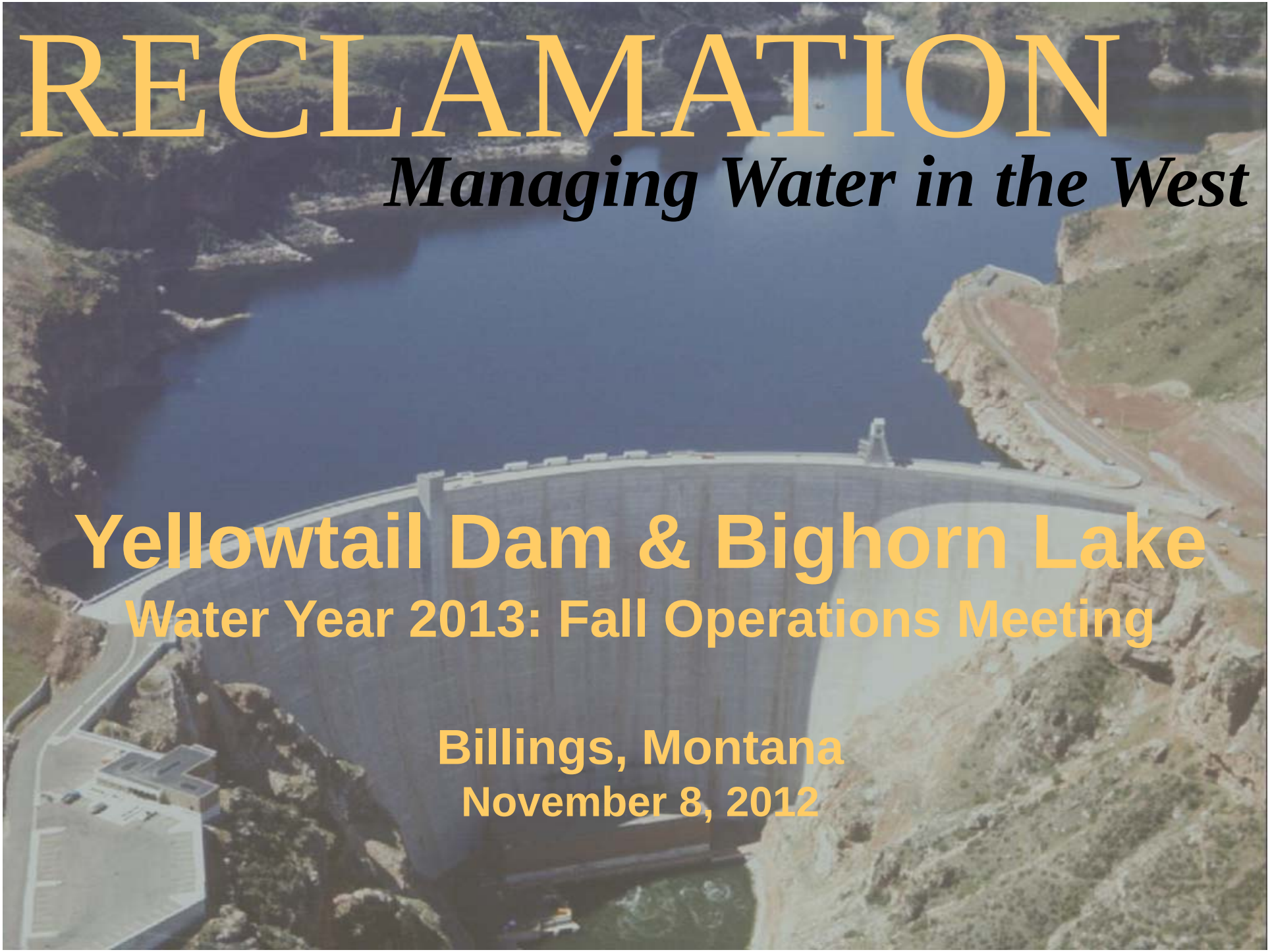


RECLAMATION

Managing Water in the West

Yellowtail Dam & Bighorn Lake

Water Year 2013: Fall Operations Meeting

Billings, Montana

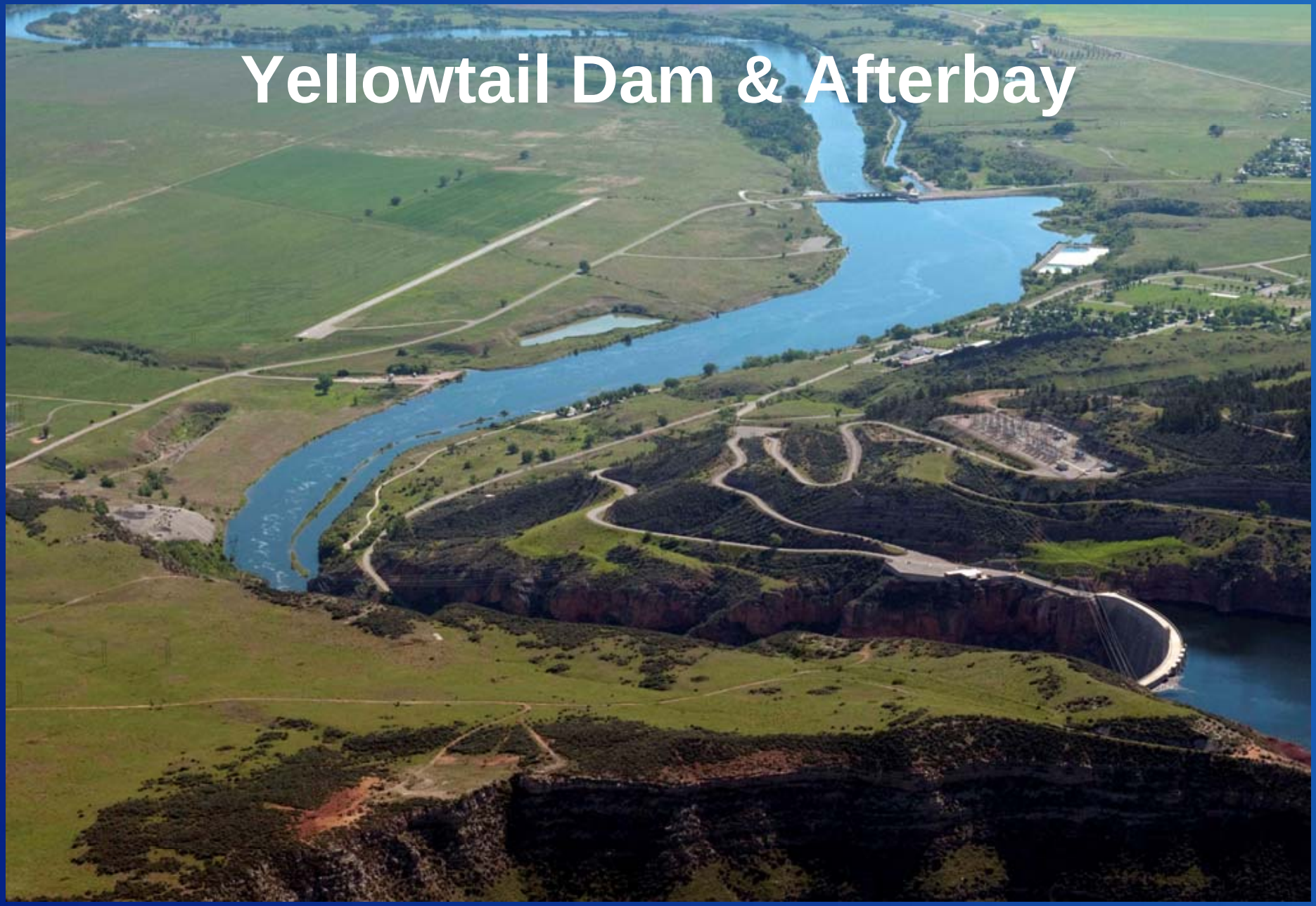
November 8, 2012

Agenda

- Welcome & Introductions
- Review of Water Year 2012 Operations
- Preview of Water Year 2013 Fall & Winter Operations
- Open Discussion

RECLAMATION

Yellowtail Dam & Afterbay



RECLAMATION

BIGHORN LAKE
2012 Operations Review

RECLAMATION

BIGHORN LAKE CONDITIONS

November 1, 2011

Elevation

3639.30 ft – 0.7 ft below full pool

Storage

1,011,836 acre-feet (99% full)

Inflows = 2,600 cfs

Total Outflow = 3,500 cfs

River = 3,500 cfs

BIA Canal = 0 cfs

RECLAMATION

BIGHORN LAKE FALL OPERATIONS

Operating Criteria Used for 2012 Plans

NOVEMBER - MARCH

Bighorn Lake River Release Rate

11/2/2011 9:18

A	B	C	D	E	F	G	H	I	J	K
ENTER	CALCULATED	**ENTER**	**ENTER**	**ENTER**	End of March	CALCULTED	CALCULATED	31-Mar-10	Month	Gains
Bighorn Lake	Nov-Mar	**Bighorn Lake**	**Buffalo Bill**	**Boysen Res**	Bighorn Lake	Release to	River Release	Reservoir Level	Apr	54.6
Apr-Oct Gain	Forecasted Gain	**Oct. 31**	**Nov-Mar Release**	**Nov-Mar Release**	Stor. Target	Afterbay	From Afterbay	Target	May	184.0
in Acre-feet	Acre-feet	**Storage AF**	**CFS**	**CFS**	acre-feet	CFS	CFS		Jun	390.7
					(2007 AC Table)				Jul	88.4
806,500	339,348	1,011,836	350	950	829,234	3067	3137	3619.0	Aug	-11.6
Min Probable	304,348								Sep	8.7
Max Probable	374,348								Oct	91.7
									Total	806.5

Directions: Enter appropriate values in the Yellow Cells: A10, C10, D10, & E10.
Bighorn Lake River Release for Nov. - Mar. is calculated in cell H10 and the end of March target elevatio is displayed in I10.

B = .145*A+222402 R^2 = .6756 Forecasted Gain

F = Desired end of March Storage

G is determined from calculations in J through L with Checks in M

H = Dam Release (G) + 70 cfs

Forecasted Gain Adjustments

	Elevation	Storage
1500-2000 cfs	3615	794,613
2000-2500 cfs	3617	807,921
> 2500 cfs	3619	821,949

Intermediate Calculations for River Release

J	K	L	M		K	L
CALCULATED	CALCULATED	CALCULATED	Check Results &		End of March	End of March
Step One	**Step Two**	**Step Three**	Adjust Release		Reservoir Elev.	Reservoir Storage
Release CFS	Release CFS	Release CFS	CFS		Target	Target
>2500	2000-2500	1500-2000				
3137	3184	3228	3137	If J > 2500 than set to J	3619.0	829,234
3137	**2500**	**2000**	3137	If K < 2500 than set to K	3619.0	829,234
	2000	1500	3137	If L < 2000 Then set to L	3619.0	829,234
		1500	**3137**	If L < 1500 then set to 1500	**3619.0**	**829,234**

RECLAMATION

BIGHORN LAKE FALL OPERATIONS

Operating Criteria Used for 2012 Plans

STEP 1

2011 April-October Gain = 806,500 acre-feet

2011 End-of-October Storage = 1,011,836 acre-feet

Upstream Reservoir Fall & Winter Releases =
Boysen = 950 cfs
Buffalo Bill = 350 cfs

Projected End-of-March Target Elevation = 3617

Calculated November-March Gain = 339,300 acre-feet

Calculated Fall & Winter Release for Yellowtail:
River = 3,175 cfs

RECLAMATION

BIGHORN LAKE FALL CONDITIONS

Operating Criteria Used for 2012 Plans

STEP 2

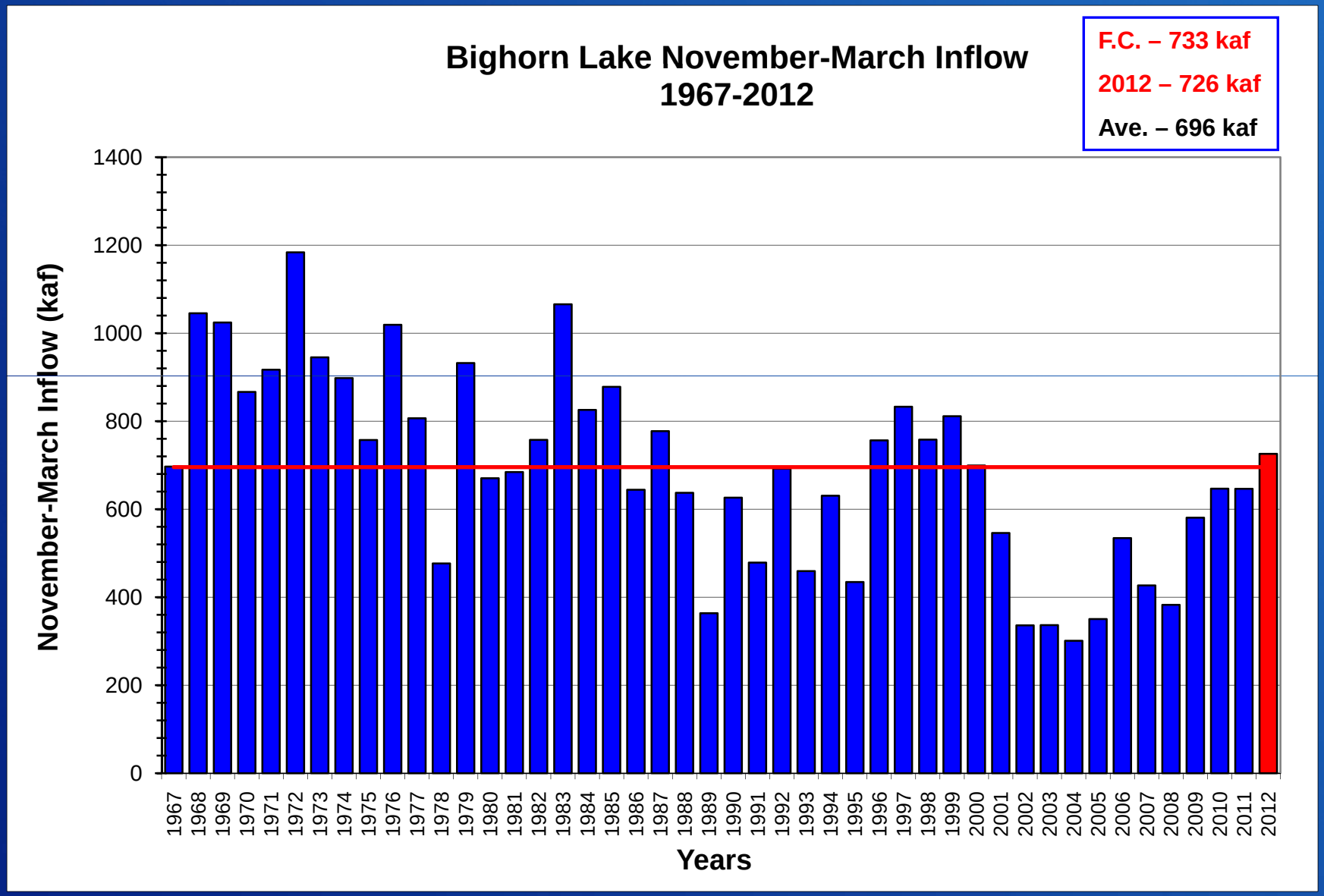
Since Calculated Fall & Winter Release was > 2,500 cfs

Set End-of-March target elevation @ 3619

Calculated New Fall & Winter Release for Yellowtail:
River = 3,130 cfs

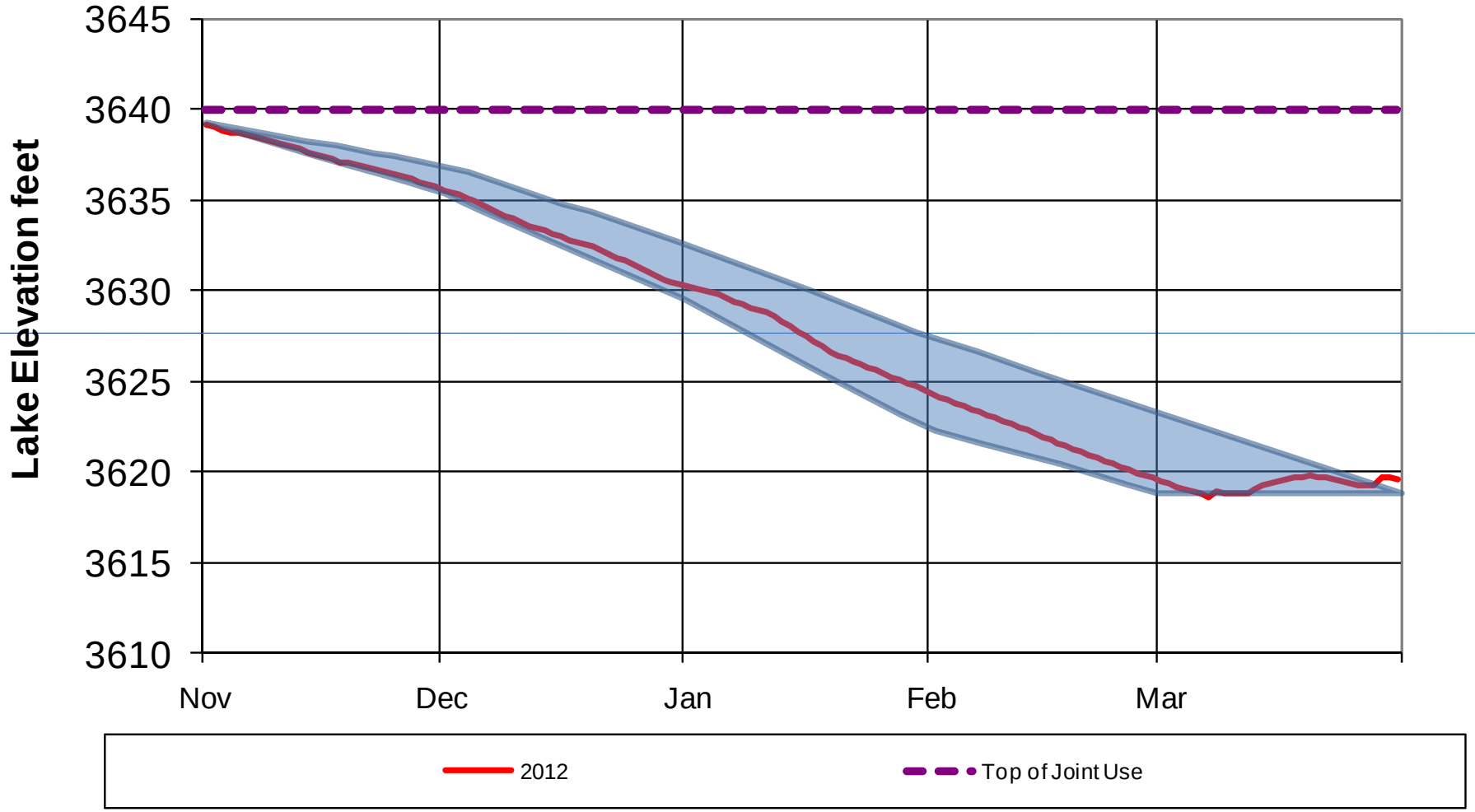
RECLAMATION

Recap of Water Year 2012



RECLAMATION

Bighorn Lake 2012 Nov-Mar Operations



RECLAMATION

November-March Operations

	Target	Actual
Oct 31 Lake Elevation	3635-3640	3639.30
Mar 31 Lake Elevation	3619	3619.58

