
Appendix O

Analysis of Lake Powell Infrastructure
Protection Releases

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Acronyms and Abbreviations

Acronym or Abbreviation	Full Phrase
CCS	Continued Current Strategies
EIS	environmental impact statement
kaf	thousand acre-feet
LB Priority	Lower Basin Priority
LB Pro Rata	Lower Basin Pro Rata
PIP	Powell infrastructure protection
UIU	Upper Initial Unit

Appendix O. Analysis of Lake Powell Infrastructure Protection Releases

O.1 Lake Powell Infrastructure Protection Release Analysis

The Final Environmental Impact Statement (EIS) includes alternatives that assume additional releases from the Colorado River Storage Project Upper Initial Units (UIUs; Flaming Gorge, Blue Mesa, and Navajo Reservoirs) to protect infrastructure at Lake Powell. Operations at these units specifically contemplated in the Final EIS alternatives are intended to remain within the scope of the existing Records of Decision. This appendix analyzes these modeled releases – referred to as Powell infrastructure protection (PIP) releases – across alternatives. The PIP release modeling assumptions are simplifications of the actual PIP process, which, like the Drought Response Operations Agreement, involves collaborative decision-making among stakeholder workgroups and includes subjective judgments that cannot be captured in a model. The modeled PIP releases represent a potential range of releases and do not necessarily reflect the views of all stakeholders. Actual releases may be lower, higher, or may not occur. The modeling assumptions regarding operation of the UIUs presented in this Final EIS are not intended to, and do not, limit the Secretary’s ability to operate these facilities as necessary to respond to hydrologic conditions in accordance with applicable federal law, including operations for the authorized purposes as stated in the 1956 Colorado River Storage Project Act. These modeling assumptions are intended solely for National Environmental Policy Act analysis and do not reflect a position by Reclamation on operations that might be implemented under a PIP collaborative process.

The Continued Current Strategies (CCS) Comparative Baseline, Basic Coordination Alternative, Supply Driven (both Lower Basin Priority [LB Priority] and Lower Basin Pro Rata [LB Pro Rata] approaches) Alternative, and Representative Preferred Alternative include modeled PIP releases, which are triggered when Lake Powell is projected to decline, or physically declines, below elevation 3,525 feet. The CCS Comparative Baseline and the Basic Coordination and Representative Preferred Alternatives assume additional releases from Flaming Gorge, Blue Mesa, and Navajo Reservoirs, while the Supply Driven (both LB Priority and LB Pro Rata approaches) Alternative assumes additional releases only from Flaming Gorge Reservoir. Each UIU’s operations are adjusted within their Records of Decision as noted in **Appendix A**, CRSS Model Documentation, **Section A.5.11**. Additionally, PIP releases in the Supply Driven (both LB Priority and LB Pro Rata approaches) Alternative are limited to 500 thousand acre-feet (kaf) annually, while the CCS Comparative Baseline, the Basic Coordination and Representative Preferred Alternatives do not have constraints on annual releases. The Lower Colorado River Basin (Lower Basin) shortage distribution method does not impact Upper Colorado River Basin operations for the Supply Driven (both LB Priority and LB Pro Rata approaches) Alternative, as the Lake Powell operations are independent from Lower Basin operations. While the results for both Lower Basin shortage distribution methods are

included, the results included in this appendix are identical and will therefore not be differentiated in the discussion. Details on modeling assumptions are in **Appendix A**, CRSS Model Documentation, **Section A.5.11**. The following sections compare the responses of individual and total annual PIP release volumes and frequency under different hydrologic conditions. Results are presented using conditional plots, which separate results based on five flow categories (see **Chapter 3.2.6** for additional details on conditional plots).

O.1.1 PIP Release Volumes

PIP release volumes shown in **Figure O-1** are estimates of the additional annual volumes released from each UIU and the total of all three UIUs. Each reservoir has different operating years and monthly targets that are used to estimate the additional releases. During years when PIP releases are triggered due to Lake Powell's projected or actual pool elevation, the following calculations are used to estimate annual additional release volumes:

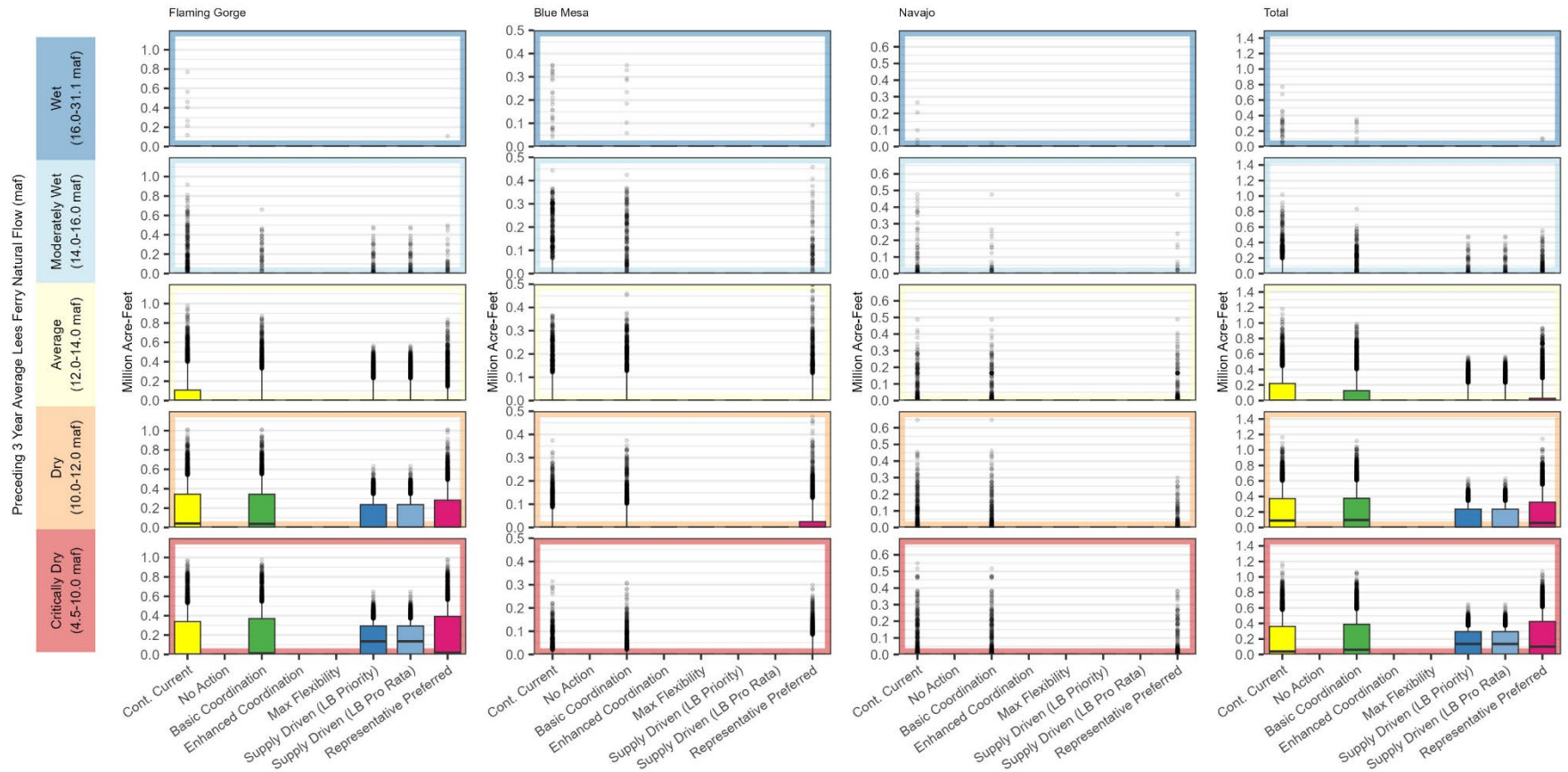
- Flaming Gorge: previous May 1 (April 30 in Colorado River Simulation System) storage minus current May 1 storage
- Blue Mesa: previous December 31 storage minus current December 31 storage
- Navajo: sum of water year additional releases

Even though the UIUs operate on different annual scales, their annual volumes are aggregated to compute a total annual volume of estimated PIP water released, since additional releases from Flaming Gorge and Blue Mesa cannot be determined each month in Colorado River Simulation System.

Figure O-1 shows PIP release volumes across all years (2027-2060) of the simulation. If there is no PIP release in a year, the data remains in the plot as zero. Each boxplot in the figure illustrates the distribution of modeled results, where the bold center line represents the median value, the top and bottom of each box shows the interquartile range, which captures the 25th to 75th percentile, the lines extend to the 10th and 90th percentiles, and the outliers are represented as dots beyond these lines. The No Action, Enhanced Coordination, and Maximum Operational Flexibility Alternatives are zero for all flow categories and all percentiles because PIP releases are not included in those alternatives.

Figure O-1 illustrates that there are limited PIP releases in the Average Flow Category. Volumes released from UIUs are zero at the median. When aggregated to total volumes, the upper quartile of the CCS Comparative Baseline is 220 kaf, the Basic Coordination Alternative is 130 kaf, and the Representative Preferred Alternative is 30 kaf, while the Supply Driven (both LB Priority and LB Pro Rata approaches) Alternative remains at zero.

