



— BUREAU OF —
RECLAMATION

Annual Report of Operations for Flaming Gorge Dam Water Year 2018

Annual Report of Operations for Flaming Gorge Dam Water Year 2018

Contents

Introduction	1
Operational Plan Development and Process for Water Year 2018	2
Four-Step Process of developing and finalizing the Annual Operation Plan	2
Pertinent dates of Four Step Process 2018	2
Operation Decision	3
Hydrology.....	4
Autumn and Winter Base Flow for Water Year 2018.....	4
Spring Operations	6
Base Flow Summer 2018.....	7
Spillway Inspection.....	8
Long Term Analysis of the Frequency of Achieving the Flow Thresholds.....	8
Temperature Objectives Achieved in Water Year 2018	11
Recommendations to Refine Operations.....	15
Flaming Gorge Technical Working Group recommendations and discussions to document planning process.....	15
References	15
Appendix -- Summary of events and meeting minutes from the FGTWG meetings.....	16

Introduction

This report details the operations of Flaming Gorge Dam during water year (WY) 2018 and is produced pursuant to the February 2006 Record of Decision for the Operation of Flaming Gorge Dam (ROD) (USBR, 2006), the Operation of Flaming Gorge Dam Final Environmental Impact Statement (FEIS) (USBR, 2005) and the 2005 Final Biological Opinion (BO) on the Operation of Flaming Gorge Dam (USFWS, 2005). This is the thirteenth year of operations of Flaming Gorge Dam under the ROD. This report will entail that information as well as hydrologic conditions to support flow regimes.

The ROD directs Reclamation to operate to achieve, to the extent possible, the Flow Recommendations as described in the FEIS (USBR, 2005). The Flow Recommendations divide the Green River below Flaming Gorge Dam into three river reaches. Reach 1 begins directly below the dam and extends to the confluence with the Yampa River. Reach 2 begins at the Yampa River confluence and continues to the White River confluence. Reach 3 is between the White River and Colorado River confluences (Muth et. al, 2000).

As described in ROD (USBR, 2006): “The administrative record referenced in Section 2.5.3 of the EIS and on page 4 above will include

- *an annual report to document the technical working group’s recommendations and discussions;*
- *Reclamation’s target flow regimes on a season by season basis;*
- *analysis of previous operations as related to recommendations and targets;*
- *a long term analysis of the frequency of achieving the flow thresholds described in the 2000 Flow and Temperature Recommendations (Muth et al., 2000).”*

and stated in the FEIS (USBR, 2005)

- *“An administrative record of the operational decisionmaking would be maintained and available to the public. This record would include analysis of previous operations and the effectiveness of achieving desired targets on a year-by-year basis.*
- *Technical Working Group meetings would also provide an opportunity to discuss historic operations in terms of the accomplishments and shortcomings of meeting the 2000 Flow and Temperature Recommendations. Reclamation would maintain an administrative record of these meetings to document the planning process.”*

Finally, the USFWS 2005 BO (USFWS, 2005) has requirements for an annual report. It is as follows: “*Reclamation will provide to the Service and Recovery Program a concise annual operations report. A primary purpose of the annual report is to provide an assessment of how well operations at Flaming Gorge Dam contributed to meeting flow targets. In addition, the annual report will provide a record of operations as identified under the incidental take statement. Basic information that should be summarized includes the following:*

- *A review of the April-July unregulated inflow forecasts provided by the National Weather Service via the River Forecast Center that were used to classify Green River hydrology.*
- *Additional factors that were used to determine which flow recommendation hydrologic category was targeted (e.g. Flaming Gorge Reservoir elevation, Yampa hydrology, past operations, power needs, Technical Working Group conversations, etc.),*

- *An accounting of actual flows and operations: spring flows and baseflows (reference USGS gages at Yampa River at Deerlodge, Green River at Greendale, Utah Jensen, Ut, and near Green River, Ut),*
- *Results from Reclamation's spillway inspections,*
- *A summary of daily and seasonal fluctuations at Jensen, Utah,*
- *An overview of Reclamation's operations to meet thermal targets,*
- *An accounting of the actual thermal regime in upper and lower Lodore Canyon and the lower Yampa River based on available information.*
- *Recommendations to refine operations.*

Operational Plan Development and Process for Water Year 2018

In 2018, the operational process developed in 2006 was used to operate Flaming Gorge Dam. The operational plan development is based on the FEIS (Section 2.5.3) (USBR, 2005) and the commitments in the ROD (Sections VI, and VII) (USBR, 2006). The four-step process is described below.

Four-Step Process of developing and finalizing the Annual Operation Plan

The four-step process is a term used to discuss the ROD requested, proposed, development, comment/input and finalization of the Flaming Gorge Operation Plan. This process will concurrently fulfill informal consultation and Endangered Species Act coordination requirements for the action agencies. Below is a brief description of the four-step Process.

1. Recovery Program may provide a request.
2. A technical working group, known as the Flaming Gorge Technical Working Group (FGTWG), consisting of biologists and hydrologists from Reclamation, Western Area Power Administration (WAPA) and the Fish and Wildlife Service (FWS), will annually propose an initial flow regime to the existing Flaming Gorge Working Group.
3. The Flaming Gorge Working Group will then provide comments and input on the proposed flows relative to all resource concerns.
4. Reclamation will then make a determination on how to incorporate the additional information into the annual operational plan.

Pertinent dates of Four Step Process 2018

The Upper Colorado River Endangered Fish Recovery Program (Recovery Program) request was received on March 19, 2018. The key portion of the request is presented below. The Larval Trigger Study Plan (LTSP) refers to the final Study Plan to Examine the Effects of Using Larval Razorback Sucker Occurrence in the Green River as a Trigger for Flaming Gorge Dam Peak Releases (ad hoc Committee, March 2012 (LTSP) (2012)).

THE RECOVERY PROGRAM'S 2018 GREEN RIVER FLOW REQUEST:

The Recovery Program's 2018 Green River Flow Request has two components: a Larval Trigger Study Plan (LTSP) spring peak, and experimentation with alternative Reach 2 base flow target ranges, the timing of which should be achieved coincident with the first presence of drifting Colorado pikeminnow larvae, and maintained through September 30. The Recovery Program believes all aspects of this request are supported by sound science and we understand that achieving both components may not be possible based on water availability and operational considerations. The Recovery Program assumes that our 2018 flow

requests will be refined in concert with the FGTWG using the best available flow forecast information, status and biological needs of the species, and other information.

To assist Reclamation and the FGTWG, should such deliberations be necessary, the Recovery Program prioritizes these flow experiments as follows:

- *Priority 1 - L TSP spring peak (as per L TSP ad hoc committee 2012)*
- *Priority 2 - New, proposed Reach 2 base flow ranges (as per Bestgen and Hill 2016a), as feasible within existing authority under the 2006 ROD*

The FGTWG notes covered 12 meetings from March 7, 2018 through June 28, 2018. No FGTWG Proposal was created. The Recovery Request is both the FGTWG Proposal and Operation Plan.

Flaming Gorge Work Group Meetings were held on April 19, 2018 in Vernal, Utah; on July 20, 2018 in Vernal, Utah; and on August 27, 2018 in Price, Utah.

Razorback sucker larvae were detected on May 18, 2018, and in response to the LTSP parameters, Flaming Gorge releases were increased to the powerplant capacity of 4,600 cfs. In response to a request submitted by the Recovery Program on behalf of the FGTWG (May 25, 2018 FGTWG Supplemental flow request) and to take advantage of favorable Yampa River flows to benefit endangered species operations in the middle Green River, Reclamation released an additional 2,000 cfs beyond 4,600 cfs. This short-duration bypass release began on May 29th and ended on May 31st.

Consistent with the 2006 Flaming Gorge ROD, considering information provided to the FGTWG, moderately dry hydrologic conditions and in response to the Recovery Program's request, Reclamation operated Flaming Gorge Dam to produce flows in Reach 2 to assist in the recovery of Colorado pikeminnow during the summer of 2018. The 2006 Flaming Gorge ROD base flow period hydrologic classification was average as of August 2018. Daily base flows fluctuated during the summer to meet or exceed 2,000 cfs on the Green River at Jensen, Utah through September 30, 2018.

Operation Decision

The Recovery Program request and intended FGTWG proposal had the same two elements concerning the flow regimes for the LTSP (2012) spring peak and alternative Reach 2 base flow target ranges for use with the ROD seasonal base flow variability.

