

# RECLAMATION

*Managing Water in the West*

## Bighorn Basin Interagency Meeting

hosted by

*Wyoming Game & Fish Department*

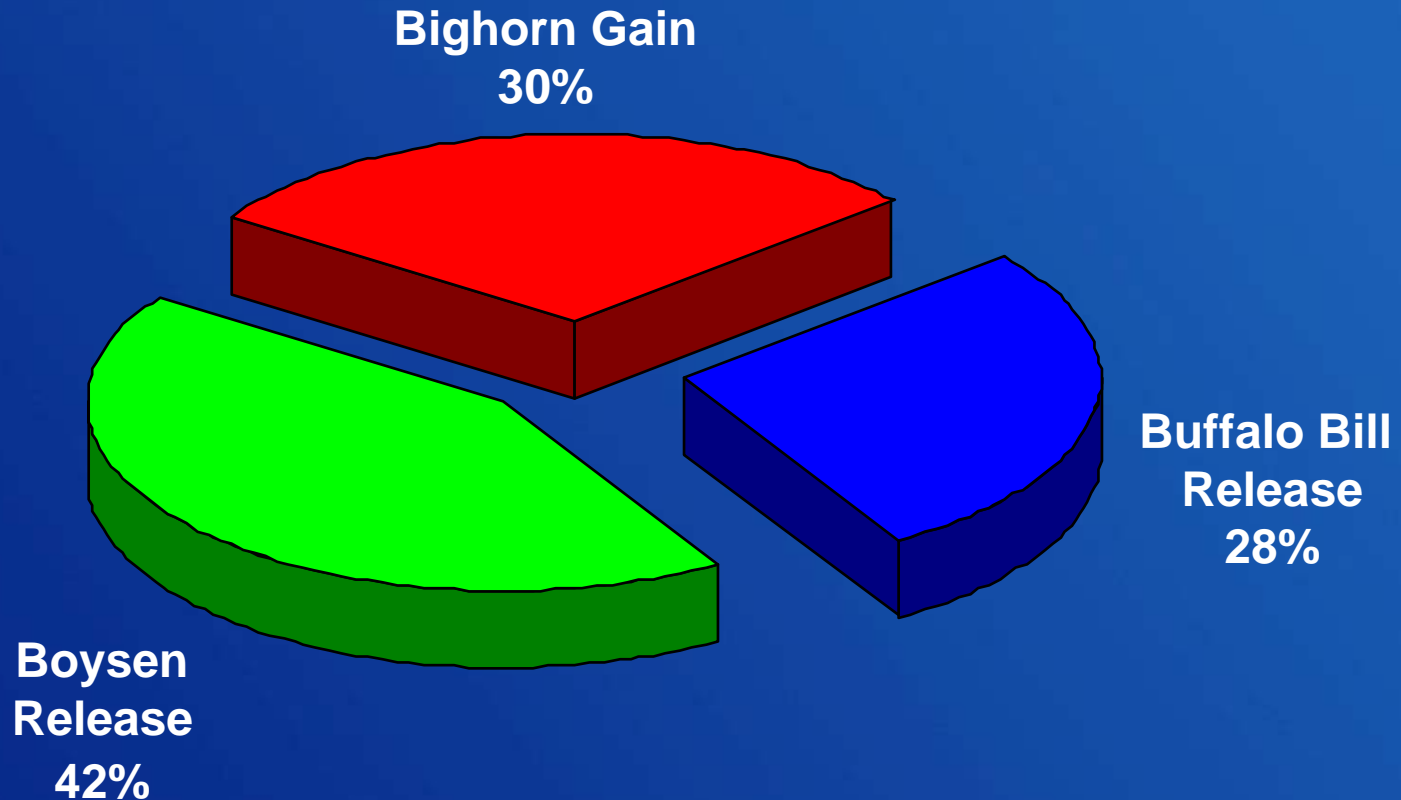
National Park Service Visitor Center

Lovell, Wyoming

March 13, 2008

# Bighorn Lake Annual Inflow Distribution

Based on 1967-2005 Data

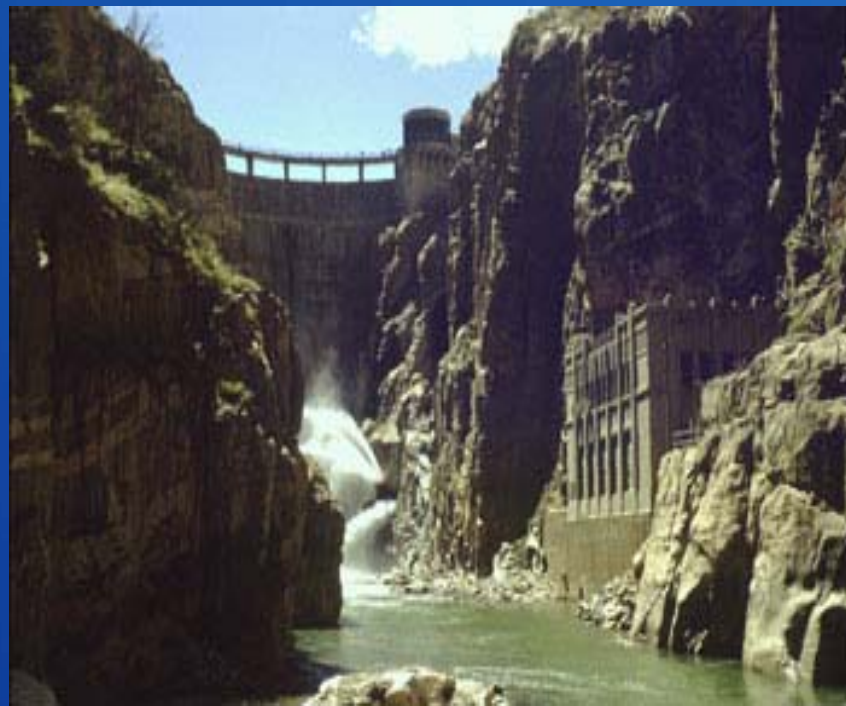


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**Operations in the Bighorn River Basin are closely coordinated with the Wyoming Area Office which is responsible for Boysen & Buffalo Bill operations.**



**Boysen Dam and Reservoir  
Wind River**



**Buffalo Bill Dam and Reservoir  
Shoshone River**

**RECLAMATION**

# OPERATING OBJECTIVES

- ✓ Recognize all downstream senior water rights.
- ✓ Meet contractual commitments for stored water.
- ✓ Maintain adequate storage space for flood control.
- ✓ Maximize the power benefits.
- ✓ Maintain lake levels for recreation, reservoir fishery, and waterfowl interests.
- ✓ Maintain river flow levels for river fishery.

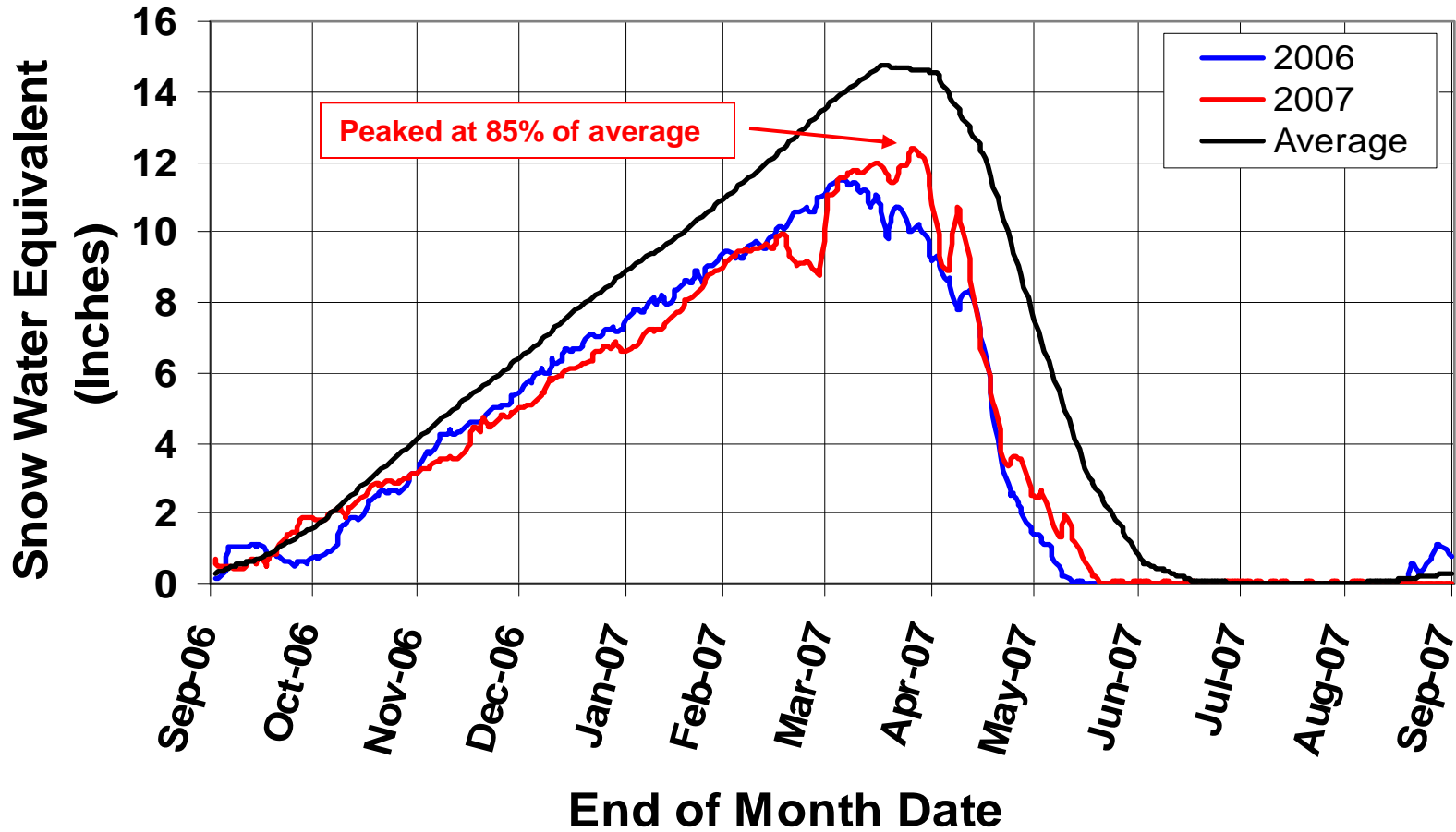


# Recap of Water Year 2007

- ✓ **Mountain Snowpack**
- ✓ **Inflow to Bighorn Lake**
- ✓ **Bighorn River Releases**
- ✓ **Bighorn Lake Storage Conditions**

# Recap of Water Year 2007

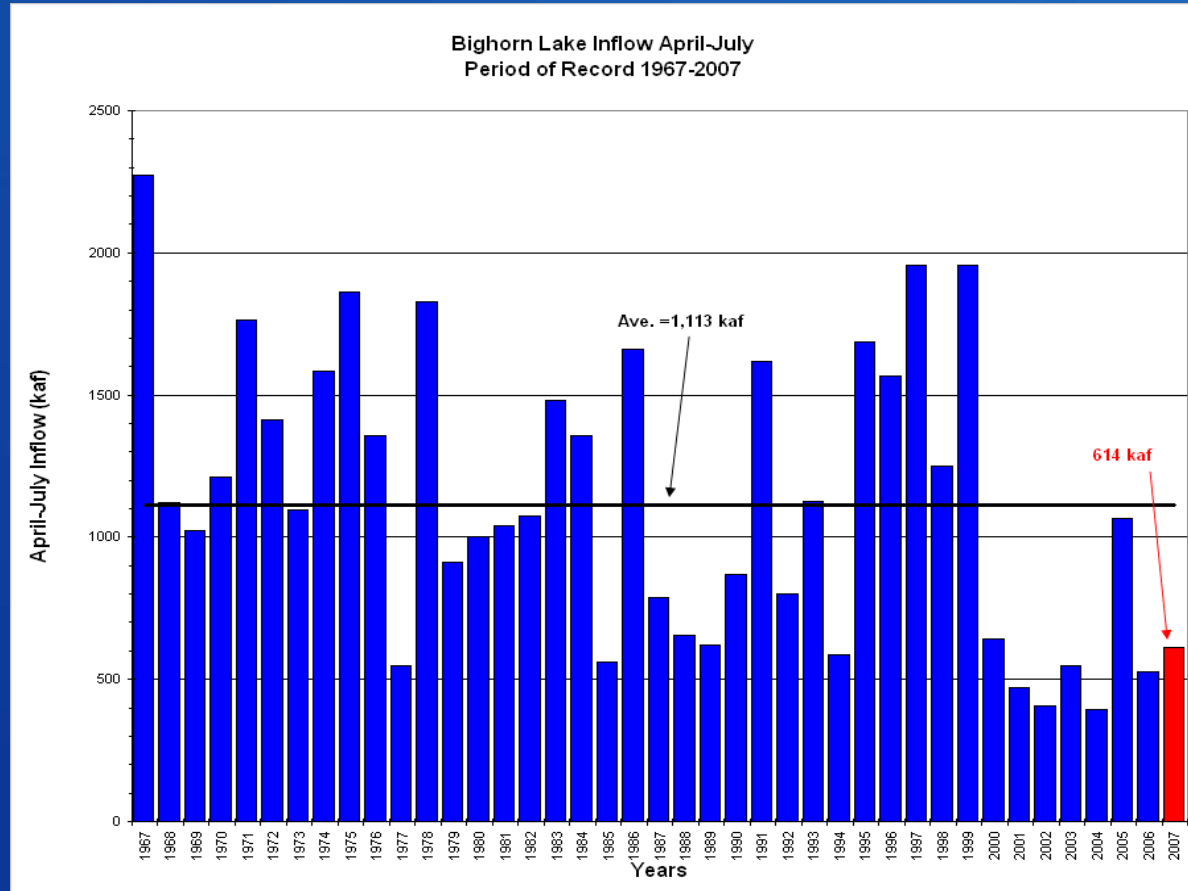
## Mountain Snowpack Conditions



# Recap of Water Year 2007

## April-July Inflow (acre-feet)

BY YEAR		RANKED		
YEAR	SUMMATION	MISS	YEAR	SUMMATION
1967	2271119.00	0	1967	2271119.00
1968	1121723.50	0	1997	1957909.38
1969	1022204.56	0	1999	1954361.38
1970	1211447.62	0	1975	1863084.12
1971	1761603.00	0	1978	1828506.38
1972	1412024.50	0	1971	1761603.00
1973	1097200.62	0	1995	1687499.88
1974	1583350.50	0	1986	1659118.12
1975	1863084.12	0	1991	1619218.88
1976	1356278.50	0	1974	1583350.50
1977	549853.88	0	1996	1567308.00
1978	1828506.38	0	1983	1482762.75
1979	910146.06	0	1972	1412024.50
1980	999731.81	0	1984	1356584.88
1981	1038870.25	0	1976	1356278.50
1982	1073918.62	0	1998	1249862.25
1983	1482762.75	0	1970	1211447.62
1984	1356584.88	0	1993	1124839.38
1985	562000.69	0	1968	1121723.50
1986	1659118.12	0	1973	1097200.62
1987	788028.94	0	1982	1073918.62
1988	653689.31	0	2005	1065040.62
1989	622719.25	0	1981	1038870.25
1990	867187.94	0	1969	1022204.56
1991	1619218.88	0	1980	999731.81
1992	801294.06	0	1979	910146.06
1993	1124839.38	0	1990	867187.94
1994	587368.44	0	1992	801294.06
1995	1687499.88	0	1987	788028.94
1996	1567308.00	0	1988	653689.31
1997	1957909.38	0	2000	643018.12
1998	1249862.25	0	1989	622719.25
1999	1954361.38	0	2007	614100.00
2000	643018.12	0	1994	587368.44
2001	469897.88	0	1985	562000.69
2002	408570.88	0	1977	549853.88
2003	548248.62	0	2003	548248.62
2004	392148.84	0	2006	528198.00
2005	1065040.62	0	2001	469897.88
2006	528198.00	0	2002	408570.88
2007	614100.00	0	2004	392148.84



2007 - 9<sup>th</sup> Lowest of Record

2000's - Lowest of Record

Average of 54 years:  
2007 is 51 percent of average

1113300

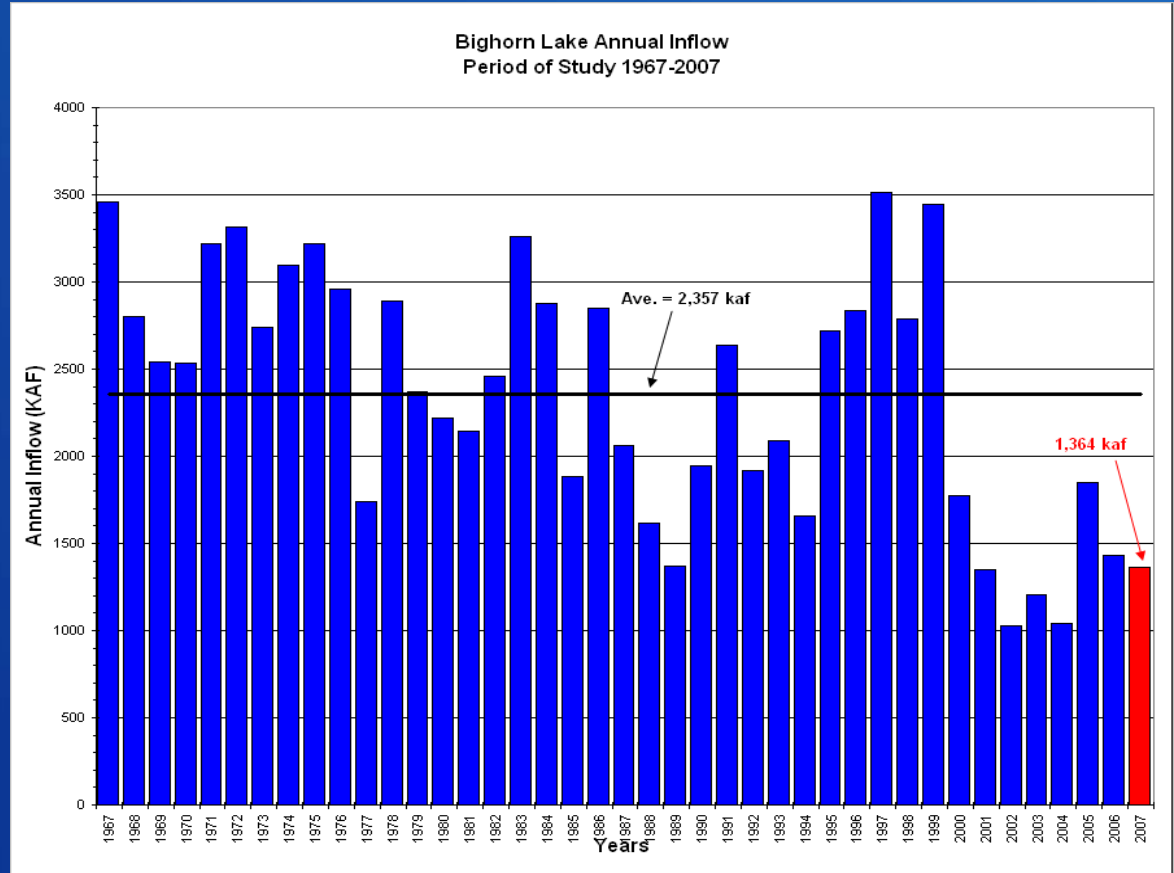
# RECLAMATION

# Recap of Water Year 2007

## Annual Inflow (acre-feet)

BY YEAR		RANKED		
YEAR	SUMMATION	MISS	YEAR	SUMMATION
1967	3458698.00	0	1997	3516450.50
1968	2805523.00	0	1967	3458698.00
1969	2538975.00	0	1999	3443793.50
1970	2536716.75	0	1972	3320208.00
1971	3215818.25	0	1983	3259034.00
1972	3320208.00	0	1975	3221720.25
1973	2738184.75	0	1971	3215818.25
1974	3094672.25	0	1974	3094672.25
1975	3221720.25	0	1976	2966925.50
1976	2966925.50	0	1984	2887518.75
1977	1740630.88	0	1978	2887243.00
1978	2887243.00	0	1986	2851288.75
1979	2370932.00	0	1996	2842566.75
1980	2226959.75	0	1968	2805523.00
1981	2143234.00	0	1998	2787867.25
1982	2458121.25	0	1973	2738184.75
1983	3259034.00	0	1995	2718941.00
1984	2887518.75	0	1991	2639744.75
1985	1883584.62	0	1969	2538975.00
1986	2851288.75	0	1970	2536716.75
1987	2064115.00	0	1982	2458121.25
1988	1619253.75	0	1979	2370932.00
1989	1367536.38	0	1980	2226959.75
1990	1942052.25	0	1981	2143234.00
1991	2639744.75	0	1993	2092193.75
1992	1925226.38	0	1987	2064115.00
1993	2092193.75	0	1990	1942052.25
1994	1657113.88	0	1992	1925226.38
1995	2718941.00	0	1985	1883584.62
1996	2842566.75	0	2005	1847983.25
1997	3516450.50	0	2000	1776761.12
1998	2787867.25	0	1977	1740630.88
1999	3443793.50	0	1994	1657113.88
2000	1776761.12	0	1988	1619253.75
2001	1347515.12	0	2006	1432633.00
2002	1029821.19	0	2007	1364200.00
2003	1208316.75	0	1989	1367536.38
2004	1041571.12	0	2001	1347515.12
2005	1847983.25	0	2003	1208316.75
2006	1432633.00	0	2004	1041571.12
2007	1364200.00	0	2002	1029821.19

