Appendix G

CRSS Initial Conditions

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Contents

Tables

Figures

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Appendix G. CRSS Initial Conditions

G.1 Initial Reservoir Conditions

The Colorado River Simulation System (CRSS) was initialized with three sets of initial conditions to cover a range of possible system conditions on December 31st, 2026. Projected system conditions were chosen from the Reclamation's official mid-term operations model, the Colorado River Mid-term Modeling System (CRMMS). CRMMS uses an ensemble of monthly unregulated streamflow forecasts developed by the National Weather Service's Colorado Basin River Forecasting Center using the Ensemble Streamflow Prediction method (CRMMS-ESP).

The CRSS modeling for the Draft Environmental Impact Statement (DEIS) used the November 2024[1] CRMMS-ESP projections of system conditions on December 31st, 2026 as the initial conditions for CRSS. Three traces from CRMMS-ESP were selected based on Lake Powel and Lake Mead elevations and correspond to projected Low (Trace 14), Mid (Trace 12), and High (Trace 6) condition at the end of 2026 (**Table G-1**).

Table G-1
End-of-Month December 2026 Reservoir Conditions Used as Initial Conditions

Reservoir	Low (Trace 14)		Mid (Trace 12)		High (Trace 6)	
	Elevation (feet)	Storage (acre-feet)	Elevation (feet)	Storage (acre-feet)	Elevation (feet)	Storage (acre-feet)
Fontenelle	6,485.00	195,027	6,486.07	201,631	6,483.49	185,892
Flaming Gorge	6,015.59	2,763,425	6,023.52	3,031,117	6,022.43	2,993,369
Strawberry	7,589.00	886,880	7,589.00	886,880	7,589.00	886,880
Starvation	5,704.82	141,791	5,704.82	141,791	5,704.82	141,791
TMD[2]	5,068.11	593,435	5,068.11	593,435	5,068.11	593,435
Taylor Park	9,294.05	47,513	9,308.16	67,009	9,308.50	67,537
Blue Mesa	7,444.41	279,616	7,477.52	484,034	7,490.00	577,661
Morrow Point	7,153.73	112,001	7,153.73	112,001	7,153.73	112,001
Crystal	6,753.04	16,970	6,753.04	16,970	6,753.04	16,970
McPhee[3]	77.10	218,374	77.10	218,374	77.10	218,374
Navajo	6,010.59	785,430	6,039.82	1,058,713	6,052.23	1,197,223
Powell	3,511.36	4,792,558	3,574.39	8,853,268	3,629.01	13,866,921

[1] November 2024 CRMMS projections were used as initial conditions because CRSS results for multiple alternatives were finalized in December 2024 and sent to the next stages of resource modeling needed for the DEIS.
[2] The Trans Mountain Diversion (TMD) Reservoir is an aggregate representation of Colorado western slope transmountain diversion storage facilities, including Lake Granby, Willow Creek Reservoir, Dillon Reservoir, and Homestake Reservoir.
[3] McPhee elevation in CRSS is the height above dead pool storage.

Reservoir	Low (Trace 14)		Mid (Trace 12)		High (Trace 6)	
	Elevation (feet)	Storage (acre-feet)	Elevation (feet)	Storage (acre-feet)	Elevation (feet)	Storage (acre-feet)
Mead	1,038.03	6,842,897	1,063.29	8,674,470	1,078.61	9,896,475
Mohave	639.51	1,604,100	639.51	1,604,100	639.51	1,604,100
Havasu	446.50	551,700	446.50	551,700	446.50	551,700

Four reservoirs are not modeled in CRMMS: Strawberry, Starvation, TMD, and McPhee. Strawberry and Starvation Reservoirs assume a static initial condition. TMD and McPhee use a regression based on previous year's Lake Powell unregulated inflow. For all initial conditions, the December 2026 conditions for TMD and McPhee reservoirs are computed using the Mid initial condition Lake Powell unregulated inflow from CRMMS.

