AGENDA

RIO GRANDE REGIONAL WATER PLANNING GROUP (RGRWPG) (REGION M)

Groundwater/Surface Water Modeling Subcommittee

9:30 A.M. WEDNESDAY, APRIL 17, 2024

LRGVDC MAIN CAMPUS
INITIATED AND CHAIRED VIA GoToMeeting & IN PERSON AT
301 W. RAILROAD ST., WESLACO, TEXAS

Virtual access is available at: https://meet.goto.com/706881013

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Access Code: 706-881-013
United States: +1 (872) 240-3212

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1. Background and Purpose of Meeting ..... Jaime Burke
   Black & Veatch

2. Public Comment ..... Subcommittee Members

3. Discussion of WAM Modeling Results ..... Kirk Kennedy
   Kennedy Resource Company

4. Additional Q&A ..... Jaime Burke and Kirk Kennedy

Rio Grande RWPG Committee Meeting:

Groundwater/Surface Water Modeling

2026 Region M Regional Water Plan

April 17, 2024

BLACK & VEATCH

1. Background and Purpose

- Technical Memorandum presentation at Feb 21st Region M meeting
- Questions asked about surface water modeling methodology and results
- Suggested a subcommittee meeting be held to answer questions in more detail

Table 1: Reservoir Firm Yields Using Rio Grande WAM Run 3 and Modified Rio Grande WAM Run 3

SOURCE	FIRM YIELD FROM UNMODIFIED WAM RUN 3 [A] (ACFT/YR)		FIRM YIELD FROM MODIFIED WAM RUN 3 [A] (ACFT/YR)	
	2030	2080	2030	2080
Amistad-Falcon Reservoir System	999,768	990,268	1,001,776	995,863
Casa Blanca Lake/Reservoir	600	412	600	412

Notes:

A Firm yields incorporate sedimentation

2. Public Comments

3. Discussion of WAM Modeling Results

Guide of Presentation Details

Presenter: Kirk Kennedy, Kennedy Resource Company

WAM Overview

- Naturalized Flow (Input)
- WAM Model (Output)
- WAM Structure

Two WAM's will be Discussed

- TCEQ RUN3
- Region M Supply

WAM Extractions of Select Treaty Related Waters

Firm Annual Yield of the Amistad/Falcon System

- How the Yield calculation is Made.
- Review Tables and Plots of Various WAM Results

All Quantities are in Acre-Feet


Fort Quitman, Texas
Pecos River
Devils River
San Felipe Creek
Pinto Creek
Alamito Creek
Terlingua Creek
Rio Conchos
Amistad Reservoir
A De Las Vacas
Rio San Diego
Rio San Rodrigo
Rio Escondido
Rio Salado
Falcon Reservoir
Rio Alamo
Rio San Juan
TEXAS
MEXICO
N

Rio Grande Water Availability Model (WAM) Overview

Two Distinct Parts

- Naturalized Flow (Nat Flow)
- WAM Model

Part 1 - Nat Flow - Process outside of WAM

Used to Develop Inflows to WAM

Observed flows with all major historical water supply activities adjusted for (reversed out)

- Historical diversions added back in.
- Historical return flows subtracted out.
- Water stored in reservoirs added back in (and releases subtracted out).
- Evaporation losses added back in.

Result:

- Flow that would have occurred without major water supply activities
- Period of Record was 1940-2000; now extended through 2018.
- Critical Drought Period had not ended in 2000, Firm Yield Now Less
- 2001-2018 Period for Mexico Done Differently

Rio Grande WAM Overview (continued)

TCEQ manages/updates WAM for water rights permitting and TWDB uses for water planning.

Rio Grande WAM Logic

- Uses two parallel (and separate) rivers, one for each country (US and MX)
- Each Country has Separate Pools in Amistad and Falcon
- Mixed Priority Logic
  - (1) MX: Upstream to Downstream
  - (2) US: Upstream of Amistad and Falcon, Prior Appropriation
  - (3) US: Amistad and Falcon Associated Rights, Type of Use
- A few US Amistad/Falcon rights are both (2) and (3)
- The large number of US Amistad and Falcon Water Rights have been condensed into a minimal number of Water Rights that represent the entire volume of water authorized.

Rio Grande WAM Overview (continued)

Various Agreements Implemented by Moving Water Between US and MX

- Rio Grande Compact (Rio Grande Project)
- Pecos River Compact
- 1944 Treaty (US and MX)

- Begins at El Paso (Colorado and New Mexico ***not*** Simulated)
- Imposes a Future Condition on the Nat Flows
- Single Representation of Both Countries' Activities are Simulated Against the Nat Flow Condition for the Entire Period of Record
- Have to Add Together US and MX flow at Mainstem Gages to get Result Comparable to Gaged Flow
- Not all elements of 1944 Treaty are Implemented
- **NOT** an Operational Model

TCEQ Run 3 Representation

For US Side:

- Full Authorized Storage with Demands set to Authorized Amounts
- Watermaster Rules are implemented for Amistad and Downstream
  - Domestic/Municipal/Industrial – Always met.
  - Class A and Class B – Allocated Inflows After DMI Pool and Other Reserves are Deducted from Inflows.
  - Class A Water Rights Represent Larger Authorization and are Also Allocated More Inflows than Class B Water Rights.
- Upstream of Amistad and Falcon – Priority is by Priority Date and made Senior to All Amistad/Falcon US Water Rights

- For MX Side:
  - As built Storage Amounts
  - Demands are set to “Concessions”
  - All MX Water Rights – Priority is Upstream to Downstream

Region M Supply Model Representation

Exactly Same As TCEQ RUN3, Except:

For US Side:

- Capacity in Major Reservoirs Reduced to Reflect Estimated Sedimentation
- Specific Changes to be Consistent with Other TWDB Planning Regions
- Demands Reduced to Determine Firm Annual Yields

Sedimentation Information Details

- For US Side, Sedimentation Condition Estimated for Major Reservoirs in Region M Planning Area
- Most recent sedimentation from IBWC used for Amistad and Falcon (~2014)
- Sedimentation Rate between most recent comparable surveys used to estimate future capacity
  - 5,543 af/y for Amistad (based on 2005 & 2014 IBWC surveys)
  - 537 af/y for Falcon (Based on 1992 & 2005 IBWC surveys)
- Separate WAM run made for each decade, 2030 thru 2080 and Firm Yield was Determined
- For MX Side, No Changes from TCEQ RUN 3

Firm Yield Determination – US Share of Amistad/Falcon

Definition of Firm Annual Yield

- The Maximum Annual Amount that can Diverted Each and Every Year, Including the Drought of Record, Without Shortage

Process to Determine Firm Annual Yield

- Both Countries Demands from Amistad/Falcon Must be set to Firm Yield of each County.
- Determination of Firm Yield is an Iterative Process:
    - MX Firm Yield is Simple and can be Automated in WAM.
    - US Firm Yield is complex and has to be hand Iterated After MX Yield is Solved.

