SIERRA CLUB

March 1, 2026

Bureau of Reclamation
Attn: BCOO-1000
P.O. Box 61470
Boulder City, NV 89006

Submitted via email to: crbpost2026@usbr.gov

Re: Post-2026 Operational Guidelines and Strategies for Lake Powell and Lake Mead – **Draft Environmental Impact Statement**

Dear Bureau of Reclamation,

Thank you for the opportunity to comment on the Draft Environmental Impact Statement (EIS) for the Post-2026 Operational Guidelines and Strategies for Lake Powell and Lake Mead.

The Sierra Club's mission is "to explore, enjoy, and protect the wild places of the earth; to practice and promote the responsible use of the earth's ecosystems and resources; and to educate and enlist humanity to protect and restore the quality of the natural and human environments."

This letter is on behalf of the National Sierra Club and has been developed in collaboration with the ten Sierra Club chapters whose members reside in the Colorado River Basin or receive water from the Colorado River: Angeles, Colorado, Grand Canyon (Arizona), Rio Grande (New Mexico), San Diego, San Gorgonio, Santa Barbara-Ventura, Toiyabe (Nevada), Utah and Wyoming and the Sierra Club California Water Committee, and its Water Sentinels group.

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I. Executive Summary

The Draft EIS fails to meet legal requirements under the National Environmental Policy Act (NEPA), the Grand Canyon Protection Act (GCPA), and the Endangered Species Act (ESA). First, the Draft EIS does not analyze the most probable scenario. After 25 years of megadrought with 18 of the past 25 years experiencing flows that would trigger infrastructure crisis under analyzed alternatives, the Draft EIS inadequately addresses Dry and Critically Dry hydrologic conditions that represent the "new normal."

The Colorado River crisis is not a future problem. It is here now. Lake Powell and Lake Mead held only **6.2 maf[1] of realistically accessible storage[2]** as of November 2025. That is less than half their combined capacity and not enough for one year of deliveries. We cannot wish away this crisis with optimistic hydrology assumptions or incremental policy changes. We need bold action based on physical reality, scientific evidence, and environmental protection principles.

Second, the Draft EIS lacks operational guidelines for Minimum Power Pool and Dead Pool scenarios. The Draft EIS provides no analysis of how Glen Canyon Dam would be operated if Lake Powell drops below minimum power pool (3,490 feet) or approaches dead pool (3,370 feet). These scenarios have a significant probability under modeled futures. Dead pool would catastrophically impact the Colorado River Ecosystem in Grand Canyon, four federally listed endangered fish species, tribal resources, and the national park natural and cultural resources.

Third, the Draft EIS artificially constrains scope to infrastructure protection and water delivery. The Draft EIS fails to examine direct and indirect environmental impacts as required under NEPA. The consequences of Dead Pool at Glen Canyon Dam extend far beyond infrastructure. They include ecosystem collapse in Grand Canyon National Park, extinction of endangered species, loss of tribal cultural resources, and violation of federal environmental laws.

Fourth, the Draft EIS imposes a disproportionate burden on the Lower Basin while exempting the Upper Basin. No alternative discusses Upper Basin conservation, creating inequitable burden-sharing that undermines system-wide sustainability.

After careful review of all alternatives, Sierra Club concludes that no alternative, as currently analyzed, adequately protects critical infrastructure, tribal rights, endangered species, or long-term system sustainability under realistic hydrologic conditions. The Draft EIS contains fundamental deficiencies that must be corrected in the Final EIS. While there are some merits to the Maximum Operational Flexibility Alternative, this alternative also requires several critical modifications such as adoption of pro rata shortage distribution from the Enhanced Coordination Alternative and additional environmental protection elements.

The climate crisis demands bold, science-based action to protect the Colorado River system for future generations. The Maximum Operational Flexibility Alternative can provide a broad framework for safeguarding critical infrastructure, protecting endangered species, maintaining

[1] Million acre-feet (maf). See XI. Appendix C - Glossary
[2] Colorado River Insights, 2025: Dancing with Deadpool. Published:12/3/2025 12/3/2025. Link

ecosystem function, and ensuring climate resilience. However, its use of priority-based shortage distribution creates unacceptable risks of catastrophic municipal water cutoffs that would trigger political backlash against environmental protections and undermine the alternative's conservation goals. In addition, none of the alternatives offered sufficiently protect the health of the river and its ecosystem in the form of environmental flows. Further, none of the alternatives discuss any cuts in the Upper Basin, while imposing cuts in the Lower Basin to the detriment of adequate resource management.

The Final EIS must expand its scope beyond infrastructure protection and water delivery to comply with federal environmental laws.The Bureau of Reclamation (“Reclamation”) must analyze Dead Pool scenario impacts through comprehensive analysis of ecological, tribal, recreational, and legal consequences if Glen Canyon Dam can no longer release water or has to switch to “run of the river”. This analysis must include impacts to four endangered fish species (Humpback Chub, Colorado Pikeminnow, Razorback Sucker, Bonytail), Grand Canyon Colorado River Ecosystem, tribal treaty rights and cultural resources, and Mexico water and environmental rights under the 1944 Water Treaty.

The Final EIS must also analyze emergency operations for critical pool levels. Reclamation must provide detailed operational protocols for Lake Powell below 3,500 feet, including infrastructure modifications necessary to maintain flows through Grand Canyon (such as river bed-level outlet works), water temperature management to prevent invasive species establishment, sediment management when High Flow Experiments (HFEs) become infeasible, and coordination with Upper Basin reservoirs to prevent dead pool.

Additionally, the Final EIS must employ climate-appropriate hydrologic modeling with emphasis on Dry and Critically Dry futures rather than average conditions. Given that 72% of years since 2000 would trigger an infrastructure crisis under the Supply Driven Alternative, models must address sustained flows below 8 maf/year; a threshold reached multiple times in the past decades.

The Final EIS must include enforceable operational requirements, not discretionary recommendations. Environmental flows, tribal protections, and shortage mechanisms must use mandatory language ("shall") with physical impossibility as the only exception for non-implementation. This ensures compliance with the Grand Canyon Protection Act (GCPA), the Endangered Species Act (ESA), and federal trust obligations to tribes. For infrastructure and environmental protection, the Final EIS must include explicit contingency plans for Lake Powell below 3,500 feet, including defined triggers for increased releases from CRSP Upper Initial Units.

For Mexico and the Colorado River Delta, the Final EIS must include Mexico in all shortage scenarios and environmental impact analysis. The Final EIS should establish a binational cooperation framework for Colorado River Delta restoration and Cienega de Santa Clara protection. The Final EIS must recognize that keeping water in the river longer benefits the entire system.

The Draft EIS acknowledges that certain alternatives may face legal constraints under the Law of the River, yet it fails to resolve these conflicts. Selection of an alternative that is legally non-implementable would expose the Department of Interior to immediate litigation. Sierra Club recommends the Final EIS incorporate required environmental protections, drawn from elements across multiple alternatives and expert reports. Sierra Cub's approach to focus on key environmental protection elements will require cooperation from all water users. It will test our political will and legal frameworks, but it is achievable. By prioritizing river health, acknowledging current hydrology and future projections, and recognizing that ecology and compliance are coequal constraints, we are combining proven elements from alternatives that stakeholders have already proposed and refined.

For environmental protection, the Final EIS must establish Lake Powell elevation targets with 3,570 - 3,575 feet as the optimal range for water temperature management that supports native fish while deterring invasive species. The Final EIS must require HFEs frequency of minimum once every 3 years when sediment is present, with binding implementation language that prevents cancellation for non-emergency reasons. Minimum Grand Canyon flows must be established at 5,000 cfs as the critical minimum and 6,000 cfs as preferred to maintain ecosystem connectivity. The Final EIS must include monthly release limits to protect sediment resources and mandatory water temperature monitoring and adaptive management protocols.

For equitable shortage distribution, the Final EIS must adopt pro rata shortage distribution across all users to prevent catastrophic municipal cutoffs. The Final EIS must establish a Protection Pool of 2.0 maf minimum designed through government-to-government consultation with Basin Tribes.

For Upper Basin accountability, Reclamation must work with the Upper Basin for conservation scaling from 200 kaf to 500 kaf based on hydrologic conditions. Reclamation must impose a moratorium on new Upper Basin consumptive use appropriations and diversions under Reclamation's control, particularly for fossil fuel extraction and St. George pipeline, until the system stabilizes above 60% combined storage for no fewer than 10 consecutive years, and after Reclamation demonstrates through updated hydrologic modeling that projected operations do not produce a structural deficit under the most recent 20-year record.

The climate crisis and a 25-year megadrought demand Reclamation to analyze realistic scenarios and provide operational guidance for the most probable conditions, not optimistic assumptions that have failed to materialize. The Final EIS must correct the deficiencies identified above and provide legally defensible protections for the Colorado River ecosystem, endangered species, tribal rights, and long-term system sustainability.

Given the significant deficiencies of the Draft EIS, meriting major revisions, Sierra Club urges Reclamation to publish a revised Draft EIS for public review prior to releasing a Final EIS.

II. Starting Point: Deficiencies And Required Corrections to All Alternatives

Recommendation 1: While certain components across alternatives demonstrate useful concepts, no alternative may be adopted without substantial revision to address the following deficiencies. Sierra Club recommends Reclamation to use the Maximum Operational Flexibility Alternative as a **starting point** for the following reasons:

- Notwithstanding Sierra Club's position that Glen Canyon Dam be decommissioned, until that happens this alternative, in addition to the primary function to deliver water, provides the best, albeit limited, basis of all the alternatives for protecting critical infrastructure at Glen Canyon Dam and Hoover Dam and the Colorado River ecosystem. This includes appropriate responses to climate change for endangered species and native fish populations through adaptive management that creates environmental flows necessary to maintain ecosystem function even in a worst case scenario.
- This is the only alternative specifically designed to address "increasingly variable future hydrologic conditions" with the proactive measures intended to avoid catastrophic system collapse.
- This is the only alternative that attempts to prevent a Glen Canyon Dam infrastructure crisis, although it offers no solution if dead pool does occur there.

Environmental Protection Strengths

Endangered Species Protection

While recognizing the failures of the Maximum Operational Flexibility Alternative as it pertains to the Lower River Multispecies Conservation Plan (LR MSCP), this alternative does provide better, albeit limited, protection for endangered Colorado River fish species:

- Water Temperature Management:
    - Lake Powell elevations maintained by this alternative support the optimal temperature window (12-20°C) for native fish
    - Above 3,600 feet water becomes too cold (<12°C) for native fish reproduction
    - Between 3,570-3,575 feet is the optimal temperature range that supports endangered Humpback Chub while deterring invasive species
    - Below 3,525 feet water becomes too warm (>17-20°C), promoting invasive species and harming natives

- Invasive Species Control:
    - Higher Lake Powell elevations minimize the risk of smallmouth bass entrainment from Lake Powell into Grand Canyon
    - Smallmouth bass are significant predators of endangered native fish (Humpback Chub, Colorado Pikeminnow, Razorback Sucker, Bonytail)
    - Warm-water invasive fish can pass through the dam and establish populations downstream when Lake Powell is low

    - This alternative's higher elevations reduce the need for expensive and inefficient Cool Mix releases[3]

- Critical Habitat Protection:
    - This alternative maintains Lake Powell elevations that prevent inundation of Colorado Pikeminnow and Razorback Sucker critical habitat in the Colorado River and San Juan River inflows
    - And it preserves the Paiute Farms Waterfall as a barrier to upstream fish passage
    - Better protects revenue from hydropower that supports endangered fish recovery programs in the Upper Colorado River Basin and San Juan River Basin

- High Flow Experiments (HFEs):
    - This alternative results in the most futures where HFEs are conducted during the modeling period
    - HFEs are essential for rebuilding eddy sandbars and conserving sediment in Grand Canyon
    - Since 1996, HFEs have been a critical component of the Long-Term Experimental and Management Plan for Glen Canyon Dam
    - Reclamation cancelled HFEs in 2021 and 2022 when Lake Powell was too low, despite adequate sediment conditions
    - Higher Lake Powell elevations under this alternative increase the likelihood HFEs can occur approximately once every 3 years when sediment is present
    - Reclamation should make HFEs regularly scheduled events rather than “experimental” events.

Climate Resilience and Adaptive Management

The Maximum Operational Flexibility Alternative explicitly incorporates "proactive responses, targeted reservoir management strategies, and innovative and flexible tools to address an increasingly variable set of future hydrologic conditions."

Comprehensive Adaptive Triggers:

- Shortage triggers are based on combined seven-reservoir storage (not single reservoir elevations)
- Shortages begin at 60% full (1.3 maf) and scale linearly to 30% full (4.0 maf maximum)
- A starting point of 1.3 maf represents approximately the average annual evaporative and system losses at and below Lake Mead - a scientifically sound baseline
- This approach coordinates across reservoirs rather than by managing them independently

Upper Basin Conservation:

- This alternative provides for up to 500 kaf per year depending on hydrologic conditions

[3] Colorado River Insights, 2025: Dancing with Deadpool (page 12, link)

- It targets an average of 200 kaf per year
- It is more flexible than Enhanced Coordination's phased approach (200→275→350 kaf), providing higher maximum conservation potential

Maximum Release Flexibility:

- The release range from Glen Canyon Dam is 10.8 maf to 4.7 maf
- A switch to “run-of-river” occurs when Lake Powell is at elevation 3,510 feet or lower
- This is the widest range among all alternatives, providing maximum operational flexibility
- Coordinated operations are based on:
    - Combined seven-reservoir storage
    - 3-year running-average hydrology
- This alternative uses multiple operational factors that ensure responses appropriate to actual system conditions

Recommendation 2: Sierra Club recommends implementing (e.g.) a 3-year weighted average (or other more suitable methods), with the most recent year weighted more heavily than the prior two years, instead of the proposed 3-year running average. This would create a model that responds faster to hydrological conditions, and better mimics the short residence time of water in the Colorado reservoir system. This is especially important for multiple consecutive dry or critically dry years as outlined in IX. Appendix A - Hydrological Modeling.

Performance in Critically Dry Futures:

In the "Critically Dry" hydrologic category (average annual flow <10 maf), the Maximum Operational Flexibility Alternative maintains the best performance in protecting critical reservoir elevations while imposing necessary demand reductions to match limited supply.

Comprehensive Water Banking and Conservation Framework

Extensive Storage Mechanisms:

- For Lake Mead, the alternative provides for 5.0 maf water user-controlled storage + 2.0 maf Protection Pool = 7.0 maf total
- For Lake Powell it provides for a 2.0 maf conservation pool
- The total system banking capacity is 9.0 maf

Broad User Flexibilities:

- The alternative includes greater flexibility for all users and allows for interstate transactions within each basin
- It allows immediate conversion of existing Intentionally Created Surplus (ICS) to a new mechanism
- Tribal water (both conserved consumptive use and unused) is explicitly included in banking mechanisms
- System assessment (7% of user-conserved water) feeds a Protection Pool for basin-wide benefits

Conservation Incentives:

- A 4.0 maf maximum shortage creates the strongest economic pressure to improve water use efficiency
- Banking mechanisms reward users who conserve water

Infrastructure Protection Contingency

While the Maximum Operational Flexibility Alternative is designed to prevent Lake Powell from approaching critical elevations, it lacks a specific contingency plan for infrastructure protection should this operational framework prove insufficient. According to Chapter 2, Section 2.7.4.2, "this alternative does not include adjustments to the releases of the CRSP Upper Initial Units to protect infrastructure at Glen Canyon Dam," relying instead on an undefined Reclamation policy.

In contrast, the Enhanced Coordination Alternative includes specific triggers (Lake Powell below 3,525 feet) and defined actions (increased releases from Flaming Gorge, Blue Mesa, and Navajo reservoirs). The Final EIS should establish explicit, enforceable infrastructure protection triggers, including defined elevation thresholds, release adjustments, and recovery protocols: (1) establish a trigger elevation of 3,500 feet at Lake Powell, (2) specify that CRSP Upper Initial Units will increase releases within their respective Records of Decision when this trigger is reached, (3) define the process for determining necessary release volumes, and (4) clarify recovery procedures when Lake Powell elevations stabilize.

The Draft EIS does not address whether the CRSP Upper Initial Units will have sufficient water for releases downstream to Lake Powell and Lake Mead and the impacts below the upper reservoirs. This needs to be addressed in the Final EIS.

Consequently, while Maximum Operational Flexibility's operational design may prevent reaching these critical thresholds, a robust backup plan is essential for the scenarios where even 4.0 maf shortages prove insufficient. Sierra Club recommends using “wet water”, water that is actually available, instead of relying on “paper water” (legally appropriated water) which may prove more a hopeful fiction than reality. The absence of an explicit contingency plan creates greater uncertainty and risk for critical infrastructure.

Adopt Pro Rata Shortage Distribution

The Maximum Operational Flexibility Alternative currently uses a priority-based shortage distribution. This is a critical flaw that must be corrected in the Final EIS.

While Maximum Operational Flexibility has advantages in environmental protection, infrastructure resilience, and climate adaptation, its reliance on priority-based shortage distribution creates unacceptable risks that undermine these strengths. The Final EIS must evaluate and adopt a legally defensible proportional shortage distribution framework that prevents catastrophic municipal cutoffs, protects critical infrastructure, and reduces litigation risk.

Under a strict priority based allocation system water will be allocated to the senior rights holders under contract with Reclamation and could leave more junior rights susceptible to severe and unacceptable cuts in water deliveries. These include major urban supplies, especially CAP. Tribal senior water rights have historically been trampled and ignored under priority allocations despite their senior standing. This must not happen again.

Reclamation has the authority for this in emergency situations per the SCOTUS decision of 1963. This is an emergency situation. Pro rata shortage distribution creates a more equitable sharing of this increasingly diminished supply.

Reclamation has no real authority to govern distribution once the water is taken by the individual contracted diversions. That is up to the numerous contracts and agreements, including priority, within the scope of those contracted entities and agencies that control the diverted water. However, Reclamation does have considerable influence within these contracted diversion areas and should foster greater sharing where they can to insure equitable distribution beyond the Colorado River's mainstem. This could help minimize the inevitable litigation that will occur.

We urge the Bureau to:

- Stand firm on pro rata distribution as necessary for system protection.
- Develop clear legal justification citing emergency authorities and infrastructure protection mandates.
- Work with senior rights holders on mitigation measures and compensation for those communities directly affected by significant shortage cuts, e.g. impacted farm workers.
- Include provisions for transition financial and technical assistance to agricultural communities.
- Prepare for potential litigation but do not abandon pro rata due to litigation risk.

The alternative to pro rata as system collapse nears is long, expensive litigation throughout the Colorado River Basin. This serves no one's interests.

Suggested justification in Final EIS for Pro rata distribution: When combined storage in Lake Powell and Lake Mead falls below levels that threaten critical infrastructure and the Secretary's ability to make deliveries to any user, the Secretary has authority and obligation under the Colorado River Basin Project Act, Endangered Species Act, and general principles of Federal reserved water rights to implement proportional reductions to all users to protect the system. This authority extends, but is not limited to, exigent circumstances where the physical limitations of infrastructure (dead pool, minimum power pool) prevent deliveries regardless of priority. In such circumstances, the priority doctrine must yield to the physical reality that water cannot be distributed based on priority - proportional reduction is the only mechanism that preserves some delivery to all users while protecting critical infrastructure.

Testing the Shortage Allocation Model Beyond Current Hydrology

Sierra Club acknowledges the shortage allocation model in Appendix C to test shortages at 5 maf. We encourage Reclamation to test the hydrological models beyond the limits stated by the five alternatives and include guidelines on how to manage periods of critically dry years.

As evident in the historical Natural Flow at Lees Ferry (Figure TA 3-3) for the years of 2012 and 2021, flows lower than 8 maf are happening more frequently in the last 25 years, trending towards once every decade.

Applying the hydrological model as presented in Maximum Operational Flexibility Alternative to dry and critically dry conditions, the Sierra Club confirmed the defined triggers and shortages can protect infrastructure, mainly Glen Canyon Dam for a multi-year dry period around 8 maf of Natural Flow measured at Lees Ferry. However, our modeling highlighted risks when reservoirs are already at a critical level below 30% and the Natural Flow would fall below 8 maf per year. The maximum shortage of 4 maf, paired with yearly system losses in the range of 1.3-1.5 maf[4] will not be sufficient to stabilize the reservoirs and will result in a dead pool situation.

Summary: The Case for Modified Maximum Operational Flexibility

The Maximum Operational Flexibility Alternative is the best of the existing alternatives for infrastructure protection (never triggered historically), for endangered species protection (the most HFEs and optimal temperatures), for climate resilience (4.0 maf max shortage, adaptive triggers) and the most comprehensive banking framework, but its priority-based shortage distribution could create a municipal cutoff crisis.

The Enhanced Coordination Alternative has a pro rata shortage distribution (it's more equitable), a Tribal-designed Protection Pool, better infrastructure protection according to Reclamation's modeling. However, it offers lower maximum shortage (3.0 maf vs. 4.0 maf) providing less climate headroom and fewer HFEs.

Sierra Club to adopt the strongest elements for the Final EIS:

- The operational framework that is the best alternative for environmental protection alternative's operational framework
- The pro rata distribution, which is more equitable and implementable than the Enhanced Coordination Alternative
- The protection pool process of the Enhanced Coordination Alternative that provides for tribal government-to-government design
- The environmental targets of Cooperative Conservation Alternative (HFEs, temperature, flows, etc.)

This approach combines the best elements of multiple alternatives to create stronger environmental protection, climate resilience, and equitable water management.

[4] An Historical Perspective on the Accounting for Evaporation and System Losses in the Lower Colorado River Basin (pages 16-18, link)

We urge Reclamation to:

- Revise all alternatives to include explicit infrastructure protection triggers.
- Include proportional shortage distribution modeling.
- Include binding environmental flow requirements.
- Provide full analysis of tribal water rights impacts.
- Expand modeling to reflect critically dry futures (<8 maf).

III. Rejection Of Other Alternatives as currently proposed

No Action Alternative

The No Action Alternative is wholly inadequate for 21st century conditions based on the following major concerns.

Critical Failures:

- Infrastructure Crisis Risk: It creates the highest probability of approaching Glen Canyon Dam dead pool. It is vulnerable if 5-year average flow ≤12.9 maf (which has occurred 13 times since 2000)
- Climate Inadequacy: It is based on 20th century hydrology with fixed 8.23 maf release objectives regardless of conditions
- Tribal Rights Violation: There are no mechanisms for unused tribal water banking or wet water access
- Environmental Flows: The maximum shortage of only 600 kaf is grossly insufficient to protect critical elevations in dry conditions
- No Adaptive Management: There are no triggers or effective responses to changing hydrologic conditions
- Endangered Species: There are no provisions for HFEs, water temperature management, or invasive species control when reservoir levels are low

This alternative guarantees system failure in sustained drought, such as what we are experiencing. It perpetuates the false assumption that the Colorado River can continue to deliver an average of 8.23 maf from Lake Powell annually with diminishing supply. The No Action Alternative will lead to catastrophic consequences.

Basic Coordination Alternative

The Basic Coordination Alternative represents minimal improvement over No Action and is insufficient for future challenges.

Key Weaknesses:

- It is still vulnerable. Lake Powell could fall below 3,500 feet if 5-year average ≤11.3 maf (occurred 6 times since 2000)

- It is reactive rather than proactive. "Secretary will determine additional measures" below 1,000' Lake Mead is not a plan - it defers critical decisions
- Limited Shortages are inadequate. Maximum 1.48 maf shortage inadequate for critically dry futures
- There is no Tribal Water Banking. No mechanisms for unused tribal water storage or wet water access
- Environmental Justice Failure. Arizona tribes will face 49,000 fallowed acres and $77.6M losses with no mitigation
- Limited Adaptation. Shortages based on Lake Mead elevation only; no combined storage triggers.

This alternative meets bare minimum requirements but fails to address systemic problems. It would be adequate only for wet hydrologic futures, which cannot be guaranteed given current climate trends. The vague provision for "additional measures" below critical elevations is an admission that the alternative is incomplete.

Enhanced Coordination Alternative

The Enhanced Coordination Alternative has some strengths, but is unacceptable as a standalone alternative.

Strengths:

- Tribal Framework: Protection Pool (2.0 maf) was designed with Basin Tribes input and holds the best tribal provisions among all alternatives. However, we feel that the affected Native American communities must be deferred to for their expressed needs.
- Better Infrastructure Protection: It has the second-best vulnerability metrics (Lake Powell protected unless 20-year average <9.7 maf - never occurred)
- Comprehensive Banking: Three-pool system (Lake Powell 2.0 maf, Lake Mead user pool 5.0 maf, Protection Pool 2.0 maf)
- Phased Conservation: Upper Basin contribution phases from 200 to 350 kaf over time
- Pro Rata shortages provide equitable burden-sharing.

Why This Alternative Ranks Second:

- Lower Maximum Shortage: 3.0 maf vs. 4.0 maf provides less headroom in critically dry conditions and may prove inadequate
- Fewer HFEs: Second-fewest futures where HFEs are conducted (tied with Enhanced Coordination)
- Less Protection: Slightly more vulnerable to critical elevations than Maximum Operational Flexibility
- Environmental Protection: Lower performance level for endangered species and ecosystem function

Recommendation 3: While we do not endorse any alternative, some tenets of the Maximum Operational Flexibility Alternative and Enhanced Coordination Alternative would be improved if strengthened with:

- Adoption of 4.0 maf or greater maximum shortage (rather than 3.0 maf)
- Explicit HFE frequency targets (once every 3 years when sediment present)
- Water temperature management protocols from Cooperative Conservation proposal

We strongly support incorporating the Tribal Protection Pool concept from Enhanced Coordination into the Final EIS.

Supply Driven Alternatives (Both Priority and Pro Rata)

Sierra Club rejects both versions of the Supply Driven Alternative because they are fundamentally flawed, and present unacceptable legal, hydrologic, and environmental risks.

Supply Driven (LB Priority)

This alternative represents the worst environmental justice outcome and highest infrastructure risk among action alternatives. The priority-based shortage distribution protects powerful California agricultural interests at the expense of vulnerable Arizona tribal communities. This outcome is unacceptable. Additionally, the rigid 65% formula provides a false sense of security - it will calculate releases mathematically but physics prevents those releases when Lake Powell is below 3,490 feet.

Fatal Flaws:

- Environmental Justice Catastrophe: Arizona tribal agriculture faces 52,000 fallowed acres (highest among all alternatives) while California tribal agriculture faces zero impact - this is textbook environmental injustice
- Most Vulnerable to Infrastructure Crisis: Lake Powell could fall below 3,500 feet if 20-year average ≤13.9 maf - this has occurred 18 times since 2000 - worst performance among action alternatives
- Rigid Formula: 65% of 3-year average natural flow is inflexible and doesn't adapt to system conditions
- Gap Water Fiction: When Lake Powell can't meet releases due to low elevation, "gap water" is introduced and tracked - this is an accounting mechanism that doesn't create actual water
- Lower Basin Only: All shortages imposed on Lower Basin; minimal Upper Basin contribution (200 kaf, doesn't phase up)

Supply Driven (LB Pro Rata)

This alternative improves environmental justice over Priority but retains fundamental flaws.

While pro rata distribution is more equitable than priority, this alternative combines pro rata with a fundamentally inadequate operational framework. The 65% formula and high infrastructure vulnerability make this alternative unacceptable regardless of shortage distribution method. Both Supply Driven alternatives prioritize supply-side accounting over demand-side management, which is the wrong approach in a supply-constrained future.

Persistent Flaws in comparison to Supply Driven (LB Priority):

- The same Infrastructure Vulnerability with identical Lake Powell metrics as Priority and is still the most vulnerable action alternative.
- The same Rigid Formula with a 65% calculation that doesn't respond to system conditions.
- The same Gap Water Fiction with an accounting mechanism that doesn't solve physical constraints.
- The same Limited Upper Basin role with only 200 kaf conservation that doesn't phase up.
- A slow ICS Transition, a 10-year conversion vs. the immediate conversion in Max Flex/Enhanced Coordination.

IV. Elements From Other Alternatives To Incorporate in Final EIS

As otherwise outlined, there are pieces of the Maximum Operational Flexibility Alternative that should be incorporated into the Final EIS, alongside the following elements:

1. Pro Rata Shortage Distribution from Enhanced Coordination Alternative (detailed in Section I.C above)
2. Tribal Protection Pool Design Process from Enhanced Coordination Alternative (government-to-government tribal consultation)

Important additions from previous proposed alternatives and reports:

1. Resource-specific targets from Cooperative Conservation proposal (HFE frequency, water temperature, minimum flows)
2. Monthly release limits for sediment protection from Enhanced Coordination
3. Upper Basin endangered fish recovery program support from Cooperative Conservation
4. In consultation with Mexico, Ecological flows for the Lower Basin that will reach the Gulf of California.

From Enhanced Coordination Alternative

From Enhanced Coordination Alternative - Pro Rata Shortage Distribution

The Final EIS should adopt pro rata shortage distribution methodology from Enhanced Coordination Alternative (Chapter 2, Section 2.6.1.1, Table 2-3). Shortages should be distributed proportionally across all Lower Basin water users to ensure equitable burden-sharing and system protection. See Adopt Pro Rata Shortage Distribution.

Tribal Protection Pool Design Process

Adopt the tribal-designed Protection Pool (2.0 maf) from the Enhanced Coordination Alternative (see comments in Enhanced Coordination Alternative).

Why This Matters:

- Maximum Operational Flexibility includes a Protection Pool designed without Tribal consultation.
- Tribal nations hold approximately 25% of Colorado River water rights (~3.2 maf of quantified rights).
- Federal trust obligations require meaningful tribal participation in design, not just consultation after design.

Enhanced Coordination references: "Appendix H, Sensitivity Analysis – Effects of Demand Schedule Assumptions on Modeled Unused Tribal Water Available for Storage." The Final EIS should incorporate this sensitivity analysis to show how different assumptions about tribal water use affect all alternatives, not just Enhanced Coordination.

Explicit Upper Monthly Release Limits for Sediment Protection

Enhanced Coordination includes: "Maximum monthly release limits of 900 kaf to ensure that operationally mandated high water year and monthly release volumes do not negatively impact sediment."

Why This Matters:

- Sediment management is critical for HFE effectiveness
- High sustained releases can scour sediment that should be conserved for HFEs
- Monthly limits protect sediment resources while maintaining operational flexibility

Recommendation 4: The Final EIS should include the following provision: : "Monthly release volumes will be limited to protect sediment resources for High Flow Experiments, with specific limits to be determined through consultation with the Grand Canyon monitoring and research program."

Also, see Minimum Grand Canyon Flow Targets and Wildlife Protection.

From the Cooperative Conservation Proposal (Basis for Max Operational Flexibility)

The Cooperative Conservation proposal that informed Maximum Operational Flexibility contains several specific resource targets that should be explicitly incorporated into the Final EIS.

Lake Powell Elevation Targets for Water Temperature

Adopt the temperature-based elevation storage release targets from Cooperative Conservation. The Final EIS should state: "Lake Powell operations will target elevation range 3,570-3,575 feet to optimize water temperatures in the 12-20°C window for native fish protection and invasive species deterrence, while maintaining flexibility for HFE implementation when sediment conditions are appropriate."

Minimum Grand Canyon Flow Targets

Adopt the flow targets from Cooperative Conservation:

Preferred Minimum: 6,000 cfs (~4.34 maf/year)

- Ensures integrity of natural resources
- Supports Grand Canyon recreation economy
- Maintains habitat connectivity

Critical Minimum: 5,000 cfs (~3.23 maf/year)

- Ensures annual connectivity of river system
- Provides variation to mimic more natural hydrograph
- Releases should never go below this except in extreme infrastructure emergency (e.g. dead pool)

Recommendation 5: As a binding operational requirement, the Final EIS should incorporate that Glen Canyon Dam releases will maintain a minimum flow of 5,000 cfs (3.23 maf/year) to ensure river system connectivity and ecosystem function, with a preferred minimum of 6,000 cfs (4.34 maf/year) when hydrologic conditions allow.

HFE Frequency Target

Adopt the specific HFE target from Cooperative Conservation:
"Strive to maintain Powell elevations that support HFEs (over 24 hours) occurring once every 3 years (if sediment is present in the system), allow for interannual release adjustments (when sediment is present) to support mimicry of natural hydrograph and preserve HFE benefit in upcoming season."

Recommendation 6: The Final EIS should commit to High Flow Experiments conducted approximately once every three years when sediment conditions in the Paria River, Little Colorado River and other tributaries are sufficient, provided Lake Powell elevation supports HFE implementation (generally above 3,570 feet).

Upper Basin Endangered Fish Recovery Programs

Cooperative Conservation specifically calls for protection of:

- Upper Colorado River Endangered Fish Recovery Program
- San Juan River Basin Recovery Implementation Program

These programs protect four species of warm-water fish found nowhere else in the world:

- Colorado Pikeminnow
- Razorback Sucker
- Humpback Chub
- Bonytail

Recommendation 7: The Final EIS should state that operations will support recommended flows for endangered fish and wildlife in the Upper Colorado River and San Juan River, with reservoir releases timed to maximize ecological benefits including appropriate water temperatures for native fish spawning and rearing.

Lower Basin Environmental Stewardship Additions

The Lower Colorado River Multi-Species Conservation Program (LCR MSCP) has been marginally successful in achieving restoration goals identified as of 2006. Conditions over the past 20 years reveal a need for similar actions in response to changing conditions or the potential need for increased reductions in deliveries from Lake Mead along the Lower Colorado River corridor in years to come.

Recommendation 8: Fully resource the LCR MSCP with adequate flows, and habitat restoration when river and reservoir levels change.

Water to provide flows to and through the Cienega de Santa Clara and the Delta

The Cienega de Santa Clara depends on agricultural runoff from Arizona. While this water is unsuitable for agriculture, a desalination facility exists which could purify the water to be suitable for agriculture. This would eliminate the supply of water for the Cienega de Santa Clara which the Sierra Club would oppose. Very little or no water reaches the Gulf of California in most years.

Recommendation 9: The Final EIS should evaluate and incorporate analysis of the potential for the potential for creating up to 45 kaf of binational water annually and for a 135 kaf release of that water from Lake Mead storage and deliveries every three years to keep the possibility of a Delta Flow release open during US/Mexico negotiations.

The Final EIS should develop a baseline for a continuous delivery reduction curve relating Lake Mead deliveries to observed (and available) live storage from CRSP Initial Units, Lake Mead, Lake Mohave and Lake Havasu on October 1, allowing larger Mead deliveries when the whole system storage is closer to full (e.g. >80%), and reduced releases down to a minimum level when the system is low (e.g. <10%).

Wildlife Protection

Grand Canyon Protection Act Mandate for Environmental Flows

Recommendation 10: The Final EIS should explicitly state that ecosystem protection and restoration in Grand Canyon is a core purpose, as required by the Grand Canyon Protection Act (GCPA) of 1992, Section 1802(a)[5]: *"The Secretary shall operate Glen Canyon Dam in*

[5] https://www.congress.gov/bill/102nd-congress/house-bill/814/text

accordance with the additional criteria and operating plans specified in section 1804 and exercise other authorities under existing law in such a manner as to protect, mitigate adverse impacts to, and improve the values for which Grand Canyon National Park and Glen Canyon National Recreation Area were established, including, but not limited to natural and cultural resources and visitor use".

Low reservoir levels, hydropower or Basin Fund concerns cannot serve as justifications for canceling or postponing HFEs, temperature management actions, or other flows necessary to comply with GCPA and Endangered Species Act (ESA) mandates. The Final EIS must include explicit language stating that environmental flows will be implemented unless physically impossible to pass water through the dam.

Recommendation 11: The Final EIS must explicitly include protection and restoration of the Colorado River Ecosystem (CRE) in Grand Canyon in the **Purpose and Need statement**, not merely in alternatives analysis. As required by:

1. Grand Canyon Protection Act Section 1802(a) - as mentioned above
2. Endangered Species Act Section 7 - Federal agencies must ensure actions do not jeopardize endangered species (Humpback Chub, Colorado Pikeminnow, Razorback Sucker, Bonytail)
3. National Park Service Organic Act - Duty to "conserve the scenery and the natural and historic objects and the wild life" in Grand Canyon National Park

The Draft EIS Purpose and Need currently focuses on reservoir operations and water delivery without adequately addressing the CRE in the Grand Canyon that lies between the two reservoirs. This omission suggests ecosystem protection is optional rather than mandatory under federal law. Proposed Purpose and Need addition: "...and to operate Glen Canyon Dam in compliance with the Grand Canyon Protection Act to project, mitigate adverse impacts to, and improve the Colorado River Ecosystem in Grand Canyon, including endangered fish species, sediment resources necessary for beach and habitat maintenance, and water temperatures that support native species while deterring invasive species."

In addition to GCPA and ESA, the National Park Service Organic Act of 1916 requires the Secretary to "conserve the scenery and the natural and historic objects and the wildlife" in Grand Canyon National Park. Reservoir operations that degrade beaches, harm endangered fish, or eliminate natural sediment processes violate this foundational conservation mandate.

Mandatory Implementation Language for Environmental Flows

Recommendation 12: The Final EIS must include binding implementation language that removes Reclamation's discretion to cancel environmental flows for non-legal reasons. Specifically: “High Flow Experiments (HFEs), temperature management actions, and other flows necessary to comply with the Grand Canyon Protection Act, Endangered Species Act, and Glen Canyon Dam Long-Term Experimental and Management Plan shall be implemented when

scientific monitoring indicates appropriate conditions, without discretionary override for non-statutory considerations, unless it is physically impossible to release water through Glen Canyon Dam due to infrastructure constraints. Concerns about hydropower generation, Basin Fund impacts, or reservoir pool elevation that do not create physical impossibility of water passage shall not constitute grounds for cancellation or postponement of environmental flows that have no net impact on annual water delivery volumes."

In 2021 and 2022, U.S. Geological Survey scientists documented conditions for an unprecedented 192-hour (8-day) High Flow Experiment; the first time criteria were met for this duration. Sandbar size was at a 10-year low, meaning maximum ecological benefit. Reclamation cancelled the HFE citing "concerns about pool elevation and the Basin Fund,"[6] despite acknowledging "(1) HFEs do not affect annual water release volumes, and (2) there would have been a positive effect on sediments especially given the unprecedented drought conditions." This cancellation violated GCPA's mandate. The Secretary had an unprecedented opportunity to improve the Grand Canyon and chose not to act based on factors (hydropower, Basin Fund) that Congress explicitly subordinated to ecosystem protection. The Post-2026 Guidelines must prevent this from recurring.

Endangered Species Act Mandates Scientific Decision-Making

ESA Section 7(2) requires BOR to "use the best scientific and commercial data available" when operating Glen Canyon Dam. This is not discretionary. When USGS scientists determine that:

- Sediment conditions support HFEs
- Temperature management is necessary to prevent smallmouth bass establishment
- Flow modifications would benefit Humpback Chub

Reclamation must implement those recommendations unless physically impossible. The Secretary cannot override scientific recommendations based on administrative convenience, hydropower economics, or Basin Fund concerns.

Daily Flow Fluctuation Minimization

Beyond monthly volume limits, Glen Canyon Dam operations must minimize daily (within-day) flow fluctuations to protect the Colorado River Ecosystem. Research by Deemer et al. (2022) demonstrated that experimental reductions in sub-daily flow fluctuations increased gross primary productivity for 425 river kilometers downstream of Glen Canyon Dam. Daily fluctuations, historically driven by hydropower peaking, cause:

- Beach and sandbar erosion
- Stranding mortality of native fish and invertebrates
- Disruption of aquatic food webs
- Reduced ecosystem productivity

[6] USBR Potential LTEMP Experiments Fall - Water Year 2022 Technical Work Group Meeting 10/14/2021 https://www.usbr.gov/uc/progact/amp/twg/2021-10-14-twg-meeting/20211014-PotentialLTEMPExperimentsFall%20-WaterYear2022-Presentation-508-UCRO.pdf

Recommendation 13: The Final EIS should commit to steady flows (minimal ramping) except during planned HFEs. When operational flexibility requires flow changes, ramping rates should be limited to protect aquatic resources consistent with LTEMP protocols.

Spring Flood Timing to Mimic Natural Hydrograph

Pre-dam Colorado River floods naturally peaked in May-June during snowmelt runoff. This timing was ecologically synchronized with:

- Native fish spawning and rearing
- Riparian vegetation recruitment
- Tributary sediment inputs
- Invertebrate production cycles

Research on other western rivers (Richter et al. 2003, Rood et al. 2003) demonstrates that mimicking natural hydrograph timing produces superior ecological outcomes compared to floods released at administratively convenient times. Recent studies in the Grand Canyon (Healy et al. 2022) confirm that native fish populations benefit from spring floods coinciding with natural life history patterns.

Recommendation 14: HFEs should be timed for spring/early summer (May-June) when sediment conditions allow, to match pre-dam flood timing and maximize ecological benefit. The current LTEMP framework that constrains spring flood implementation should be modified to allow ecologically-timed releases.

Integrated System Management Imperative

The Colorado River Conversations Final Conference Report (University of Arizona, 2019) documented stakeholder consensus that future management must "consider the river as a whole, not as two individual basins or as a series of separate segments between dams that are operated to optimize particular objectives." This systems perspective requires accounting for:

- **Sediment:** "The fundamental dilemma for Grand Canyon is the stream water is out of balance with sediment supply... Equalization flows wipe out sand bars. There are ecological consequences of moving that much water all at once."
- **Temperature:** Cold water from reservoir depths vs. warm surface water
- **Connectivity:** Maintaining flows through entire system
- **Tributaries:** Protecting natural flow regimes and sediment inputs
- **Groundwater:** Bank storage and aquifer interactions

V. Additional Recommendations From Expert Reports

Environmental Protection and Endangered Species

Comprehensive Temperature Management Protocol

Recommendation 15: Develop and implement a comprehensive water temperature management protocol for Glen Canyon Dam. The Final EIS, regardless of the selected alternative, must include operational objectives that include these protocols to protect endangered species.

Optimal Temperature Ranges:

- 12-16°C: Optimal for Humpback Chub reproduction and growth
- <12°C: Too cold for native fish reproduction
- >20°C: Promotes invasive species, stresses native fish

Operational Responses:

- When Lake Powell elevation >3,600 feet: Consider selective withdrawal or mixing to warm releases
- When Lake Powell elevation 3,570-3,575 feet: Optimal - maintain this range
- When Lake Powell elevation <3,525 feet: Implement Cool Mix releases if needed to cool water below 20°C

Monitoring and Adaptive Management:

- Real-time water temperature monitoring at multiple locations below Glen Canyon Dam
- Temperature forecasting based on Lake Powell elevation and inflow temperatures
- Annual review of temperature management effectiveness for native vs. invasive species

Legal Basis: The Grand Canyon Protection Act of 1992 requires the Secretary to operate Glen Canyon Dam "in such a manner as to project, mitigate adverse impacts to, and improve the values for which Grand Canyon National Park and Glen Canyon National Recreation Area were established."

Temperature management is essential to protecting endangered fish values in the Grand Canyon.

Smallmouth Bass Eradication Program

Background: The recent invasion of smallmouth bass into Grand Canyon, caused by low Lake Powell elevations allowing fish entrainment, threatens the stronghold Humpback Chub population.

Recommendation 16: Given the demonstrated linkage between declining reservoir elevations and increased entrainment risk, the Final EIS should commit to:

1. Immediate Response:

    a. Expand mechanical removal efforts in Grand Canyon
    b. Increase monitoring to track smallmouth bass population growth
    c. Implement rapid response when individuals are detected
2. Prevention Through Operations:
    a. Maintain Lake Powell elevations above 3,570 feet to minimize entrainment risk
    b. Implement Cool Mix releases when necessary to disrupt smallmouth bass spawning
    c. Coordinate with Glen Canyon Dam Adaptive Management Program
3. Long-term Solutions:
    a. Study feasibility of fish screens or other infrastructure to prevent entrainment
    b. Develop population models to predict invasion risk under different operational scenarios
    c. Coordinate with National Park Service and U.S. Fish and Wildlife Service on removal strategies

The impacts to the ecosystem from losing a species are far more severe than simple monetary losses due to loss of hydropower.

Sediment Augmentation Study

Recommendation 17: Reclamation should study sediment augmentation, while simultaneously protecting sediment delivery from tributaries and optimize HFEs.

Climate Resilience and Scenario Planning

Expand Hydrologic Scenario Range

Recommendation 18: The Final EIS must expand scenario analysis to include sustained mega-drought scenarios with average flows below 8 maf for 10+ consecutive years, based on paleo-climate reconstructions showing historical mega-droughts and tree-ring data indicating droughts worse than any in modern record have occurred.

Climate warming scenarios, including increased evapotranspiration, earlier snowmelt timing, reduced snowpack, lead to temperature-driven supply reduction. Reclamation should analyze non-linear system responses to temperature increases.

Highly unpredictable "black swan" scenarios, such as simultaneous multi-year drought in both Upper and Lower Basins, can lead to accelerated decline beyond current projections. Reclamation must prepare for infrastructure failure scenarios (e.g., river outlet works damage).

Understanding worst-case scenarios that allow for identification of trigger points for emergency measures, development of contingency plans, realistic assessment of system limits, and informed decision-making about infrastructure investments.

Annual Review and Adjustment Process

Recommendation 19: Reclamation should establish a formal annual public review and reporting process that is timely, transparent, and inclusive.

Annual reporting must include:

1. State of the System Report (October):
    a. Current reservoir elevations and storage
    b. Current and recent natural flows (wet water)
    c. Climate and hydrologic forecasts
    d. Endangered species status
    e. HFE sediment conditions
2. Operational Adjustments (November):
    a. Adjust next water year releases based on system conditions
    b. Update shortage determinations
    c. Identify conservation opportunities
    d. Plan HFEs if appropriate
3. Stakeholder Engagement (December-January):
    a. Present findings to Basin States, tribes, water users, NGOs and the general public
    b. Solicit input on adaptive management options
    c. Build consensus for coming year operations
4. Formal Documentation (February):
    a. Publish Annual Operating Plan
    b. Document decisions and rationale
    c. Provide transparency for all stakeholders

VI. Recommendations Beyond The Scope Of This EIS

The following recommendations involve actions or studies that fall outside the scope of Post-2026 operational guidelines but are critical to long-term Colorado River management. We urge the Bureau to pursue these initiatives in parallel with EIS implementation.

Glen Canyon Dam Infrastructure Modifications

"Fill Mead First" Concept and River Bed-Level Outlet Works

Background: Currently, Lake Powell and Lake Mead are managed as separate reservoirs with independent operations. Some organizations have proposed a "Fill Mead First" approach where Lake Powell would be drawn down significantly while Lake Mead is maximized. Fill Mead First would require new river bed-level outlet works at Glen Canyon Dam to release water even when Lake Powell is at minimum pool or dead pool.

If Glen Canyon Dam approaches dead pool (elevation 3,370 feet) without river bed-level outlets, Reclamation would have no operational flexibility. Water trapped below elevation 3,370 feet (approximately 4.2 maf) would be inaccessible. This infrastructure gap poses catastrophic risk to the Lower Basin water supply. Reclamation should not wait until a crisis occurs.

Recommendation 20: Reclamation must fully analyze the feasibility, cost, and environmental implications of constructing new outlet works at or near the river bed level that would allow release of water from Lake Powell at any elevation.

Comprehensive Dam Safety and Infrastructure Review

Recommendation 21: Reclamation should conduct a comprehensive assessment of all Colorado River storage project dams, including, but not limited to:

1. Structural Integrity:
    a. Concrete deterioration at Glen Canyon Dam (evidence of seepage, cracking)
    b. Spillway capacity and functionality
    c. Foundation stability
    d. Seismic vulnerability assessment
2. Operational Infrastructure:
    a. River outlet works condition and capacity
    b. Penstock condition and efficiency
    c. Turbine condition and replacement needs
    d. Electrical and control systems modernization
3. Climate Adaptation:
    a. Probable Maximum Flood (PMF) recalculation based on climate change
    b. Spillway adequacy for extreme events
    c. Emergency action plans for dam failure scenarios
4. Deferred Maintenance:
    a. Backlog of repairs and upgrades
    b. Prioritization based on safety and operational criticality
    c. Cost estimates and funding needs

Upper Basin Agricultural and Municipal Resilience Programs

Recommendation 22: Reclamation needs to use its considerable influence with other federal agencies and the states and municipal water utilities to further encourage Upper Basin agricultural and municipal supply resilience programs.

Mexico Binational Cooperation Framework

Recommendation 23: Departments of Interior and State should expand U.S.-Mexico cooperations beyond minimum Treaty obligations for environmental cooperation such as habitat values from the border to the Gulf of California, flow to the Cienega de Santa Clara, Colorado River delta restoration, pulse flows, migratory bird habitat management, and also infrastructure investment and funding for Mexican and American water conservation projects. Past pulse flows

revealed an excitement for a flowing river, creating local community opportunities for enjoyment of the river and habitat restoration.

VII. Geographical Scope

Salton Sea

This Draft EIS improperly excludes and defers analysis of impacts to the Salton Sea.

The environmental impacts analysis is deficient in improperly relying on the California Salton Sea Management Plan's (SSMP's) long range plan and the upcoming US Army Corps Imperial Streams and Salton Sea Ecosystem Restoration Feasibility Study's (Corps Study) NEPA analysis under preparation. The SSMP's long range plan was only a concept-level planning document with no accompanying environmental review whatsoever.

NEPA prohibits deferral of impact analysis. Therefore, this Draft EIS may not rely on the future environmental review of the Corps Study for doing the NEPA analysis of the foreseeable direct, indirect and cumulative impacts that this Draft EIS's alternatives will cause. Those impacts are likely to include, but not be limited to, significant adverse air quality, health, biological and economic impacts. The available options of the Corps Study will be constrained by the very decisions made in these Post-2026 Operational Guidelines and Strategies for Lake Powell and Lake Mead - and the impacts of those options must be analyzed concurrently with decisions being made here.

Mexico

The Draft EIS is weakened by not including Mexico's plans for Colorado River water management in its geographic scope. While we recognize that Reclamation excludes Mexico from the Draft EIS geographically as well as the impacts of water management actions in the United States on Mexico for legal-political reasons, failing to include impacts of the two alternatives on the whole of the Colorado River Basin makes the Draft EIS much less useful to reviewers. Our understanding is that Executive Order 12114 ("Environmental effects abroad of major Federal actions,") may apply, in particular, Section 2.3(d):

> *"major Federal actions outside the United States, its territories and possessions which significantly affect natural or ecological resources of global importance designated for protection under this subsection by the President, or, in the case of such a resource protected by international agreement binding on the United States, by the Secretary of State. Recommendations to the President under this subsection shall be accompanied by the views of the Council on Environmental Quality and the Secretary of State."*

The Upper Gulf of California and Delta of the Colorado River Biosphere Reserve is a UNESCO World Heritage Site and also a protected wetland area designated under the Ramsar agreement

(González Barajas 2021[7], Ramsar n.d.[8]). This area includes the Ciénega de Santa Clara (Santa Clara Slough), which is fed water by a canal that originates in the Wellton-Mohawk Irrigation and Drainage District in the United States, so any effects on Colorado River flows to Wellton-Mohawk could well have an effect on water flows to the Ciénega de Santa Clara, and operation of the desalination plant in Yuma County would have a very direct and adverse effect on the Ciénega de Santa Clara. However, these possible effects of the proposed and cumulative actions are not analyzed in the Draft EIS.

VIII. List Of Recommendations

In conclusion, Sierra Club reiterates that no alternative, as currently drafted, adequately protects critical infrastructure, tribal rights, endangered species, or long-term system sustainability under realistic hydrologic conditions. The Final EIS must correct the following deficiencies and incorporate binding, system-wide protections grounded in physical water availability rather than optimistic assumptions. We offer these recommendations:

Recommendation 1: While certain components across alternatives demonstrate useful concepts, no alternative may be adopted without substantial revision to address the following deficiencies. Sierra Club recommends Reclamation to use the Maximum Operational Flexibility Alternative as a **starting point** for the following reasons:

- Notwithstanding Sierra Club's position that Glen Canyon Dam be decommissioned, until that happens this alternative, in addition to the primary function to deliver water, provides the best, albeit limited, basis of all the alternatives for protecting critical infrastructure at Glen Canyon Dam and Hoover Dam and the Colorado River ecosystem. This includes appropriate responses to climate change for endangered species and native fish populations through adaptive management that creates environmental flows necessary to maintain ecosystem function even in a worst case scenario.
- This is the only alternative specifically designed to address "increasingly variable future hydrologic conditions" with the proactive measures intended to avoid catastrophic system collapse.
- This is the only alternative that attempts to prevent a Glen Canyon Dam infrastructure crisis, although it offers no solution if dead pool does occur there.

Recommendation 2: Sierra Club recommends implementing (e.g.) a 3-year weighted average (or other more suitable methods), with the most recent year weighted more heavily than the prior two years, instead of the proposed 3-year running average. This would create a model that responds faster to hydrological conditions, and better mimics the short residence time of water

[7] Gonzáles Barajas, Socorro. 2021. Blog Post. Where the Desert Meets the Sea: A Place of Extremes. Intercultural Center for the Study of Deserts and Oceans (CEDO), March 31, 2021. https://www.cedo.org/read/cedo-en/where-the-desert-meets-the-sea/. Accessed February 27, 2026.

[8] Ramsar. n.d. Humedales del Delta del Río Colorado. Ramsar Sites Information Service. https://rsis.ramsar.org/ris/814?language=en. Accessed February 27, 2026.

in the Colorado reservoir system. This is especially important for multiple consecutive dry or critically dry years as outlined in IX. Appendix A - Hydrological Modeling.

Recommendation 3: While we do not endorse any alternative, some tenets of the Maximum Operational Flexibility Alternative and Enhanced Coordination Alternative would be improved if strengthened with:

- Adoption of 4.0 maf or greater maximum shortage (rather than 3.0 maf)
- Explicit HFE frequency targets (once every 3 years when sediment present)
- Water temperature management protocols from Cooperative Conservation proposal

Recommendation 4: The Final EIS should include the following provision: : "Monthly release volumes will be limited to protect sediment resources for High Flow Experiments, with specific limits to be determined through consultation with the Grand Canyon monitoring and research program."

Recommendation 5: As a binding operational requirement, the Final EIS should incorporate that Glen Canyon Dam releases will maintain a minimum flow of 5,000 cfs (3.23 maf/year) to ensure river system connectivity and ecosystem function, with a preferred minimum of 6,000 cfs (4.34 maf/year) when hydrologic conditions allow.

Recommendation 6: The Final EIS should commit to High Flow Experiments conducted approximately once every three years when sediment conditions in the Paria River, Little Colorado River and other tributaries are sufficient, provided Lake Powell elevation supports HFE implementation (generally above 3,570 feet).

Recommendation 7: The Final EIS should state that operations will support recommended flows for endangered fish and wildlife in the Upper Colorado River and San Juan River, with reservoir releases timed to maximize ecological benefits including appropriate water temperatures for native fish spawning and rearing.

Recommendation 8: Fully resource the LCR MSCP with adequate flows when possible, and habitat restoration when river and reservoir levels change.

Recommendation 9: The Final EIS should evaluate and incorporate analysis of the potential for the potential for creating up to 45 kaf of binational water annually and for a 135 kaf release of that water from Lake Mead storage and deliveries every three years to keep the possibility of a Delta Flow release open during US/Mexico negotiations.

Recommendation 10: The Final EIS should explicitly state that ecosystem protection and restoration in Grand Canyon is a core purpose, as required by the Grand Canyon Protection Act (GCPA) of 1992, Section 1802(a): *"The Secretary shall operate Glen Canyon Dam in accordance with the additional criteria and operating plans specified in section 1804 and exercise other authorities under existing law in such a manner as to protect, mitigate adverse impacts to, and improve the values for which Grand Canyon National Park and Glen Canyon*

National Recreation Area were established, including, but not limited to natural and cultural resources and visitor use".

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1. Grand Canyon Protection Act Section 1802(a) - as mentioned above
2. Endangered Species Act Section 7 - Federal agencies must ensure actions do not jeopardize endangered species (Humpback Chub, Colorado Pikeminnow, Razorback Sucker, Bonytail)
3. National Park Service Organic Act - Duty to "conserve the scenery and the natural and historic objects and the wild life" in Grand Canyon National Park

Recommendation 12: The Final EIS must include binding implementation language that removes Reclamation's discretion to cancel environmental flows for non-legal reasons. Specifically: "High Flow Experiments (HFEs), temperature management actions, and other flows necessary to comply with the Grand Canyon Protection Act, Endangered Species Act, and Glen Canyon Dam Long-Term Experimental and Management Plan shall be implemented when scientific monitoring indicates appropriate conditions, without discretionary override for non-statutory considerations, unless it is physically impossible to release water through Glen Canyon Dam due to infrastructure constraints. Concerns about hydropower generation, Basin Fund impacts, or reservoir pool elevation that do not create physical impossibility of water passage shall not constitute grounds for cancellation or postponement of environmental flows that have no net impact on annual water delivery volumes."

Recommendation 13: The Final EIS should commit to steady flows (minimal ramping) except during planned HFEs. When operational flexibility requires flow changes, ramping rates should be limited to protect aquatic resources consistent with LTEMP protocols.

Recommendation 14: HFEs should be timed for spring/early summer (May-June) when sediment conditions allow, to match pre-dam flood timing and maximize ecological benefit. The current LTEMP framework that constrains spring flood implementation should be modified to allow ecologically-timed releases.

Recommendation 15: Develop and implement a comprehensive water temperature management protocol for Glen Canyon Dam. The Final EIS, regardless of the selected alternative, must include operational objectives that include these protocols to protect endangered species.

Recommendation 16: Given the demonstrated linkage between declining reservoir elevations and increased entrainment risk, the Final EIS should commit to:

1. Immediate Response:
    a. