RECLAMATION
Managing Water in the West

Flaming Gorge Technical Working Group

February 14, 2017 Hydrology Summary

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For the purposes of discussions related to implementing the ROD in 2017, an evaluation has been made of the current hydrologic conditions in the Upper Green River (*i.e*. above Flaming Gorge Dam) and Yampa River Basins. The evaluation centered on the historical unregulated inflow statistics for Flaming Gorge Dam during the period from 1963 through 2016. The February 1, 2017 final forecast was 1,650,000 acre-feet for Flaming Gorge. Continued storms in the system have increased raw model guidance forecast for the Upper Green to 1,986,000 acre-feet. The hydrologic classification will be wet (<10% exceedance) for spring 2017.

The combined April through July forecast of the Yampa River at Maybell and Little Snake at Lily is 1,400,000 acre-feet. This forecast would fall into the average (above median) hydrologic classification of the ROD.

Snow water equivalent (SWE) as of February 14, 2017, for the Upper Green River and Yampa/White River Basins are 177 and 126 percent of median, respectively. Flaming Gorge SWE is similar to 1986 and 1997, while Deerlodge SWE is similar to 2008, 2009, and 2014. The Tower snotel site, used as a reference point for Yampa snowpack and runoff, currently has 35.4 inches of SWE (112 percent of median). On February 14, Tower SNOTEL measured SWE inches of:

- 2008 = 33.7 in; Yampa 1,846 kaf obs spring (145%)
- 2009 = 31.2 in; Yampa 1,653 kaf obs spring (130%)
- 2014 = 39.2; Yampa 1,396 kaf obs spring (110%)

The difference between the Tower SNOTEL figures and Yampa River observed spring volume differs significantly and needs to be considered when comparing any values this early in the snow accumulation season.

Basin Hydrology

Green River Basin Hydrology

The February 14, 2017, ESP forecast of April through July unregulated inflow (current forecast) for Flaming Gorge Reservoir is 1,986,000 acre-feet (AF) (203% of 30-year average). This forecast falls at approximately 5% exceedance based on the historic unregulated inflow record (1963-2016).

Figure 1 illustrates the Upper Green River SWE as of February 14, 2017 and compares it against water years 1986 and 1997. Figures 2 and 3 show the spatial extent of significant areas of modeled snow accumulation for the Upper Green River Basin and how this is incorporated into the water supply forecasts. Figure 3 indicates that the forecast for Flaming Gorge Reservoir has continued to increase and the February 14, 2017, estimated forecast has increased from 1,650 kaf to 1,986 kaf from two weeks ago.

Historic year unregulated inflow volumes that compare with current snowpack are 1986 with total inflow into Flaming Gorge of 2,222 kaf (maximum historic year) and 1997 with total inflow into Flaming Gorge of 1,668 kaf (170 percent of average).

Figure 4 illustrates the current forecast in relation to the historic unregulated inflow volumes. Figure 5 illustrates Flaming Gorge Reservoir March final forecast probability (percent exceedance).