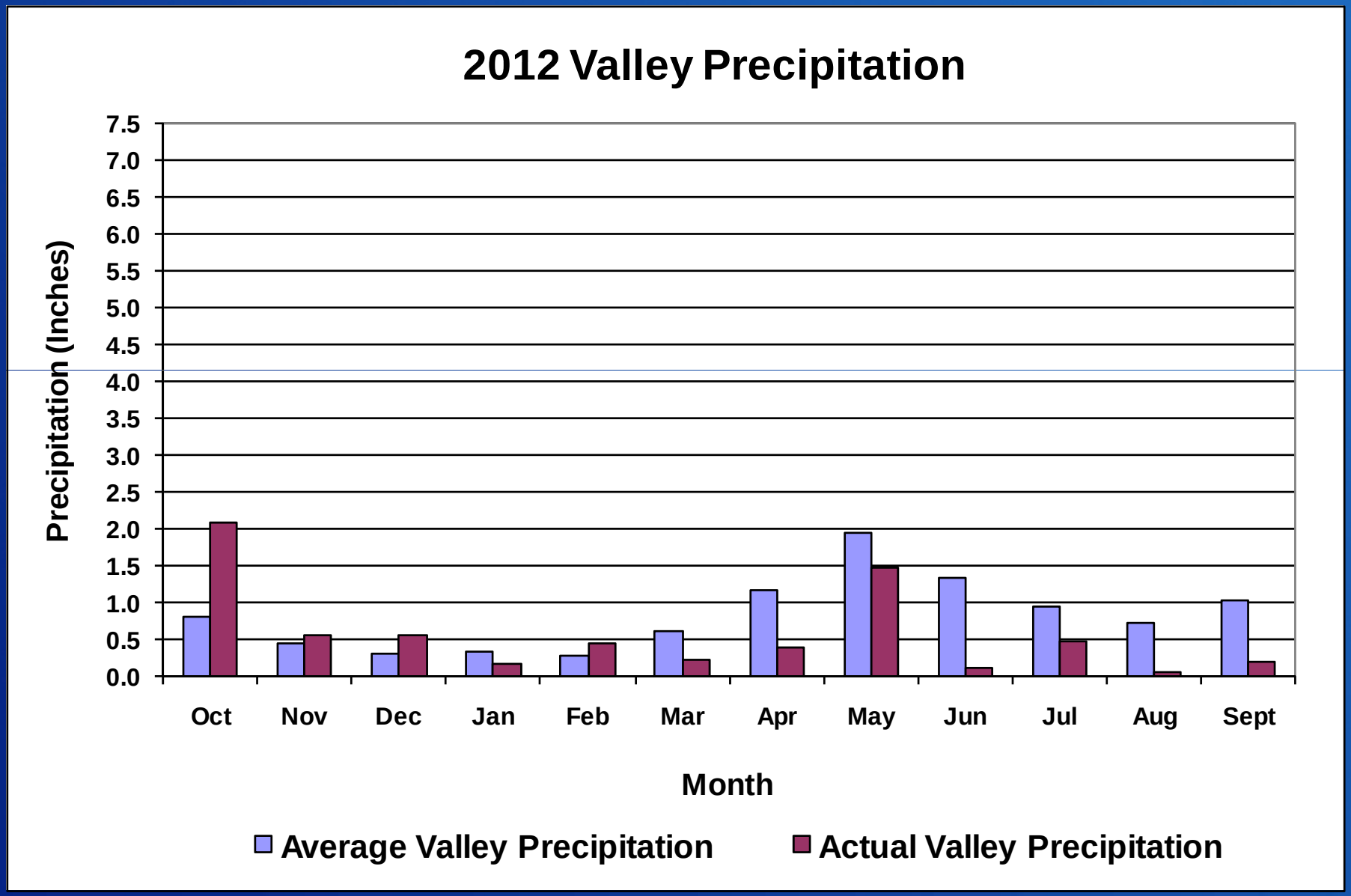
Nov-Mar Release 3,130 cfs

RECLAMATION

Spring Runoff Conditions

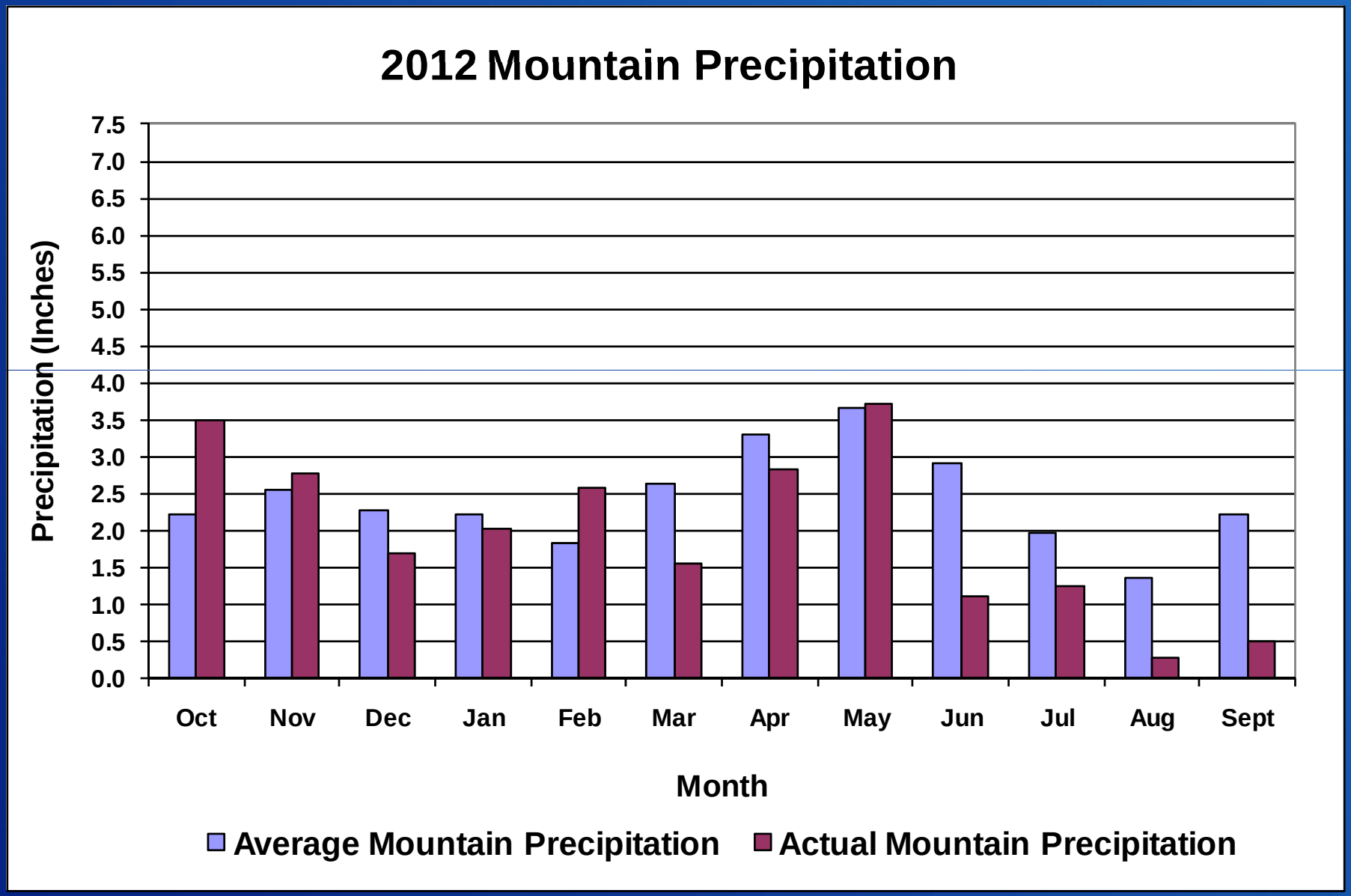
RECLAMATION

Recap of Water Year 2012



RECLAMATION

Recap of Water Year 2012



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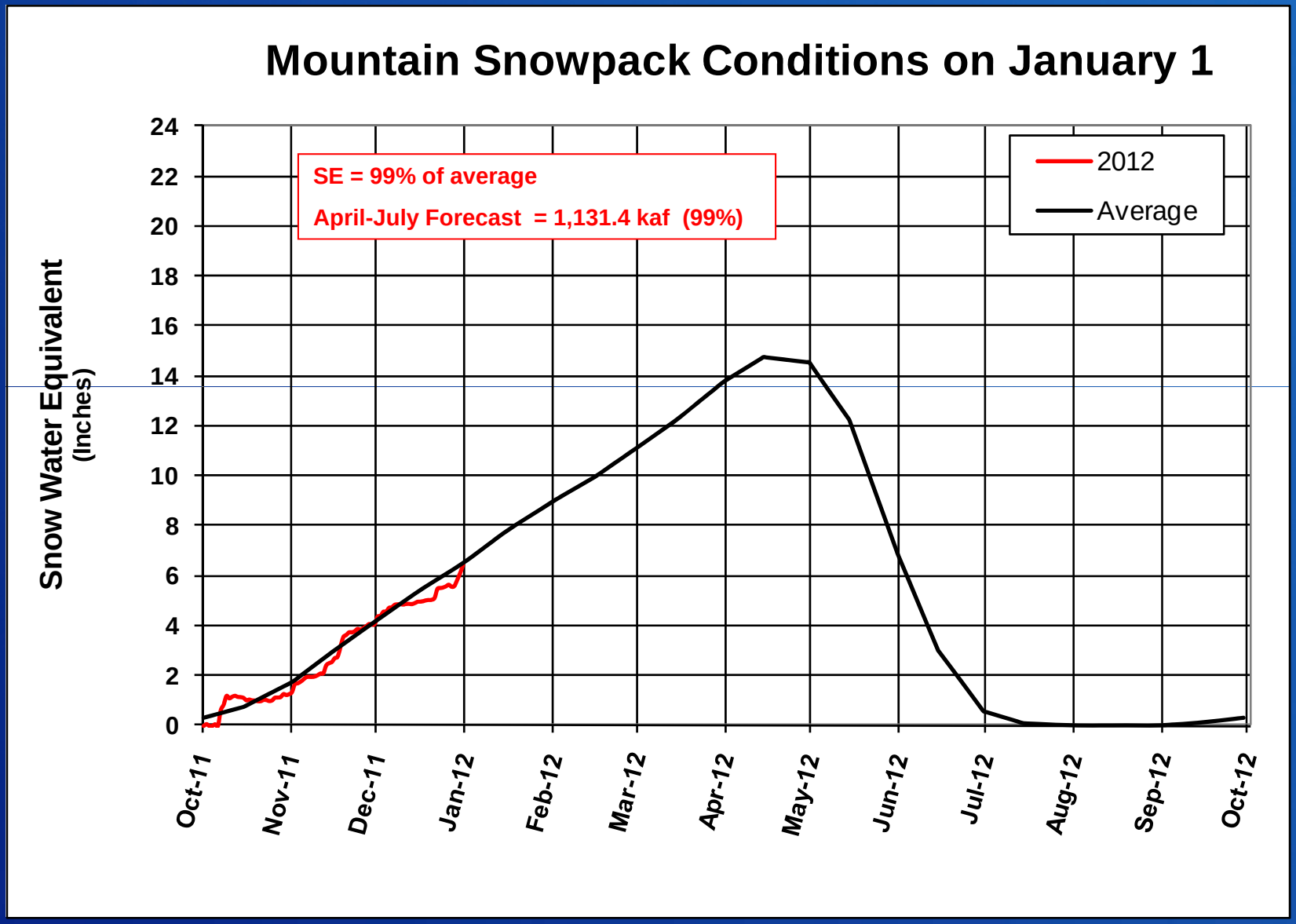
Recap of Water Year 2012



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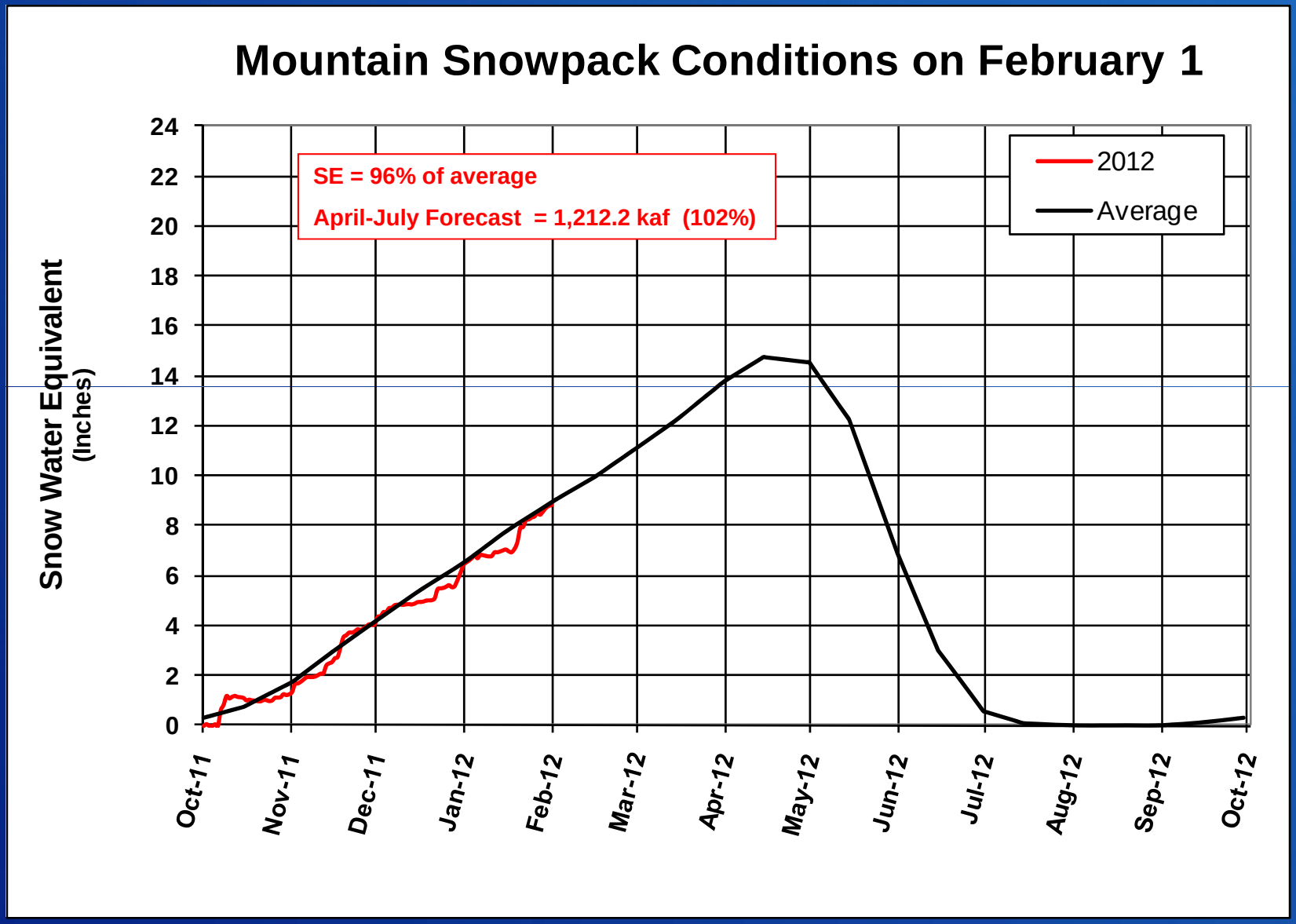
Recap of Water Year 2012