The Recovery Program's 2018 Spring Flow Request established a release regime that facilitated further research under the LTSP. The LTSP's primary research objective was the request that "Reclamation use the occurrence of razorback sucker larvae in channel margin habitats (as determined by real-time monitoring) as the 'trigger' to determine when peak releases should occur from Flaming Gorge Dam."

The second flow regime request was to use the seasonal base flow flexibility identified in the 2006 ROD to achieve revised range of summer base flows (Bestgen and Hill, 2016) intended to improve survival of age-0 Colorado pikeminnow (*Ptychocheilus lucius*). This request from the RIP did not have a valid study plan at the time of implementation. It was determined that the requested summer base flows could be achieved for all hydrologic conditions within the +/- 40% flexibility allowed in the 2000 Flow and Temperature Recommendations (Muth et al.,

2000). Therefore, to the maximum extent possible the objective flows in Reach 2 were attempted between the Request and 2000 Flow and Temperature Recommendations (Muth et al., 2000). The July to April observed unregulated inflow is an average classification and observed flows in Reach 2 met the average base flow 2000 Flow and Temperature Recommendations (Muth et al., 2000) targets. This resulted in an average hydrologic classification operation that was used for comparative analyses to develop this report.

Hydrology

Reservoir storage in Flaming Gorge decreased during WY 2018. At the beginning of WY 2018, Flaming Gorge storage was 93 percent of live capacity at elevation 6,033.63 feet, with 3,490,000-acre feet in storage. The unregulated inflow to Flaming Gorge during WY 2018 was 1,590,000-acre feet which is 110 percent of average. At the end of the WY, Flaming Gorge storage was at 90 percent of live capacity at elevation 6,030.75 feet, with 3,380,000-acre feet resulting in a net decrease during WY 2018 of 113,000-acre feet.

Table 1 –April – July Forecasts and Spring and Base Flow Hydrologic Classifications

Year	May 1st A-J, Unreg Inflow Forecast (1000 AF)	Spring Hydrologic Classification	Observed A-J Unreg Inflow (1000 AF)	Base Flow Hydrologic Classification
2006	1,100	Average (Abv Mdn)	724	Moderately Dry
2007	500	Moderately Dry	370	Dry
2008	820	Average (Blw Mdn)	728	Moderately Dry
2009	890	Average (Blw Mdn)	1,197	Average (Abv Mdn)
2010	515	Moderately Dry	705	Moderately Dry
2011	1,660	Moderately Wet	1,925	Wet
2012	630	Moderately Dry	570	Moderately Dry
2013	480	Moderately Dry	361	Dry
2014	1,320	Average (Abv Mdn)	1,159	Average (Blw Mdn)
2015	570	Moderately Dry	1,035	Average (Blw Mdn)
2016	770	Moderately Dry	1,047	Average (Blw Mdn)
2017	2,260	Wet	2,214	Wet
2018	1,000	Average (Blw Mdn)	1,118	Average (Abv Mdn)

Autumn and Winter Base Flow for Water Year 2018

Base Flow Calculation Autumn and Winter Water Year 2018 -- The autumn and winter base flow target were established using October 2017 Most 24-Month Study. To achieve a 6,027 feet elevation by March 1, starting at a pool elevation of 6,033.63 feet, approximately 2,400 cfs of dam releases achieved this condition. Initially 2,400 cfs was established as the base flow target for the October-November period. Due to dam facility issues, only one unit could be used, thus for 31 days only 1,500 cfs was being released. Releases in December 2018, January 2018, and February 2018 were near 2,800 cfs which was approximately 12% above this base flow target which is allowed under the Flaming Gorge ROD. As a result of this elevated base flow the pool elevation on March 1, 2018 was 6,025.91 feet.

Two base flow objectives were targeted during WY 2018.

3% Daily Flow Changes -- As described in the FEIS, flow changes no greater than 3% of the total river flow are to occur during the base flow period. During autumn and winter WY 2018, release changes during the base flow periods were limited to no more than 50 cfs per day and this largely achieved the daily flow change restriction throughout the base flow periods during WY 2018. Due to only one unit being used and the necessity to ramp down from 2,400 cfs to 1,500 cfs in a short period of time, larger than 50 cfs/day changes occurred on the ramp up and ramp down, that resulted in 8 days greater than 50 cfs/day changes.

Jensen 0.1- stage change -- As described in the 2000 Flow and Temperature Recommendations (Muth et al., 2000) “Flow variation resulting from hydropower generation at Flaming Gorge Dam should be limited to produce no more than a 0.1-m stage change within a day at the USGS gage near Jensen, Utah.”

In WY 2018, during the base flow periods Reclamation coordinated with WAPA to establish Flaming Gorge release patterns for power production. This is to meet the requirement that hydropower generation at Flaming Gorge dam should produce no more than 0.1-m stage change at the USGS Jensen Gage. To estimate the impact of proposed release patterns, a routing model called the SSARR model was used to predict stage changes under various steady flow conditions for the Yampa River. Based on results from the SSARR model, a release pattern was developed which optimized power production that also met the stage change requirement of the FEIS. As conditions changed, the release pattern was modified to attempt to maintain this daily stage change restriction.

The observed 24-hour stages during the months of October and November 2017 at the USGS Jensen gage were all below 0.15 meters, except 3 days. There were 5 days with a stage change greater than 0.125-meter. During the months of December (2017), January (2018), and February (2018) observed 24-hour stage changes remained below a 0.12 meters stage change, with only one day above a 0.15-meter stage change.

USGS Gage – Greendale, UT – The autumn and winter base flow at Reach 1 targets per the 2000 Flow and Temperature Recommendations for the wet condition is 1,800 – 2,700 cfs. The winter maximum and minimum at a +/- 25% is 1,350 – 3,375 cfs. Releases started near 2,400 cfs and because there was only have one-unit available releases were reduced to 1,500 for 31 days. Releases during the winter base flow season were near 2,800 cfs.

USGS Gage – Yampa at Deerlodge Park, CO – The Yampa at Deerlodge Park (aka Yampa) gage supplements Reach 2 Targets. The autumn base flow period started with a storm that peaked at above 900 cfs, then flows ranged between 400 cfs and 600 cfs. During winter base flow the Yampa provided approximately 250 cfs to 525 cfs with an average near 400 cfs.

USGS Gage – Jensen, UT -- The autumn and winter base flow at Reach 2 targets per the 2000 Flow and Temperature Recommendations for the wet condition is 2,800 – 3,000 cfs. The winter maximum and minimum at +/- 25% is 2,100 – 3,750 cfs. The autumn flows ranged from 1,940 cfs to 3,620 cfs which was measured at the USGS gage Green River near Jensen, UT. The winter flows ranged from 3,050 cfs to 3,770 cfs with one day at 3,840 which was measured at the USGS gage Green River near Jensen, UT. Average flows during the winter period is near 3,400 cfs.

USGS Gage – Green River, UT -- The autumn and winter base flow at Reach 3 targets per the 2000 Flow and Temperature Recommendations for the wet condition is 3,200 – 4,700 cfs. The

autumn flows ranged from 2,840 cfs to 4,150 cfs which was measured at the USGS gage Green River near Jensen, UT. The winter flows ranged from 3,650 cfs to 4,490 cfs measured at the USGS gage Green River near Jensen, UT. Average flows during the winter period is near 4,100 cfs.

Spring Operations

Flaming Gorge Dam operations in 2018 were conducted in compliance with the 2006 Flaming Gorge ROD (USBR, 2006). The Razorback sucker larvae were initially detected on May 18, 2018. Reclamation manage releases to the Green River to meet the commitments of the 2006 Flaming Gorge ROD and, to the extent possible, meet the experimental design parameters outlined in the Recovery Program Larval Trigger Study Plan (LTSP). After public notification, releases from Flaming Gorge Dam were increased to full powerplant capacity on May 22, 2018. Bypass releases were utilized to bring the total release from Flaming Gorge Dam to 6,600 cfs for one day, starting on May 29, 2018, to enhance floodplain operations in the middle Green River for the benefit of endangered species.

In total, Flaming Gorge Dam released at or above powerplant capacity releases of 4,600 cfs for 9 days during the April through July runoff period. Yampa River flows at the Deerlodge gage peaked at 8,690 cfs on May 13, 2018. The peak release from Flaming Gorge Dam occurred after the Yampa River peak to support larval entrainment and reservoir management during the high spring flows. Flows measured on the Green River at the Jensen, Utah gage reached levels at or above 10,000 cfs for 9 days between May 23 and May 31, 2018 with a peak of 12,100 cfs on May 30, 2018.