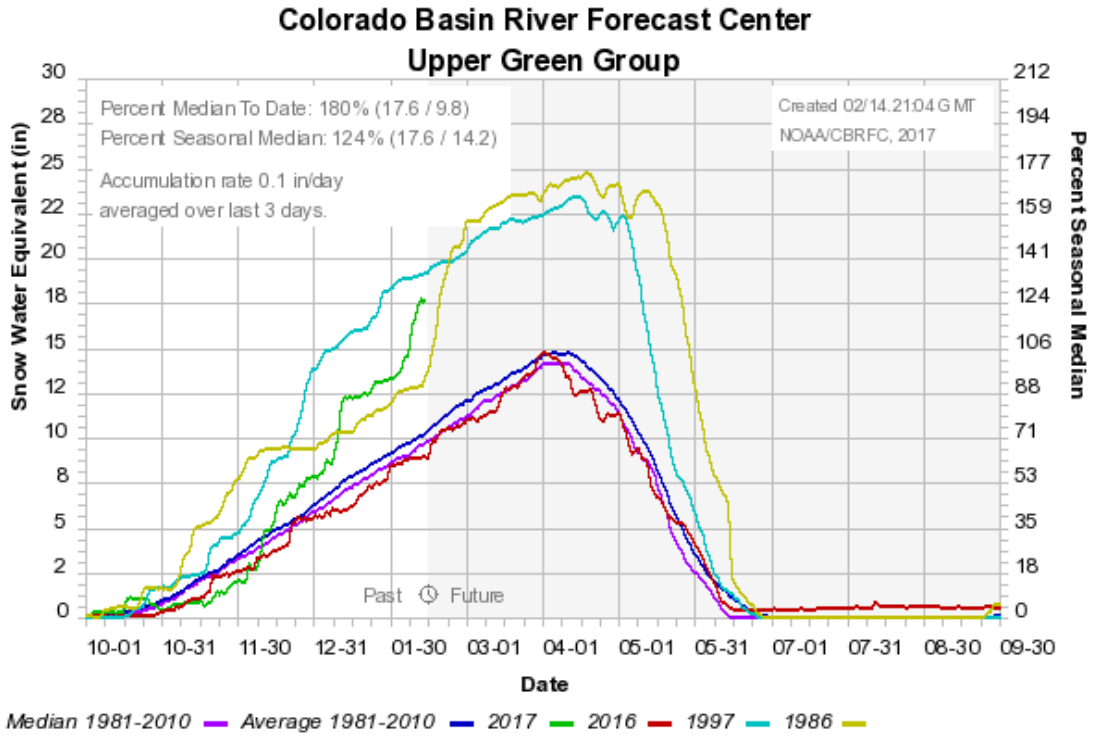


FIGURE 1. Upper Green River Basin Snotel Tracking. 1981-2010 percent of median compared against 2017 YTD Snow Water Equivalent (SWE) and 1986, 1997 and 2016 percent of average SWE

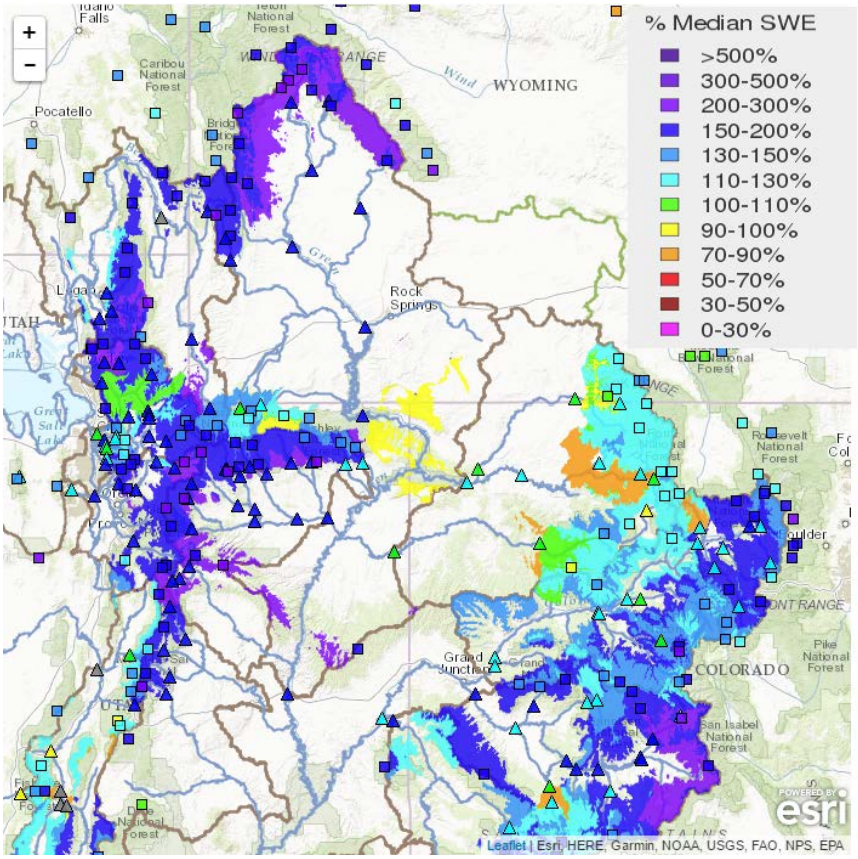


FIGURE 2. Upper Green River Basin modeled SWE significant areas as of February 14, 2017.