Average of 54 years: 2357000  
 2007 is 54 percent of average



2007 - 6<sup>th</sup> Lowest of Record

2000's - Lowest of Record

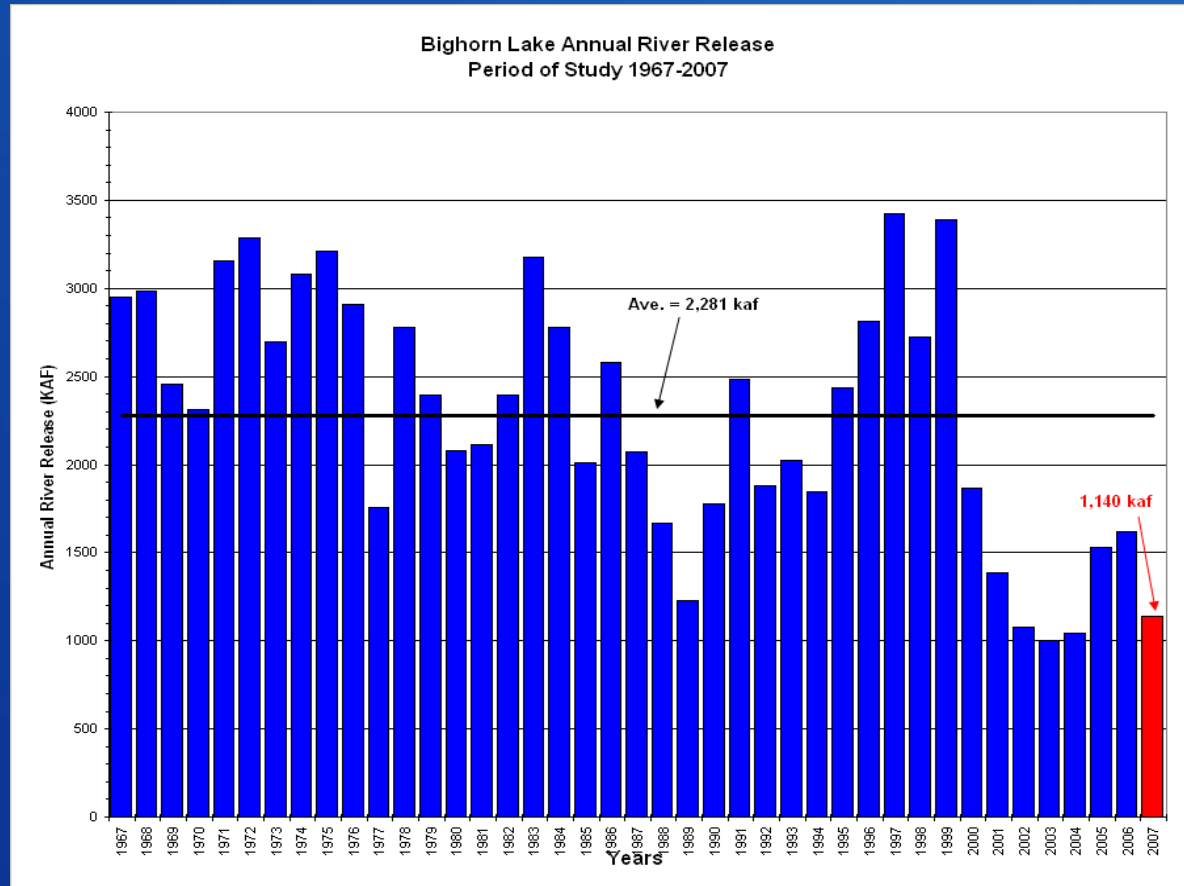
# RECLAMATION



# Recap of Water Year 2007

## Total Annual River Release (acre-feet)

BY YEAR		RANKED		
YEAR	TOTAL	YEAR	TOTAL	
1967	2950342.25	0	1997	3420569.75
1968	2986805.00	0	1999	3390721.00
1969	2453562.00	0	1972	3285960.75
1970	2311800.25	0	1975	3212272.25
1971	3153999.75	0	1983	3176994.25
1972	3285960.75	0	1971	3153999.75
1973	2693269.50	0	1974	3079622.75
1974	3079622.75	0	1968	2986805.00
1975	3212272.25	0	1967	2950342.25
1976	2907066.25	0	1976	2907066.25
1977	1759073.50	0	1996	2812201.50
1978	2781031.00	0	1984	2781852.75
1979	2393363.50	0	1978	2781031.00
1980	2079321.62	0	1998	2726333.00
1981	2112384.75	0	1973	2693269.50
1982	2397572.00	0	1986	2577931.00
1983	3176994.25	0	1991	2483863.25
1984	2781852.75	0	1969	2453562.00
1985	2013182.38	0	1995	2434736.25
1986	2577931.00	0	1982	2397572.00
1987	2074388.50	0	1979	2393363.50
1988	1664645.25	0	1970	2311800.25
1989	1226968.88	0	1981	2112384.75
1990	1776188.00	0	1980	2079321.62
1991	2483863.25	0	1987	2074388.50
1992	1883047.62	0	1993	2021183.12
1993	2021183.12	0	1985	2013182.38
1994	1842472.88	0	1992	1883047.62
1995	2434736.25	0	2000	1867542.12
1996	2812201.50	0	1994	1842472.88
1997	3420569.75	0	1990	1776188.00
1998	2726333.00	0	1977	1759073.50
1999	3390721.00	0	1988	1664645.25
2000	1867542.12	0	2006	1617845.75
2001	1385071.00	0	2005	1530368.38
2002	1076322.25	0	2001	1385071.00
2003	1004899.62	0	1989	1226968.88
2004	1045489.62	0	2007	1139823.12
2005	1530368.38	0	2002	1076322.25
2006	1617845.75	0	2004	1045489.62
2007	1139823.12	0	2003	1004899.62



2000's - Lowest of Record

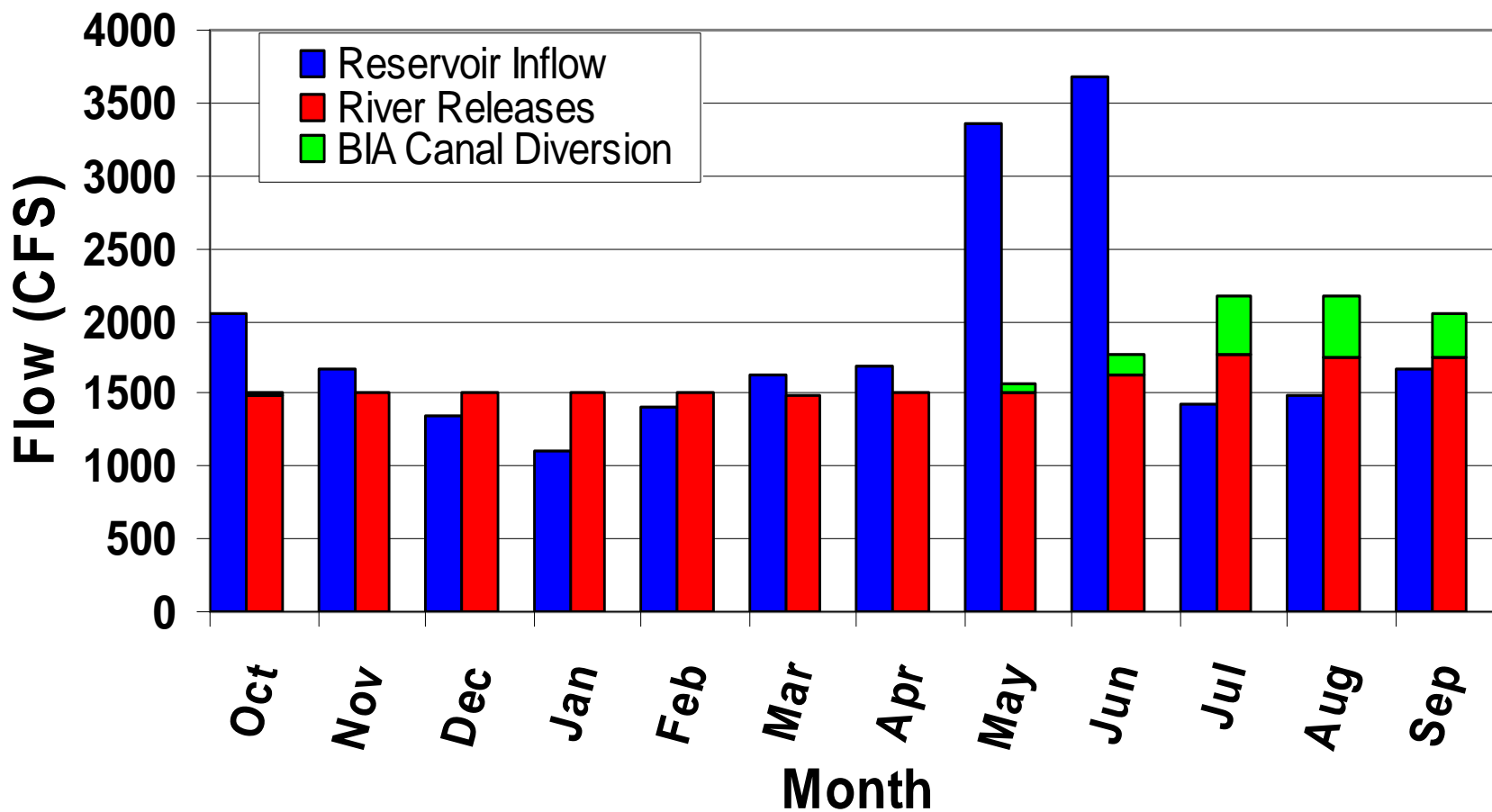
2007 - 4<sup>th</sup> Lowest of Record

Average of 41 years: 2281270.50  
2007 is 50 percent of average

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# Recap of Water Year 2007

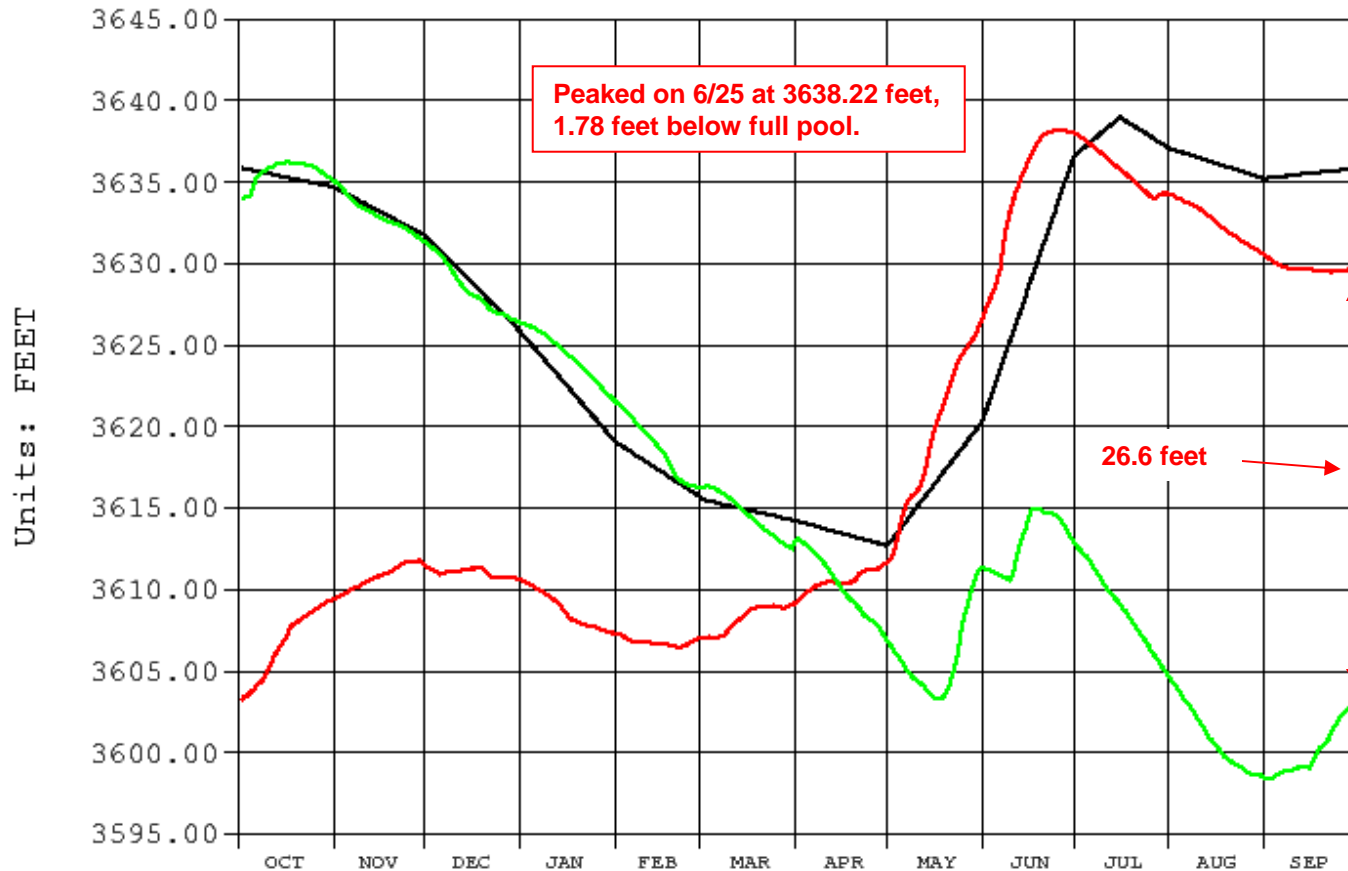
## 2007 Bighorn Flows



# Recap of Water Year 2007

Archive Data From 1-OCT Through 30-SEP

Plotted 03/01/2008 17:21



BHR Bighorn Lake (Yellowtail), Bighorn River near Fort Smith, MT

FB\_OPAV Operation Model Average Forebay Elevation (feet)