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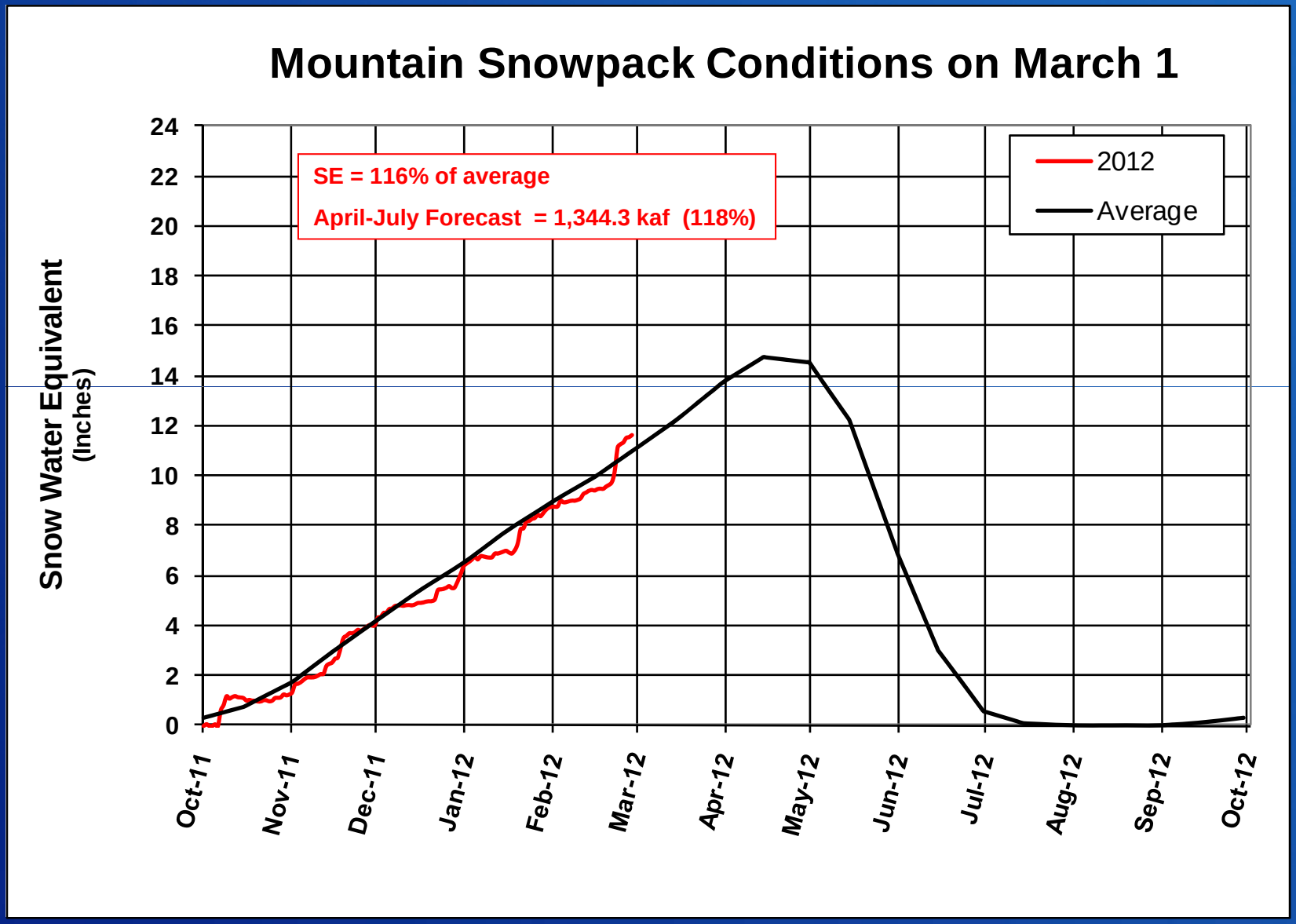
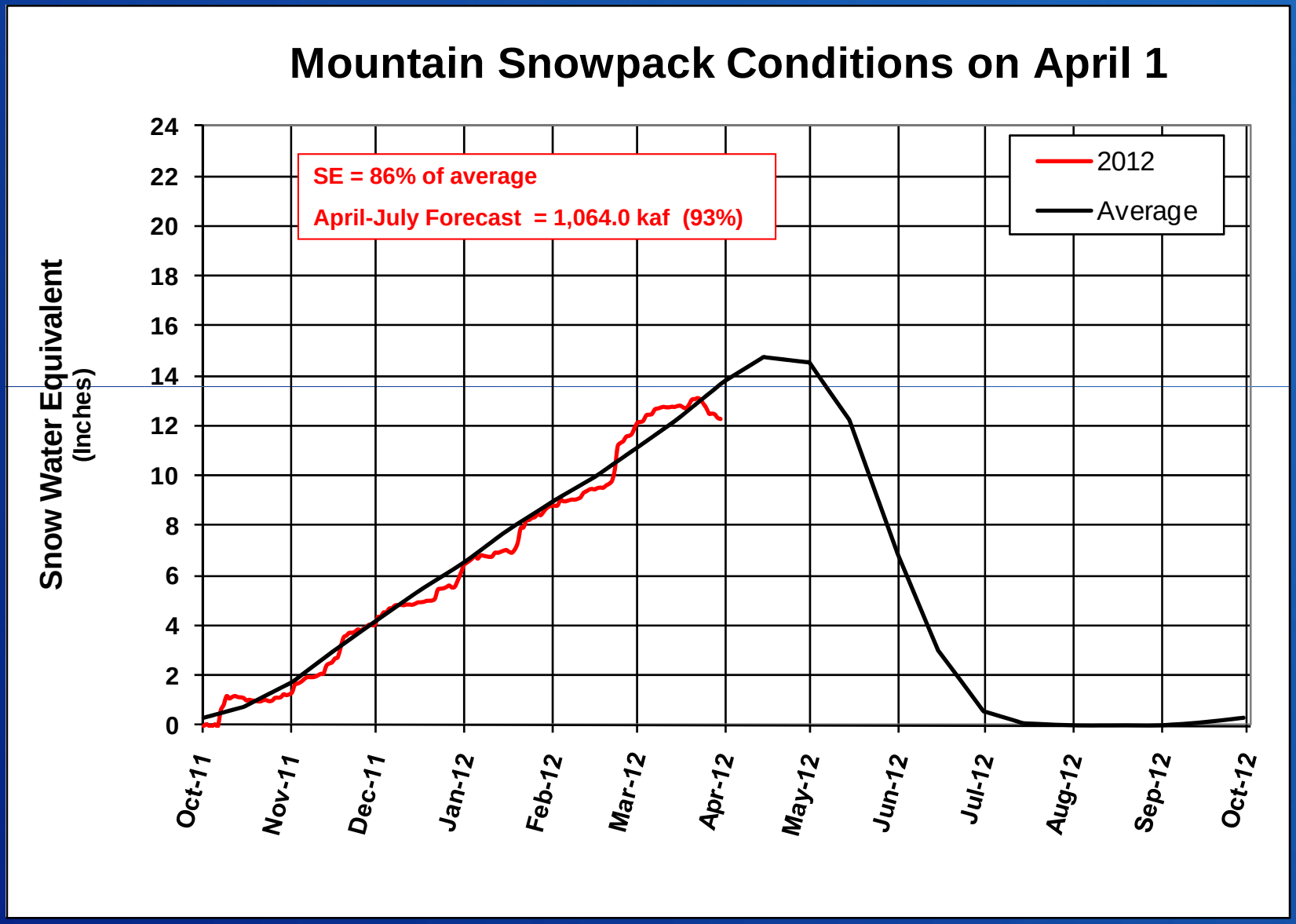
Recap of Water Year 2012



RECLAMATION

Recap of Water Year 2012



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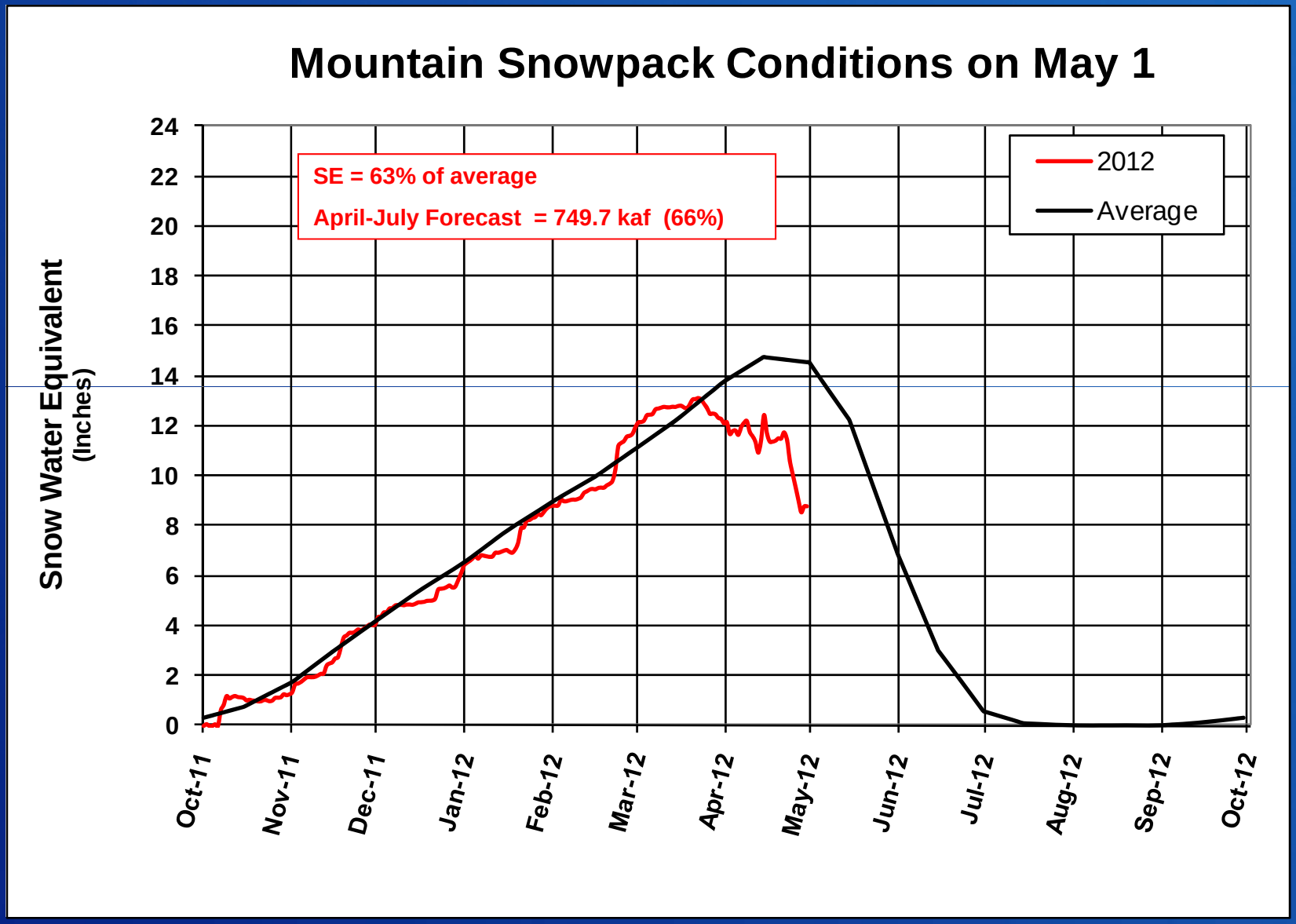
Recap of Water Year 2012



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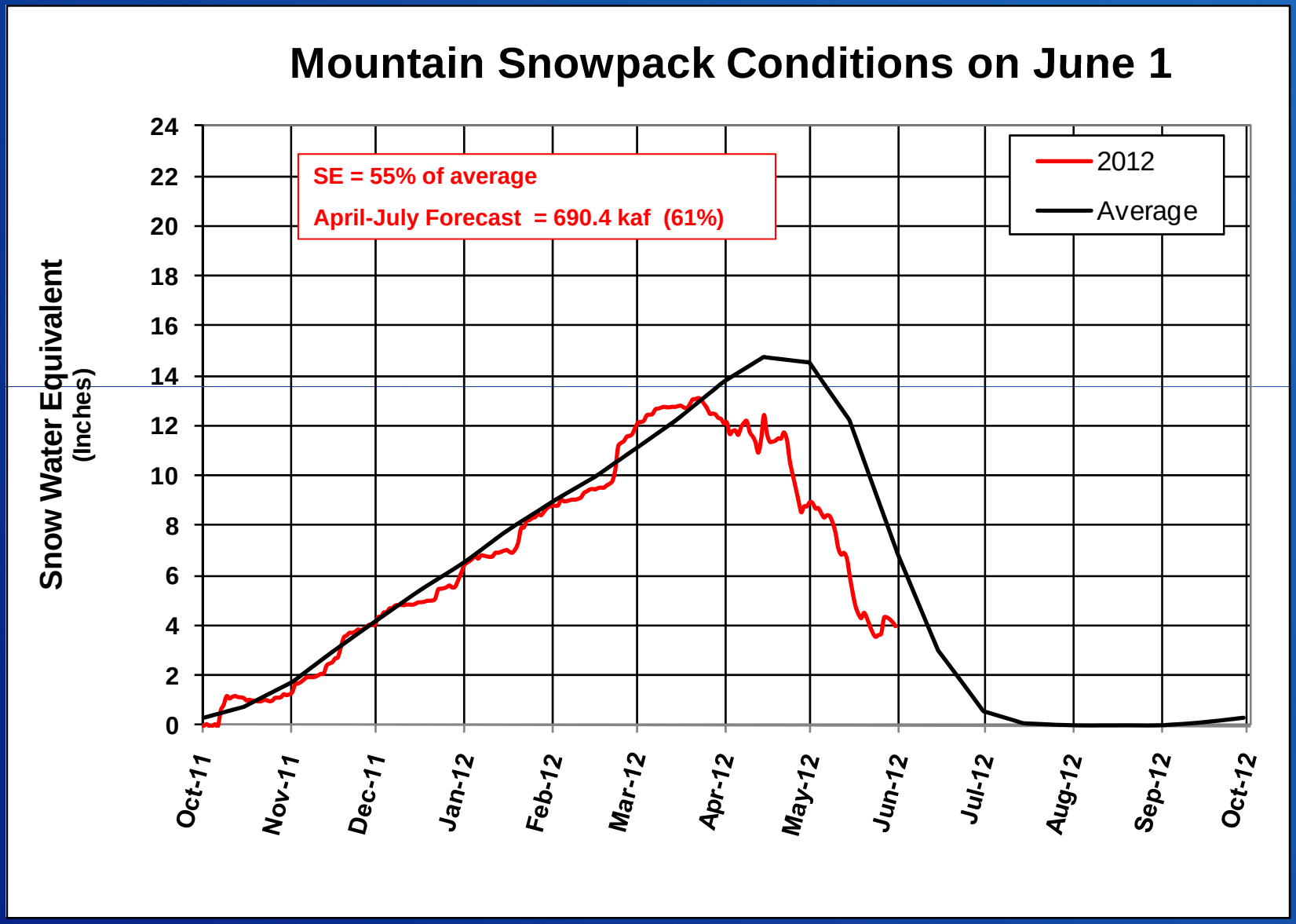
Recap of Water Year 2012



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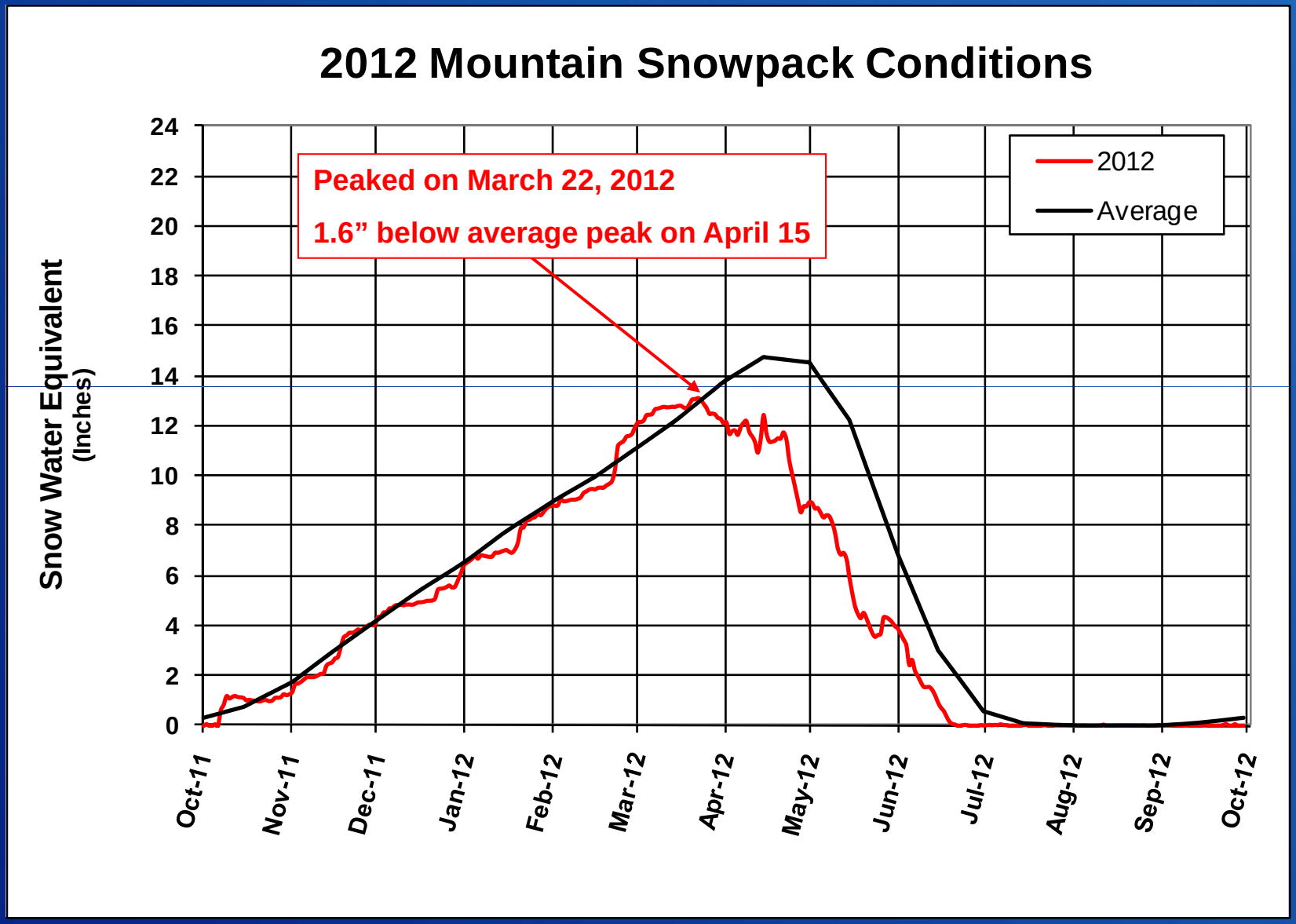
Recap of Water Year 2012