General Steps to Determine US Share of Firm Annual Yield:

- Turn Off US Water Rights Below Amistad that are Authorized from Both Rio Grande and Tributaries.
- Overwrite (reduce) Class A and Class B Authorized Demands (trial and error).
- Set MX Demands from Amistad/Falcon to MX Firm Annual Yield.
- Refine Demand for Class A and Class B Water rights Until no Shortages Occur and with Minimal Water Remaining in US System Storage.

REVIEW OF WAM RESULTS

Table of US Share of Firm Annual Yield

- Previous Drought Period
- New Drought Period

Plots of Various Storage and Inflow Information Extracted from WAM

- Inflows from the Six Named Tribs in 1944 Treaty: (2/3 MX; 1/3 US)
- Inflows from the other MX Tribs in 1944 Treaty: (100% MX)
- Inflows from the US Tribs in 1944 Treaty: (100% US)
- Total US Inflows to Amistad
- US System Storage in Amistad/Falcon.
    - TCEQ Base WAM as Received
    - Region M 2030 Supply Model
    - Region M 2080 Supply Model

Inflows to Rio Grande at Fort Quitman and Downstream of Tribs and Between Mainstem gages shared 50/50 (not plotted)

1944 Treaty Allocations of the Waters of the Rio Grande
Fort Quitman to the Gulf of Mexico

Water Source	Ownership of Water	
	United States	Mexico
Rio San Juan	None	All
Rio Alamo	None	All
Rio Conchos *	1/3	2/3
Rio San Diego *	1/3	2/3
Rio San Rodrigo *	1/3	2/3
Rio Escondido *	1/3	2/3
Rio Salado *	1/3	2/3
Arroyo de Las Vacas *	1/3	2/3
Pecos River	All	None
Devils River	All	None
Alamito Creek	All	None
Terlingua Creek	All	None
San Felipe Creek	All	None
Pinto Creek	All	None

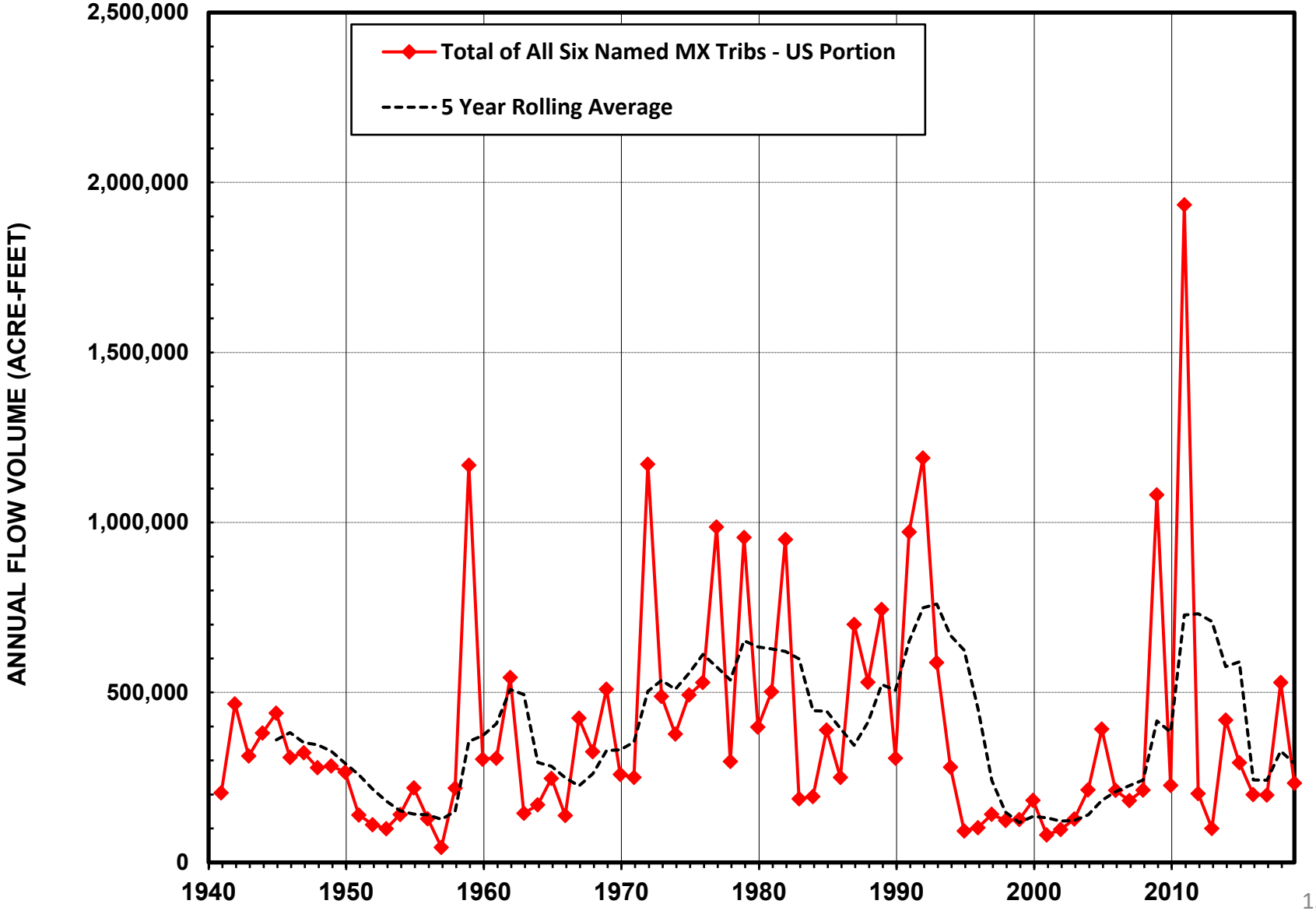
* Inflow shall not be less than an average of 350,000 acre-feet per year over cycles of five consecutive years.