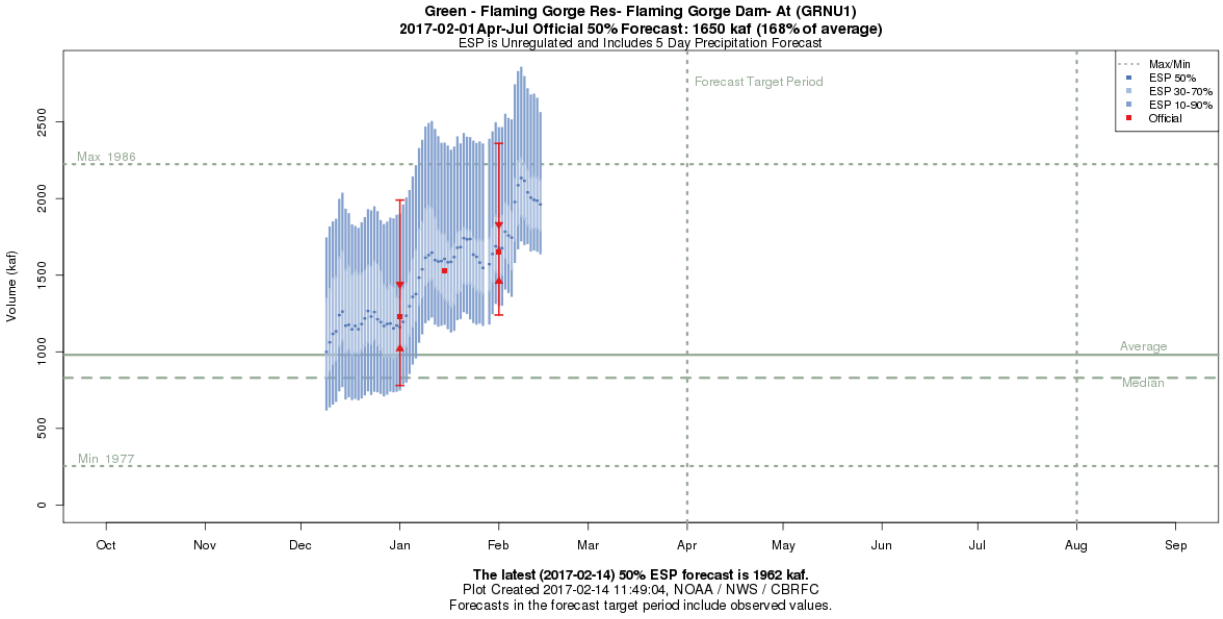


FIGURE 3. Upper Green River Basin Water Supply Forecast as of February 14, 2017.