Hydrologic conditions in the Upper Green River Basin above Flaming Gorge were above average in WY 2018. Snowpack development tracked above median with wet fall conditions increasing soil moisture resulting in above average runoff forecasts. Peak snow water equivalent reached 116 percent of seasonal median on April 11, 2018. The June forecast for the April through July inflow into Flaming Gorge Reservoir was 1,120,000-acre feet, or 114 percent of average. The observed inflow during the April to July season was 1,120,000-acre feet (1,380 mcm), or 114 percent of average.

Projected flow volumes from the Yampa River Basin were significantly different than projected flow volumes from the Upper Green River Basin and fell into the moderately dry hydrologic classification. The 2006 Flaming Gorge ROD hydrologic classification for the Upper Green was characterized as average (below median). The flexibility in the ROD allows for a change in hydrology classification two higher and one lower than that designated by the unregulated inflow volume on May 1 depending upon Yampa River conditions. It was determined that, with the drier conditions in the Yampa River Basin, the hydrologic classification was moderately dry and the LTSP hydrologic classification was moderately dry based on the May 1 forecast. Flows at Jensen did meet or exceed 2006 Flaming Gorge ROD flow targets in Reach 2 for the ROD Flow Recommendation of at least 8,300 cfs for at least one week.

Ramp down rates were consistent with 2000 Flow and Temperature Recommendations (Muth et al., 2000) at 350 cfs/day while below power plant capacity. A ramp down rate of approximately 1,000 cfs/day was used the release rate from 5,800 to 4,800 cfs, which has historically been used to ramp down above power plant capacity to reduce the duration of colder water releases from bypass. Transitioning from bypass to power plant ramp down the ramp down was near 700 cfs/day, 4,841 cfs to 4,148 cfs.

Base Flow Summer 2018

Base Flow Summer 2018 -- Hydrologic summer base flows for WY 2018 started in the first part of August 2018. From the 2000 Flow and Temperature Recommendations (Muth et al., 2000) for an average condition the beginning of the base flow season is typically about mid-July and for a moderately July condition the base flow season typically starts about early July. The WY 2018 base flow was determined using unregulated flow on the Green River and flow on the Yampa River at Deerlodge. The Colorado Basin River Forecast Center (CBRFC) observed August 2018 unregulated inflow volume into the Flaming Gorge dam was about 42,000-acre feet which was approximately 47% of average. The average unregulated inflow for the month of August month was 683 cfs calculated from the monthly CBRFC forecast. This flow was not achieved until after July 31, 2018. The July 31, 2018 unregulated inflow into the Flaming Gorge Dam is the latest base flow season which could be determined to have started based on this data. The July 2018 flow volume at the USGS Yampa Deerlodge gage was about 10,300-acre feet which was approximately 34% of average. The average flow for this August was 168 cfs. This flow was not achieved until after July 15, 2018. The start of the base flow season was determined to start based on flows measured at the USGS Yampa Deerlodge gage when flows measured near 150 cfs. This occurred on July 16, 2018.

Summer baseflow target in Reach 2 began on August 8 and the proposed flow targets from the Colorado Pikeminnow proposed study for an average condition is 2,000 - 2,600 cfs and for the 2000 Flow and Temperature Recommendations (Muth et al., 2000) is 1,500 - 2,400 cfs. The upper range of Colorado Pikeminnow study proposed flow started on June 29, 2018, at least 18 days before the hydrologic base flow period. The Reach 1 targets for 2000 Flow and Temperature Recommendations (Muth et al., 2000) is 800 cfs to 2,200 cfs. Targeted average daily releases ranged from 1,800 cfs to 2,000 cfs during the summer base flow period in Reach 1. Observed releases ranged from about 1,800 cfs to 2,050 cfs. Reach 3 targets for 2000 Flow and Temperature Recommendations (Muth et al., 2000) is 1,800 cfs to 4,200 cfs. Flows measured at the USGS gage Green River, Utah predominated range from 1,970 cfs to 2,200 cfs, with minimum and maximum flows being 1,700 cfs and 2,620 cfs.

Summer 2018 base flow calculation -- The observed April through July 2018 unregulated inflow was 1,118,000-acre feet (114 percent of average) which fell into an average hydrologic condition. Using the July 2018 Most Probable 24 Month Study the average releases rate from Flaming Gorge Dam to achieve the March 1 upper level drawdown target pool elevation of 6,027 was about 1,900 cfs. This release rate also achieved a base flow in Reach 2 that was within the desired base flow range for the average hydrological classification. The July through September 2018 release rate was about 2,000 cfs.

3% changes – During the summer base flow period the only changes occurred during the Utah Division of Wildlife Resources tailwater fish assessment, which occurred on September 4 and 5, 2018. During these days a larger than 3% was observed, 7% and 11%, about 150 cfs to 200 cfs change between daily average flows.

Jensen 0.1-stage change – In WY 2018, during the base flow periods Reclamation coordinated with WAPA to establish Flaming Gorge release patterns for power production. This is to meet the requirement that hydropower generation at Flaming Gorge dam should produce no more than 0.1-m stage change at the USGS Jensen Gage. Observed stage changes during this summer base flow season were at or below 0.125-meters except for two days. One of which on August 11,

2018 occurred during an outage at the dam. The other event occurred on July 11, 2018 before the hydrologic summer base flow period.

Spillway Inspection

Per the 2005 BO it is expected that spillway use would be limited to those times it was hydrologically necessary. The use of the spillway will only be used for extreme dam safety situation. Inspections of the structure would be made after each spill event. The Service expects Reclamation to report the results of their post-spill spillway inspections in 2018 Flaming Gorge Period Facility Review report. The spillway was not used in WY 2018. The spillway was inspected on July 12, 2018. The spillway, inlet, chute, walls, pier, floor, flip bucket walls and basin were inspected. Category¹ 2 and 3 recommendations were made, see below.

- Category 2
 - 2018-2-B Repair the two deteriorated areas along the left portion of the aeration slot as well as the spalls located 254-feet and 315-feet downstream of the spillway gates in the spillway tunnel.
 - 2018-2-C Repair and prevent further erosion on the river bank/hillside up to the powerplant access road, just downstream of the spillway flip bucket.
- Category 3
 - 2018-3-B Remove the calcium carbonate below the construction joint at the transition from the spillway inlet to the spillway tunnel.

Long Term Analysis of the Frequency of Achieving the Flow Thresholds

Spring Peak Targets -- Per the ROD (USBR, 2006) long term thresholds described in the 2000 Flow and Temperature Recommendations (Muth et al., 2000) are described below. The 2018 April through July May 1st forecasted and August observed hydrologic condition during spring runoff stayed as an average hydrologic condition. Due to the implementation of the LTSP (2012), two additional hydrologic conditions were evaluated, Average below median and Average above median. The May 2018 CBRFC forecasted April through July had a volume of 1,000,000-acre feet which was an Average below median condition as described by the 2012 LTSP. The August 2018 observed April through July volume was 1,118,000-acre feet which was an Average above median hydrologic condition as described by the 2012 LTSP. Yampa River Basin during the spring runoff season was determined as moderately dry. The ROD allows for flexibility to operate one classification lower or two classifications higher than indicated while being prepared to adjust if conditions warrant. Reclamation reviewed the FGTWG minutes and decided to implement the LTSP recommendations for moderately dry hydrologic conditions and operate Flaming Gorge Dam to increase releases once biologists determine razorback sucker larvae were in the system and ready to be entrained. According to the 2012 LTSP, for Moderately Dry hydrological condition, flows in Reach 2 are recommended to be great or equal to 8,300 and less than 14,000 cfs for different durations, that is great or equal to 7

¹ Category 1 O&M recommendations will be made for the correction of severe deficiencies where immediate and responsive action is required to ensure structural safety and operational integrity of a facility. Category 2 O&M recommendations will be made for a wide range of important matters where action is needed to prevent or reduce further damage or preclude possible operational failure of the facility. Category 3 O&M recommendations will be made for less important matters which are believed to be sound and beneficial suggestions to improve or enhance the O&M of the project or facility.

to less than 14 days, and greater than 14 days. According to the 2000 Flow and Temperature Recommendations, for this moderately dry condition with flows at or greater than 10,000 cfs for 9 days, this met the peak flow magnitude. For the peak-flow duration recommendations, 9 days were met in 2018.