CHANGES TO WAM – TOTAL AMISTAD AND FALCON CAPACITY

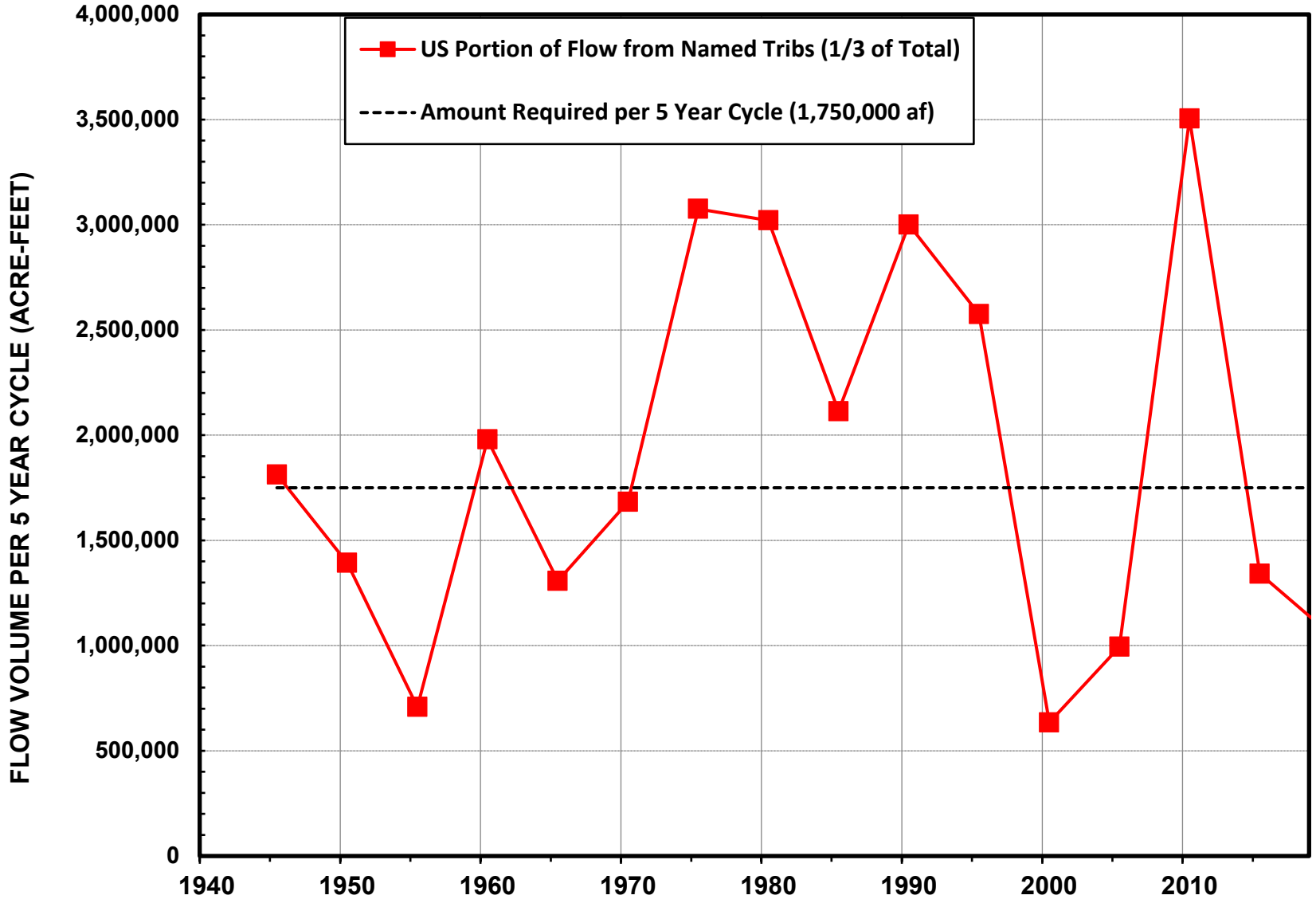
(1)	Model Name and Basis	TCEQ As Received	2030 Supply Reg M	2080 Supply Reg M
(2)	With San Solomon Springs Modification for Regions E & F.	No	Yes	Yes
(3)	With Upstream Monthly Irrigation Pattern for Regions E & F.	No	Yes	Yes
(4)	Total Combined Storage in Amistad and Falcon (US & MX)	5,923,000	5,796,212	5,492,233
(5)	Reduction from Base		126,788	430,767
(6)	Amistad (US & MX)	3,276,001	3,138,119	2,860,970
(7)	Reduction from Base (5,543 AF/Y)		137,882	415,031
(8)	Falcon (US & MX)	2,647,000	2,658,093	2,631,263
(9)	Reduction from Base (537 AF/F)		-11,093	15,737
(10)	US Portion of System			
(11)	Critical Period		6/1994 - 8/2003	
(12)	Amistad Conservation Storage (56.2% OF TOTAL)	1,841,001	1,763,623	1,607,865
(13)	Reduction from Base		77,378	233,136
(14)	Falcon Conservation Storage (58.5% OF TOTAL)	1,551,000	1,557,642	1,541,908
(15)	Reduction from Base		-6,642	9,092
(16)	Total Conservation Storage	3,392,000	3,321,265	3,149,773
(17)	Reduction from Base		70,735	242,227