Figure O-1
Response of PIP Release Volumes by Reservoir Across Alternatives

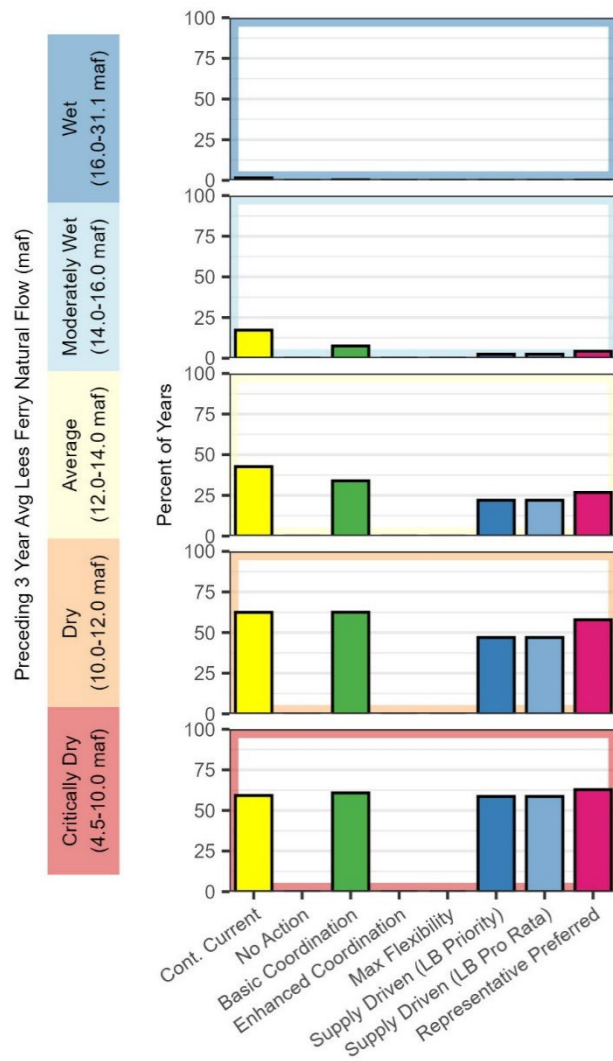


As hydrologic conditions become drier, PIP releases increase in volume. In the Critically Dry Flow Category, median PIP releases are greater than zero in all scenarios that include PIP releases; the total PIP releases are 38 kaf, 61 kaf, 100 kaf, and 136 kaf, for the CCS Comparative Baseline, Basic Coordination Alternative, Representative Preferred Alternative, and Supply Driven (both LB Priority and LB Pro Rata approaches) Alternative, respectively. Most of the PIP releases come from Flaming Gorge, which has the largest storage of any of the UIUs. For the CCS Comparative Baseline and the Representative Preferred and Basic Coordination Alternatives in the Critically Dry Flow Category, annual total releases can be as large as 1.2 million acre-feet, but 90 percent of the futures release 0.6 million acre-feet or less. The Supply Driven (both LB Priority and LB Pro Rata approaches) Alternative has releases up to 650 kaf, but 90 percent of the releases are 380 kaf or less. Under the Supply Driven (both LB Priority and LB Pro Rata approaches) Alternative, the maximum PIP release at Flaming Gorge is specified to be 500 kaf; however, there are a few instances where Flaming Gorge is modeled to release more than 500 kaf due to monthly operational constraints.

O.1.2 PIP Release Frequency

PIP release frequency across all years (2027-2060) of the simulation by hydrologic condition is shown in **Figure O-2**. Each bar in the figure reports the percent of years with PIP releases in each flow category. The No Action, Enhanced Coordination, and Maximum Operational Flexibility Alternatives are zero for all flow categories because PIP releases are not included in those alternatives. In the Average Flow Category, PIP releases occur more frequently under the CCS Comparative Baseline and the Basic Coordination Alternative at 43 percent and 34 percent of years, respectively, compared to the Representative Preferred and Supply Driven (both LB Priority and LB Pro Rata approaches) Alternatives at 27 and 22 percent of years, respectively. The frequency of PIP releases is greater in the Dry Flow Category than the Average Flow Category across all scenarios where PIP releases are modeled. In the Critically Dry Flow Category, the percent of years with PIP releases decreases slightly in the Dry Flow Category under the CCS Comparative Baseline (59 versus 62 percent of years) and the Basic Coordination Alternative (61 versus 62 percent of years). Under the Supply Driven (both LB Priority and LB Pro Rata approaches) and Representative Preferred Alternatives, PIP releases are greatest in the Critically Dry Flow Category, occurring in 59 and 63 percent of years, respectively.

Figure O-2
Percent of Years with PIP Releases Across Alternatives



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