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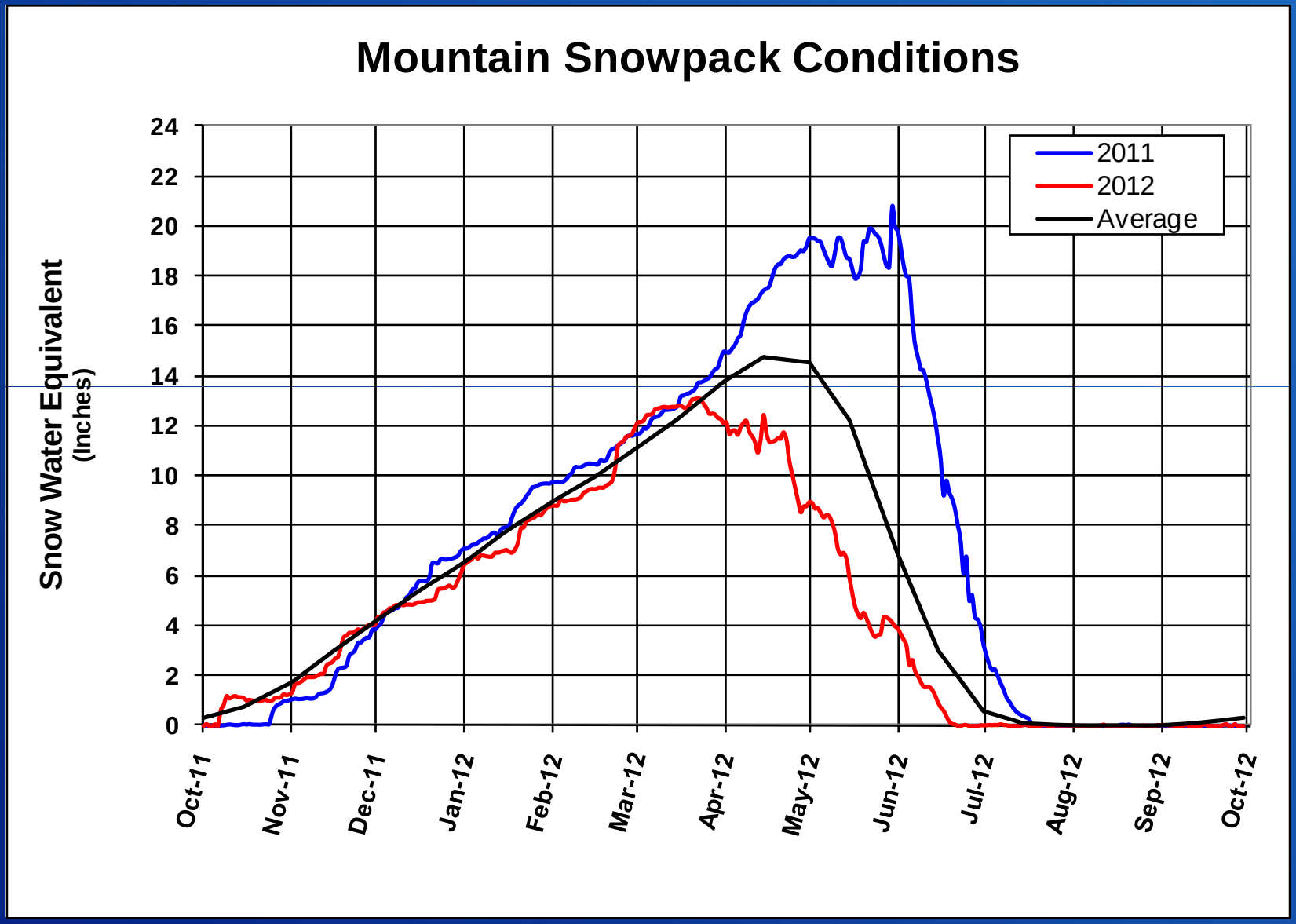
Recap of Water Year 2012



RECLAMATION

Recap of Water Year 2012

5-17-2012

RECLAMATION

Recap of Water Year 2012

6-8-2012

RECLAMATION

Recap of Water Year 2012

6-15-2012

RECLAMATION

Recap of Water Year 2012

6-20-2012

RECLAMATION

Recap of Water Year 2011

6-30-2011

RECLAMATION

Rule Curve Operations April-July

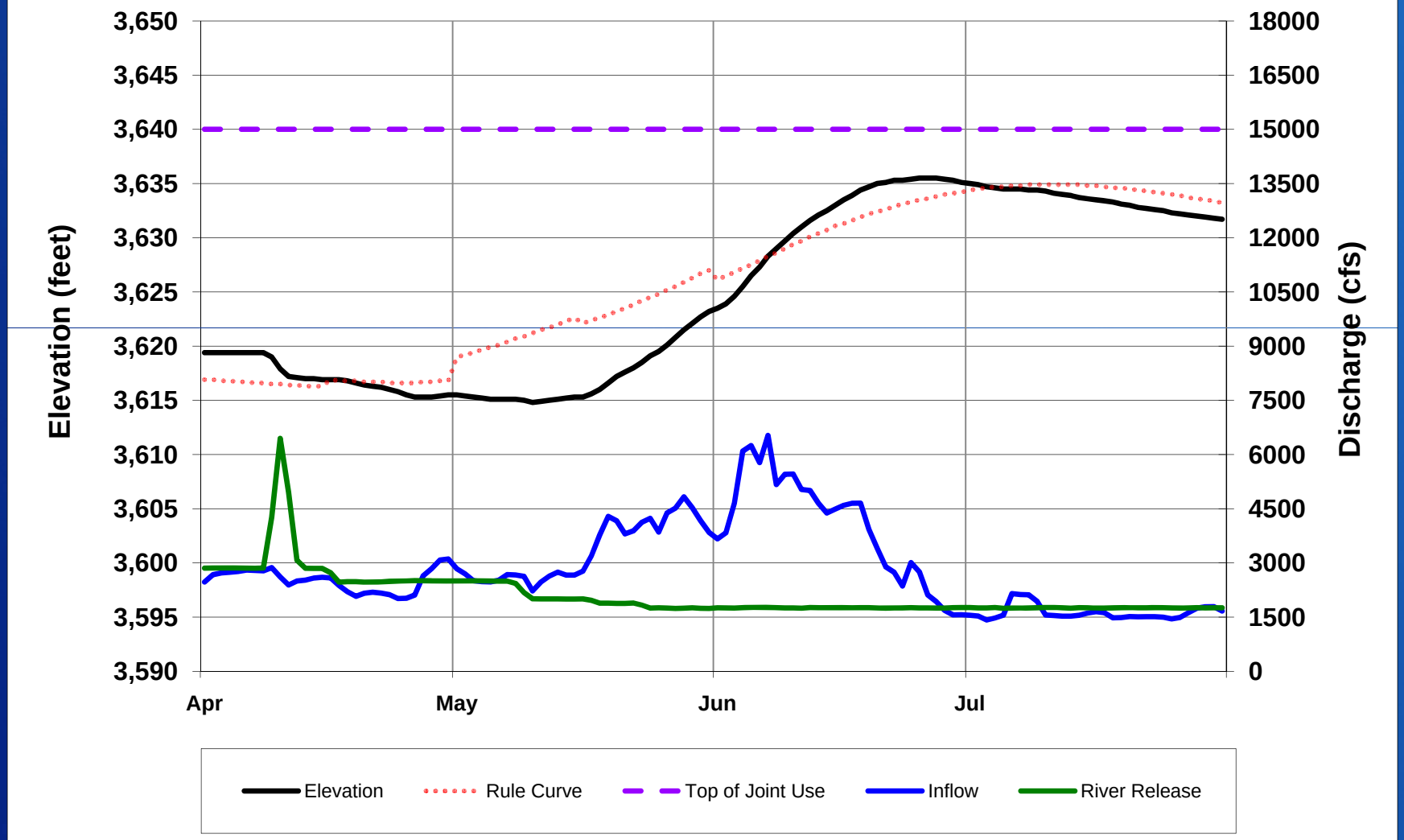
RECLAMATION

2012 April-July Forecasts & Rule Curve Targets

Date	Forecast	% of Avg	Rule Curve Min Elev.	Date
Jan. 1	1,131,400	99%	3613.4	5/03
Feb. 1	1,212,200	102%	3612.6	5/08
Mar. 1	1,344,300	118%	3611.1	5/13
April 1	1,064,000	93%	3614.4	5/02
April 15	903,900	79%	3616.6	4/26
May 1	749,700	77%	3619.0	5/01
May 15	641,800	56%	3622.1	5/16
June 1	690,500	61%	3626.1	6/01
Actual	693,100	61%		

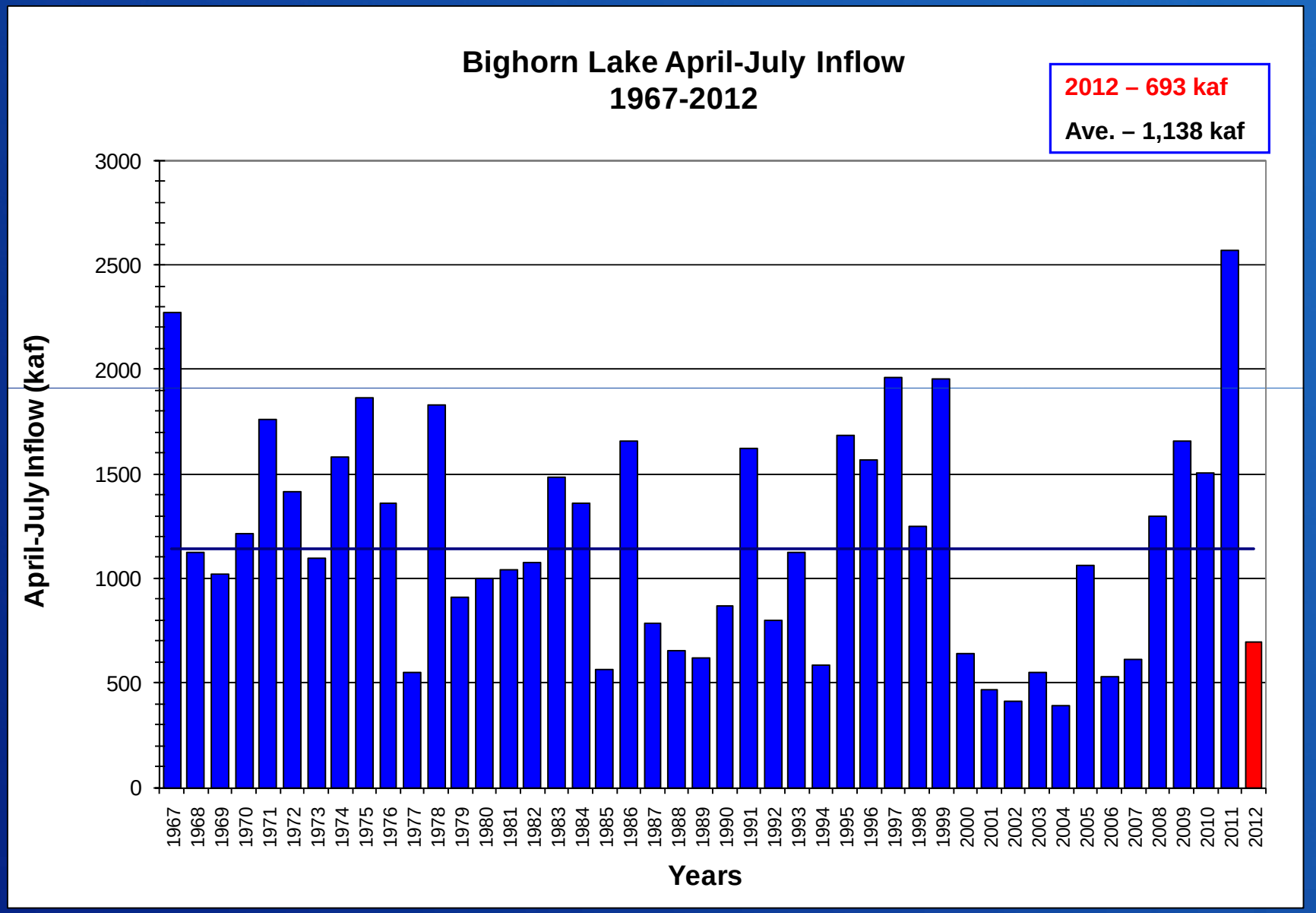
RECLAMATION

Bighorn Lake Rule Curve Operation 2012



RECLAMATION

Recap of Water Year 2012



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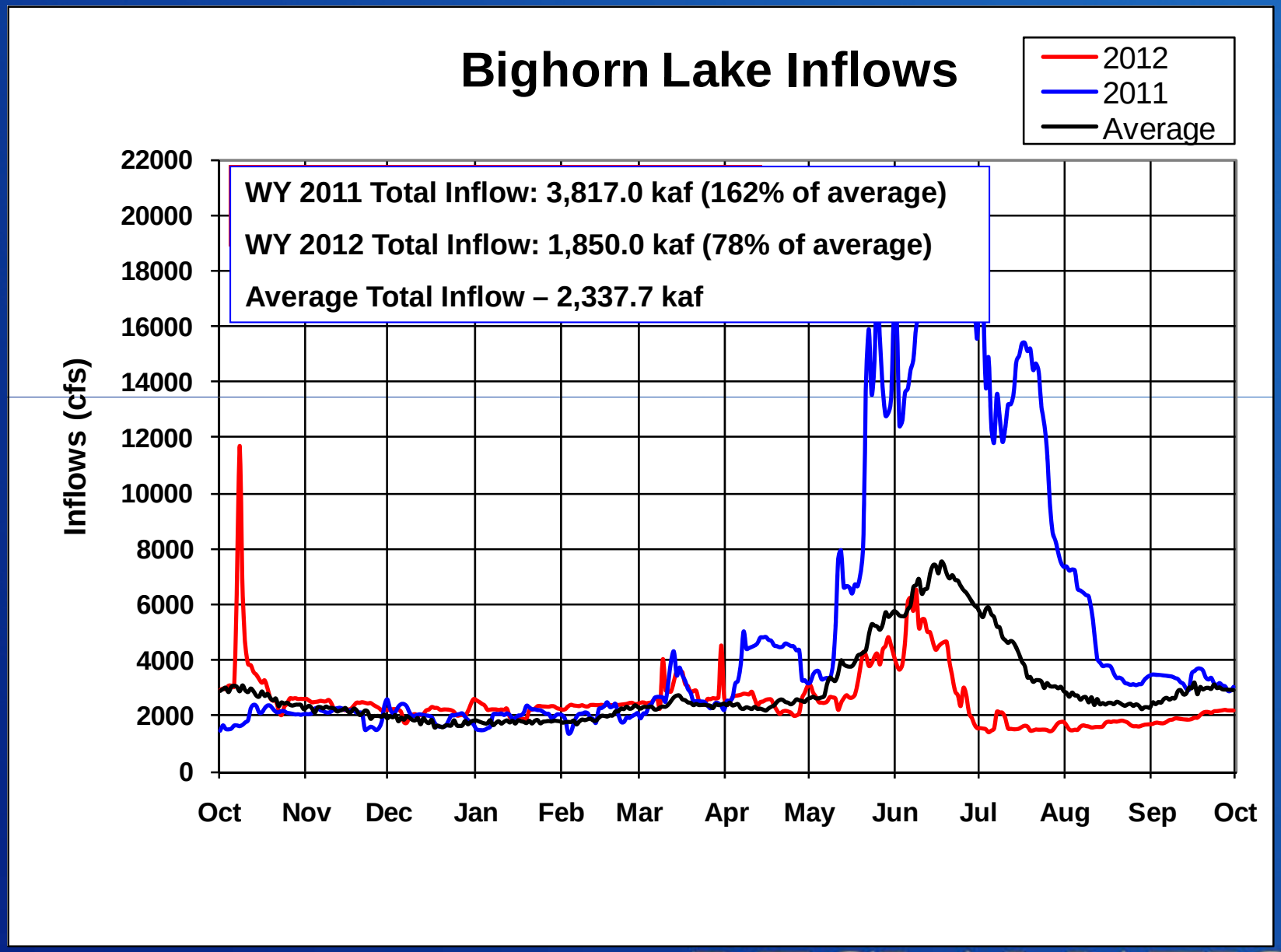
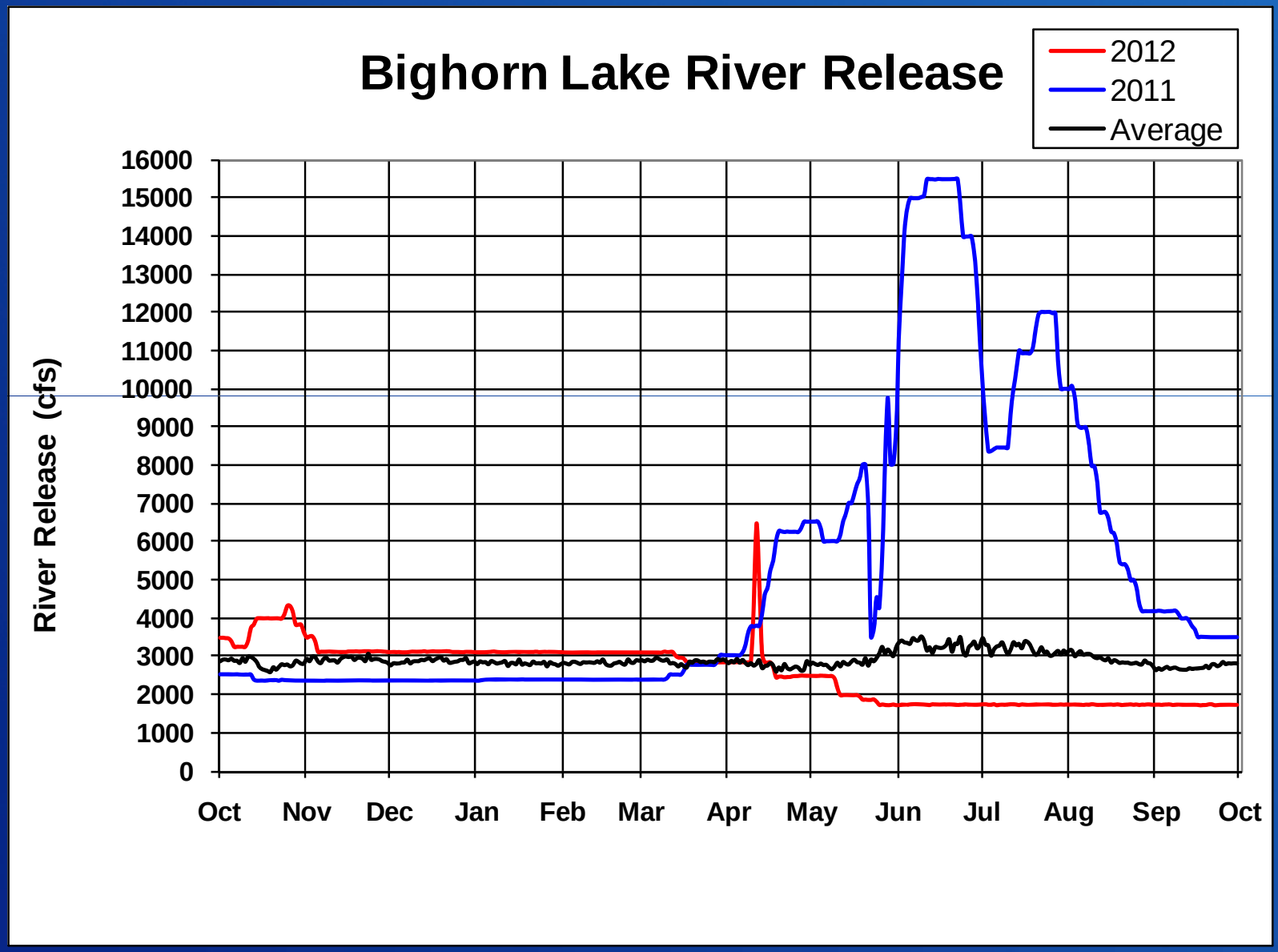
Recap of Water Year 2012



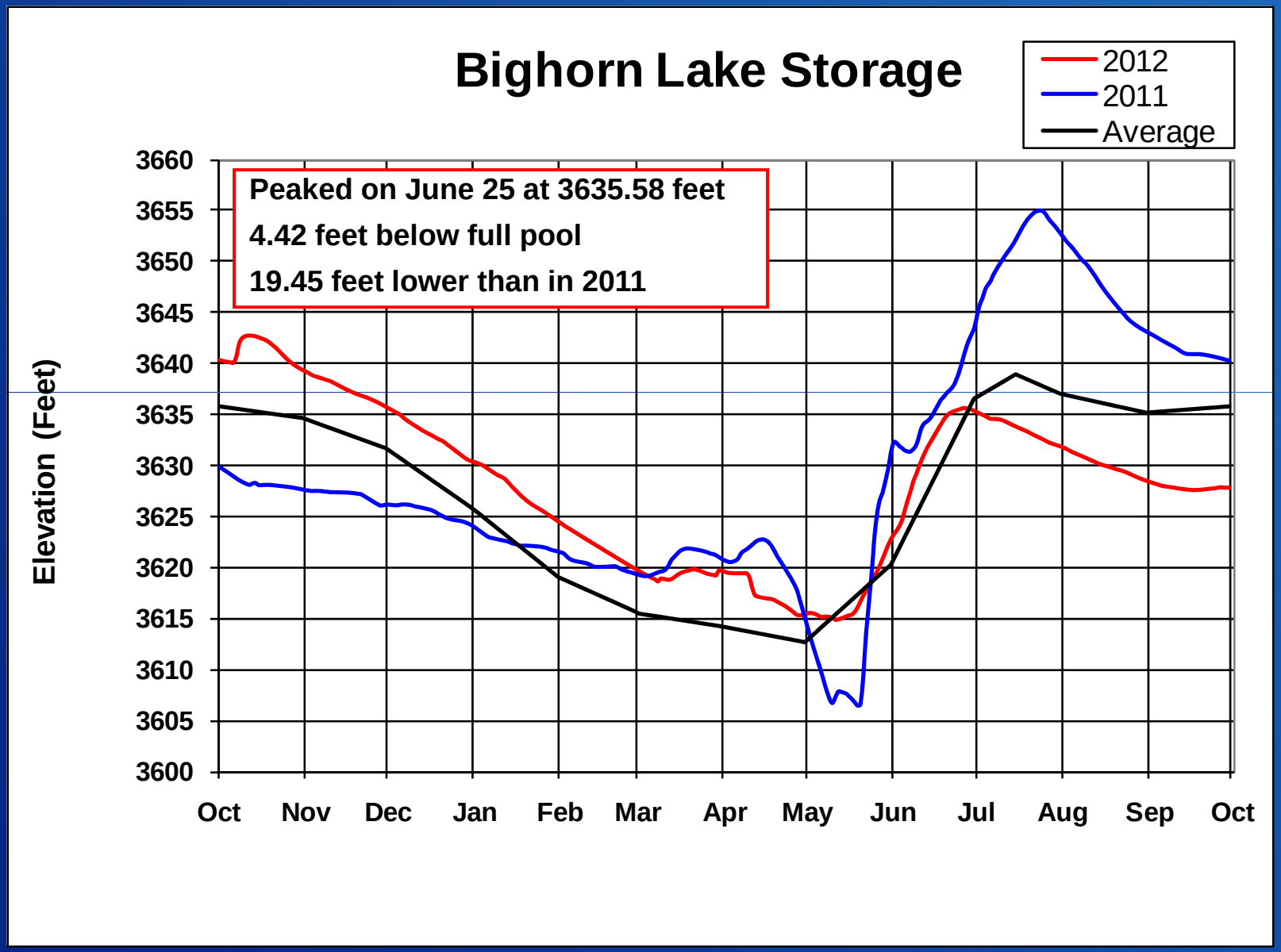
RECLAMATION

Recap of Water Year 2012



RECLAMATION

Recap of Water Year 2012



RECLAMATION

BIGHORN LAKE
2013 Fall and Winter Operations Preview

RECLAMATION

BIGHORN LAKE CURRENT CONDITIONS

November 1, 2012

Elevation

3630.85 ft – 9.15 ft below full pool

8.45 feet lower than last year

Storage

919,886 af – 90% full

Inflows = 2,000 cfs

Total Outflow = 1,750 cfs

River = 1,750 cfs

BIA Canal = 0 cfs

RECLAMATION

End of October Storage

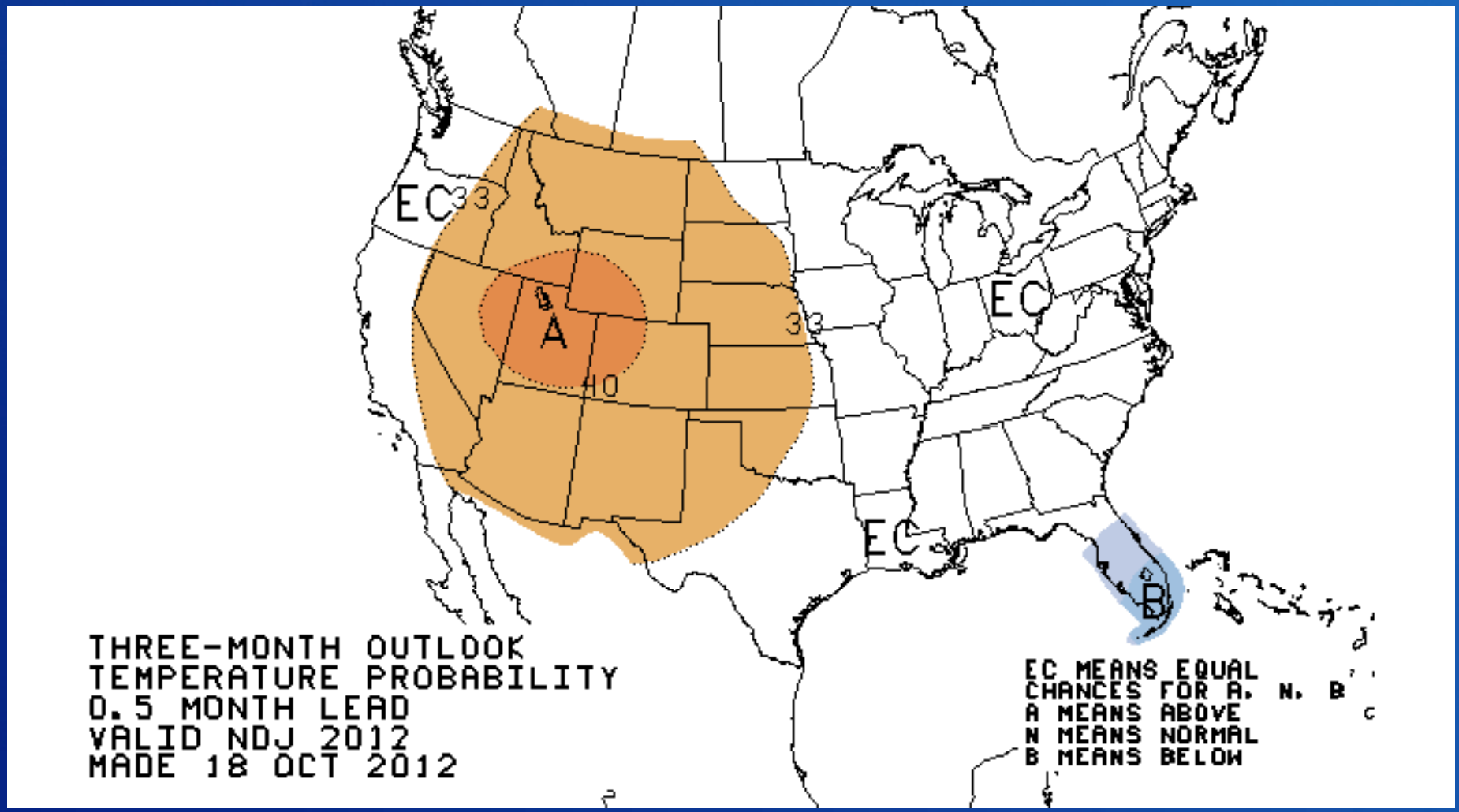
Water Year	Storage Acre-feet	Lake Elevation Feet
2012	919,225	3630.85
2011	1,011,836	3639.30
2010	938,169	3627.72
2009	1,063,770	3639.50

*Area-Capacity Table Changed January 1, 2011

RECLAMATION

NWS Long Range Temperature Forecasts

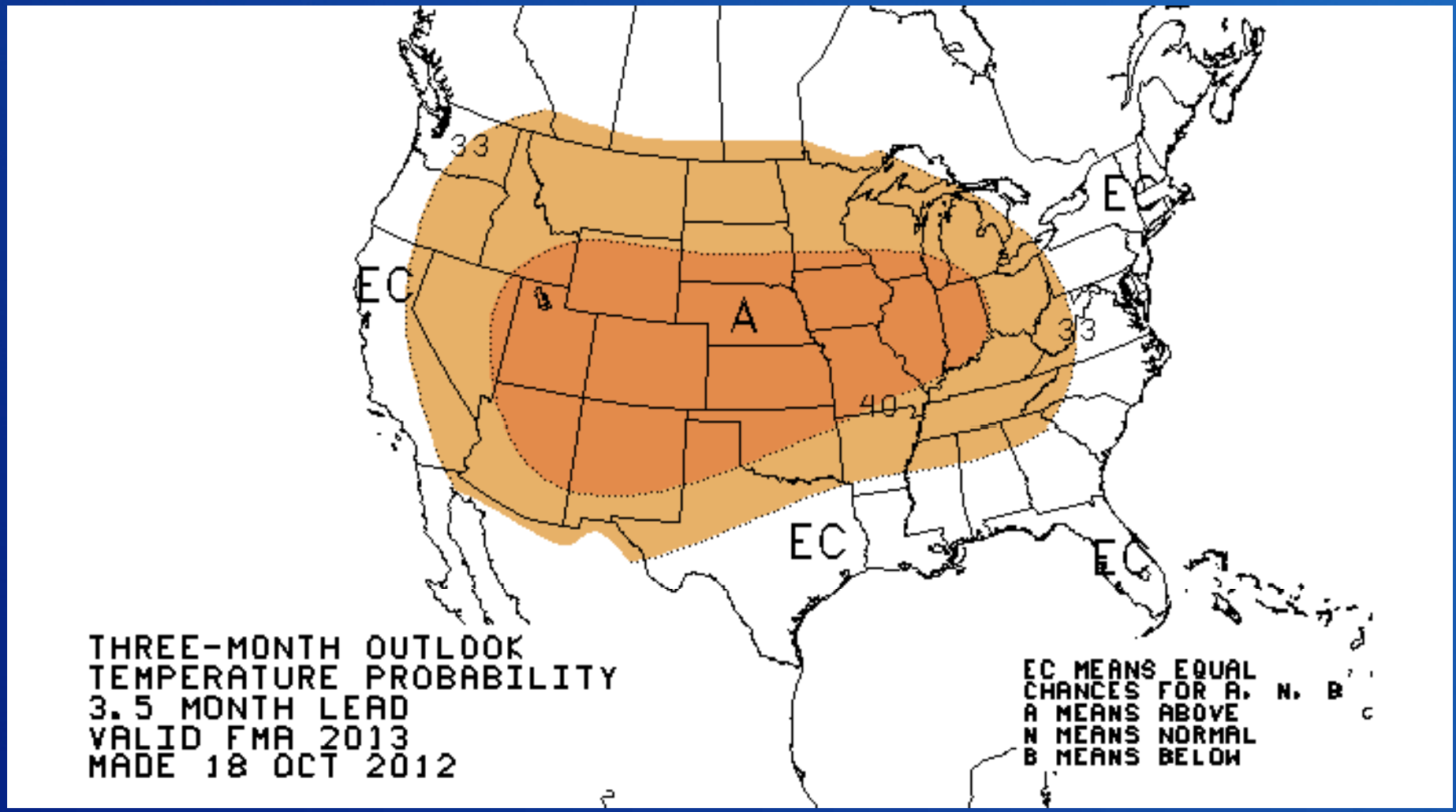
Nov-Dec-Jan



RECLAMATION

NWS Long Range Temperature Forecasts

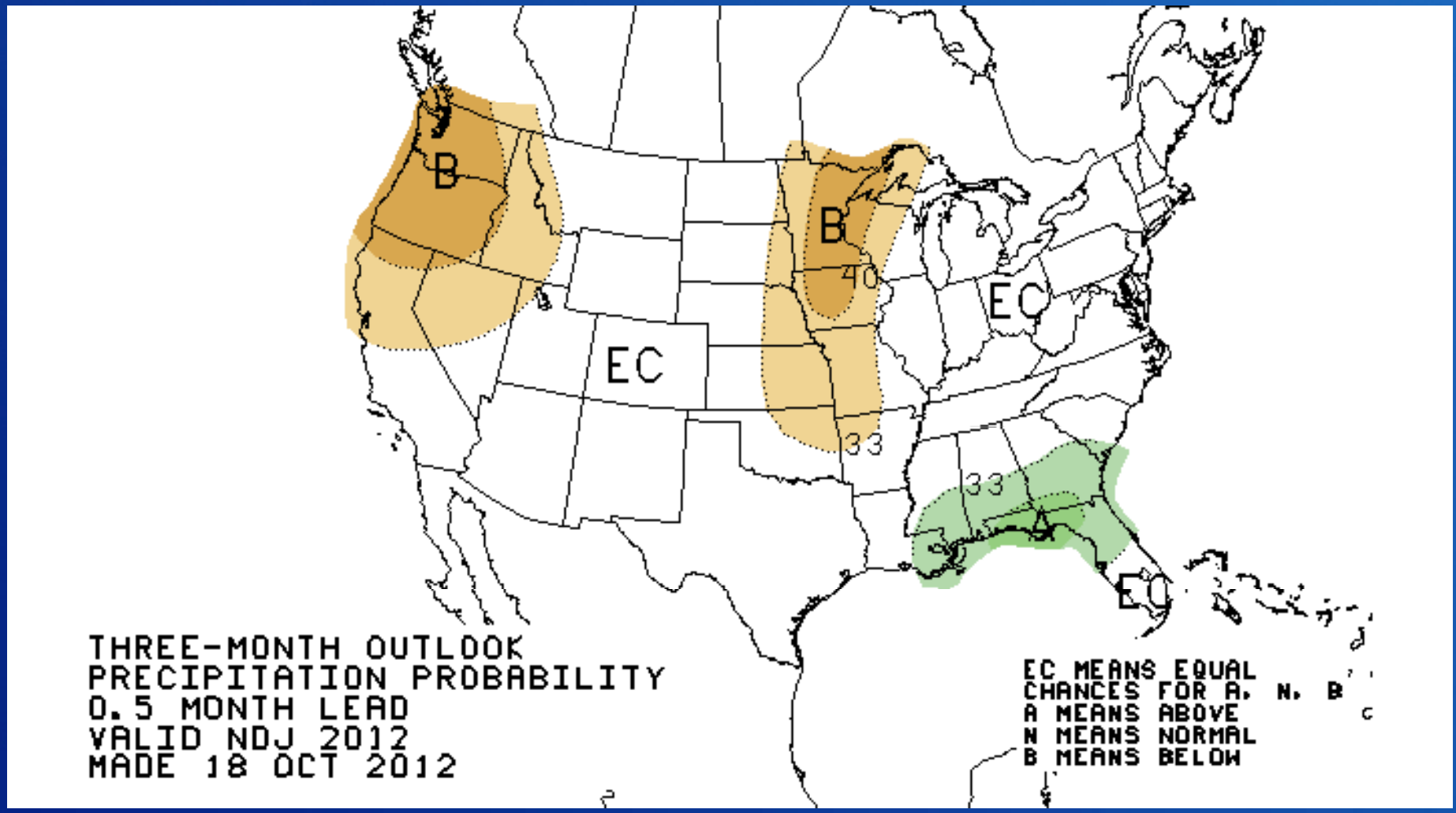
Feb-Mar-Apr



RECLAMATION

NWS Long Range Precipitation Forecasts

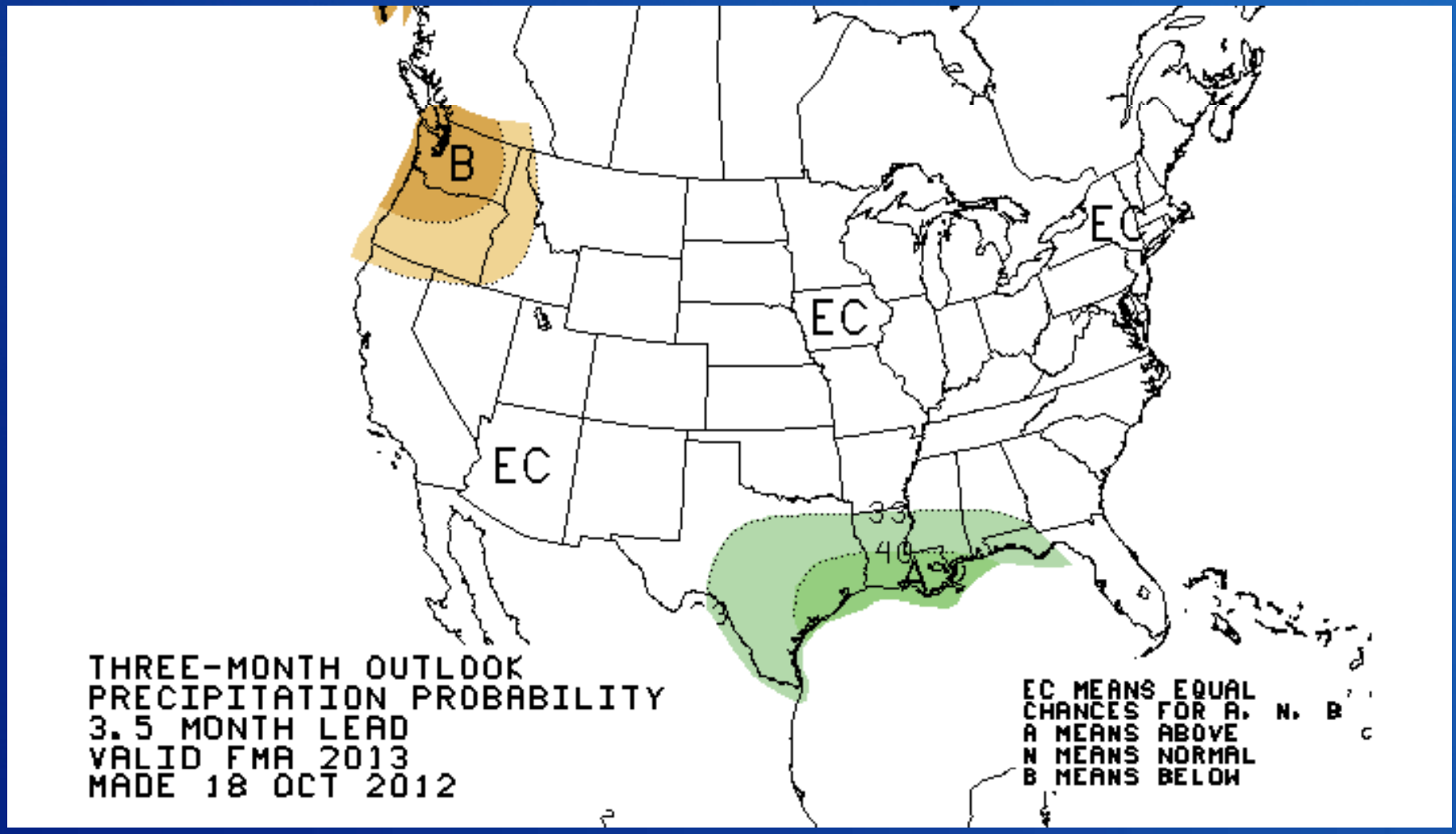
Nov-Dec-Jan



RECLAMATION

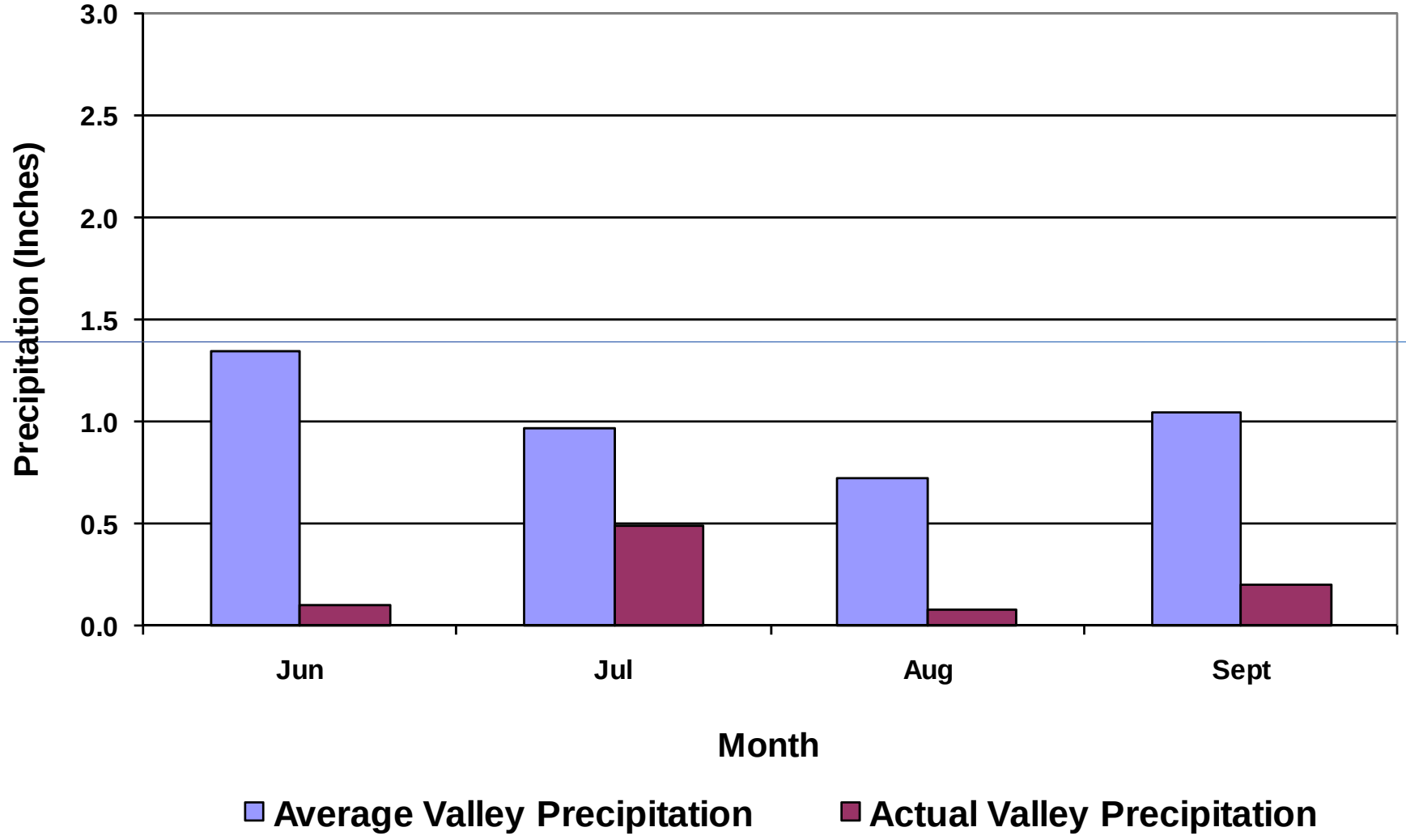
NWS Long Range Precipitation Forecasts

Feb-Mar-Apr



RECLAMATION

2012 Valley Precipitation



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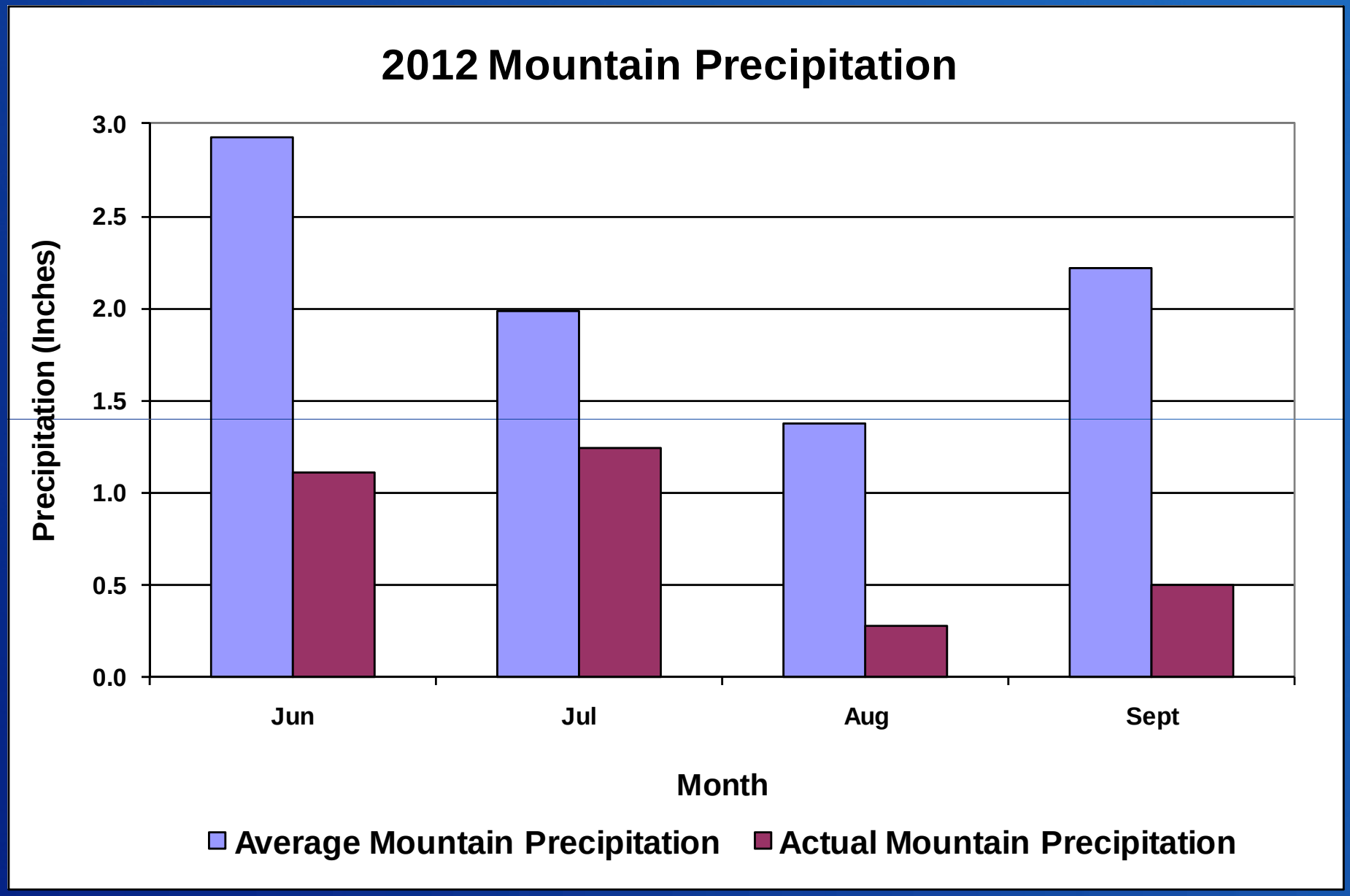
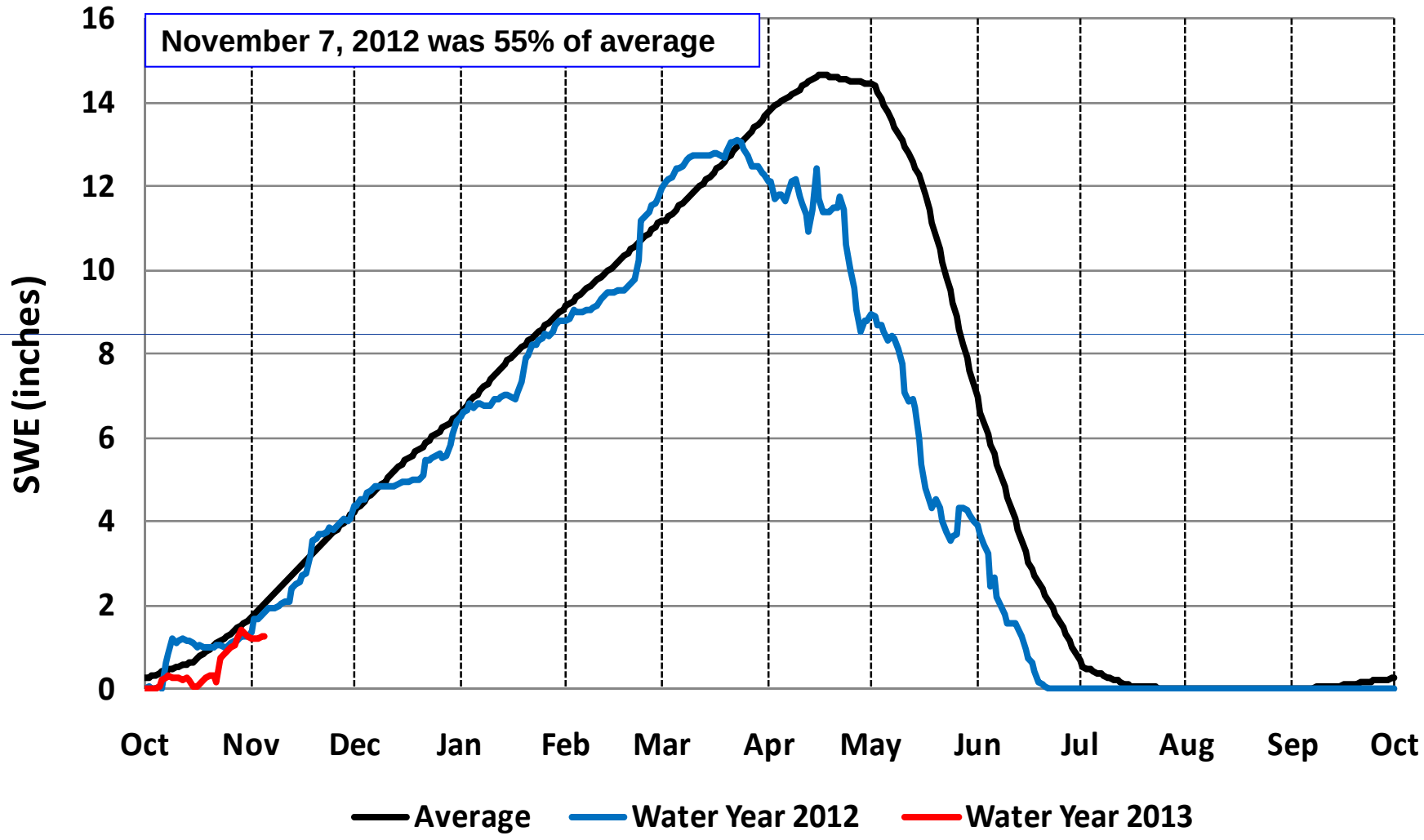


RECLAMATION

Bighorn Lake - Snow Water Equivalent



RECLAMATION

Inflow Conditions September

Bighorn Lake

- **September: 119 KAF (69% of Ave)**
  - **6th Lowest**

Boysen Reservoir

- **September: 29 KAF (53% of Ave)**
  - **6th Lowest**

Buffalo Bill Reservoir

- **September: 12 KAF (45% of Ave)**
  - **Lowest**

RECLAMATION

Inflow Conditions October

Bighorn Lake

- October: 132 KAF (75% of Ave)
  - 9th Lowest

Boysen Reservoir

- October: 24 KAF (41% of Ave)
  - 3rd Lowest

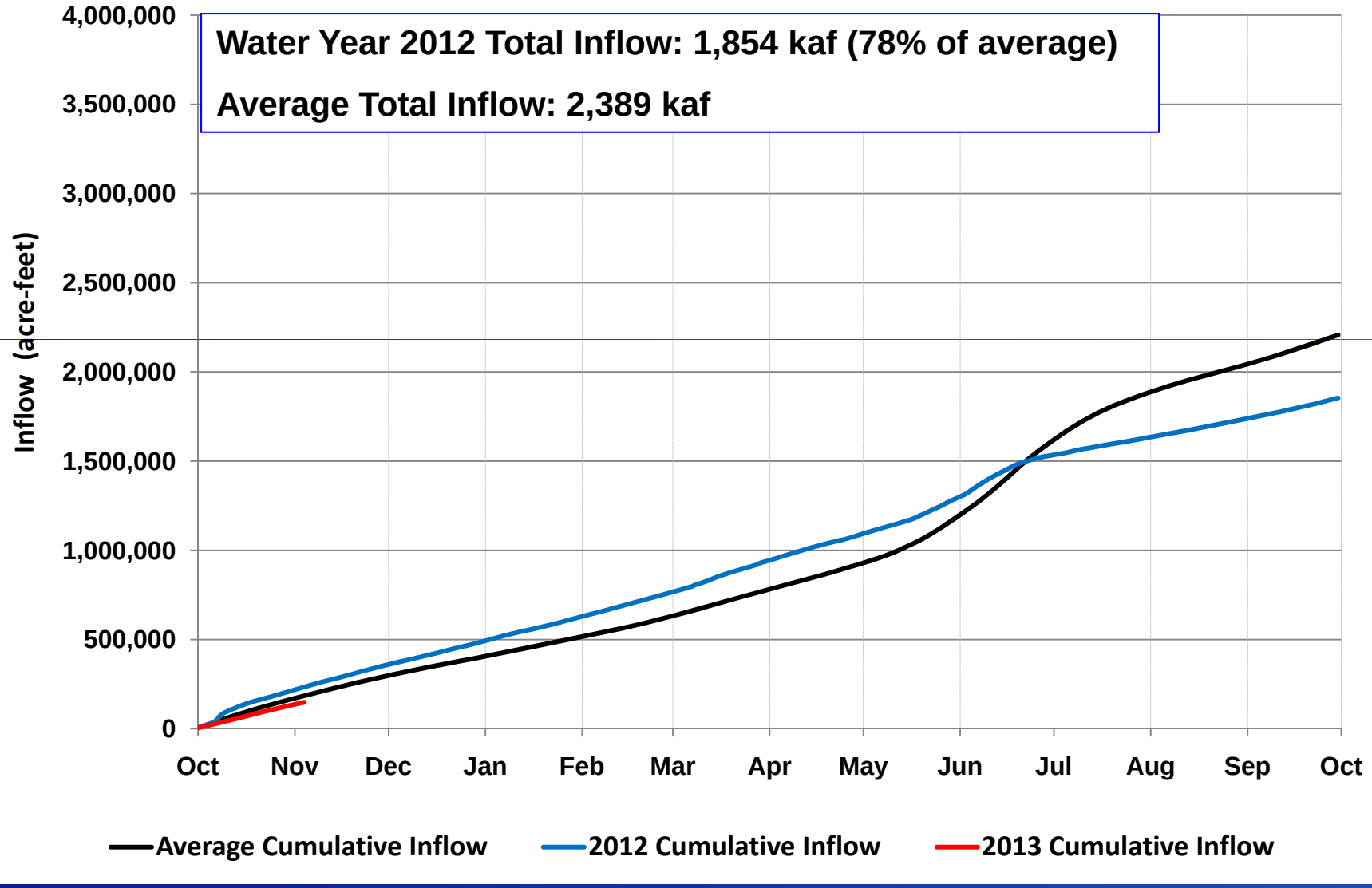
Buffalo Bill Reservoir

- October: 13 KAF (52% of Ave)
  - Lowest

RECLAMATION

Bighorn Lake Cumulative Inflow

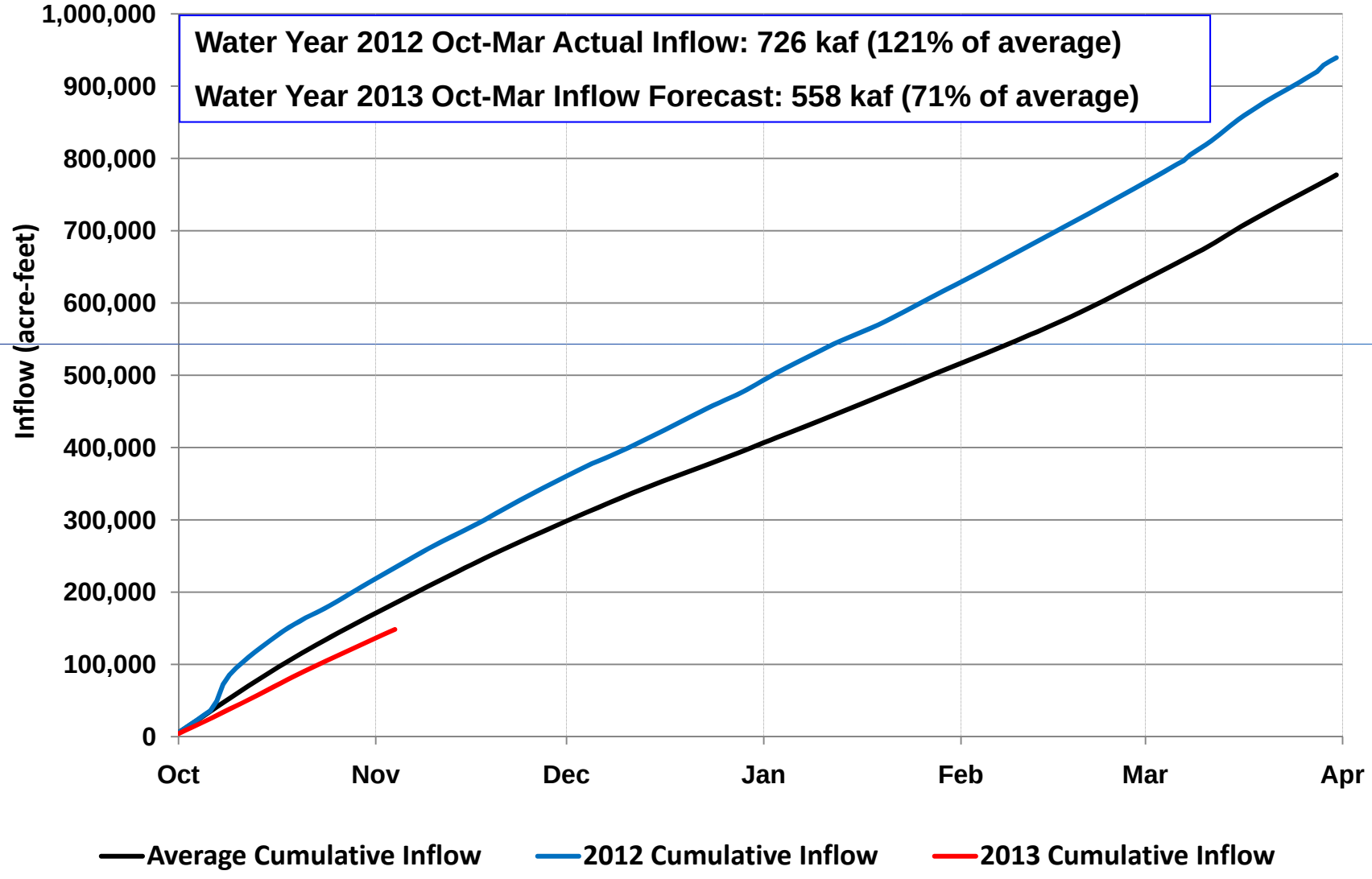
October 1 - September 30



RECLAMATION

Bighorn Lake Cumulative Inflow

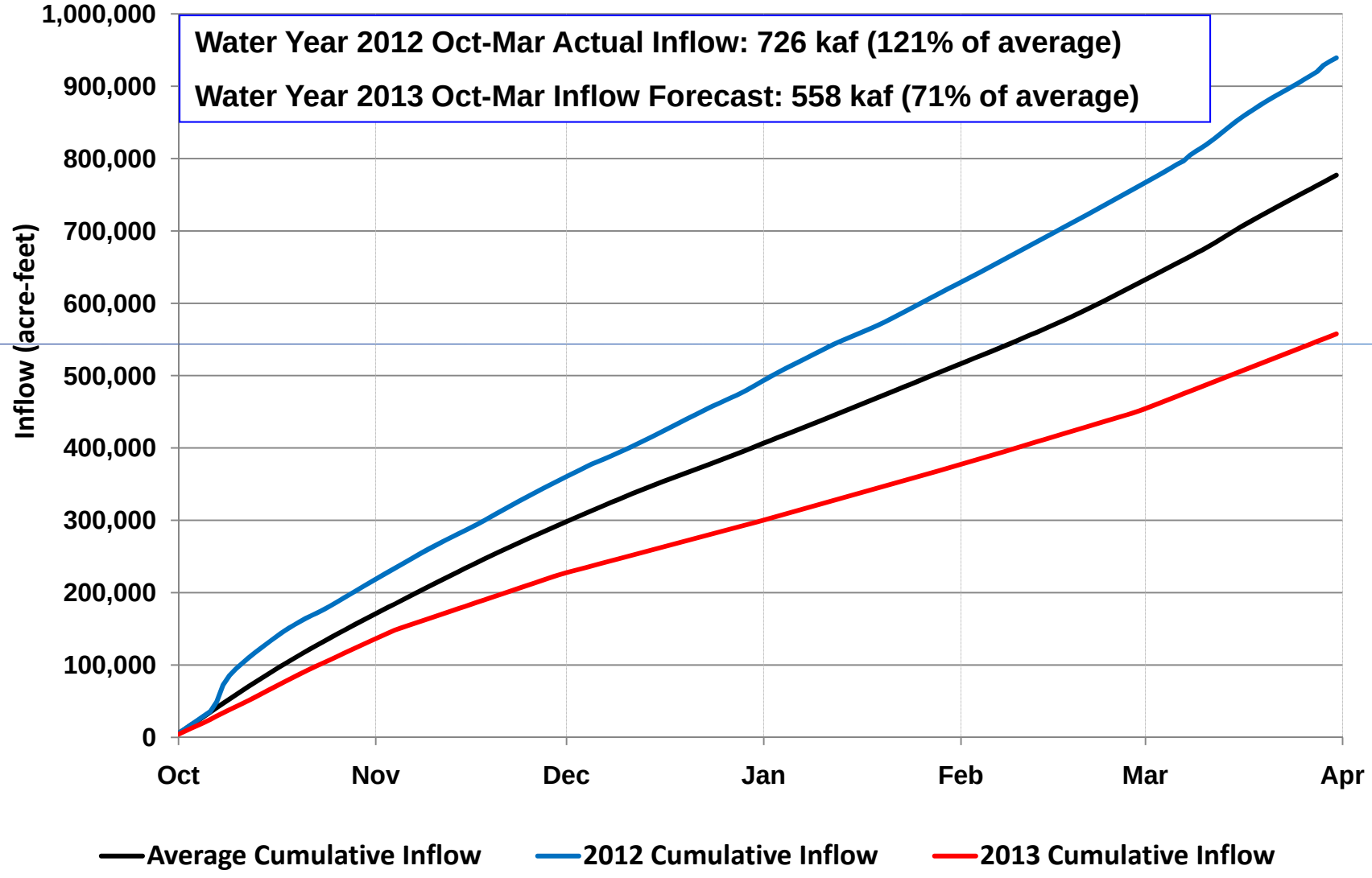
October 1 - March 31



RECLAMATION

Bighorn Lake Cumulative Inflow

October 1 - March 31



RECLAMATION

BIGHORN LAKE CURRENT CONDITIONS

Operating Criteria Used for 2013 Plans

2013 NOVEMBER - MARCH
Bighorn Lake River Release Rate

A **ENTER** **Bighorn Lake Apr-Oct Gain in Acre-feet**	B CALCULATED Nov-Mar Forecasted Gain Acre-feet	C **ENTER** **Bighorn Lake Oct. 31 Storage AF**	D **ENTER** **Buffalo Bill Nov-Mar Release CFS**	E **ENTER** **Boysen Res Nov-Mar Release CFS**	F End of March Bighorn Lake Stor. Target acre-feet (2007 AC Table)	G CALCULTED Release to Afterbay CFS	H CALCULATED River Release From Afterbay CFS	I 31-Mar-10 Reservoir Level Target
-61,362	213,505	919,225	205	500	794,613	1834	1904	3615.0
Min Probable	178,505							
Max Probable	248,505							

Month	Gain
April	35037
May	13534
June	23744
July	-95770
August	-78763
September	-18767
October	59623
Total	-61362

Directions: Enter appropriate values in the Yellow Cells: A10, C10, D10, & E10. Bighorn Lake River Release for Nov. - Mar. is calculated in cell H10 and the end of March target elevatio is displayed in I10.

B = .145*A+222402 R^2 = .6756 Forecasted Gain
F = Desired end of March Storage
G is determined from calculations in J through L with Checks in M
H = Dam Release (G) + 70 cfs

Forecasted Gain Adjustments

	Elevation	Sotrage
1500-2000 cfs	3615	794,613
2000-2500 cfs	3617	807,921
> 2500 cfs	3619	821,949

Intermediate Calculations for River Release

J CALCULATED **Step One** Release CFS >2500	K CALCULATED **Step Two** Release CFS 2000-2500	L CALCULATED **Step Three** Release CFS 1500-2000	M Check Results & Adjust Release CFS	
1813	1859	1904	1859	If J > 2500 than set to J
1813	**1859**	**1904**	1859	If K < 2500 than set to K
	2000	1500	1904	If L < 2000 Then set to L
		1500	**1904**	If L < 1500 then set to 1500

K End of March Reservoir Elev. Target	L End of March Reservoir Storage Target
3617.0	807,921
3617.0	807,921
3615.0	794,613
3615.0	**794,613**

RECLAMATION

BIGHORN LAKE CURRENT CONDITIONS

Operating Criteria Used for 2013 Plans

STEP 1

2012 April-October Gain = -61,400 acre-feet

2012 End-of-October Storage = 919,225 acre-feet

Upstream Reservoir Fall & Winter Releases =
Boysen = 500 cfs
Buffalo Bill = 205 cfs

Projected End-of-March Target Elevation = 3617

Calculated November-March Gain = 213,500 acre-feet

Calculated Fall & Winter Release for Yellowtail:
River = 1,859 cfs

RECLAMATION

BIGHORN LAKE CURRENT CONDITIONS

Operating Criteria Used for 2013 Plans

STEP 2

Since Calculated Fall & Winter Release is < 2,000 cfs

Set End-of-March target elevation @ 3615

Calculated New Fall & Winter Release for Yellowtail: River = 1,904 cfs

RECLAMATION

RECLAMATION

Most Probable Inflow Conditions

- **Nov–Mar Inflow forecast at 425 kaf (61% of ave).**
- **Reservoir level expected to reach end of March target elevation of 3615**
- **River release maintained @ 1,900 cfs during November-March**
- **Generation during November–March would total 192 GWHrs.**

RECLAMATION

Maximum Probable Inflow Conditions

- Nov–Mar Inflow forecast at 504 kaf (73% of ave).
- Reservoir level expected to reach end of March target elevation of 3615
- River release maintained @ 1,900 cfs from November-February and gradually increased in March to control storage
- Generation during November–March would total 226 GWHrs.

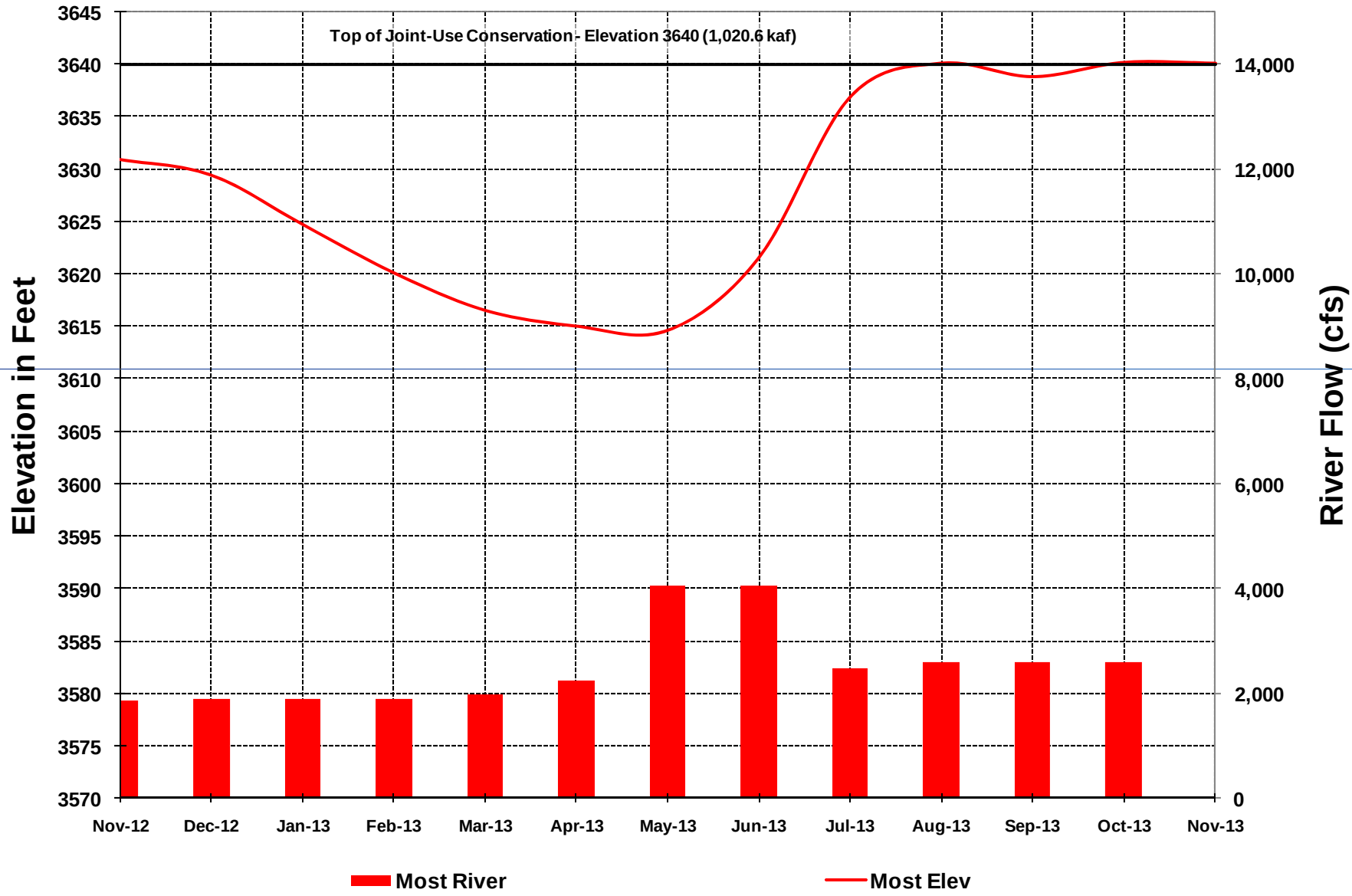
RECLAMATION

Minimum Probable Inflow Conditions

- Nov–Mar inflow forecast at 390 kaf (56% of ave)
- Reservoir level expected to reach end of March target elevation of 3615
- River release maintained @ 1,900 cfs from November-January and gradually decrease releases in February and March to conserve storage
- Power generation during November–March would total 176 GWHrs.

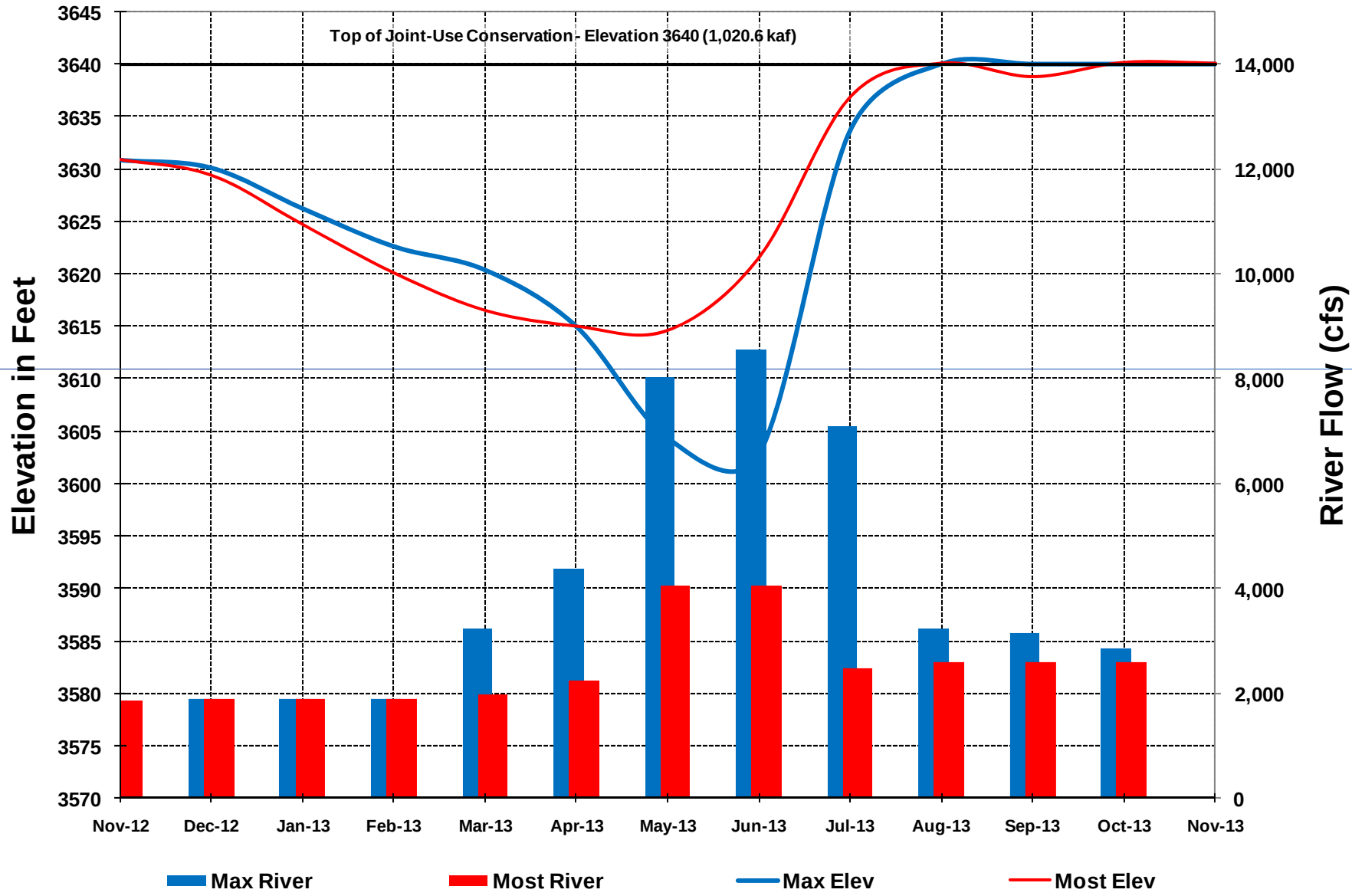
RECLAMATION

Bighorn Lake



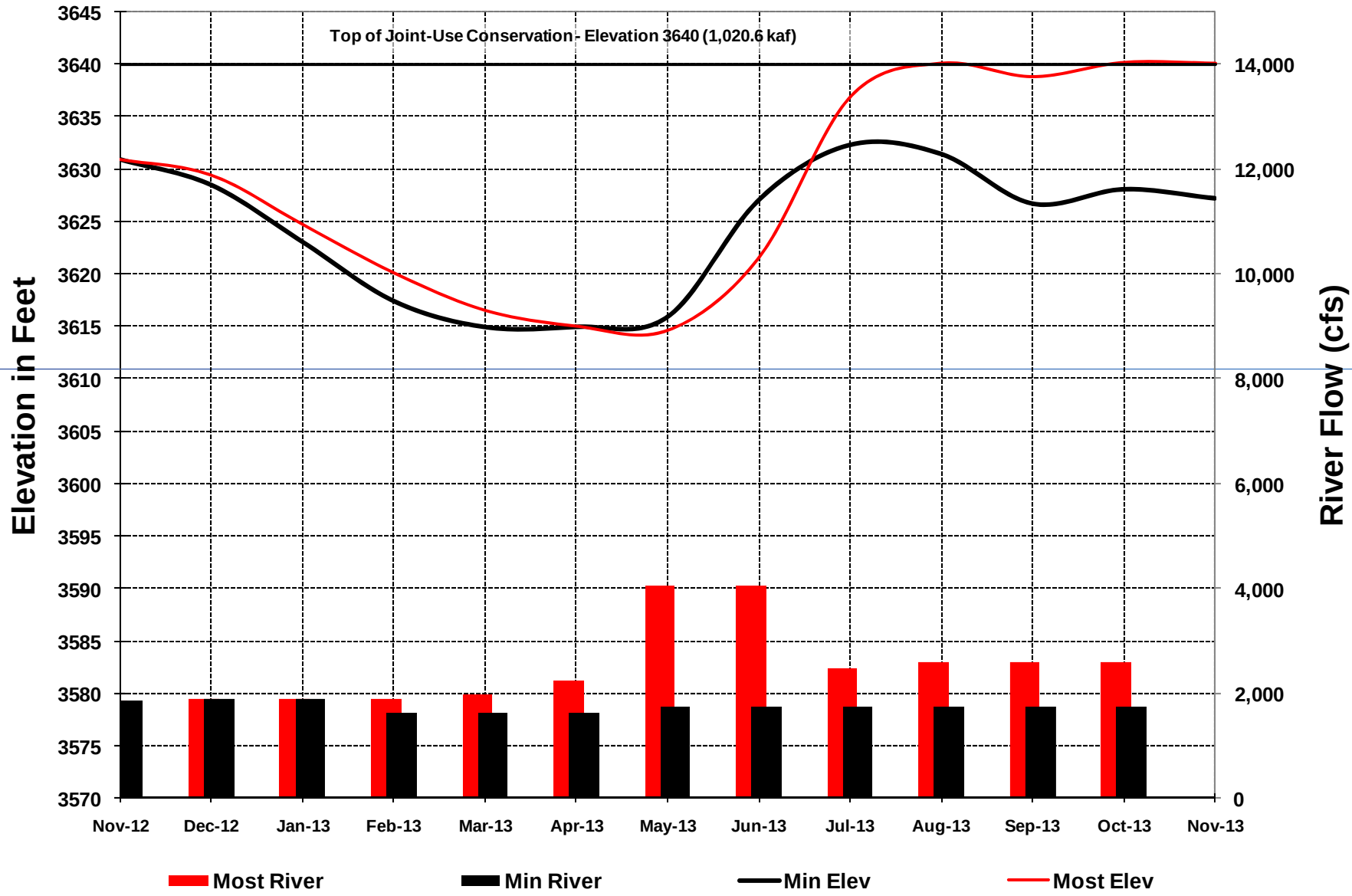
RECLAMATION

Bighorn Lake



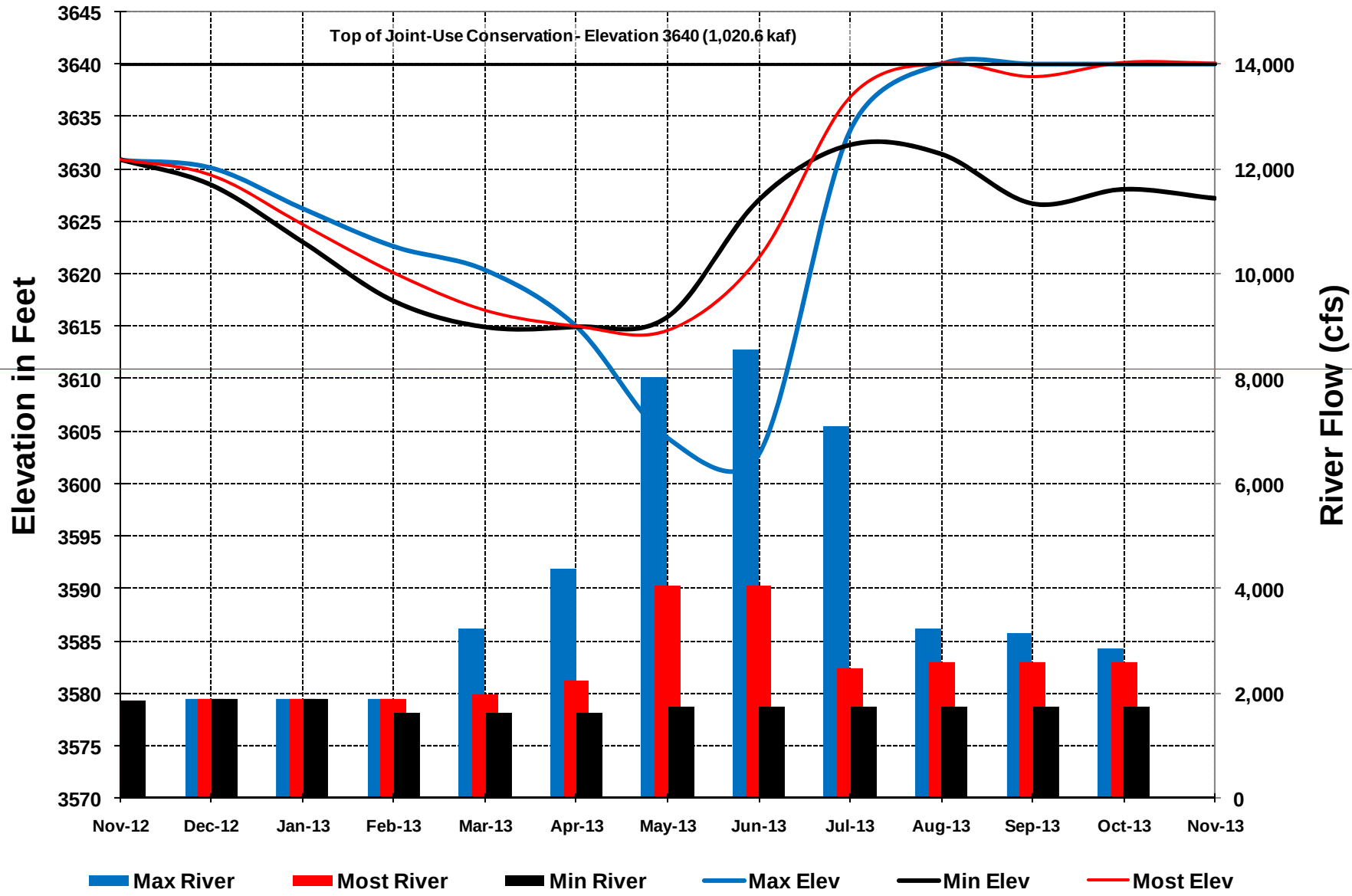
RECLAMATION

Bighorn Lake



RECLAMATION

Bighorn Lake



RECLAMATION

Summary of Current Conditions

- Lower carryover in Boysen, Buffalo Bill, and Bighorn Lake
- NWS forecast through March is for higher chance of warmer than normal temperatures
- Inflow forecast through March is below normal
- Below normal valley and mountain precipitation
- Below normal inflow in Boysen, Buffalo Bill, and Bighorn Lake in September and October

RECLAMATION

Recommended Operating Plan

- Nov–Mar Inflow forecast at 425 kaf (61% of ave).
- Reservoir level expected to reach end of March target elevation of 3617
- River release maintained @ 1,850 cfs during November-March
- Generation during November–March would total 186 GWHrs.

RECLAMATION

Recommended Operation Plan

STEP 1

2012 April-October Gain = -61,400 acre-feet

2012 End-of-October Storage = 919,225 acre-feet

Upstream Reservoir Fall & Winter Releases =
Boysen = 500 cfs
Buffalo Bill = 205 cfs

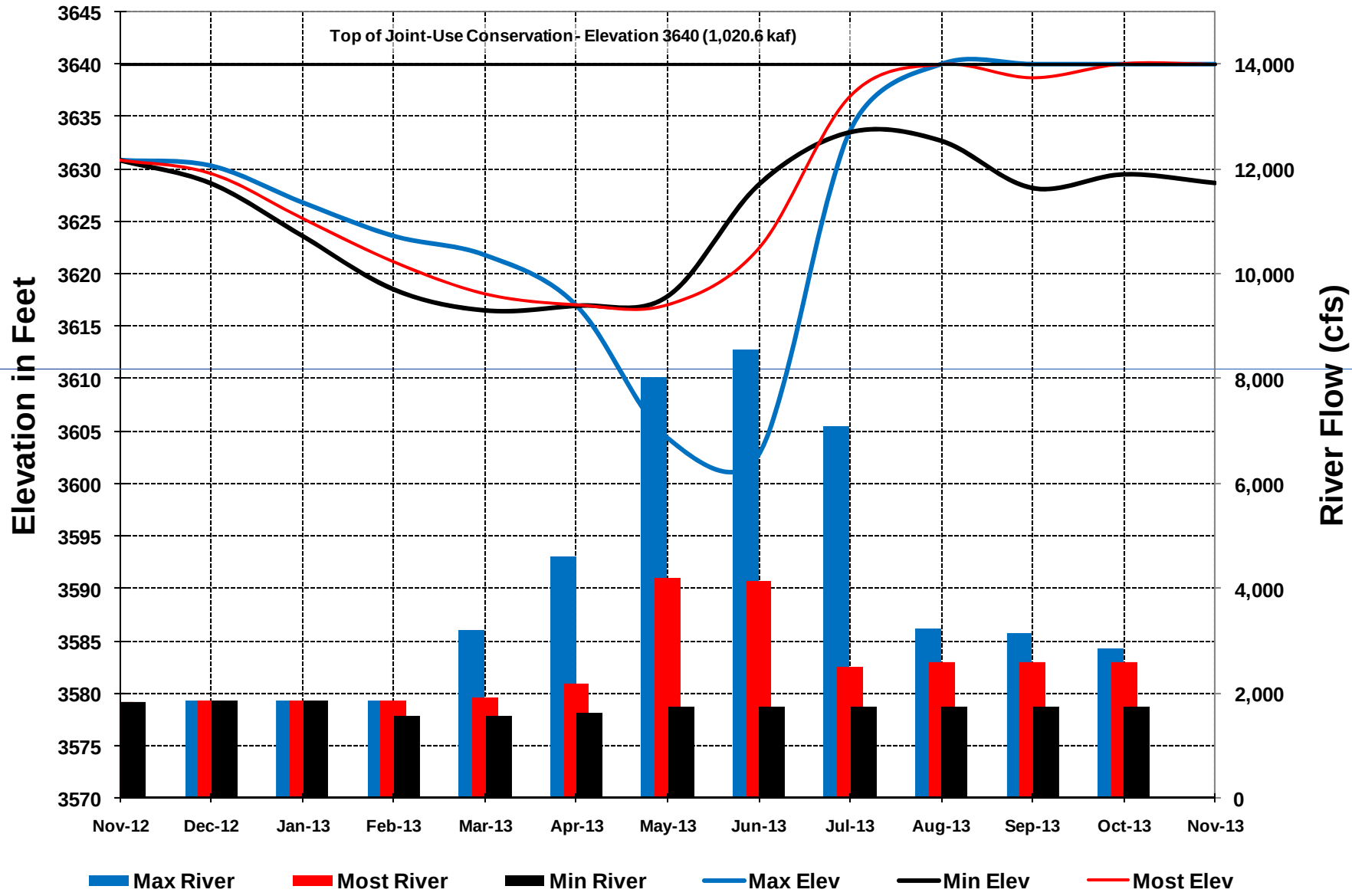
Projected End-of-March Target Elevation = 3617

Calculated November-March Gain = 213,500 acre-feet

Calculated Fall & Winter Release for Yellowtail:
River = 1,859 cfs

RECLAMATION

Bighorn Lake



RECLAMATION

Reclamation's Internet Website

http://www.usbr.gov/gp/water/

- **near real-time data available through the HYDROMET data system**
- **summaries and plots of historical data**
- **annual reservoir operating plan publication**
- **monthly water supply reports**
- **project data**
- **snow plots**
- **links to related internet sites**

Comments

The information presented at this meeting can be found on the Montana Area Office website at:

www.usbr.gov/gp/mtao/yellowtail/index.cfm

Please mail comments to:

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RECLAMATION