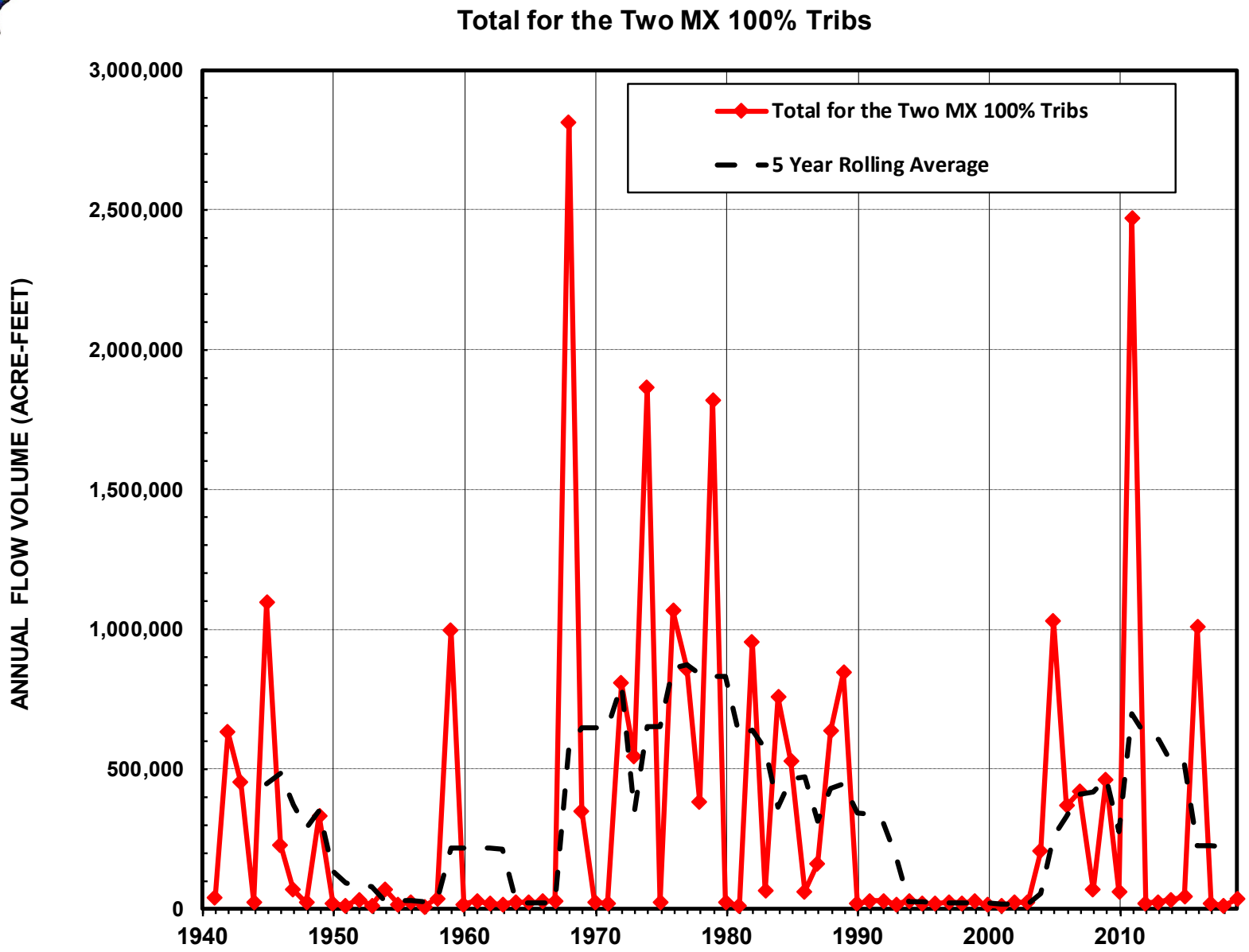
CHANGES TO WAM – US AUTHORIZED AND FIRM DEMANDS

(1)	Model Name and Basis	TCEQ As Received	2030 Supply Reg M	2080 Supply Reg M
(2)	***With Authorized Demands***			
(3)	DMI			
(4)	Annual Demand	327,644	327,644	327,644
(5)	Annual Supply	327,644	327,644	327,644
(6)	CLASS A			
(7)	Annual Demand	1,580,297	1,580,297	1,580,297
(8)	Average Annual Supply	1,034,847	1,036,487	1,034,056
(9)	Minimum Annual Supply	166,884	156,376	179,931
(10)	CLASS B			
(11)	Annual Demand	168,753	168,753	168,753
(12)	Average Annual Supply	70,549	70,451	69,847
(13)	Minimum Annual Supply	19,010	17,859	17,396
(14)	Minumum Simulated Storage	240,448	241,513	240,421
(15)	***With Firm Demands***			
(16)	DMI			
(17)	Annual Supply	327,644	327,644	327,644
(18)	CLASS A			
(19)	(factor applied to reach yield)	0.3990	0.3988	0.3954
(20)	Annual Supply	630,538	630,222	624,849
(21)	CLASS B			
(22)	(factor applied to reach yield)	0.2600	0.2602	0.2570
(23)	Annual Supply	43,876	43,910	43,369
(24)	Minumum Simulated Storage	430,333	405,891	401,373
(25)	US Firm Annual Yield	1,002,058	1,001,776	995,863
(26)	Reduction from TCEQ, as Received		282	6,195
(27)	US FIRM ANNUAL YIELD BEFORE HYDROLOGY WAS EXTENDED	1,076,710		

