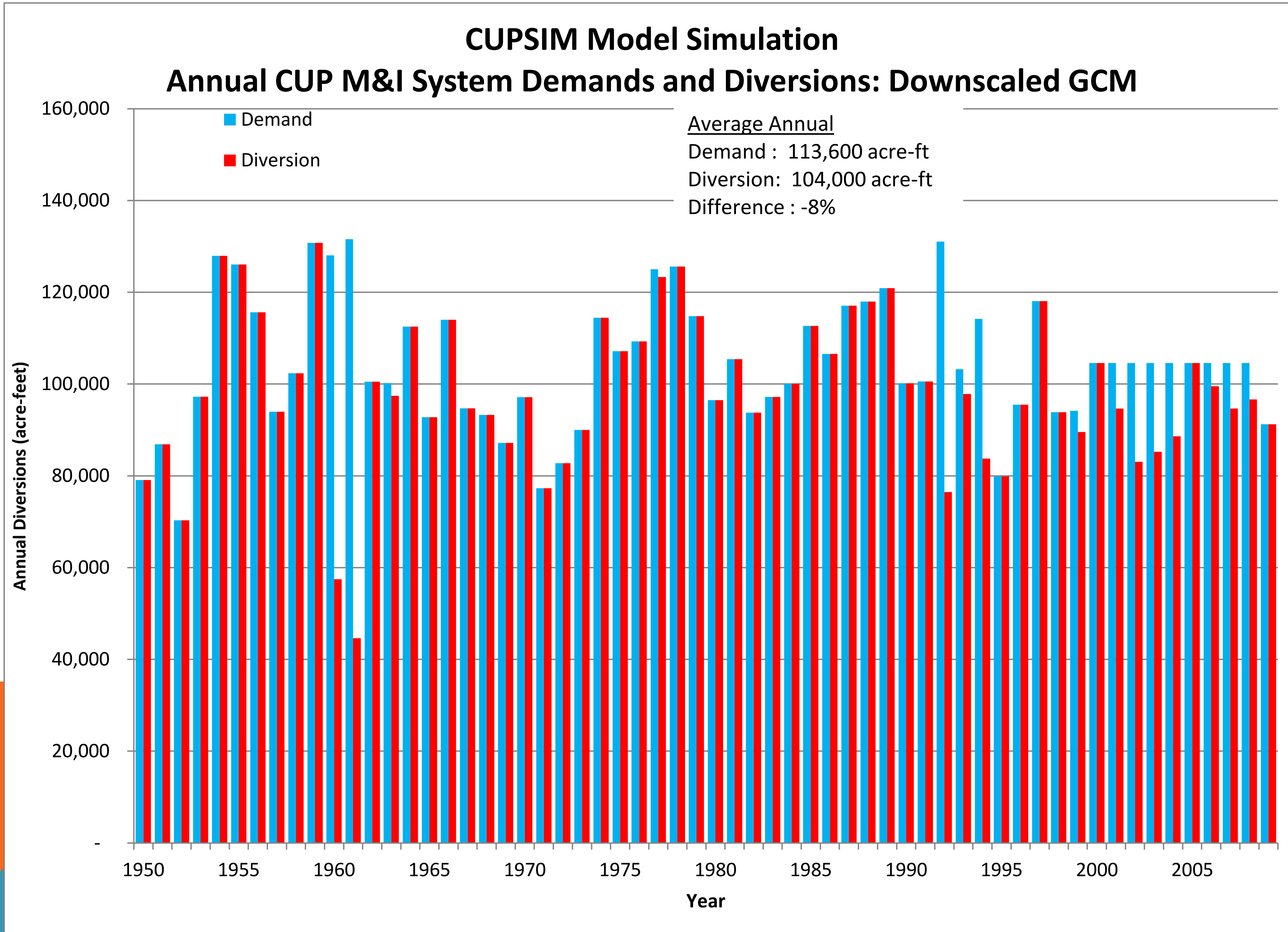

QUESTIONS?

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