FB Reservoir Forebay Elevation (feet)

Average

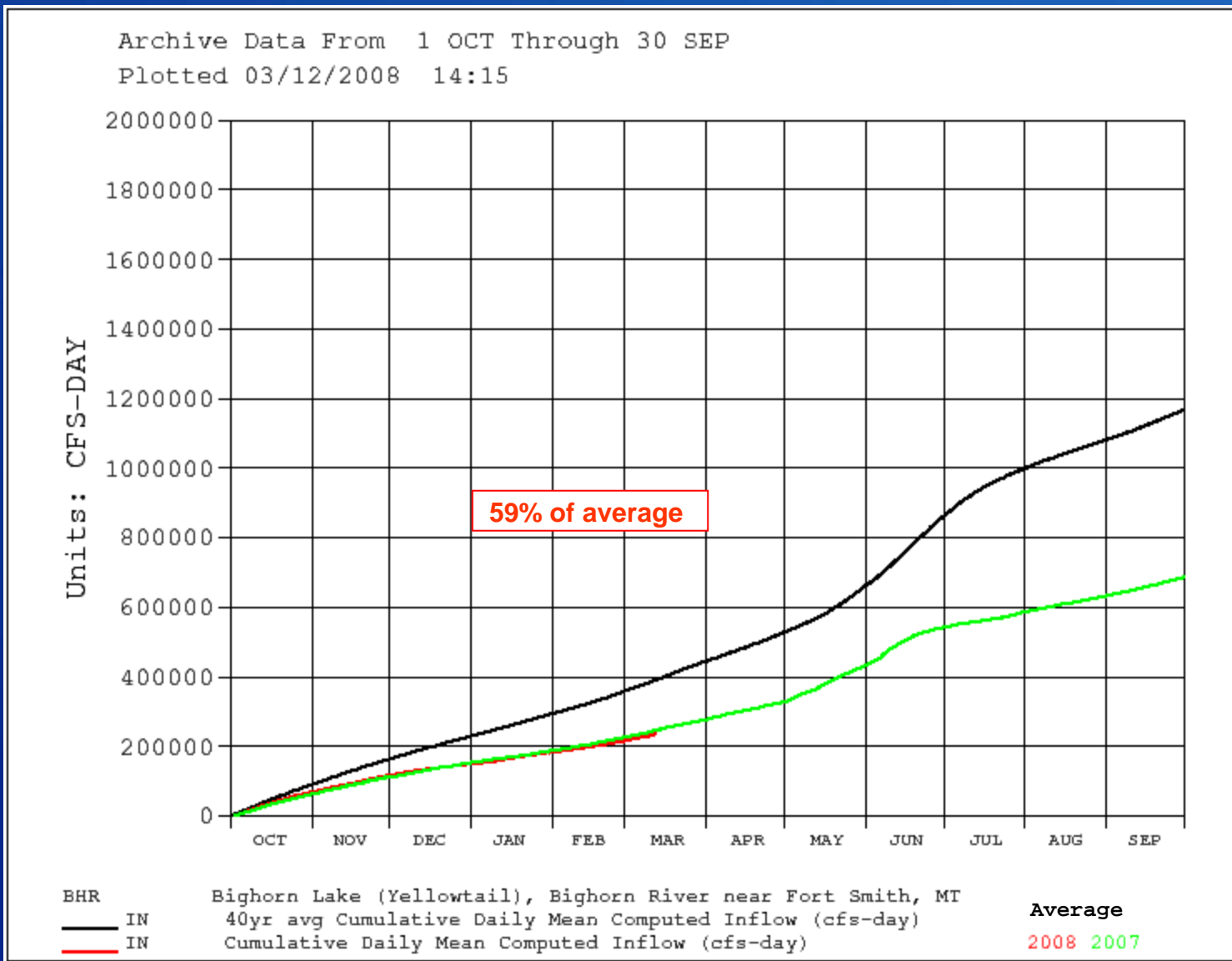
2007 2006

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**Current Conditions**  
**and**  
**2008 Water Supply Outlook**

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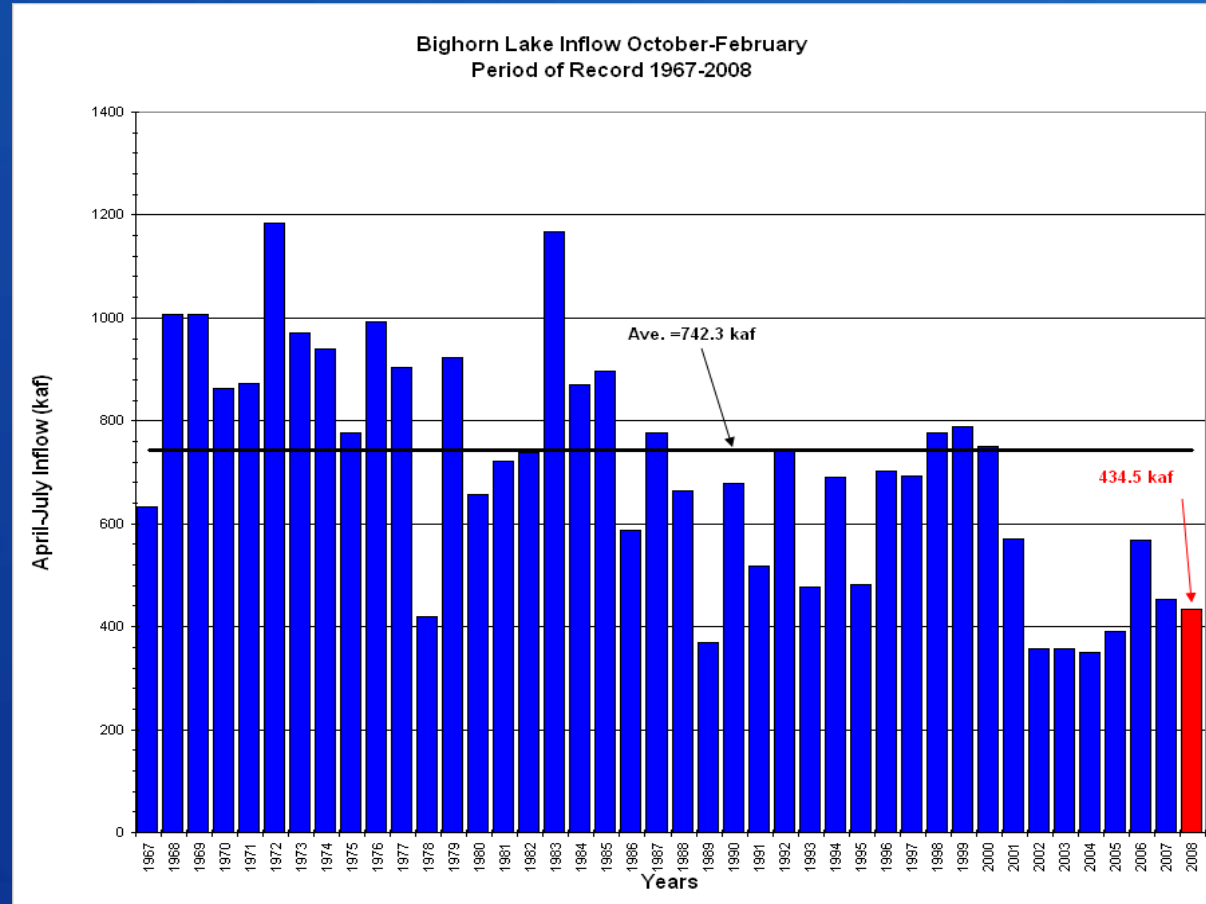
# Cumulative Inflow Since October 1, 2007





# October-February Inflow (Acre-Feet)

BY YEAR			RANKED	
YEAR	SUMMATION	MISS	YEAR	SUMMATION
1967	631860.12	0	1972	1183467.75
1968	1006331.44	0	1983	1167321.38
1969	1007956.44	0	1969	1007956.44
1970	863571.56	0	1968	1006331.44
1971	871712.81	0	1976	991732.12
1972	1183467.75	0	1973	971472.19
1973	971472.19	0	1974	939794.69
1974	939794.69	0	1979	922220.44
1975	776611.06	0	1977	904044.19
1976	991732.12	0	1985	897027.06
1977	904044.19	0	1971	871712.81
1978	419889.78	0	1984	871231.19
1979	922220.44	0	1970	863571.56
1980	656034.19	0	1999	789435.62
1981	720497.06	0	1987	777781.75
1982	738008.69	0	1998	777739.81
1983	1167321.38	0	1975	776611.06
1984	871231.19	0	2000	751464.62
1985	897027.06	0	1992	742378.81
1986	587168.00	0	1982	738008.69
1987	777781.75	0	1981	720497.06
1988	665148.12	0	1996	702316.69
1989	369291.69	0	1997	693003.00
1990	678009.94	0	1994	690217.06
1991	517673.03	0	1990	678009.94
1992	742378.81	0	1988	665148.12
1993	476090.53	0	1980	656034.19
1994	690217.06	0	1967	631860.12
1995	482786.62	0	1985	587168.00
1996	702316.69	0	2001	570347.31
1997	693003.00	0	2006	568448.19
1998	777739.81	0	1991	517673.03
1999	789435.62	0	1995	482786.62
2000	751464.62	0	1993	476090.53
2001	570347.31	0	2007	452074.41
2002	356157.91	0	2008	434546.16
2003	357313.78	0	1978	419889.78
2004	348981.44	0	2005	390645.22
2005	390645.22	0	1989	369291.69
2006	568448.19	0	2003	357313.78
2007	452074.41	0	2002	356157.91
2008	434546.16	0	2004	348981.44