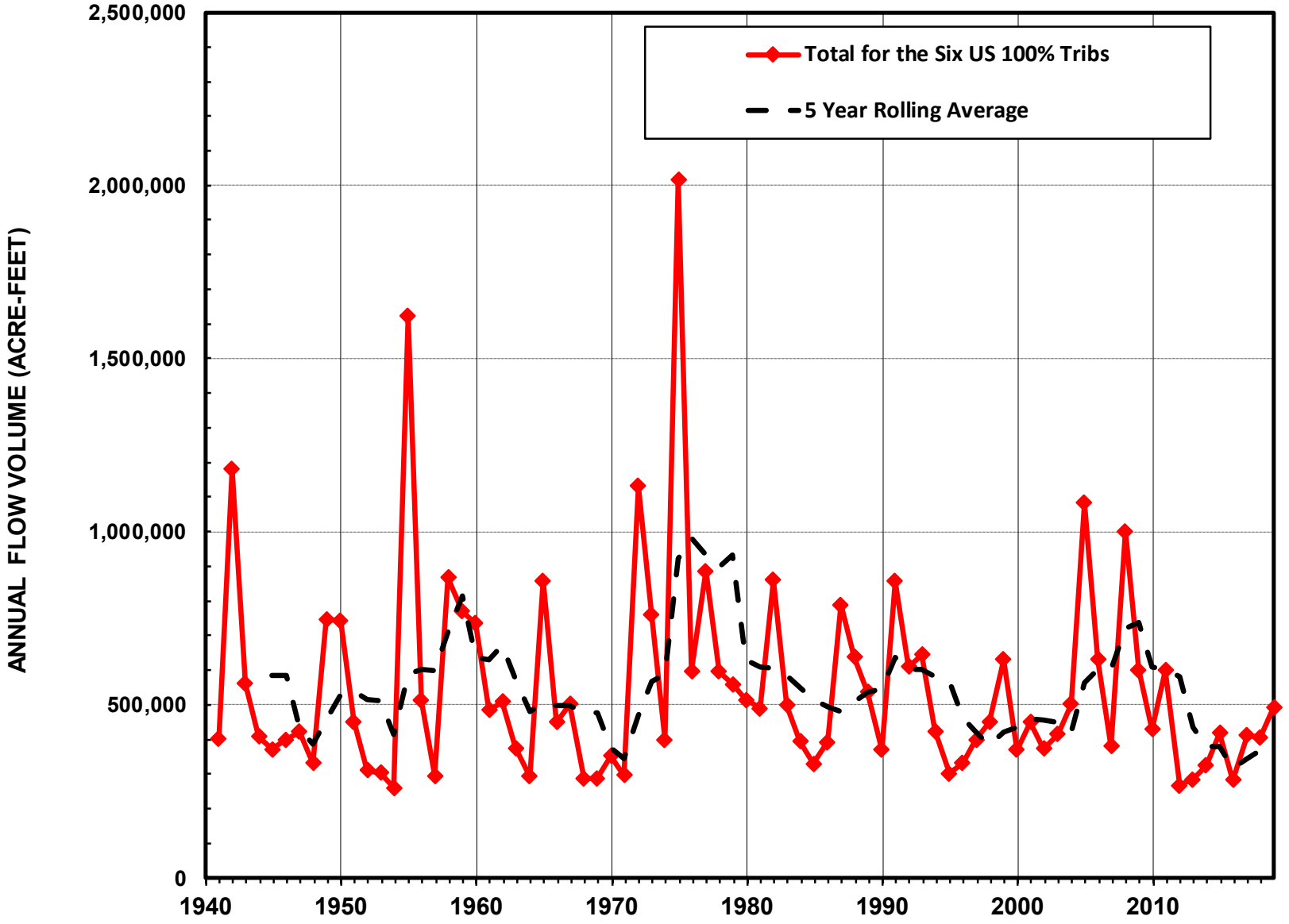

Total of All Six Named MX Tribs - US Portion
Total of All Six Named MX Tribs - US Portion
5 Year Rolling Average
ANNUAL FLOW VOLUME (ACRE-FEET)
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
1940
1950
1960
1970
1980
1990
2000
2010

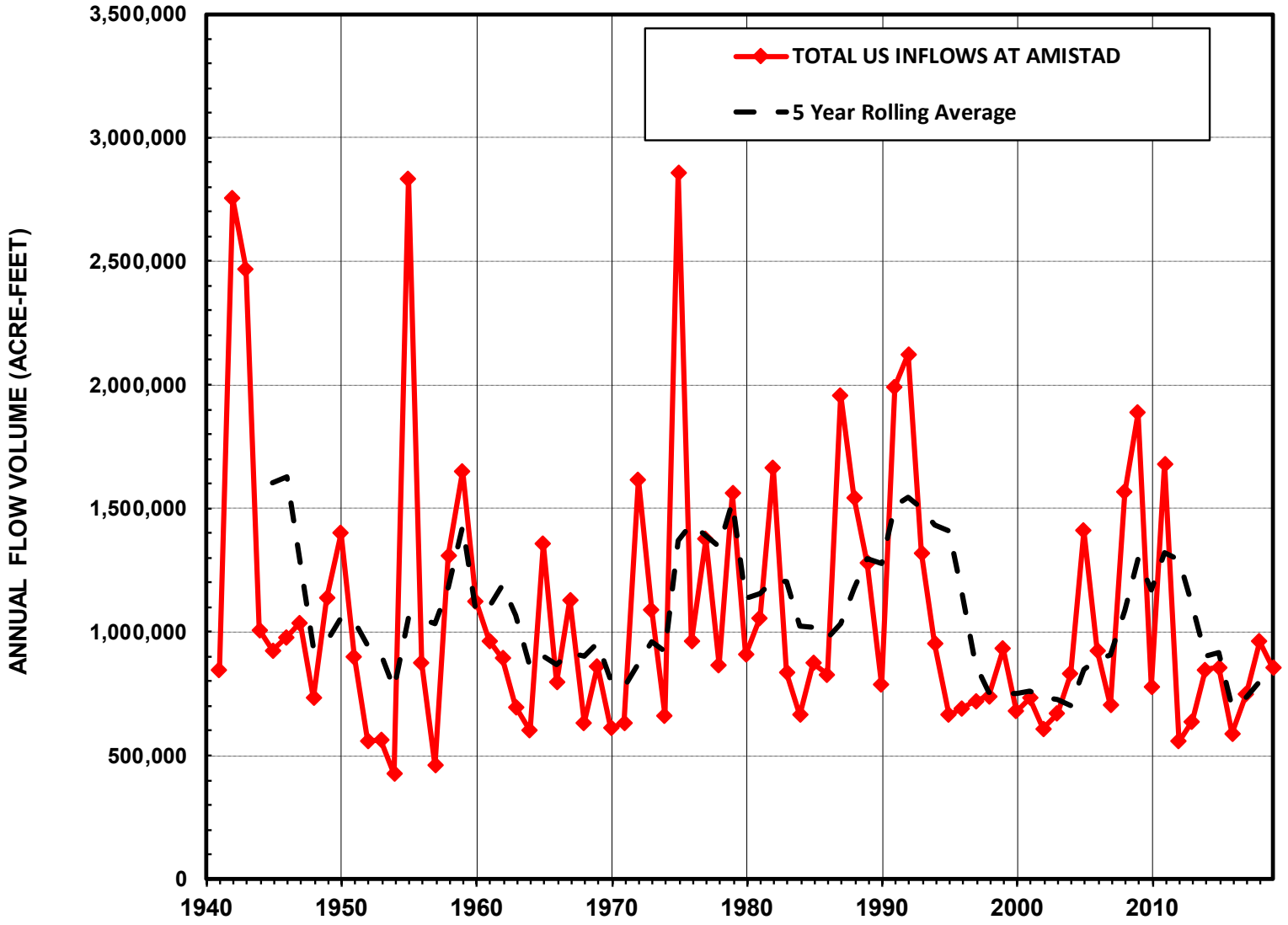
US PORTION OF NAMED TRIBS - TOTAL FLOW PER 5 YEAR CYCLE

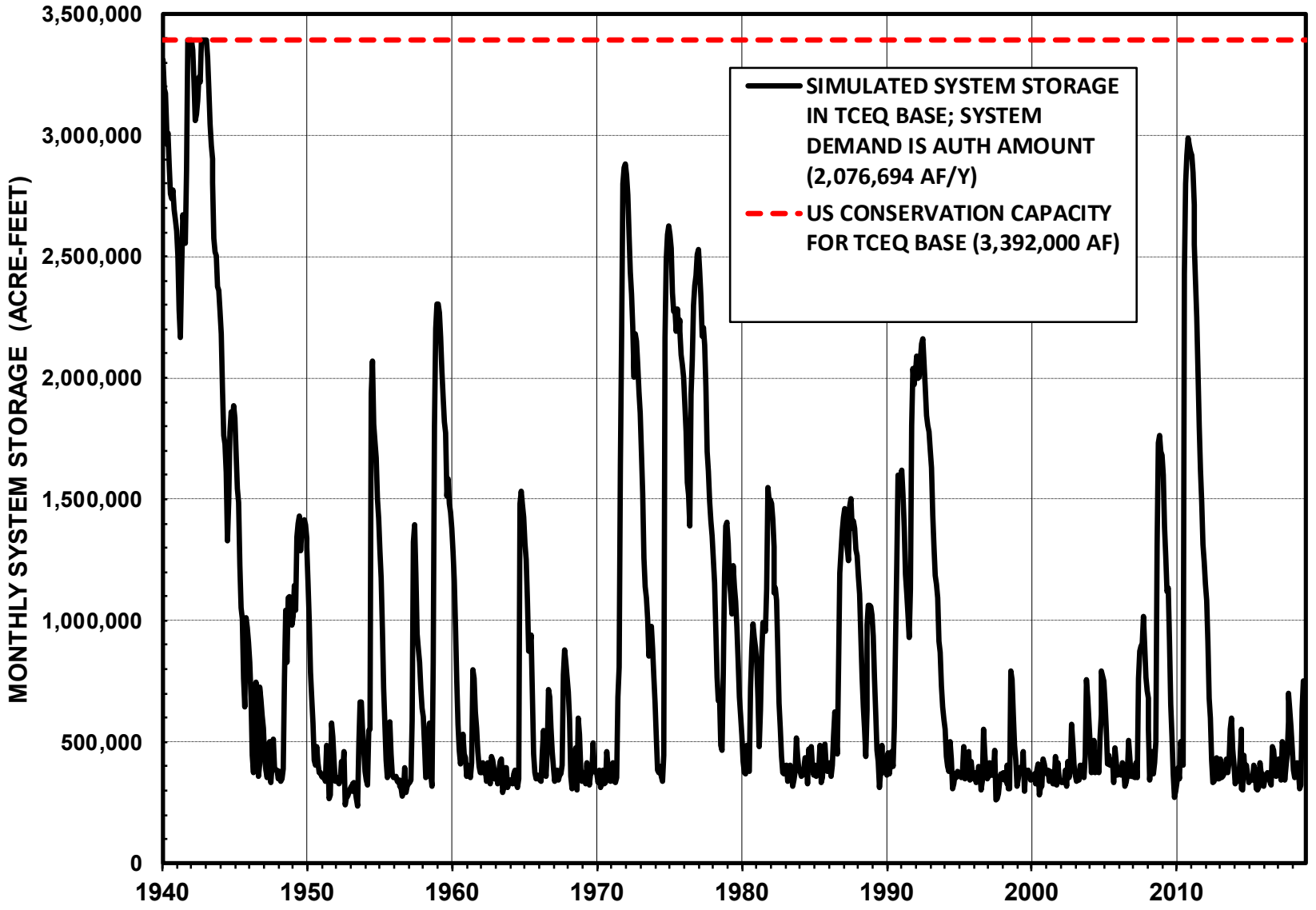


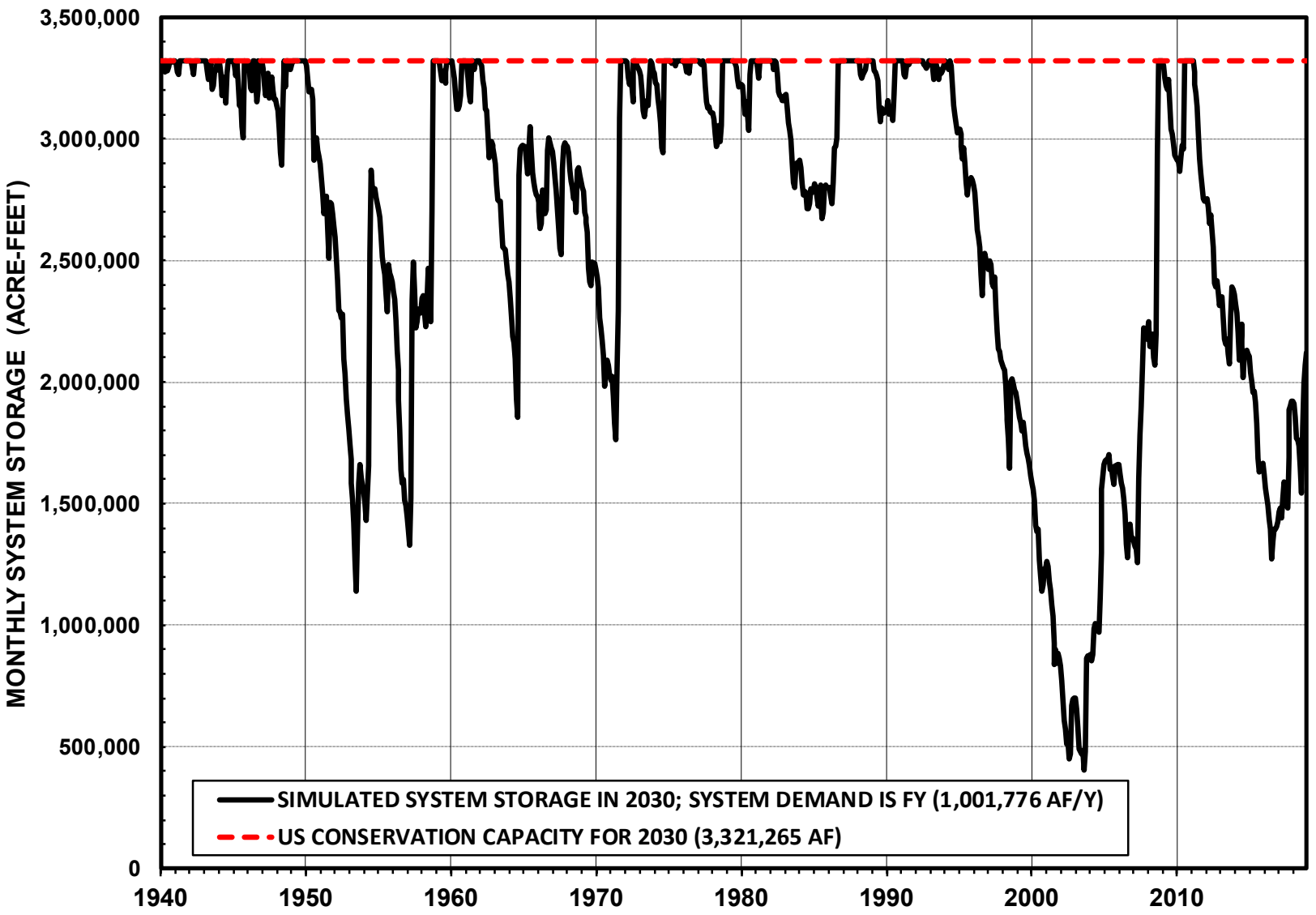

Total for the Two MX 100% Tribs
Total for the Two MX 100% Tribs
5 Year Rolling Average
ANNUAL FLOW VOLUME (ACRE-FEET)
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
1940
1950
1960
1970
1980
1990
2000
2010

Total for the Six US 100% Tribs

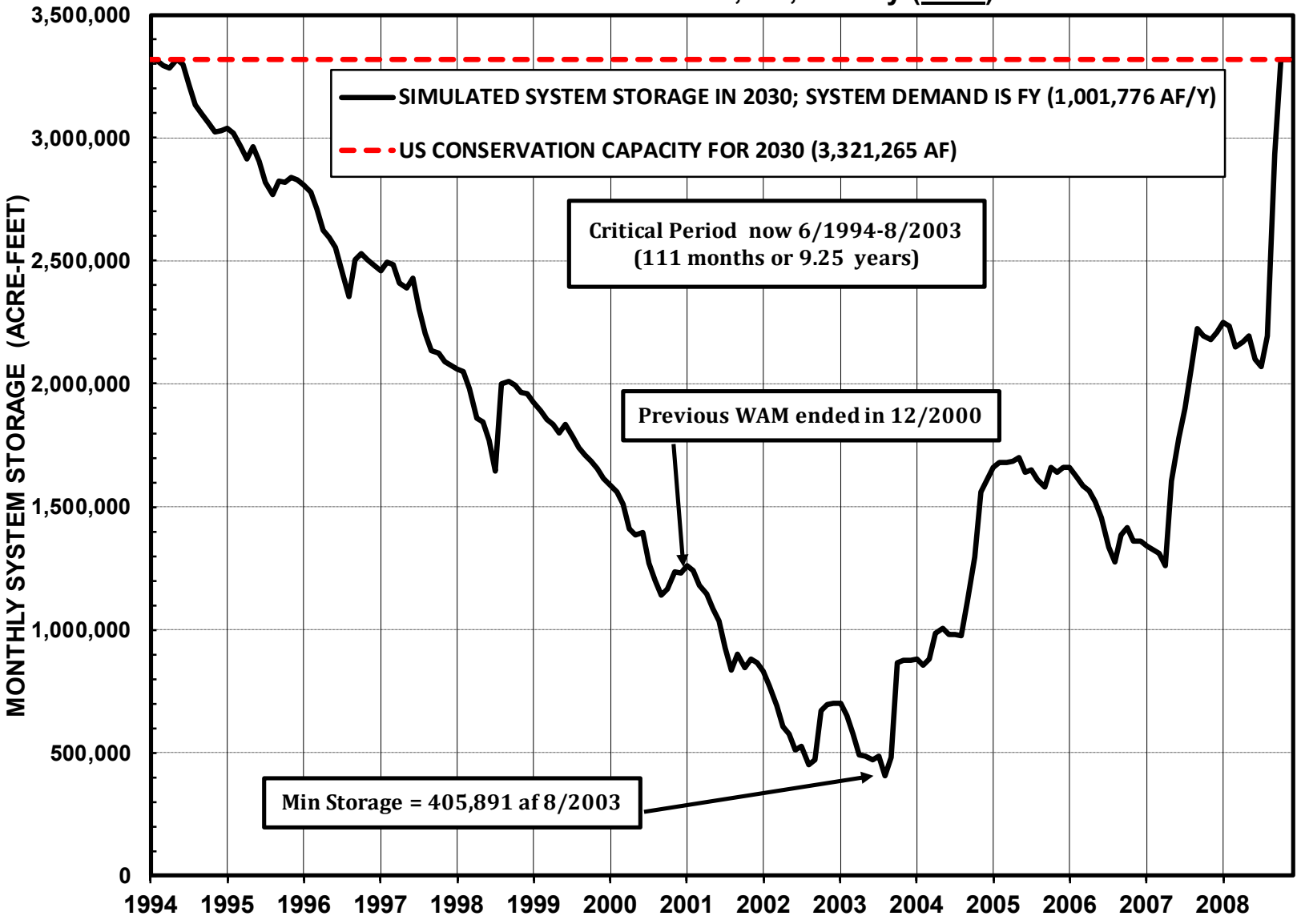


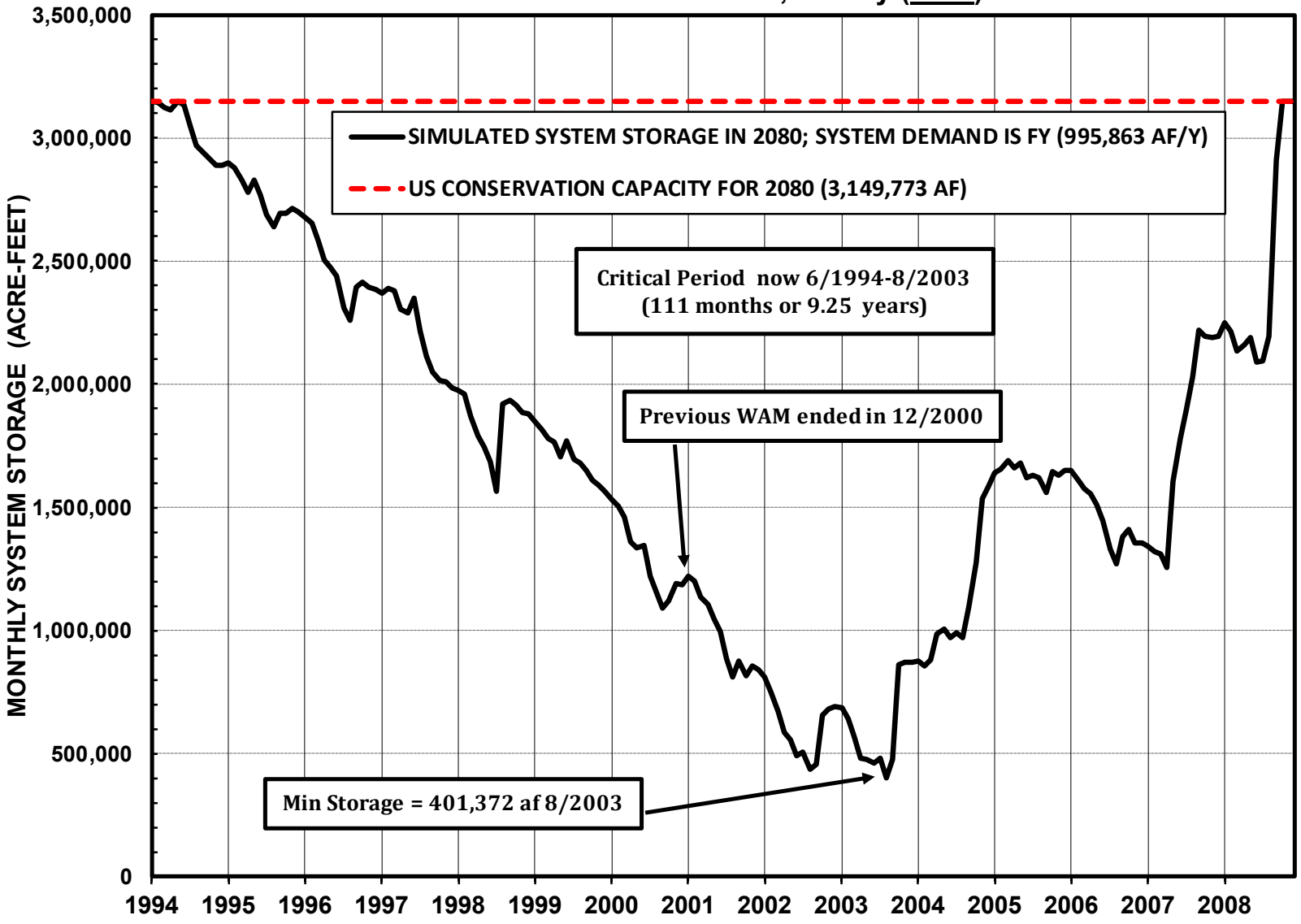

TOTAL US INFLOWS AT AMISTAD
TOTAL US INFLOWS AT AMISTAD
5 Year Rolling Average
ANNUAL FLOW VOLUME (ACRE-FEET)
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
1940
1950
1960
1970
1980
1990
2000
2010


Simulated US Storage in Amistad/Falcon System
Entire Period of Record (1940-2018)
Demand on US System is Full Authorized Water Rights (2,076,694 af/y)
MONTHLY SYSTEM STORAGE (ACRE-FEET)
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
1940
1950
1960
1970
1980
1990
2000
2010
SIMULATED SYSTEM STORAGE IN TCEQ BASE; SYSTEM DEMAND IS AUTH AMOUNT (2,076,694 AF/Y)
US CONSERVATION CAPACITY FOR TCEQ BASE (3,392,000 AF)


Simulated US Storage in Amistad/Falcon System
Entire Period of Record (1940-2018)
Demand on US System is Firm Annual Yield (1,001,776 af/y in 2030)
MONTHLY SYSTEM STORAGE (ACRE-FEET)
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
1940
1950
1960
1970
1980
1990
2000
2010
SIMULATED SYSTEM STORAGE IN 2030; SYSTEM DEMAND IS FY (1,001,776 AF/Y)
US CONSERVATION CAPACITY FOR 2030 (3,321,265 AF)

Simulated US Storage in Amistad/Falcon System
Critical Drought Period (6/1994 through 8/2003)
US Firm Annual Yield = 1,001,776 af/y (*2030*)




Simulated US Storage in Amistad/Falcon System
Critical Drought Period (6/1994 through 8/2003)
US Firm Annual Yield = 995,863 af/y (2080)
MONTHLY SYSTEM STORAGE (ACRE-FEET)
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
SIMULATED SYSTEM STORAGE IN 2080; SYSTEM DEMAND IS FY (995,863 AF/Y)
US CONSERVATION CAPACITY FOR 2080 (3,149,773 AF)
Critical Period now 6/1994-8/2003
(111 months or 9.25 years)
Previous WAM ended in 12/2000
Min Storage = 401,372 af 8/2003

4. Additional Q&A