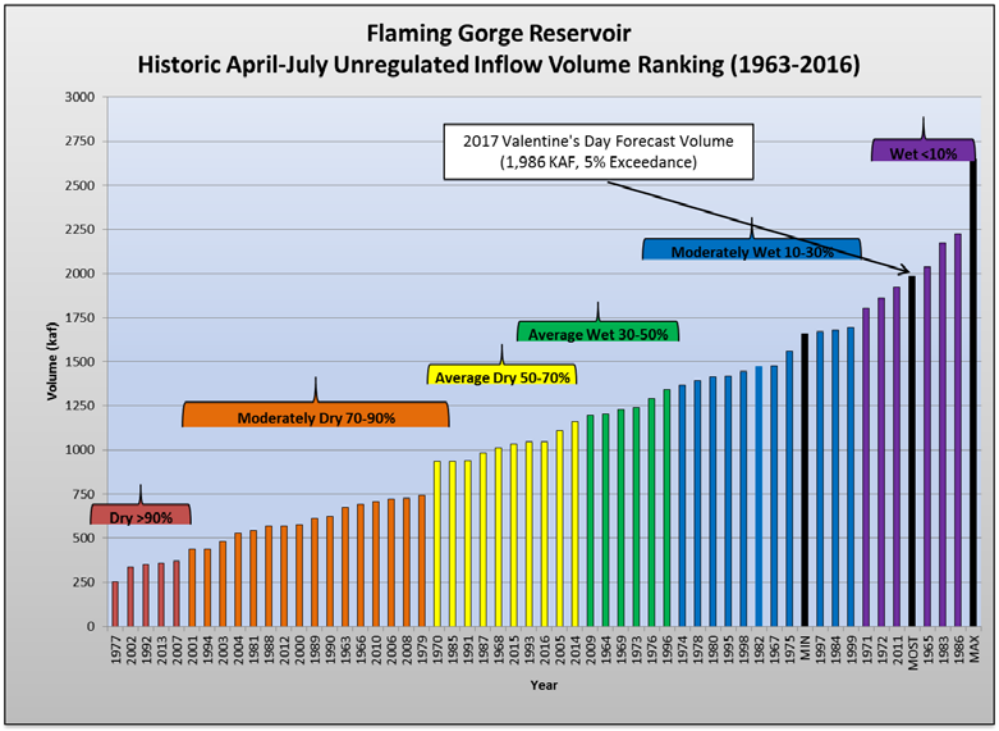


FIGURE 4. Flaming Gorge Reservoir February 14, 2017 forecast and ranked historic April-July unregulated inflow volume for years 1963-2016

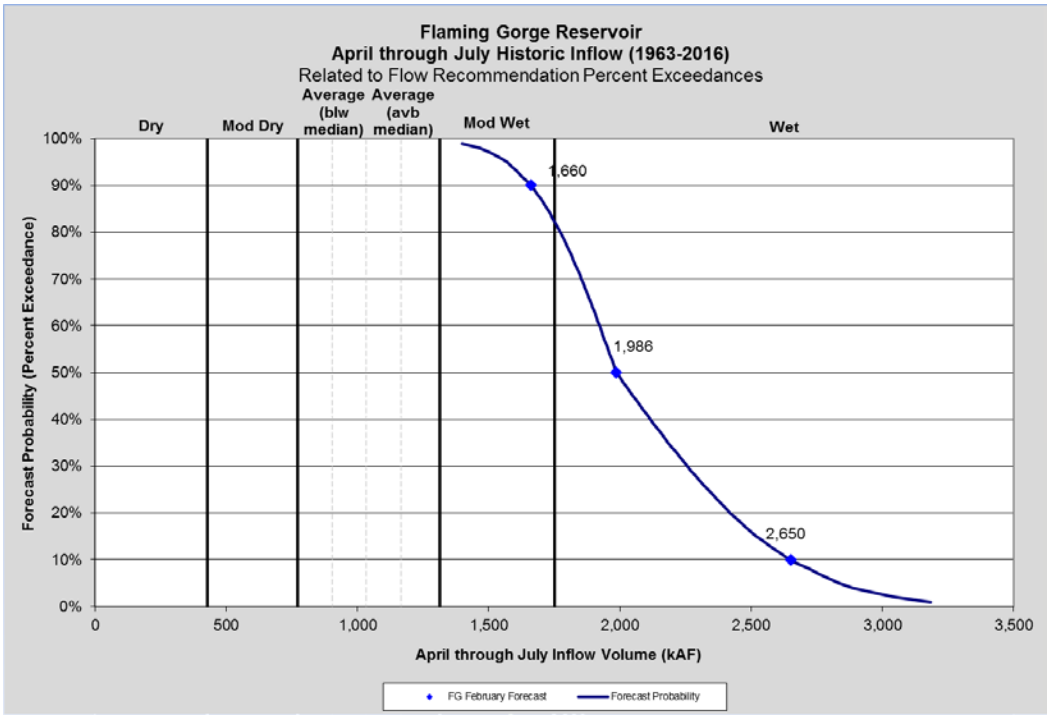


FIGURE 5. Flaming Gorge Reservoir March final forecast probability (percent exceedance) and historic April-July unregulated inflow volume for years 1963-2016