**2008 – 7<sup>th</sup> Lowest of Record**

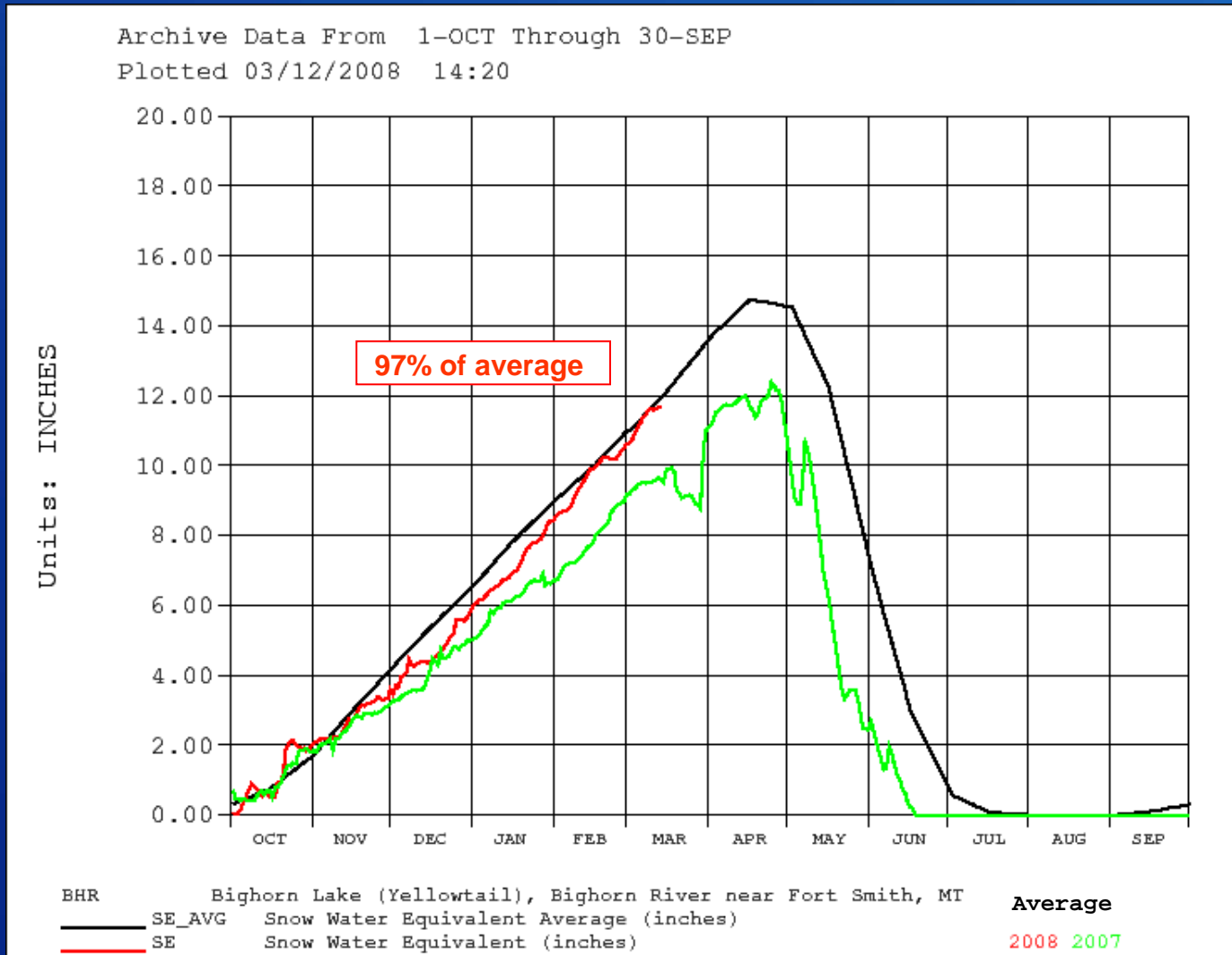
**2000's - Lowest of Record**

Average of 54 years: 742300  
2008 is 59 percent of average

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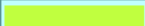





# Snow Water Equivalent in Mountain Snowpack






## March 1, 2008



## MONTANA SNOTEL Snow Water Equivalent Update Graph

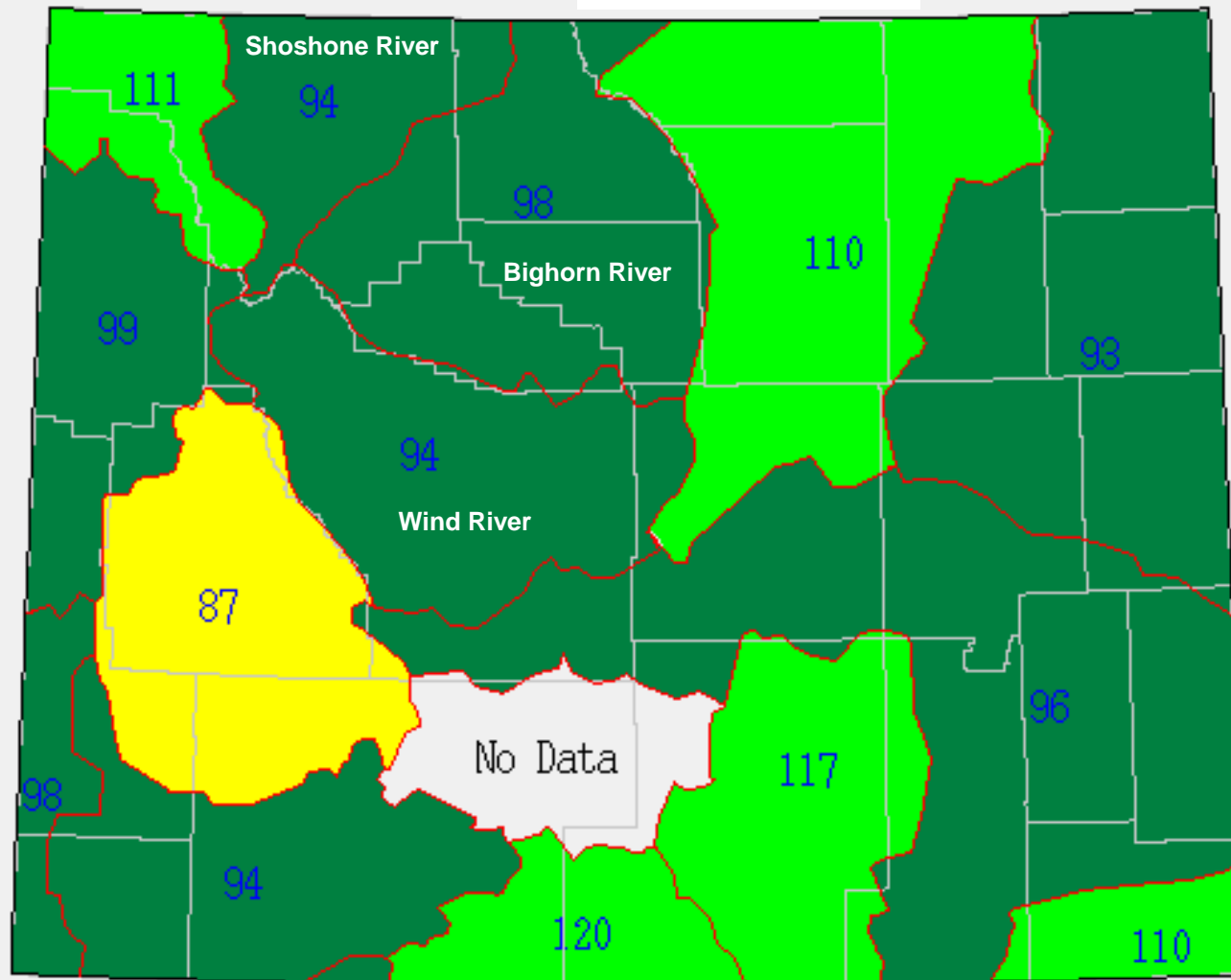
As of TUESDAY: MARCH 4, 2008

Basin	Snow Water Equivalent Percent of Average
KOOTENAI RIVER BASIN	 114%
FLATHEAD RIVER BASIN	 102%
UPPER CLARK FORK RIVER BASIN	 97%
BITTERROOT RIVER BASIN	 120%
LOWER CLARK FORK RIVER BASIN	 116%
JEFFERSON RIVER BASIN	 103%
MADISON RIVER BASIN	 109%
GALLATIN RIVER BASIN	 109%
MISSOURI HEADWATERS	 107%
HEADWATERS MISSOURI MAINSTEM	 98%
SMITH, JUDITH, AND MUSSEL SHELL RIVER BASINS	 100%
SUN, TETON AND MARIAS RIVER BASINS	 111%
MISSOURI MAINSTEM RIVER BASIN	 102%
ST MARY AND MILK RIVER BASINS	 106%
UPPER YELLOWSTONE RIVER BASIN	 103%
WIND RIVER BASIN (WYOMING)	 94%
SHOSHONE RIVER BASIN (WYOMING)	 93%
BIGHORN RIVER BASIN (WYOMING)	 98%
TONGUE RIVER BASIN (WYOMING)	 103%
POWDER RIVER BASIN (WYOMING)	 114%
LOWER YELLOWSTONE RIVER BASIN	 97%

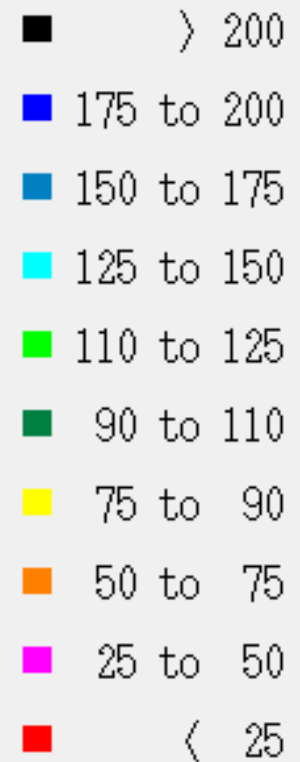
Legend:	 <70%	 70-90%	 91-110%	 111-130%	 >130%
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# State of Wyoming - Snow Water Content % of Average

March 5, 2008



Percent  
of Average



\* = Data may not provide a valid measure of conditions

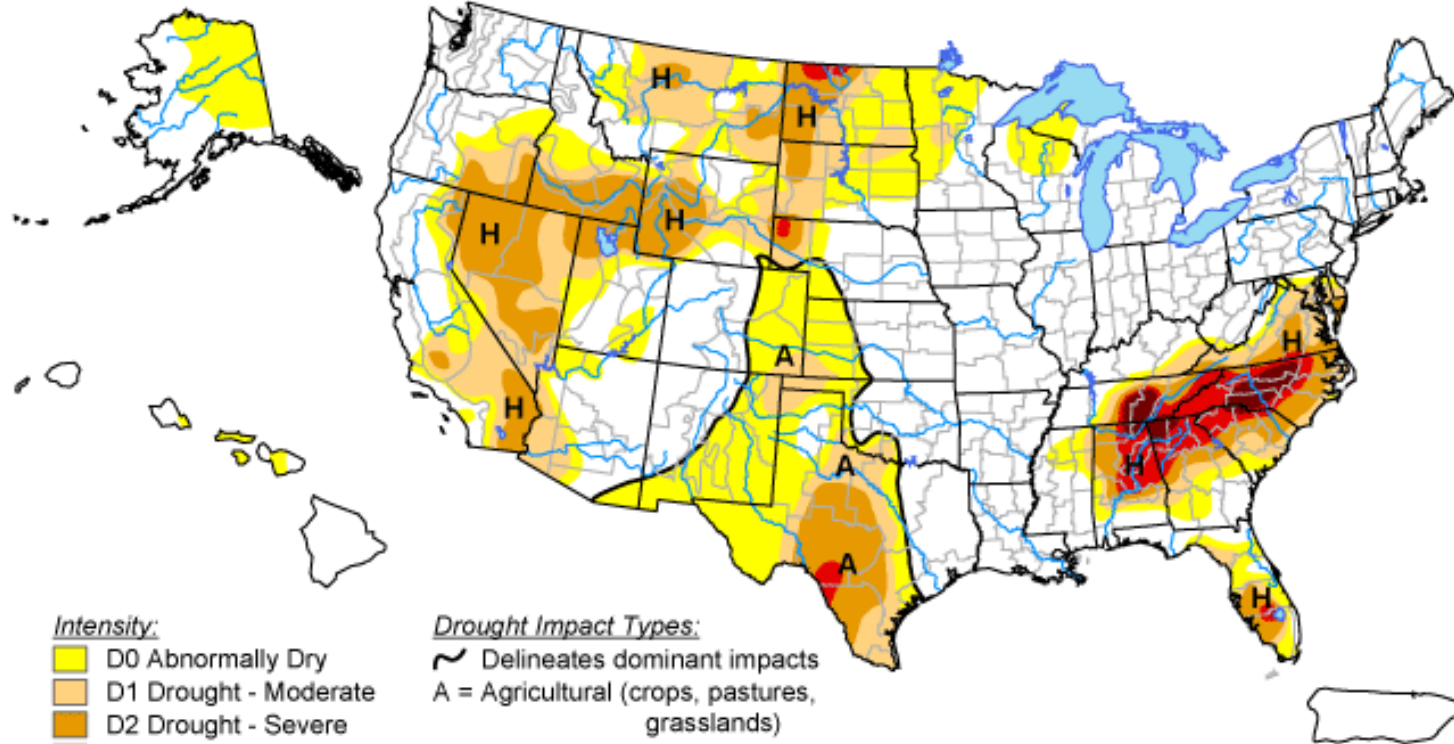
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# U.S. Drought Assessment – March

## U.S. Drought Monitor

March 4, 2008

Valid 7 a.m. EST



### Intensity:

- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

### Drought Impact Types:

- Delineates dominant impacts
- A = Agricultural (crops, pastures, grasslands)
- H = Hydrological (water)

*The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.*

<http://drought.unl.edu/dm>



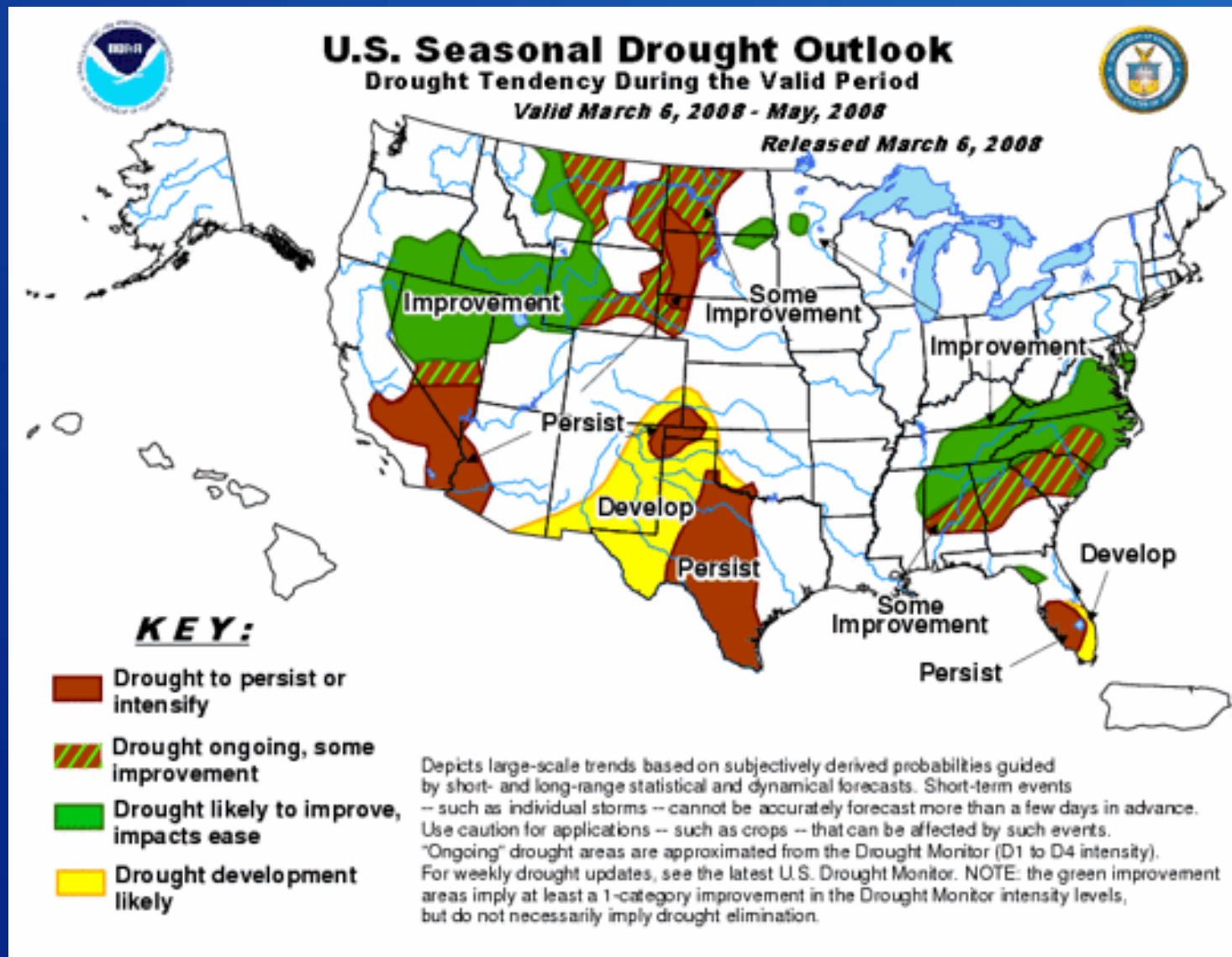
**Released Thursday, March 6, 2008**

**Author: Brian Fuchs, National Drought Mitigation Center**

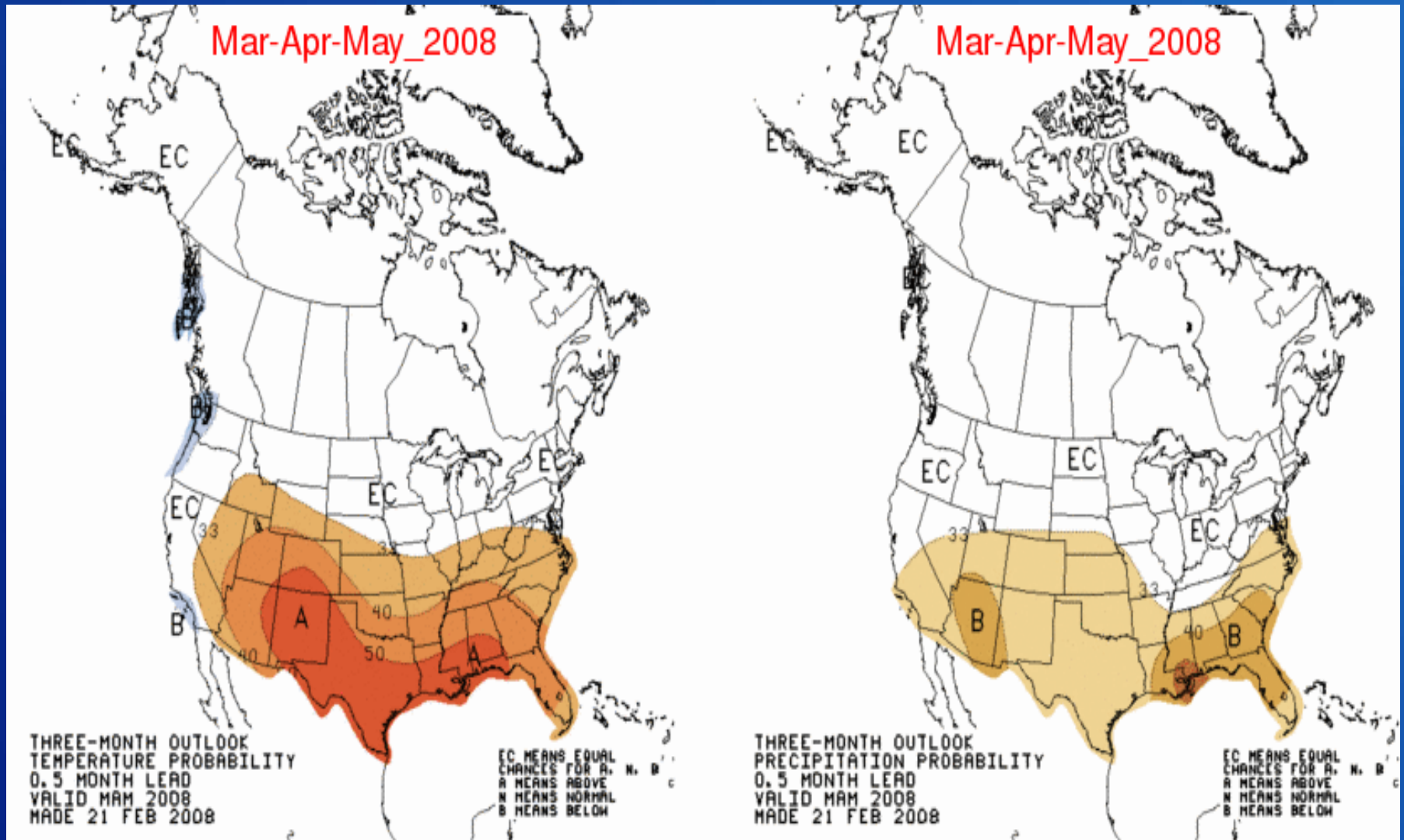
# RECLAMATION



# Seasonal Drought Outlook – Through May



# Weather Outlook – April, May, and June



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# CURRENT CONDITIONS

March 10, 2008

## BIGHORN LAKE CONDITIONS

### Elevation

3616.4 ft – 23.6 feet below full pool

1.3 feet above average

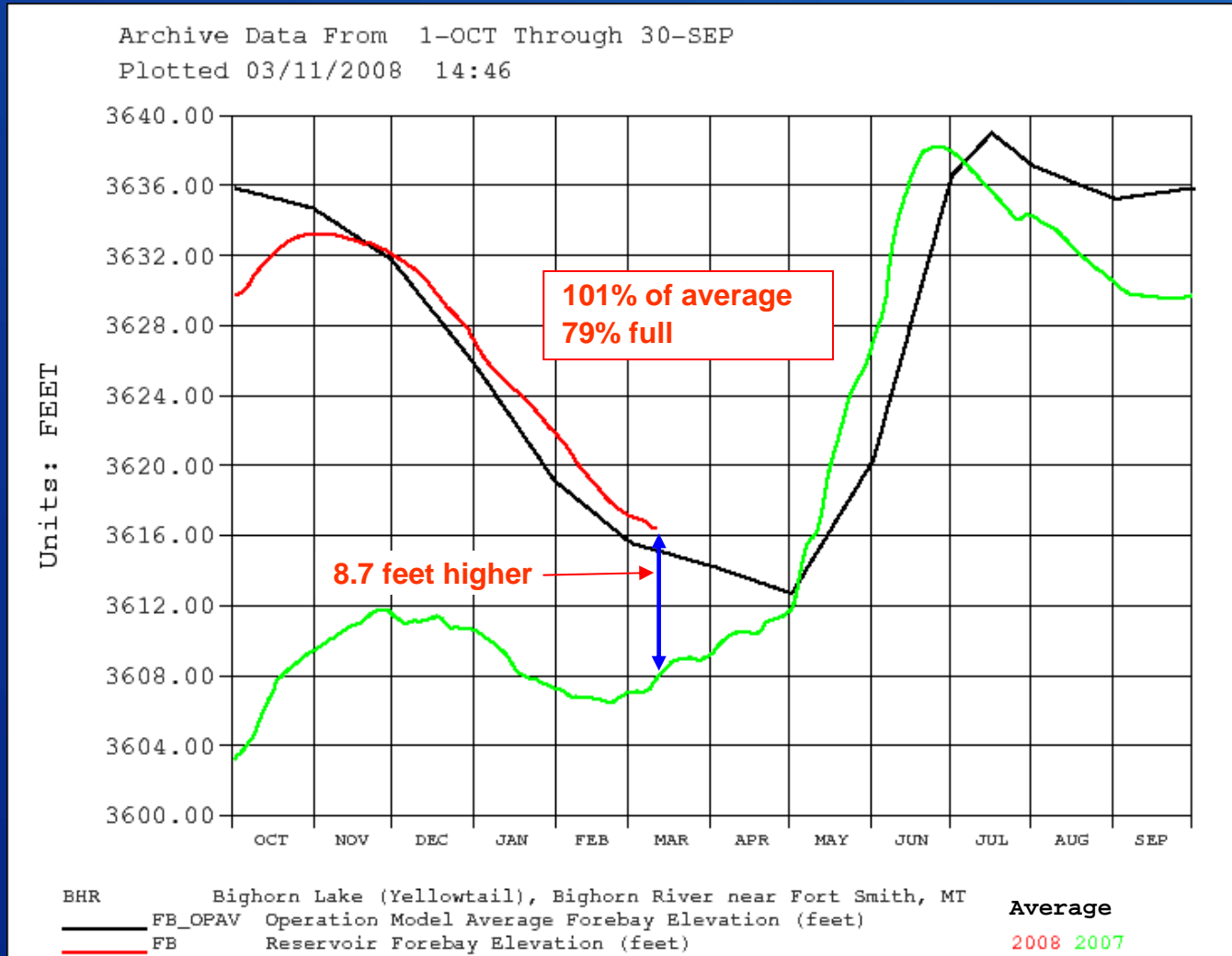
### Storage

846,800 af – 101% of average & 79% full

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# BIGHORN LAKE CURRENT CONDITIONS