Concerning base flow during the summer period (WY 2018) for an average condition this year's observed base flow for August and September averaged 2,260 cfs at the USGS Jensen gage in Reach 2. This is consistent with both the 2000 Flow and Temperature Recommendations (Muth et al., 2000) base flow as well as the Colorado Pikeminnow study proposed base flows for an average condition. Since the signing of the ROD 2006 and including this year and years where inflows were increased due to weather events 10 of 13 years were within the +/-40% of the 2000 Flow and Temperature Recommendations (Muth et al., 2000) summer base flow ranges. This is based on the April-July observed classification condition for August and September. The years 2008, 2010, 2011, 2013, and 2014 had flows outside the Reach 2 +/-40% targets. In years 2008 and 2014 this is due to short-term increases in tributary inflow resulting from weather events. In the 2010 and 2011 base flow seen on the Yampa River did not occur until later in August. Also, in 2010, Reach 2 targets were larger than +40% of maximum range but only varied near average at +46% of the base flow. In 2013 seasonal lag at the Yampa river occurred that resulted in elevated flow in late September at Reach 2.

Concerning base flow during the autumn period (WY 2018) for a wet condition (based on 2017 April-July observed unregulated inflow) this year's observed base flow for August and September averaged 2,760 cfs at the USGS Jensen gage in Reach 2. This is consistent with the 2000 Flow and Temperature Recommendations (Muth et al., 2000) base flow for a wet condition (2,800 to 3,000 cfs). Since the signing of the ROD 2006 and including this year and years where inflows were increased due to weather events 10 of 12 years were within the +/-40% of the 2000 Flow and Temperature Recommendations (Muth et al., 2000) autumn base flow ranges. The years 2007, 2008, 2011, 2014, and 2015 had flows outside the Reach 2 +/-40% targets. This is based on the previous WY April-July observed classification condition. In years 2007, 2011, and 2015 this is due to short-term increases in tributary inflow resulting from weather events. In years 2008 and 2014, both Dry Hydrologic classifications, flows in Reach 2 were above the +40% base flow ranges and this is due to dam minimum release constraints and the Yampa providing larger flows.

Concerning base flow during the winter period (WY 2018) for a wet condition (based on 2017 April-July observed unregulated inflow) this year's observed base flow for December, January, and February predominately averaged 3,370 cfs at the USGS Jensen gage in Reach 2. The flows ranged between 3,050 to 3,840. A small drift from directive release from 2,800 to around 2,900 cfs resulted in Reach 2 flows being +26% and +28% of the targeted base flows in Reach 2. Predominate the observed flows in Reach 2 is consistent with the 2000 Flow and Temperature Recommendations (Muth et al., 2000) base flow for a wet condition (2,800 to 3,000 cfs). Since the signing of the ROD 2006 and not including this year and including years where inflows were increased due to weather events 9 of 12 years were within the +/-25% of the 2000 Flow and Temperature Recommendations (Muth et al., 2000) winter base flow ranges. The years 2007, 2008, 2009, 2011, 2012, 2013, 2014, 2015, 2016, 2017, and, 2018 had flows outside the Reach 2 +/-25% targets. For the years 2007, 2008, 2009, 2011, 2013, 2015, 2016, and 2017, this is due to short-term increases in tributary inflow resulting from weather events. The 2011 and 2017 both April through July observed unregulated inflow was either a moderately wet or wet and resulted

in wet observed hydrologic conditions. Operations were such that releases were increased for the anticipated wet years, thus were operated above the flow recommendation. In 2012, flows in Reach decreased below -25% of base flow target and this occurred during transitioning the early period of the winter base flow periods and only lasted for three days. In 2014, a Dry Hydrologic classification, flows in Reach 2 were above the +25% base flow ranges and this is due to dam releases not being able to be below minimum releases and the Yampa providing larger flows.

The Reaches 1, 2 and 3, ROD Flow Recommendation spring objectives and the desired frequency of achievement are described in Tables 2, 3 and 4. WY 2018 is the 13th year of operations under the ROD.

Table 2 – Reach 1 ROD Flow Objectives Achievements in 2018

Spring Peak Flow Objective	Hydrologic Classification	Desired Frequency Percent of Achievement	Achieved in 2018	Achievement Rate to Date (Cumulative Frequency %)*
Peak \geq 8,600 cfs, \geq 1 day	Wet	10 %	Yes	31 %
Peak \geq power plant capacity \geq 1 day	Moderately Wet - Dry	100%	No	100 %

*Based on 13 years of operation under the ROD and spring hydrologic classification (2006-2018)

Table 3 – Reach 2 ROD Flow Objectives Achievements in 2018

Spring Peak Flow Objective	Hydrologic Classification	Desired Frequency Percent of Achievement	Achieved in 2018	Achievement Rate to Date (Cumulative Frequency %)*
Peak \geq 26,400, cfs \geq 1 day	Wet	10 %	No	8 %
Peak \geq 22,700, cfs \geq 2 weeks	Wet	10 %	No	8 %
Peak \geq 18,600, cfs \geq 4 weeks	Wet	10 %	No	8 %
Peak \geq 20,300, cfs \geq 1 day	Moderately Wet	30 %	No	23 %
Peak \geq 18,600, cfs \geq 2 weeks	Average	40 %	No	15 %
Peak \geq 18,600, cfs \geq 1 day	Average	50 %	No	39 %
Peak \geq 8,300, cfs \geq 1 day	Average	100 %	Yes	100 %
Peak \geq 8,300, cfs \geq 1 week	Moderately Dry	90 %	Yes	92 %
Peak \geq 8,300, cfs \geq 2 days except in extreme dry years	Dry	98 %	Yes	100 %

*Based on 13 years of operation under the ROD and spring hydrologic classification (2006-2018)

Table 4 – Reach 3 ROD Flow Objectives Achievements in 2018

Spring Peak Flow Objective	Hydrologic Classification	Desired Frequency Percent of Achievement	Achieved in 2018	Achievement Rate to Date (Cumulative Frequency %)*
Peak \geq 39,000, cfs \geq 1 day	Wet	10 %	No	8 %
Peak \geq 24,000, cfs \geq 2 weeks	Wet	10 %	No	8 %
Peak \geq 22,000, cfs \geq 4 weeks	Wet	10 %	No	8 %
Peak \geq 24,000, cfs \geq 1 day	Moderately Wet	20 %	No	31 %
Peak \geq 22,000, cfs \geq 2 weeks	Average	40 %	No	8 %
Peak \geq 22,000, cfs \geq 1 day	Average	50 %	No	31 %
Peak \geq 8,300, cfs \geq 1 day	Moderately Dry	100 %	Yes	100 %
Peak \geq 8,300, cfs \geq 1 week	Moderately Dry	90 %	Yes	92 %
Peak \geq 8,300, cfs \geq 2 days except in extreme dry years	Dry	98 %	Yes	100 %

*Based on 13 years of operation under the ROD and spring hydrologic classification (2006-2018)

Temperature Objectives Achieved in Water Year 2018

An operational plan for the selective withdrawal system (SWS) on Flaming Gorge Dam was completed by a subset of the FGTWG in June 2007 and revised in June 2012. The operational plan provides guidelines for implementation of the 2006 ROD temperature objectives below Flaming Gorge Dam (Table 5). Operational guidelines direct operators to achieve maximum gate elevation (40' below reservoir surface) by June 15 of each year in order to deliver target outflow temperatures of 15.0-16.0 °C (59.0 - 60.8 °F) during the summer months.

On June 14, 2018, SWS gates were elevated to 40' below the reservoir surface, however target dam release temperatures (15.0 °C or 59.0 °F at the Greendale gauge, USGS 09234500) were not fully achieved until August 11 (Figure 1). No high temperature stator alarms were sounded during SWS operations in summer 2018, and SWS gates remained at 41 – 45' below the reservoir's surface from June 14 through November 29, 2018.

Table 5. Temperature objectives for the Green River below Flaming Gorge Dam pursuant to the 2005 EIS and 2006 ROD. Reach 1 is from the dam to the Yampa River confluence; Reach 2 is from the Yampa River to Sand Wash, UT.