G.1.1 Comparison to Recent Projections

Since initial DEIS CRSS modeling, basin-wide reservoir storage has continued to decline. Water Year (WY) 2025 was hydrologically dry, with observed Lake Powell unregulated inflow at approximately 49 percent of average. As a result, current projections of end-of-2026 system conditions are lower than those available at the time the DEIS modeling was initiated.

Figure G-1 and **Figure G-2** present a comparison of the DEIS initial conditions to the November 2025 CRMMS-ESP ensemble projections (the latest available projections as of the preparation of this DEIS) for Lake Powell and Lake Mead pool elevation, respectively. The November 2025 CRMMS-ESP ensemble shows a broad range of potential end-of-2026 elevations for Lake Powell, spanning approximately 3,490.21 to 3,615.40 feet. The DEIS Low and Mid initial conditions fall well within the ensemble, while the High initial condition is approximately 20 feet above the upper bound of the current projection range. The high bias in initial conditions is consistent with expectations given that the DEIS initial conditions were based on the November 2024 CRMMS-ESP ensemble, prior to the below-average WY 2025 runoff ().

For Lake Mead, the November 2025 CRMMS-ESP ensemble projects end-of-2026 elevations ranging from 1,032.06 to 1,077.41 feet. Similar to Lake Powell, the DEIS Low and Mid initial conditions fall within the November 2025 ensemble range, whereas the High initial condition exceeds the current upper bound. Notably, the DEIS Low initial condition is lower than all but one of the 30 CRMMS-ESP traces, indicating that it continues to represent plausible system conditions under current streamflow projections.

Overall, despite deterioration in system conditions since the DEIS initial conditions were finalized, the DEIS initial conditions continue to span the range of plausible end-of-2026 system states represented in the most recent CRMMS-ESP projections. The Low and Mid initial conditions, in particular, remain well aligned with the November 2025 projections and thus provide an appropriate basis for evaluating the performance of alternatives given current hydrologic uncertainty. Additionally, the DEIS analysis applies a Decision Making Under Deep Uncertainty (DMDU) framework, rather than a probabilistic risk analysis, so the analysis is able to provide information (particularly the vulnerability results) that is less dependent on the choice of initial conditions (see **Appendix E** for more details).

Figure G-1
Comparison of DEIS Lake Powell Pool Elevations to Current Projections

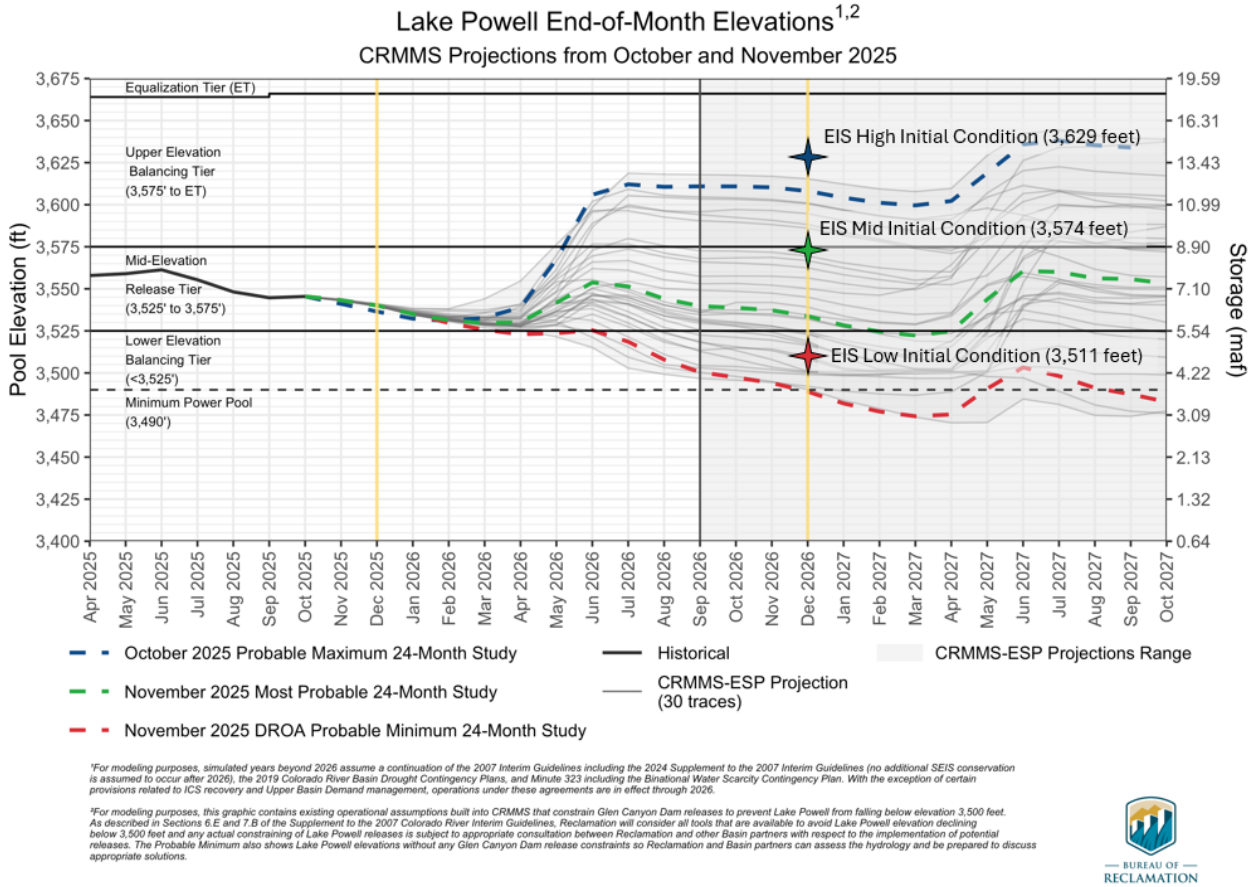
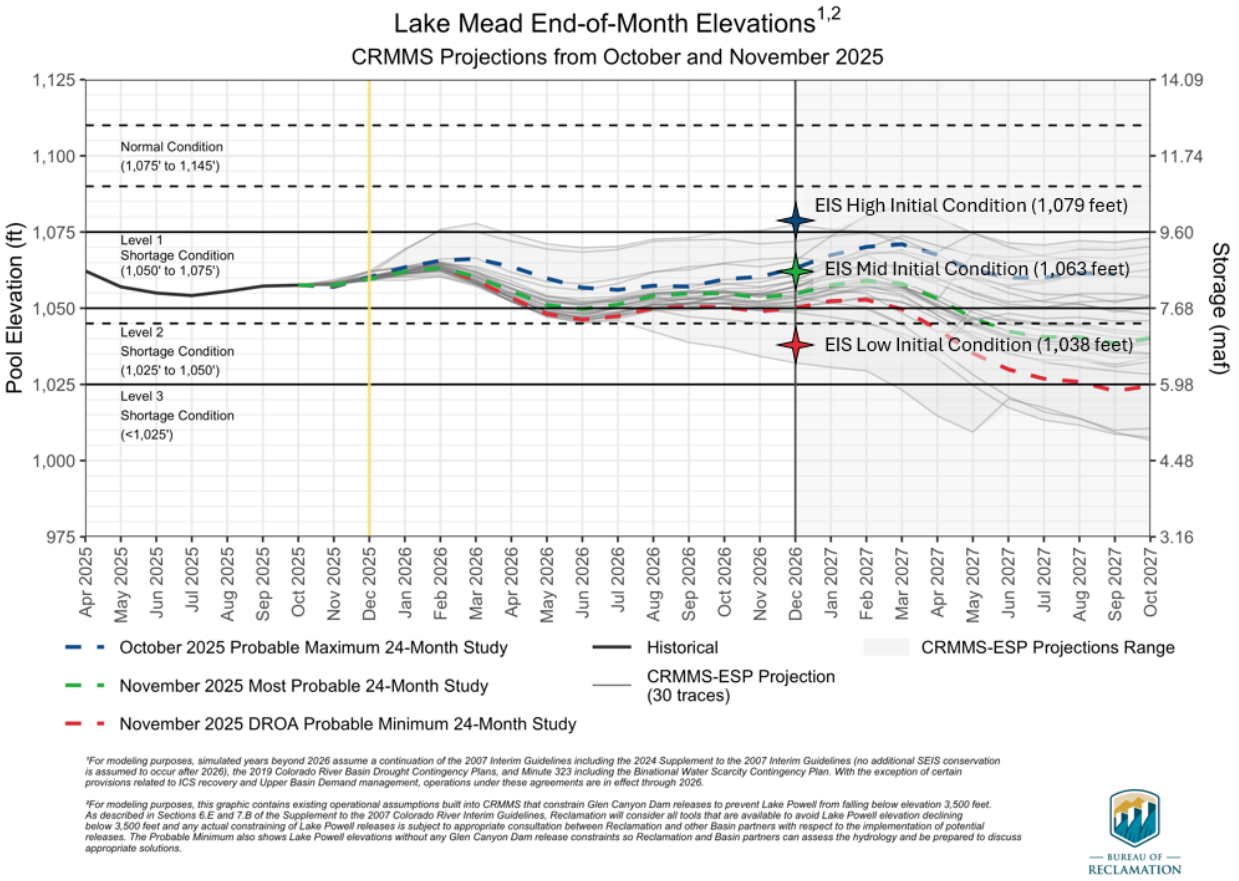


Figure G-2
Comparison of DEIS Lake Mead Pool Elevations to Current Projections



G.2 Preceding Lees Ferry Flows

CRSS and the DMDU analysis rely on Lees Ferry natural flow for the period prior to 2026 to support various modeling assumptions and to compute hydrologic statistics. **Table G-2** summarizes Lees Ferry natural flow for Water Years 2017–2026. Historical natural flow estimates are available through 2024, with 2021–2024 values considered provisional. Natural flow estimates for 2025 and 2026 vary by initial condition, as they are derived from CRMMS. Since CRMMS operates in unregulated flow space, the unregulated flow is converted to natural flow using the following equation:

$$NF = (0.7311 * U / 9.60 + 0.2689) * 13.49$$

Where *NF* is the WY Lees Ferry natural flow in million acre-feet (maf); *U* is the WY Lake Powell unregulated inflow in maf; 9.6 is the 1991-2020 average unregulated inflow in maf; 13.49 is the 1991-2020 average Lees Ferry Natural Flow in maf; and 0.7311 and 0.2689 are the slope and intercept of a linear regression between historical WY unregulated and natural flow at Lees Ferry using 1991-2020 data.

Table G-2
Lees Ferry Natural Flow Data

Year	Historical Natural Flow (af)	CRMMS-Derived Lees Ferry Flow (af)		
		Low	Mid	High
2017	16,396,512	-	-	-
2018	8,633,462	-	-	-
2019	17,672,049	-	-	-
2020	9,887,593	-	-	-
2021	7,152,000	-	-	-
2022	9,851,000	-	-	-
2023	17,408,000	-	-	-
2024	12,145,000	-	-	-
2025	-	11,179,060	14,113,200	19,350,706
2026	-	7,028,224	10,948,969	12,173,544

In **Chapter 3** and **Volume III**, conditional boxplots are organized according to the preceding 3-year average Lees Ferry natural flow. Because natural flows in 2025 and 2026 depend on the selected initial condition, the 3-year averages entering 2027 differ across the Low, Mid, and High initial-condition scenarios. Using the values in **Table G-2**, the resulting preceding three-year averages and the flow category they fall within are:

- Low: 10,117,428 af – Dry
- Mid: 12,402,390 af – Average
- High: 14,556,416 af – Moderately Wet

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