## Bighorn Lake Storage Conditions – March 10, 2008

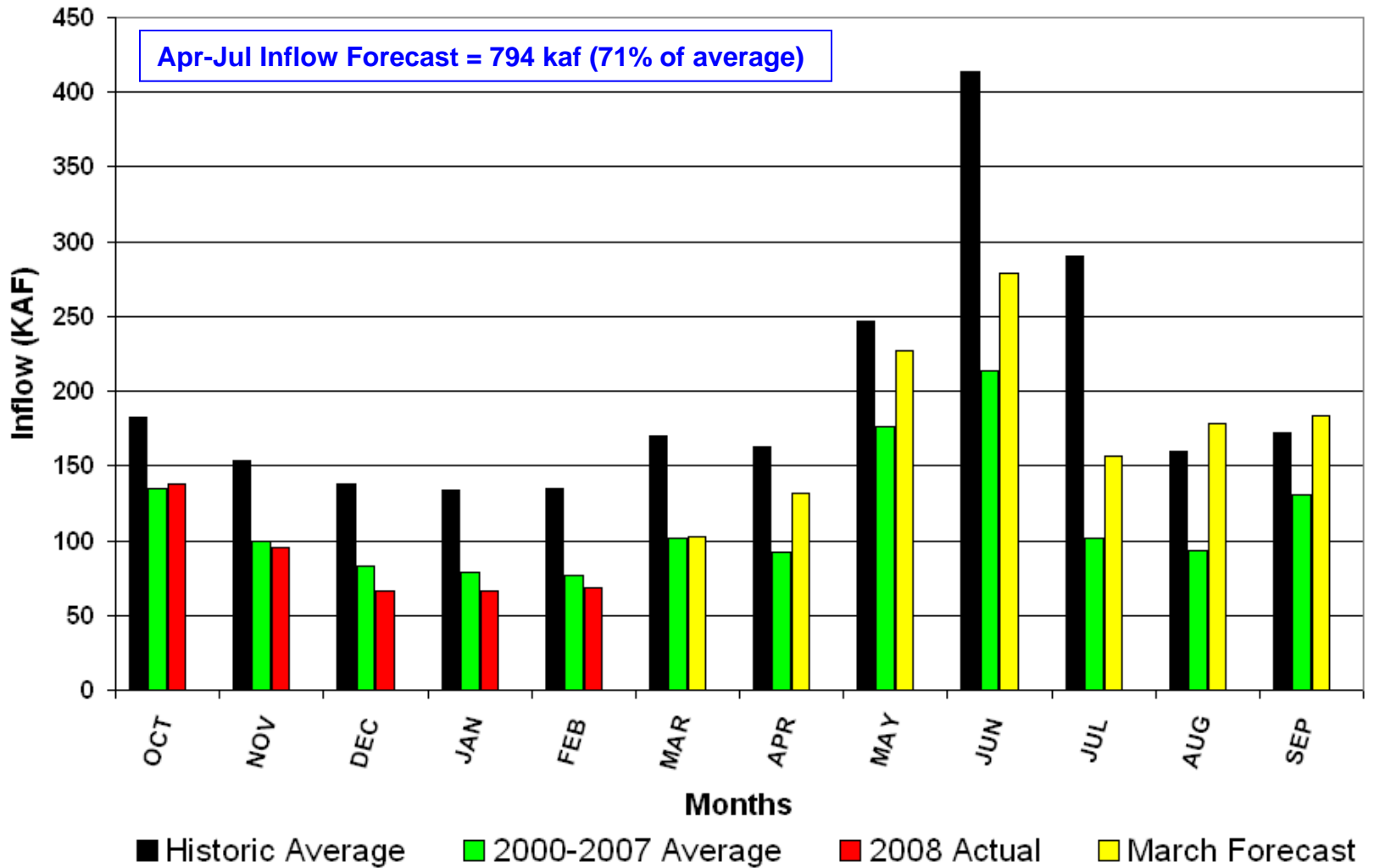


# Water Supply Forecasts

- Reclamation monitors snowpack data each month from mid-October through June
- Snowpack Accumulations
  - January 1 – 45% on the ground
  - February 1 – 61% on the ground
  - March 1 – 75% on the ground
  - April 1 – 93% on the ground
  - April 15 – 100% on the ground
  - May 1 – 99% and generally melting out
- This time of year, monthly plans are adjusted as appropriate, based primarily on snow & precipitation information
- Significant changes to operation plans may be required as we approach and are into the spring runoff season
- Fall forecasts are heavily dependent upon statistical information and analysis



# Bighorn Lake Inflows



# Bighorn Lake April-July Inflow Projections

## Minimum Probable Inflow

90% chance of exceedence (535,000 af @ 48% of average)

## Maximum Probable Inflow

10% chance of exceedence (1,278,000 af @ 115% of average)

## Most Probable Inflow

50% chance of exceedence (794,000 af @ 71% of average)

## \* 2007 Actual April-July Inflow

614,100 af @ 55% of average

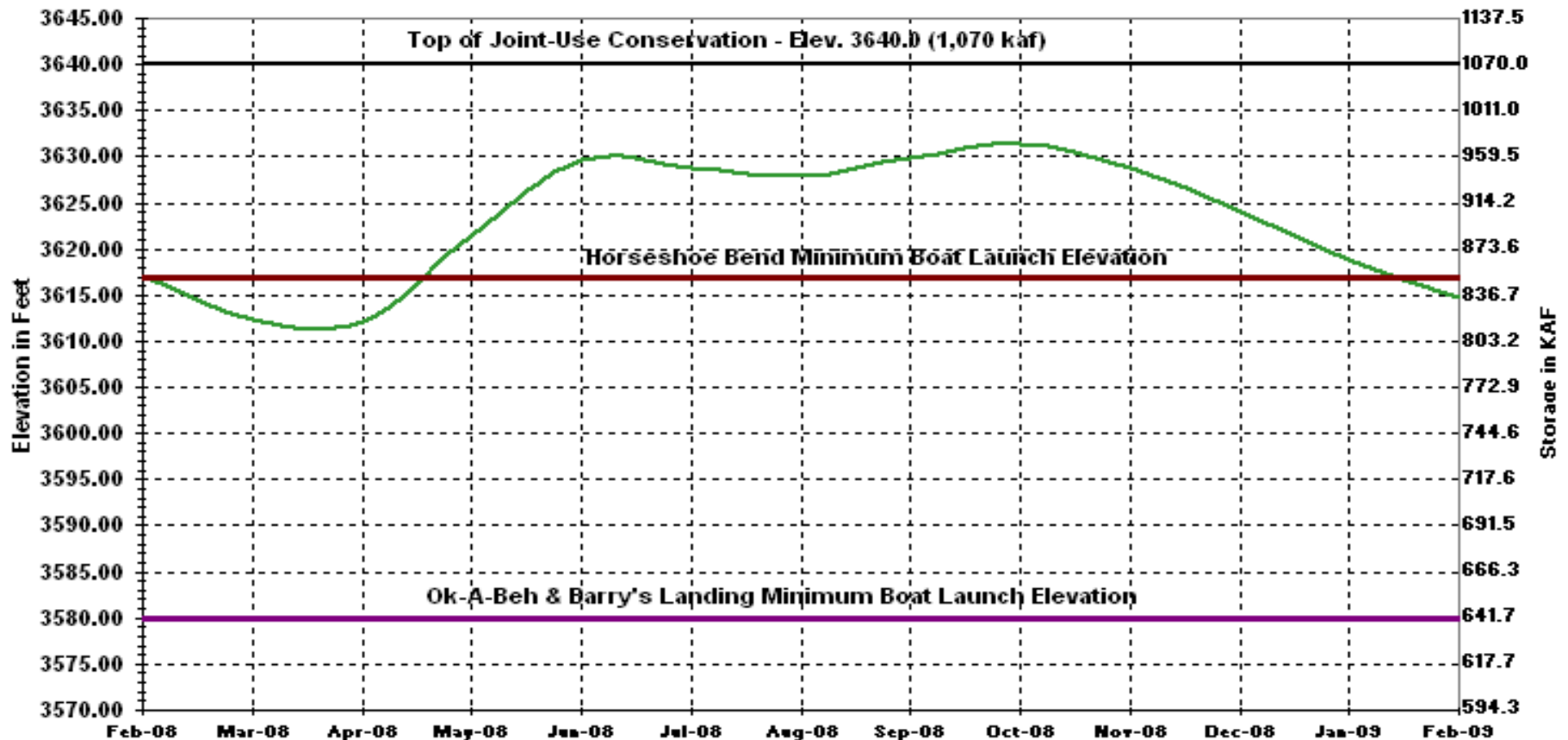
RECLAMATION

# Minimum Probable Runoff Scenario

- Fill by June/July if possible
- Maximize storage during summer & fall
- Meet end of March target storage level
- Avoid dropping storage during April & May
  - 
  -
- Release 1,500 cfs through October
- Release 1,900 cfs during October through March to reach elevation 3614 by end of March
- Option to increase spring & summer flows in exchange for decreasing fall & winter
- Generate 491.0 GWHrs

# Bighorn Lake Operation Based on Minimum Probable Inflow

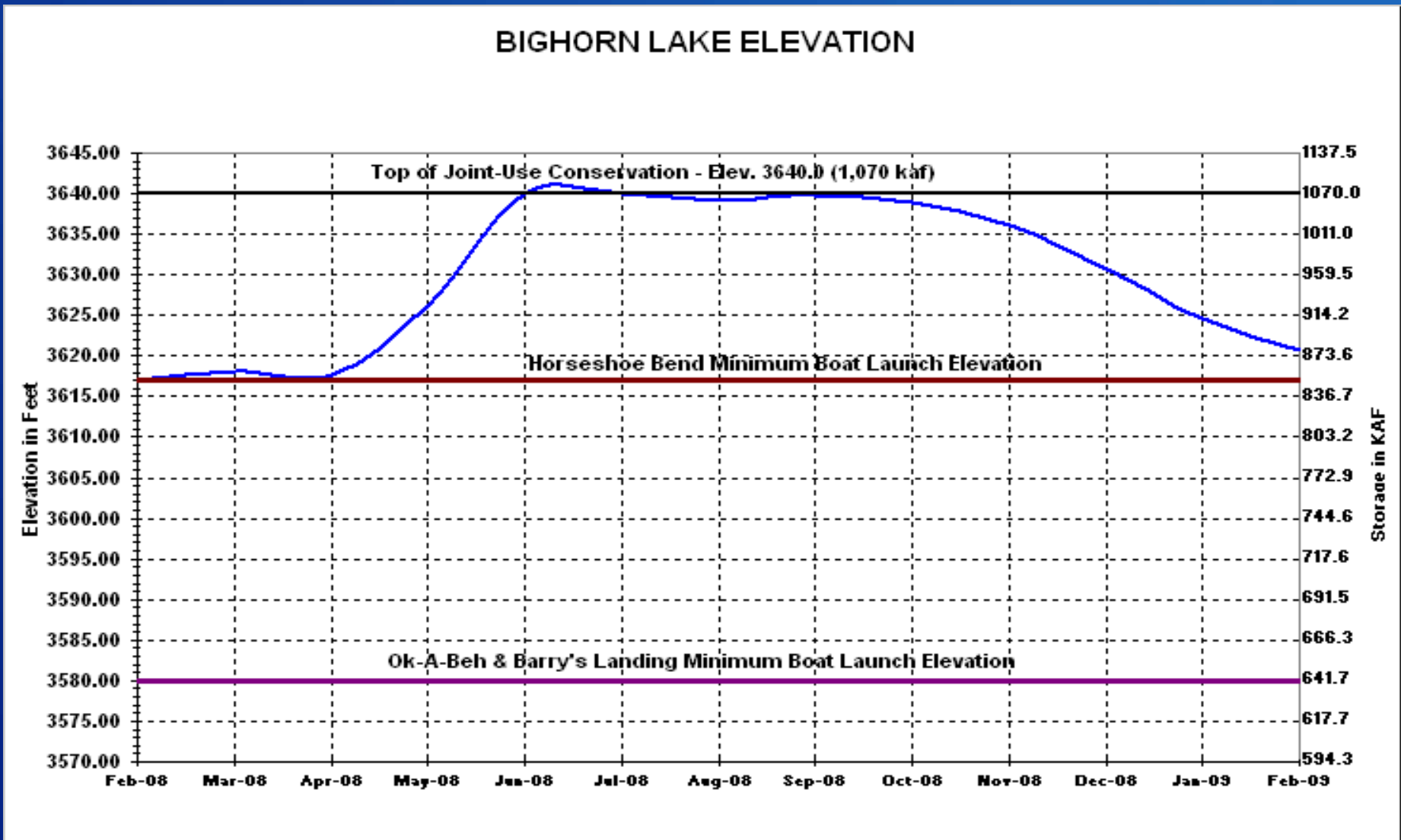
## BIGHORN LAKE ELEVATION



# Maximum Probable Runoff Scenario

- Fill by June/July if possible
- Maximize storage during summer & fall
- Stay out of exclusive flood pool
- Limit release to 4,500 cfs to maintain power peaking capability
- Meet end of March target storage level
- Avoid dropping storage during April & May
- 
- 
- Release 2,500-5,700 cfs during April through July
- Release 3,200 cfs during August through February
- Generate 1,010.7 GWHrs

# Bighorn Lake Operation Based on Maximum Probable Inflows



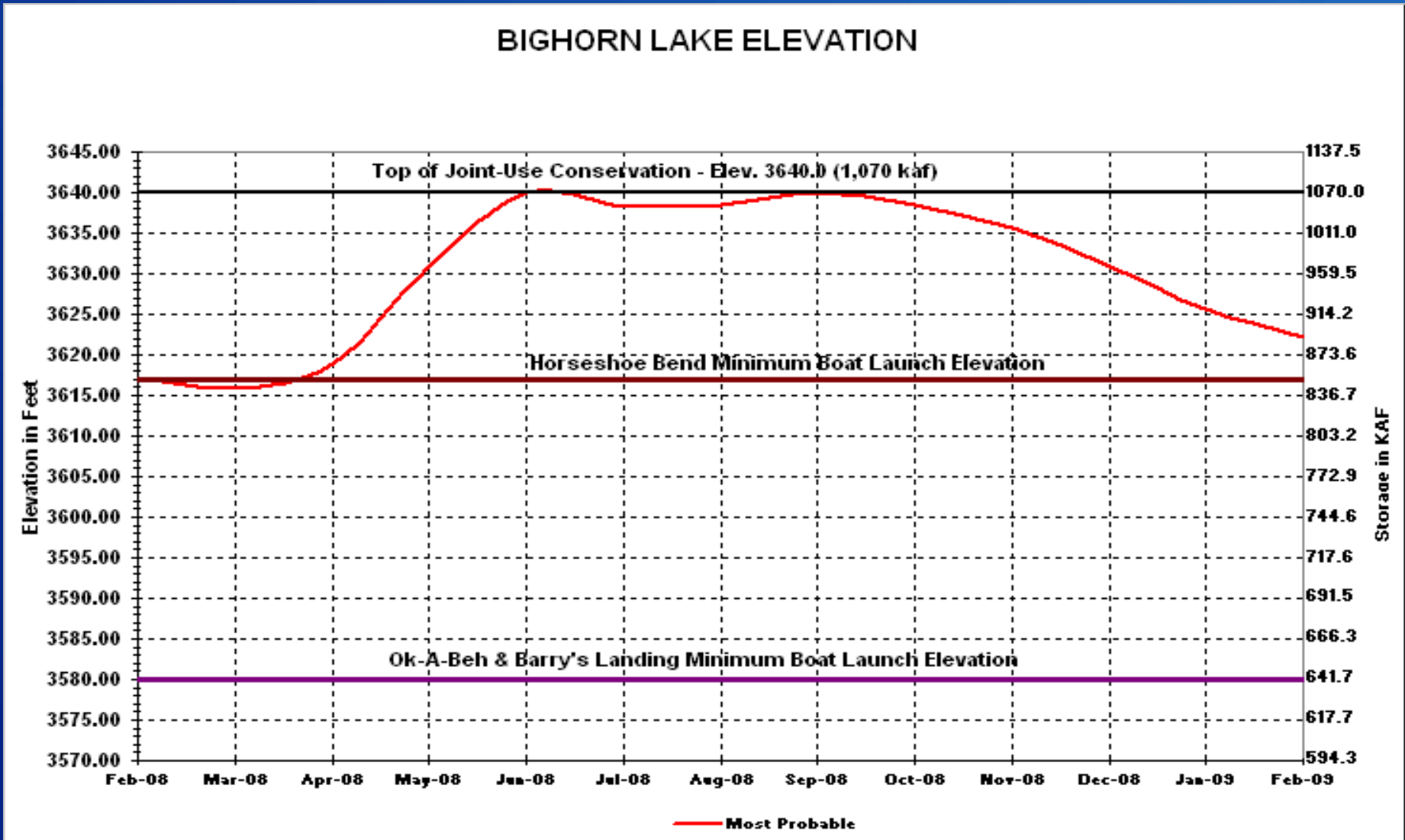
RECLAMATION



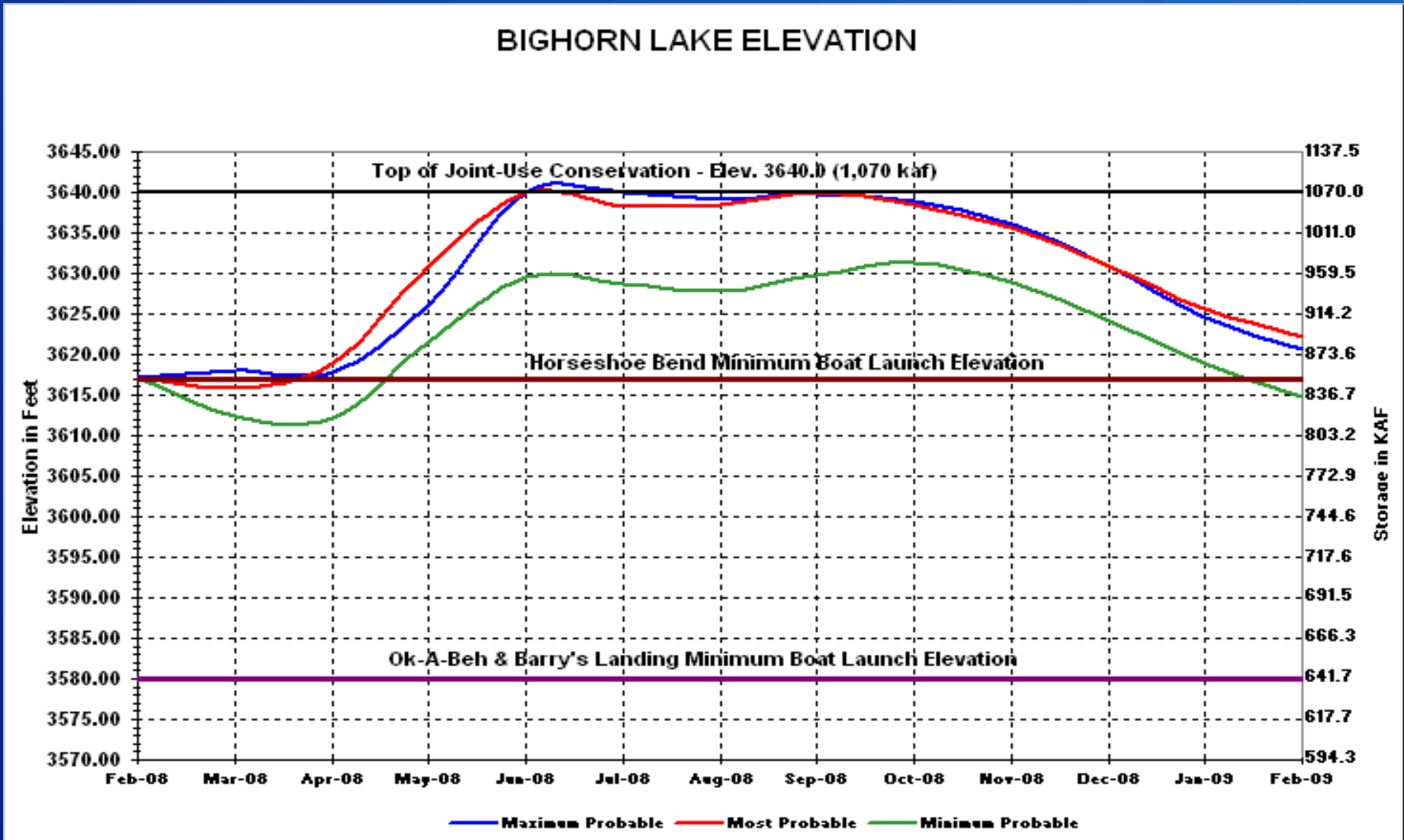
# Most Probable Runoff Scenario

- **Fill by June/July if possible**
- **Maximize storage during summer & fall**
- **Stay out of exclusive flood pool**
- **Meet end of March target storage level**
- **Avoid dropping storage during April & May**
- 
- 
- **Release 1,900 cfs through May**
- **Release 2,500 cfs during summer, fall, & winter**
- **Generate 708 GWHrs**

# Bighorn Lake Operation Based on Most Probable Inflows



# Bighorn Lake Operation-Max., Min., & Most Probable Inflows



# 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

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- **Discussion & Comments**

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# 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](http://www.usbr.gov/gp/mtao/yellowtail/index.cfm).

Please mail comments to:

**Ms. Paula A. Holwegner**

**Bureau of Reclamation**

**P.O. Box 30137**

**Billings, MT 59107-0137**

fax your comments to:

406-247-7338

or email your comments to:

[pholwegner@gp.usbr.gov](mailto:pholwegner@gp.usbr.gov)

by **April 4, 2008**

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