Temperature Objectives	Reach	Achievement during base flow period (July 15 – Sept 30)	Achievement during larval drift (Jun 20 – Aug 3)
Temperatures ≥ 18.0 °C (64.4 °F) at Gates of Lodore for 3-5 weeks ² starting in June - July (dry-average years) or July - August (moderately wet-wet years)	1	17 days after July 15	20 of 45 larval drift days
Green River should be no more than 5.0 °C (41 °F) colder than the Yampa River during the base flow period in order to minimize thermal shock to drifting Colorado pikeminnow larvae	2	Objective not achieved on 8 days	Objective not achieved on 17 days

Both Muth et al. (2000) and the Operation of FEIS (USBR, 2005) state that achievement of temperature objectives for Gates of Lodore and the Green/Yampa confluence should coincide with the onset of the summer base flow period which varies with hydrologic classification of each year (Table 5). However, one of the basic assumptions for these objectives is that delivery of optimal water temperatures by the prescribed start times would coincide with drift of larval Colorado pikeminnow out of the Yampa River and minimize chances for thermal shock as the larvae enter the Green River. The FEIS describes operations to reach the Green/Yampa objective as occurring “...during the [base flow period] *and/or* when Colorado pikeminnow larvae are present at this confluence” (italics added; Reclamation 2005), and Muth et al. (2000) considers presence of Colorado pikeminnow larvae as real-time information that should be considered when implementing flow and temperature recommendations. Therefore, to evaluate success of achieving temperature objectives in 2018, statistics for evaluating the onset and duration of target temperatures were considered both in relation to the onset of the base flow period (base flow period start date through September 30) and also the onset and duration of Colorado pikeminnow larval drift.

Average daily temperatures at Gates of Lodore (USGS 404417108524900) in 2018 intermittently equaled or exceeded Reach 1 objectives (18.0 °C or 64.4 °F; Figure 1) for 28 days between June 26 and August 17. However, these objectives were met for only 17 days (as opposed to the objective’s minimum of 21 days) after July 15 (81% success rate), which is the approximate start date of the base flow period according to the for an average hydrologic year according to Muth et al. (2000) and the 2006 ROD. Drift of Colorado pikeminnow larvae began on June 20 and lasted through August 3 (45 days), during which time temperatures equaled or exceeded 18.0 °C at Gates of Lodore for a total of 20 days (95% success rate). Temperature differences between the

² The U.S. Fish and Wildlife Service (K. McAbee, personal communication, 2012) has advised Reclamation to observe the target duration of the Lodore temperature objective specified in the 2005 Biological Opinion, which is 3-5 weeks at or above 18°C.

Yampa and Green rivers in June through September 2018 exceeded 5.0 °C for a total of 19 days, eight of which occurred on and after July 15 and 17 of which occurred during the period of Colorado pikeminnow larval drift (62% success rate).

The primary reason that temperature objectives were not fully achieved in 2018 is most likely the flow magnitude in the Green River during the base flow period, particularly in relation to that of the Yampa River. Average releases from Flaming Gorge Dam during July through September were 2,113 cfs, which is one of six years since 1992 where base flows averaged 2,000 cfs or greater (1997-1999, 2011, 2017-2018) during that timeframe. In each case, the 18.0 °C objective was not achieved, which suggests that base flows of this magnitude may not allow sufficient longitudinal warming potential to fully meet the objective.

Whereas releases from Flaming Gorge Dam exceeded 2,000 cfs for most of July through September 2018, Yampa River flows (measured at the Deerlodge gauge, USGS 9260050) averaged only 106 cfs, about a 20-fold difference. Extreme low flows in the Yampa River and were most likely associated with high warming rates, particularly in relation to those of the Green River, a disparity which led to frequent temperature differences exceeding 5.0 °C at the confluence of the Green and Yampa rivers.

Like 2017, base flow temperatures in 2018 largely fell short of 2006 ROD objectives, and in both cases failure can be attributed to extreme differences in flows in the Green and Yampa rivers.

One means to minimize frequency of these extreme differences would be to limit Green River flows to levels conducive to more rapid warming, especially in years when the Yampa River is comparatively dry. In 2018, for example, flows could have been made closer to levels based solely on observed inflow (in relation to the following year's May 1 reservoir elevation target) rather than increased by the full 40% allowance in the ROD. To better achieve temperature objectives, though, determining optimal flows for the Green River in relation to Yampa River hydrology may have to consider optimal base flow elevations prescribed by Bestgen and Hill (2016) for optimizing habitat for larval Colorado pikeminnow.

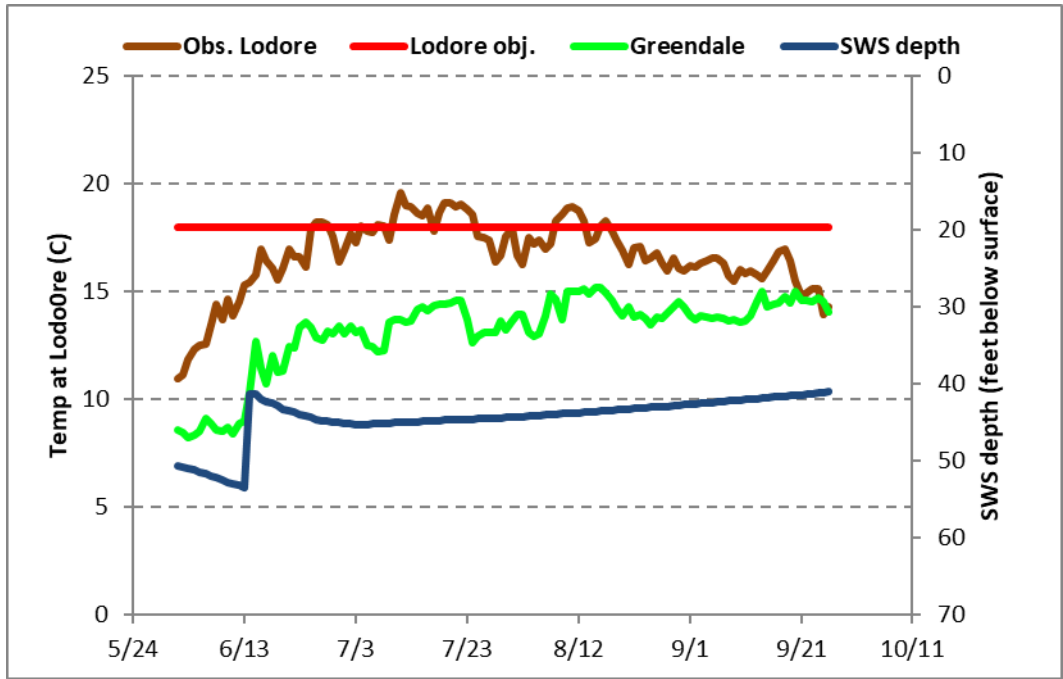


Figure 1. Average daily temperatures recorded at the Gates of Lodore gage (brown series), Greendale gage (green series; USGS 09234500), Reach 1 (Gates of Lodore) objective (red line), and SWS gate depth below reservoir surface (blue series, second axis), June-September 2018. SWS gate depths are the average of three units.

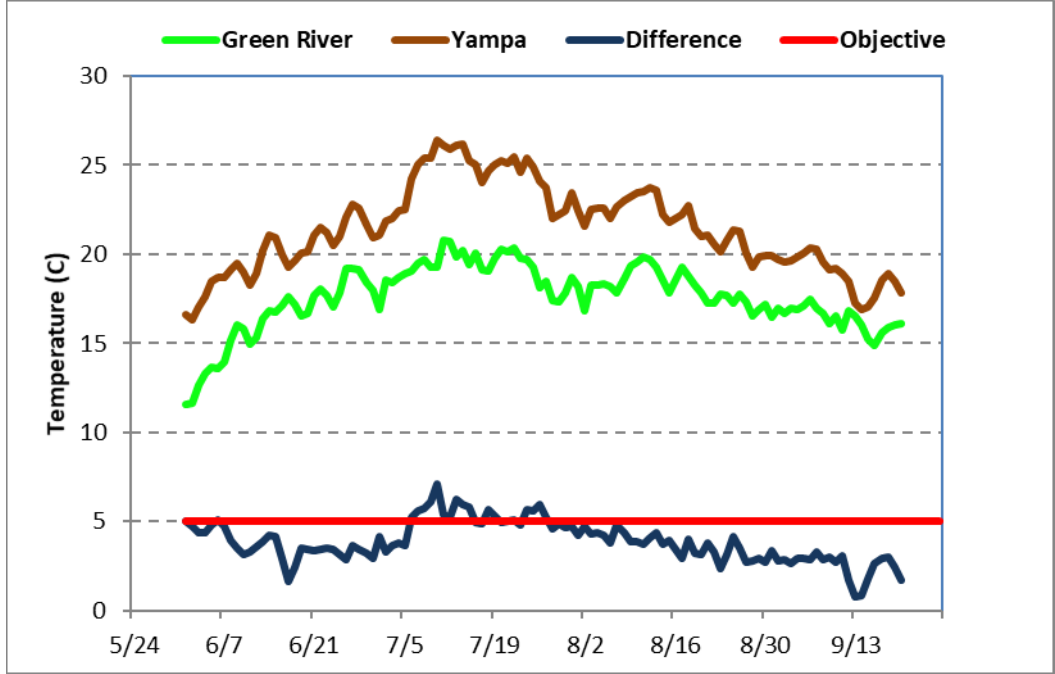


Figure 2. Temperature of the Green River (green series) at the Yampa River confluence and of the Yampa River (brown series), the difference between the two rivers (blue line), and the maximum temperature difference (5.0 °C) specified in the 2006 ROD (red line), June-September 2018.

Recommendations to Refine Operations

Recommendations are to have a formal FGTWG Proposal and Operation Plan as outlined in the four-step process.

Flaming Gorge Technical Working Group recommendations and discussions to document planning process

Included in the Appendix is a summary of events and meeting minutes from the FGTWG meetings.

References

- Bestgen, K. R., and A. A. Hill. 2016. Reproduction, abundance, and recruitment dynamics of young Colorado pikeminnow in the Green River Basin, Utah and Colorado, 1979-2012. Final report to the Upper Colorado River Endangered Fish Recovery Program, Project FW BW-Synth, Denver, CO. Department of Fish, Wildlife, and Conservation Biology, Colorado State University, Fort Collins. Larval Fish Laboratory Contribution 183. Available at: <http://www.coloradoriverrecovery.org/documents-publications/technical-reports/isf/BestgenHillFR-BWtopoGreenRiverpikeminnowreportFinalFebruary2016.pdf>
- Bestgen, K.R., and L.W. Crist. 2000. Response of the Green River fish community to construction and re-regulation of Flaming Gorge Dam, 1962-1996. Upper Colorado River Endangered Fish Recovery Program, Lakewood, CO.
- Larval Trigger Study Plan Ad Hoc Committee (LTSP). 2012. Study Plan to Examine the Effects of Using Larval Sucker Occurrence in the Green River as a Trigger for Flaming Gorge Dam. Available at: <http://www.coloradoriverrecovery.org/documents-publications/technical-reports/isf/larvaltriggerstudyplan.pdf>
- Muth, R. T., L. W. Crist, K. E. LaGory, J. W. Hayse, K. R. Bestgen, T. P. Ryan, J. K. Lyons, and R. A. Valdez. 2000. Flow and temperature recommendations for endangered fishes in the Green River downstream of Flaming Gorge Dam. Final report FG-53 to the Upper Colorado River Endangered Fish Recovery Program. U. S. Fish and Wildlife Service, Denver, CO. Available at: <http://www.coloradoriverrecovery.org/documents-publications/technical-reports/isf/flaminggorgeflowrecs.pdf>
- Bureau of Reclamation (USBR). 2005. Operation of Flaming Gorge Dam Final Environmental Impact Statement. U.S. Department of the Interior, Bureau of Reclamation, Salt Lake City, Utah.
- Bureau of Reclamation (USBR). 2006. Record of Decision on the Operation of Flaming Gorge Dam Final Environmental Impact Statement. U.S. Department of the Interior, Bureau of Reclamation, Salt Lake City, Utah.
- U.S. Fish and Wildlife Service (USFWS). 2005. Final Biological Opinion on the operation of Flaming Gorge Dam (Consultation # 6-UT-05-F-006). U.S. Department of the Interior, Fish and Wildlife Service, Utah Field Office, West Valley City, Utah.

Appendix -- Summary of events and meeting minutes from the FGTWG meetings.

Meeting Notes -- Wednesday, March 7, 2018

In attendance: Heather Patno, Jerry Wilhite, Randy Staffeldt, Michael Kartlow, Dan Schaad, Dave Speas, Don Anderson, Kevin Bestgen, Tom Chart, Ashley Nielson, Leslie Bennett

Welcome to the 2018 Kick Off

1. FGTWG Overview:

- Authority comes from the 2006 Record of Decision (ROD), Section VII, Environmental Commitments #10 state that in coordination with the Recovery Program, Reclamation, Western and FWS proposals will be made to the Flaming Gorge Work Group.
- This group has grown with a lot of experts pertaining to forecasts, Stewart Lake, Refuges and razorback sucker and Colorado pikeminnow fish. Biologists and hydrologists will gather information to make proposals to the Flaming Gorge Workgroup. Discussion should be limited to endangered fish and how Flaming Gorge can help.

2. March 5, 2018 Hydrology Summary Review

- Flaming Gorge falls in the average (below median) hydrologic classification
- Yampa River will likely be moderately dry. The North slope of the Uintah is very dry. Fontenelle may see a higher inflow than Flaming Gorge because of this. Comparison years on the Yampa are 2002 and 2013. The Yampa did not see additional water in 2002, however 2013 saw some increased precipitation in April. Yampa is much dryer than the Upper Green. Keep in mind there are two different data types looking at similar statistics. Heather uses the 10 historic most similar years of Yampa; Ashley takes the ensemble prediction using temperature and precipitation with initial conditions. There is a good chance at meeting 4,000-6,000 cfs. There will likely be no days at 18,600 at Jensen this year. Ashley shows 35 years of historical information and feels 8,000-8,500 cfs is the probable peak. Still very early in the season especially regarding peak flows. March meteorological models are showing a dryer pattern with a small storm Friday and Saturday limited in significance. Next week warm/dry conditions. Middle to end of the month there is a decent storm predicted.

3. Draft Recovery Program - Tom Chart

- Current draft request mimics where we were last year. Closed out the Technical Committee on February 28, 2018. Sent to Management Committee for comments by COB Friday this week. Asking for continued experimental flows for Larval Trigger Study Plan. Reference is made to the importance of spike flows to disadvantage smallmouth bass. Not asking specifically for that this year but keeping it on the radar. The Appendix includes information compiled over the years.
- Heather informed the team that Reclamation is internally discussing the request dealing with experimentation on down ramping rates from spring releases to benefit Colorado pikeminnow. In the past year Reclamation has deviated from the 3 percent daily change from the ROD during the baseflow season to increase/decrease from month to month. BOR did not use the 50 cfs per day for the dive team inspection in August 2017 and used 300 cfs daily change. It would have taken a month to reach the necessary level at 50 cfs a day. Information from the GREAT team and a NEPA

analysis were done to assess impacts from the deviation from the ROD. BOR is determining what would be needed to accommodate the experimentation request during the down ramp period from spring peak releases. We are still operating in the ROD and doing NEPA analysis when deviating. There is a different down ramp rate for each classification. BOR supports experimentation through adaptive management and is looking at all possible options.

- The Recovery Program is interested in saving as much water as possible with increasing down ramp rates during the dry conditions this year.
4. The FGTWG is in approval of the April 23-24, 2018 spring electrofishing flows request from UDWR.
 5. Flaming Gorge Working Groups
 - The March 8, 2018 meeting in Price has been canceled. Outside groups have requested a placeholder for that meeting in high water years in the future. The spring working group meeting will be April 18, 2018, in Vernal. Not a lot of outside concern due to the lower water levels. Flow Request presentation by Tom or Don. Ashley will present the forecast.
 6. Next FGTWG Meeting will be held at April 10, 2018 at 1:00 pm
Heather will send the summary link with calendar invite.

Meeting Notes -- Tuesday April 10, 2018

In attendance: Heather Patno, Jerry Wilhite, Mike Kartlow (UDWR), Dan Schaad, Dave Speas, Don Anderson, Kevin Bestgen, Tom Chart, Ashley Nielson, Jed Parker

1. April 10, 2018 Hydrology Review
 - The April 1 Final Forecast projected 1,000,000 acre-feet for Flaming Gorge, putting it in the average-dry classification. The April 8 ESP projects 1,090,000 acre-feet which, if it holds, would likely put Flaming Gorge in the average-wet classification. Reclamation is currently looking at a 14-day peak at power plant capacity, given current hydrology.
 - Current Yampa River flows have reached above 4,000 cubic feet per second (cfs) and Jensen flows are currently ~6,000 cfs. Current FG releases are 1,700 cfs/day with fluctuations for hydropower. Operations will meet about one foot below the average May 1 target of 6027 ft, and there is flexibility to discuss baseflow rate and temperature prior to spring runoff to assist razorback sucker spawning. An estimate of razorback sucker spawning time will be given at the next FGTWG meeting as information to assist decision-making.
 - The April 1 Final Forecast projected 755,000 acre-feet for the Yampa (Lily + Maybell), putting it in the moderately dry condition. The 50% exceedance probability for the maximum peak daily flow in the Yampa as of April 04 is for a 9,500-10,000 cfs peak for limited duration. The Yampa condition would increase to average (dry) if it reaches 989,000 acre-feet.
 - Significant precipitation has occurred in both Green and Yampa river basins since the April forecast was released, and more precipitation is likely through April. The mid-month forecasts may increase runoff projections compared to the April 1 final forecast.
 - The RP maintains its request for smallmouth bass (SMB) spike flows during the descending limb of the spring peak flows to assist in disadvantaging the nonnative

fish during their emergence. The RP understands that Reclamation may require additional NEPA for this experimental regime.

2. Draft Recovery Program - Tom Chart

- Recovery Program (RP) is requesting similar experimental flow regimes that we've seen in the past. The Larval Trigger Study Plan (LTSP) for the razorback sucker during spring peak is one request.
- The RP continues to request that Reclamation explore its seasonal flexibility to get into the Bestgen and Hill baseflow range using the $\pm 40\%$ summer flexibility outlined in the ROD. It's important for Colorado pikeminnow (CPM) early life history survival to get into the CPM baseflow range from LTSP peak coincident to or during CPM presence. Timing of the baseflow range is as important as the level of baseflows.
- The Recovery Program is requesting increasing down ramp from the rates after the spring peak to accommodate the CPM. This request will be evaluated within Reclamation to determine if it can be accommodated or if it's outside the ROD, and Reclamation will respond to the Recovery Program.
- The US Fish & Wildlife Utah Ecological Field Office will provide Reclamation its annual sufficient progress letter for Reclamation to implement the LTSP and other experimental flow requests from the RP.

3. Stakeholder input

- Reclamation has decided that the Yampa White Green River Basin and Green River Stakeholders concerns are best addressed in the Flaming Gorge Working Group meetings typically held in April and August.

4. Next FGTWG Meeting will be held at April 26, 2018 at 2:00 pm
Heather will send the summary link with calendar invite.

Meeting Notes -- Thursday, April 26, 2018

In attendance: Don Anderson, Kevin Bestgen, Ashley Nielson, Jed Parker, Matt Breen, George Weekly, Peter Crookston

1. April 26, 2018 Hydrology Review

- The April 1 Final Forecast projected 1,000,000 acre-feet for Flaming Gorge, putting it in the average-dry classification. The April 24 ESP projects 1,060,000 acre-feet which, if it holds, would likely put Flaming Gorge in the average-wet classification. Reclamation is currently looking at a 14-day peak at power plant capacity, given current hydrology.
- The April 24 ESP Forecast projected 819,000 acre-feet for the Yampa (Lily + Maybell), putting it in the moderately dry condition. The 50% exceedance probability for the maximum peak daily flow in the Yampa as of April 26 is for an 8,000 – 9,000 cfs peak for limited duration in late-May. It is unlikely to expect a 10,000+ cfs Yampa Peak this year.
- Current Yampa River flows have reached above 4,000 cubic feet per second (cfs) and Jensen flows are currently ~6,000 cfs. Current FG releases are 1,700 cfs/day with fluctuations for hydropower. Flaming Gorge pool elevation will be about one foot below the average May 1 target of 6027 ft.

- Signs of razorback sucker spawning have occurred. An estimate was given putting a likely larval emergence May 20-24. This estimate should be taken as such and not relayed to the public until further confidence can be applied.
2. Working Group Review
 - Stakeholders within the Working Group expressed two concerns that were worth restating in the FGTWG. Stakeholders first wanted to know what the possibilities of varying from the 14-day, 4,600 cfs release were. In addition, stakeholders restated their desire to be informed of decisions as far in advance of action as possible.
 - A review of the proposed 14-day, 4,600 cfs peak was given at the Working Group meeting. Concern exists that stakeholders may perceive that this release plan is unlikely to change when in fact the FGTWG would like to further explore flexibility that may alter the presented plan. A desire within the FGTWG was expressed to present a range of possibilities at future Working Group meetings according to the requirements within the ROD.
 - The Recovery Program indicated to the public that they would request 14-day, 4,600 cfs releases volume be reshaped to include bypass releases in the FGTWG. The official flow request discussion is further described below.
 3. Flow request discussion
 - An alternate release schedule from Flaming Gorge was presented: three days at 4,600 cfs followed by a week of bypass flows ending with three-four days at 4,600 cfs before returning to base flows. Reclamation will comment on the possibility of achieving this schedule at the May 8 FGTWG meeting.
 - The group will defer finalizing the peak flow schedule until the May 8 FGTWG meeting or until conditions manifest with the Yampa during larval emergence.
 - Discussion of the base flow releases was tabled until further FGTWG meetings.

The next FGTWG Meeting will be held May 8, 2018 at 1:00 pm and Jed will send the summary link with calendar invite.

Meeting Notes -- Tuesday May 8, 2018

In attendance: Heather Patno, Jerry Wilhite, Dan Schaad, Kevin Bestgen, Tom Chart, Ashley Nielson, Jed Parker, George Weekly, Tildon Jones, Peter Crookston, Randy Staffeldt

1. May 8, 2018 Hydrology Review
 - a. Flaming Gorge April-July forecast = 1,000,000 acre-feet (102% of 30-year average), average (below median) hydrologic classification.
 - b. Yampa-Maybell + Lily April-July forecast = 841,000 acre-feet (66% of 30-year average, moderately dry hydrologic condition.
 - c. Combined hydrology leads to recommendation to operate Flaming Gorge within the moderately dry hydrologic classification.
 - d. Yampa 15-day deterministic model from the CBRFC presently indicates a sub-9,000 cfs peak occurring May 12 – May 13, 2018.
2. Down ramp rates
 - a. The recovery program would like to explore the possibility of utilizing enhanced down ramp rates for the benefit of Colorado pikeminnow, possibly by utilizing rates in different hydrologic classification

- b. Reclamation would prefer that requests for altered down ramp rates be considered through a study request, which would likely require discussion in a public forum such as the Working Group meetings per the 2005 Biological Opinion.
- 3. Biological benefits of Recovery Program flow request
 - a. The Recovery Program was asked to comment on the biological benefits of reshaping the current planned release of 4,600 cfs for 14 days. The following are the stated benefits:
 - i. Higher peaks are more likely to entrain larval razorback suckers in the managed floodplains.
 - ii. Due to head pressure on the gates of the managed floodplains, a higher peak will put more water into the floodplains, enhancing habitat and overall water quality above what a lower magnitude peak would yield.
- 4. Modeled emergence projection
 - a. Current guidance indicates that likely razorback sucker larval emergence to take place between May 15 and May 22, 2018.
 - b. Fish & Wildlife Service has begun light trapping for razorback sucker larvae. Nothing has been captured yet.
- 5. Jed will create calendar placeholders for weekly FGTWG meetings through May. The dates and times established are as follows:
 - a. Tuesday, May 15th at 12:00 p.m.
 - b. Wednesday, May 23rd at 1:00 p.m.
 - c. Tuesday, May 29th at 12:00 p.m.

Meeting Notes -- Friday, May 18, 2018

In attendance: Heather Patno, Jerry Wilhite, Kevin Bestgen, Tom Chart, Jed Parker, George Weekly, Don Anderson, Dave Speas

- 1. May 18, 2018 Hydrology Review
 - a. Flaming Gorge April-July forecast = 1,120,000 acre-feet, average (below median) hydrologic classification.
 - b. Yampa-Maybell + Lily April-July forecast = 841,000 acre-feet (66% of 30-year average, moderately dry hydrologic condition.
 - c. Combined hydrology leads to recommendation to operate Flaming Gorge within the moderately dry hydrologic classification.
 - d. Yampa 15-day deterministic model from the CBRFC presently indicates a gradually decreasing flow from the ~9,000 cfs peak which occurred on May 13, 2018.
- 2. Managed floodplain discussion
 - a. Johnson Bottom
 - i. Likely requires sustained flows of 12,000 cfs or more to be able to utilize.
 - ii. Flows of 12,000 cfs or more will require significant bypass flows.
 - iii. Unlikely to recommend using Johnson bottom during the 2018 runoff period.
 - b. Stewart Lake
 - i. Discussion on the extensive effort required to remove or control cattails previous to the runoff period
 - ii. Division of Wildlife Resources recommends filling Stewart Lake to assist in cattail control

- iii. Flows at or above 10,000 cfs would be recommended to manage Stewart Lake
 - iv. No concerns regarding water quality impacts from the burning of vegetation because supplemental water has been used to assist operations
- 3. Larval emergence
 - a. Two possible razorback larvae were detected in light traps on Thursday, May 17. Confirmation of razorback identification is not complete.
 - b. A single razorback larva was detected in Stewart Lake light traps on the morning of Friday, May 18.
- 4. Increasing Flaming Gorge Dam releases
 - a. Increasing flows to power plant capacity, beginning Monday, May 21, was suggested.
 - b. Consensus was reached to move ahead with directive and notifications regarding power plant capacity flows beginning on Monday.
- 5. Flaming Gorge update
 - a. Jed to compose a more in-depth update to send out to the Flaming Gorge notification group over the weekend.

Meeting Notes -- Monday, May 21, 2018

In attendance: Jed Parker, Nick Williams, Ashley Nielsen, Paul Abate, Heather Patno, Jerry Wilhite, Kevin Bestgen, Tom Chart, George Weekly, Don Anderson, Dave Speas, Randy Staffeldt, Dan Shaad, Matt Breen

- 1. May 21, 2018 Hydrology Review
 - a. Yampa River Basin SWE continues to track 2001
 - b. Comparison of 2018 and 2001 flows given
 - c. Potential release scenarios given based off of previous FGTWG discussion regarding desire to maintain flows at 10,000 cfs to enhance Stewart Lake operations
- 2. Release scenario discussion
 - a. Desire expressed to evaluate possibility of utilizing bypass flows to maintain 11,000 cfs at Jensen to benefit Stewart Lake operations
 - b. Reclamation asked for clarification on benefits of 11,000 cfs flows as opposed to benefits under current release schedule
 - i. Generally, higher flows result in more head on the gates at Stewart Lake resulting in more chance for larval entrainment. In addition, extended periods of higher flows result in more likely chance of capturing the higher period of larval drift
 - c. After evaluating higher flow effects on Stewart Lake operations on Friday, more details and benefits of potential increased flows to be discussed during potential Friday FGTWG
- 3. Discussion on larvae
 - a. A total of 10 razorback sucker larvae were capture overnight in light traps
 - b. Still in the ascending limb of larval emergence
- 4. Next FGTWG – Wednesday, May 23 at 1:00 pm

Meeting Notes -- Wednesday, May 23, 2018

In attendance: Jed Parker, Nick Williams, Ashley Nielsen, Heather Patno, Jerry Wilhite, Kevin Bestgen, Tom Chart, George Weekly, Don Anderson, Dave Speas, Randy Staffeldt, Dan Shaad, Tildon Jones

1. May 23, 2018 Hydrology Review
 - a. Yampa River Basin SWE continues to track 2001
 - b. Reclamation presented figures generated by Ashley Nielsen (CBRFC) to demonstrate current projections for Green River at Jensen based off of current powerplant capacity release schedule
 - c. Jensen expected to see over seven days above 10,000 cfs with small spikes above 11,000 cfs.
 - d. Current projections indicate well over 7 or 14 days above 8,300 cfs at Jensen, after larval emergence, as required by LTSP
2. Release scenario discussion
 - a. Reclamation conveyed results of internal discussions with management on requests, received through two prior FGTWGs, on the possibility of utilizing bypass flows to achieve higher sustained flows for the benefit of Stewart Lake operations
 - b. Reclamation will not release above power plant capacity for these purposes for the following reasons:
 - i. Timing and magnitude of higher releases and their impact on downstream stakeholders
 - ii. Previously stated objectives relayed to stakeholders of only utilizing bypass flows to achieve 8,300 cfs flows at Jensen
 - iii. Stated benefits of higher flows are not likely to be quantified in time for increased releases to make a significant difference at Jensen given the Yampa River's declining flow
3. Discussion on Reclamation decision
 - a. Concern expressed that endangered species concerns were not considered as decision was being made
 - b. Concern expressed regarding the impact of the decision of progress on Section 7 compliance
4. Stewart Lake discussion
 - a. Filling expected to begin on Thursday, May 24
 - b. Discussion on the current water level of Stewart Lake and recent management decisions
 - c. Current flows of ~10,000 provide 6-8 inches of head on the inlet gates
5. Next FGTWG – Friday, May 25 at 10:00 am

Meeting Notes -- Friday, May 25, 2018

In attendance: Jed Parker, Heather Patno, Jerry Wilhite, Kevin Bestgen, Tom Chart, Randy Staffeldt, Tildon Jones, Matt Breen

1. Possible flow scenarios
 - a. An overview of the difference in projected flows in the Yampa River between 5/23 and 5/25.

- b. The 5/25 ESP run highlights that the Yampa projection have turned favorable in terms of benefits to floodplain operations.
- 2. Current CBRFC projections for Jensen gage
 - a. Overview of projected flows given for Jensen gage which shows a number of days above 11,000 cfs under current release scheme.
- 3. Benefits of increased bypass flows from Flaming Gorge Dam on Stewart Lake operations was discussed. Generally, higher flows would benefit larval entrainment at Stewart Lake.
- 4. Recovery program expressed desire to revisit previous Reclamation decision to not release above power plant capacity. Recovery program informed that a written request would be needed, and that if received, would be passed on to leadership, though it is unlikely to be implemented.
- 5. Recovery program agreed to write a formal request for increased releases.
- 6. Next FGTWG – Monday, May 29 at 12:00 pm

Meeting Notes -- Monday, May 29, 2018

Attendees: Jed Parker, Heather Patno, Ashley, Nielsen, Don Anderson, Tom Chart, Matt and Randy, Dan Schaad, Peter Crookston

- 1. Hydrology summary:
 - a. Yampa not falling out as quickly as was forecast on the previous Friday. Flows will continue to put water into Stewart Lake along with larvae.
- 2. The short bypass release to 6,600 will be likely be reaching Stewart Lake within 48 hours, providing a pulse of flow to enhance operations.
- 3. Review of baseflows:
 - a) Typically target 2,000 at Jensen when Pikeminnow emerge, early as June 15th, July 1st.
 - b) Decreased below average baseflow, until target reached, then increase by 50 cfs until we get to target.
 - c) Dave – Tom, have overview of recovery program discussion to take place on June 28th.

Meeting Notes -- Monday, June 12, 2018

Attendees: Jed Parker, Ashley Nielsen, George Weekly, Heather Patno, Kevin Bestgen, Tom Chart, Don Anderson, Jerry Wilhite, Dave Speas

Baseflow discussion:

- 1. Larval drift sampling – Main spawning area, lower Yampa River. Early pikeminnow occupy in channel backwaters. Average first date of drift is first week in July. Drier and warmer June may time first presence in late-June and first few days of July.
- 2. Hold 2,200 at Jensen through September 30th. FGTWG on the 28th. Possible follow up in early-July to potentially increase releases.
- 3. Selective withdrawal structure overview given by Dave Speas.
- 4. Bad fishing – Anglers requesting use of SWS earlier than planned to increase temperatures.
- 5. Dave Speas to explore the possibility of utilizing SWS to release warmer water earlier than what is currently in SOP.

Meeting Notes -- Thursday, June 28, 2018

Attendees: Jed Parker, Tom Chart, Dave Speas, Don Anderson, Kevin Bestgen, Peter Crookston, Heather Patno, Matt Breen, Jerry Wilhite, George Weekly

Baseflow Discussions:

1. Green River system classified as moderately dry, through the end of July. Potential to revisit classification in August, based on actual inflows to Flaming Gorge.
2. Pikeminnow larvae were detected on June 21, 2018, which is earlier than usual.
 - a. Flow magnitude and timing is important for pikeminnow.
 - b. Past years, Flaming Gorge would supplement water in Green River by increasing.
3. FGTWG recommendation as of today is to maintain 2,100 cfs through the end of September.
4. Reclamation will evaluate this request and relay the decision to FGTWG prior to reconvening.