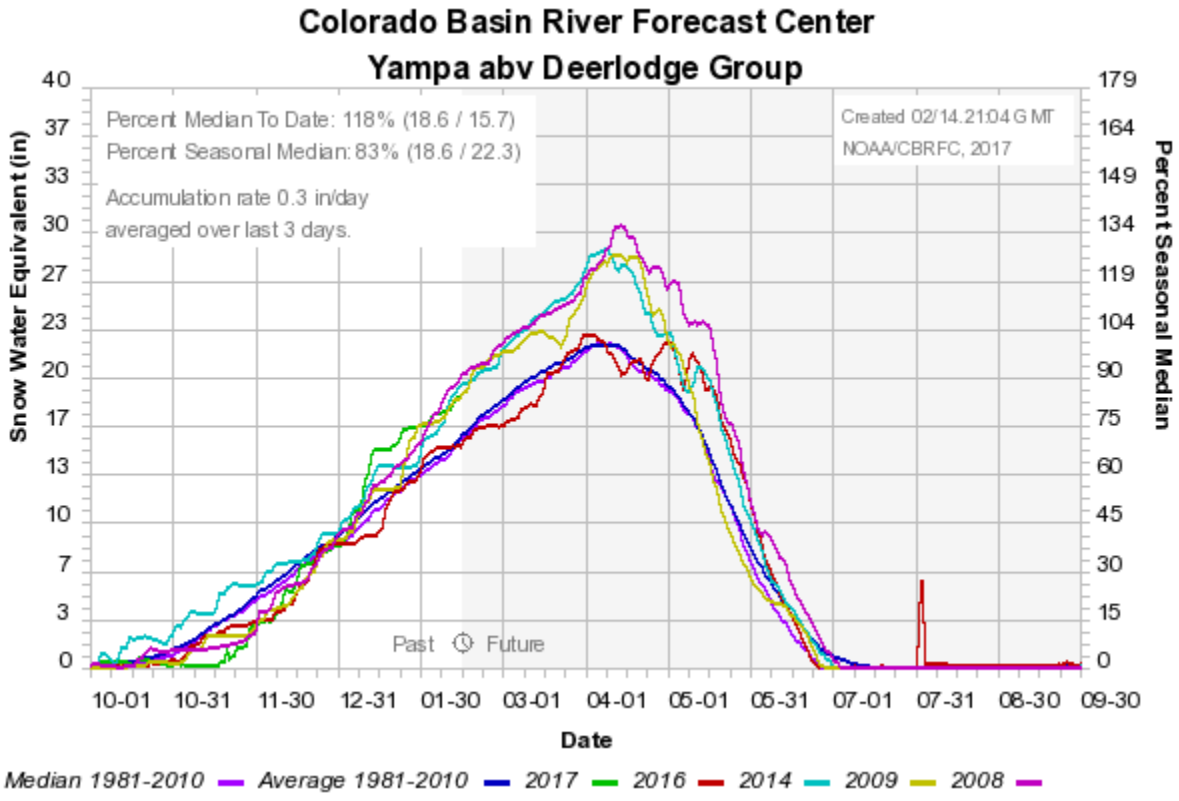
Yampa River Basin Hydrology

The combined current forecast for the Little Snake at Lily plus Yampa River at Maybell is 1,377,000 AF (108% of 30-year average). This forecast falls at approximately 39% exceedance based on a ranking of the historic record (1922-2016).

Figure 6 illustrates the Yampa River at Deerlodge Park SWE as of February 14, 2017and compares it against water years 2008, 2009 and 2014.

Figures 7 and 8 show the spatial extent of significant areas of modeled snow accumulation for the Yampa River Basin and how this is incorporated into the water supply forecasts. Figure 8 indicates that the forecast for the Yampa River at Deerlodge is remaining stable and the February 14, 2017, estimated forecast has decreased from 1,400 kaf to 1,377 kaf from two weeks ago.[1]

Figure 9 below shows the current forecast in relation to historic flow volumes. Figure 10 illustrates the Yampa River at Maybell plus Lily March final forecast probability (percent exceedance).



[1] The Yampa River at Deerlodge forecast volume differs from the Yampa River – Maybell Plus Lily volume. The historic gage record to calculate the Maybell plus Lily forecast volume is significantly longer than the Deerlodge dataset. The forecast volumes will be close, but the actual volume may differ due to routing in the CBRFC forecast model.

FIGURE 6. Yampa River above Deerlodge SNOTEL Group. 1981-2010 percent of average SWE compared against 2016 YTD, and analog years 2008, 2009, 2014 and 2016 percent of median SWE

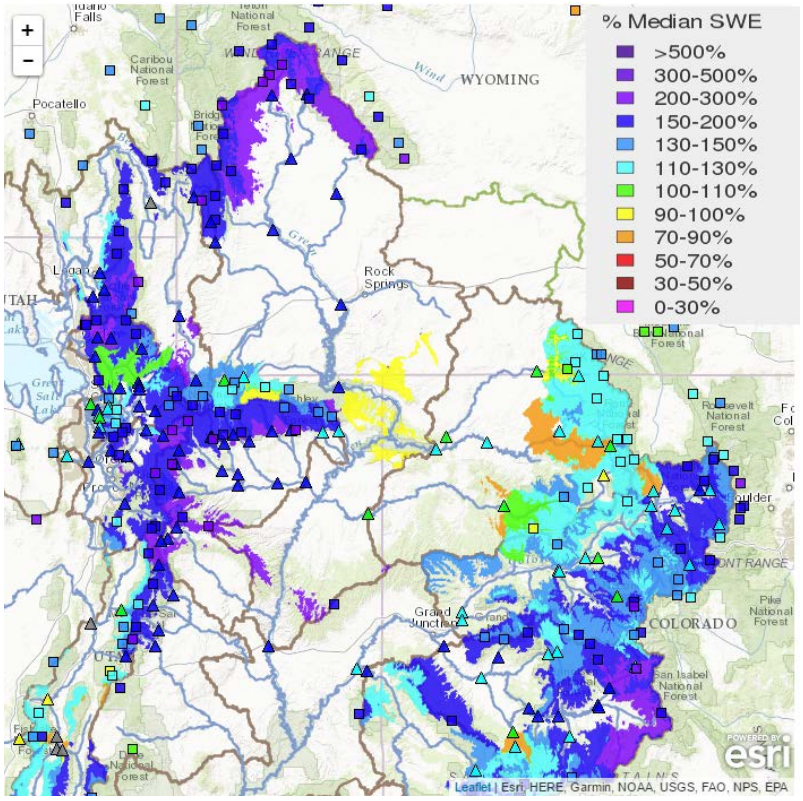


FIGURE 7. Yampa River Basin modeled SWE significant areas as of March 7, 2016.

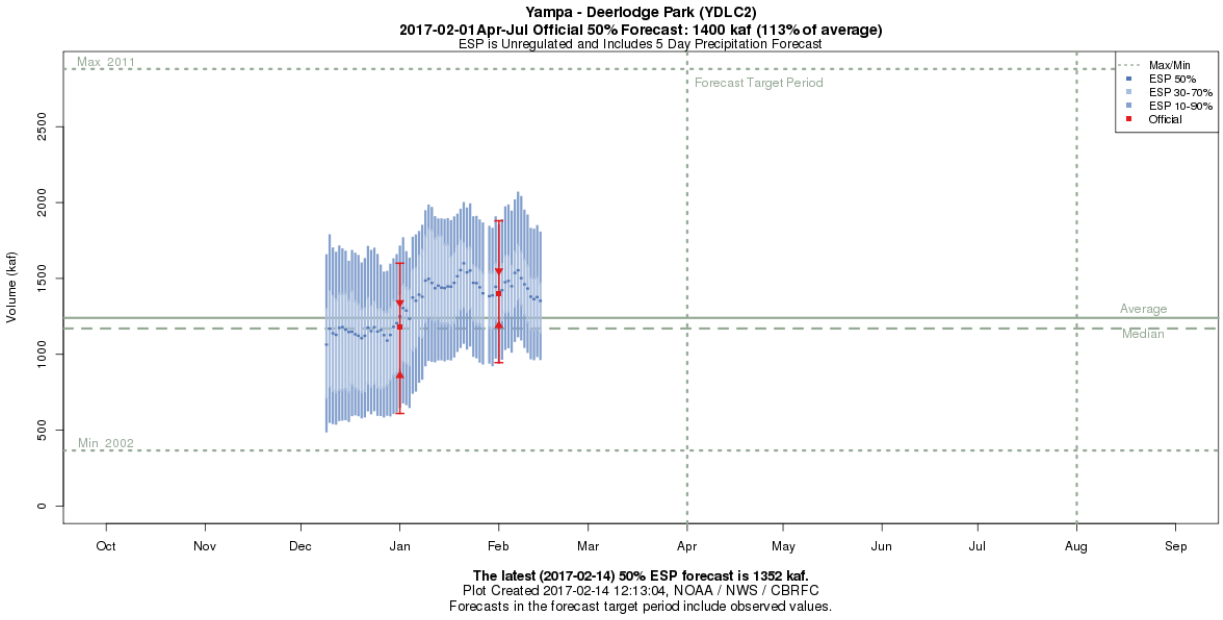


FIGURE 8. Yampa – Deerlodge Park Water Supply Forecast as of March 7, 2016.

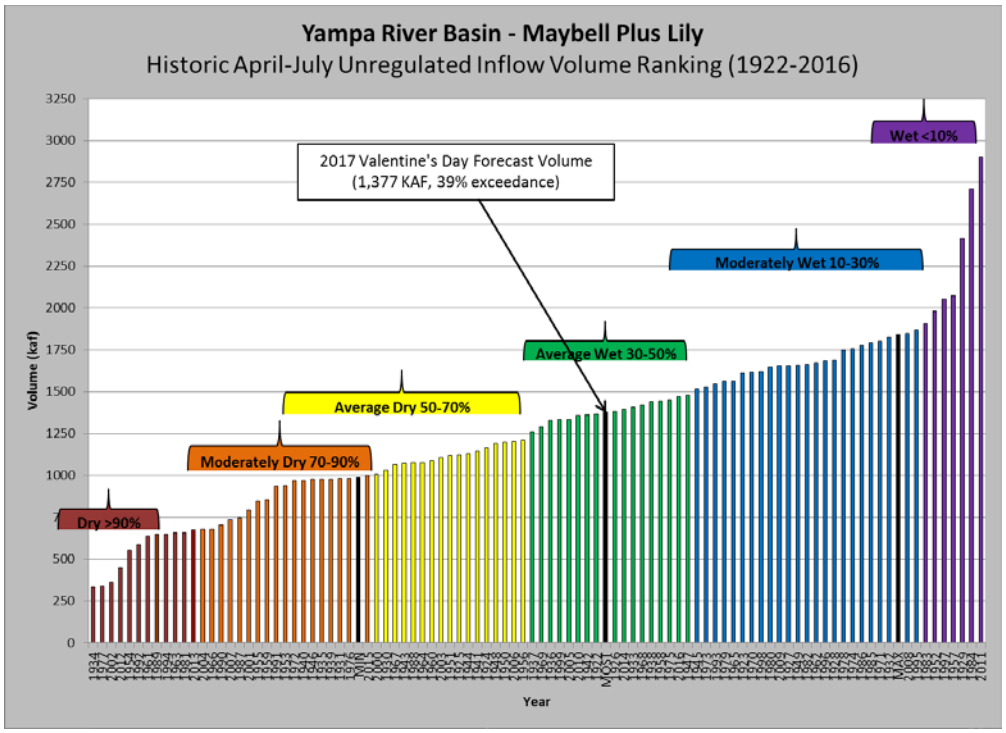


FIGURE 9. Yampa River Basin (Maybell plus Lily) March forecast and ranked April-July unregulated inflow volume for years 1922-2016

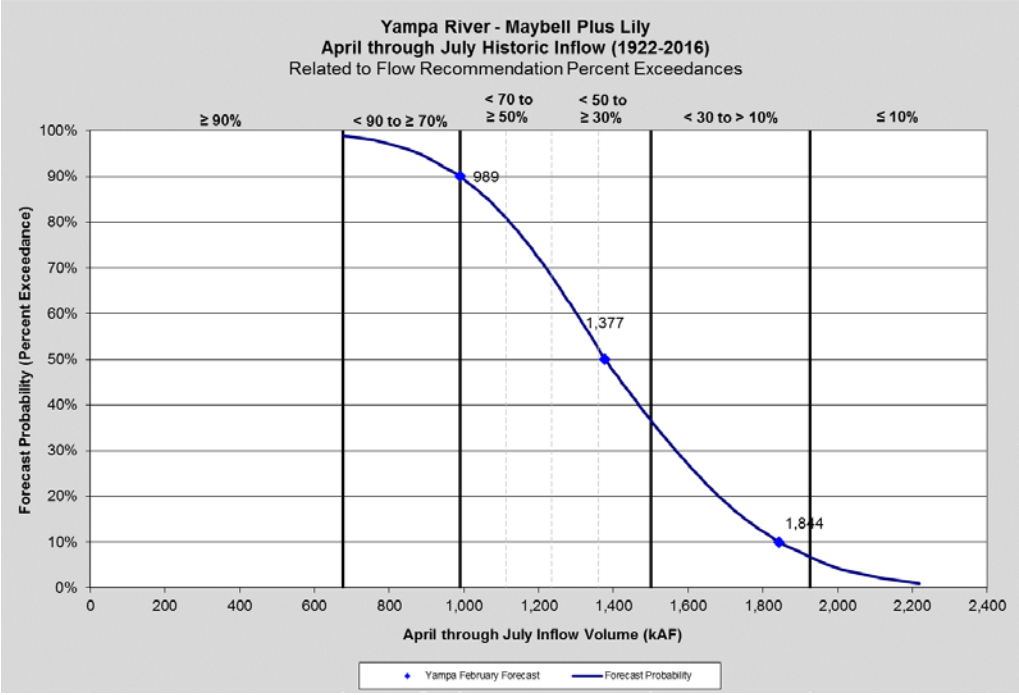


FIGURE 10. Yampa River – Maybell Plus Lily March final forecast probability (percent exceedance) and historic April-July unregulated inflow volume for years 1963-2015

Probabilities of Flow Events for Spring 2016

The Flaming Gorge unregulated inflow and Yampa River forecasts are wet and average (above median), respectively, and trending wetter. An analysis was completed to assist in the determination of appropriate flow objectives for spring and summer 2017. The Flaming Gorge forecast is so high that ten similar between the minimum and maximum forecasts are unavailable. The ten most similar historic years for the Yampa River Basin (Maybell plus Lily) compared to the current forecast (Table 1) were analyzed assuming a normal distribution.

Table 2 presents the percent exceedance of cumulative days greater than or equal to various flow levels at Yampa River (Maybell plus Lily). The current analysis indicates that it is likely Yampa River flows above 20,000 cfs will not be achieved this year.

Table 1
Yampa River (Maybell plus Lily) – April through July Unregulated Volume
Ten Similar Years to the February 14, 2017 Forecast
Thousand Acre-Feet (KAF)

Year	April-July Unreg Inflow Volume (KAF)
MIN	969
1999	1,330
2005	1,332
2010	1,359
1942	1,361
1922	1,364
MOST	1,377
1926	1,381
2014	1,396
1933	1,406
1968	1,420
1938	1,439
MAX	1,844

Table 2
Spring 2017 – Days above Specific Flow Thresholds in the Yampa River
(Maybell plus Lily)
Based on the February 14, 2017 Forecast
Percent Exceedance (%)

February 14, 2017 Forecast	% Exceed	Days above 6000 cfs	Days above 8000 cfs	Days above 10000 cfs	Days above 12000 cfs	Days above 14000 cfs	Days above 16000 cfs	Days above 18000 cfs
YAMPA	25%	55	40	27	14	7	2	0
	50%	51	32	18	9	4	0	0
	75%	43	27	16	7	1	0	0
	90%	0	0	0	0	0	0	0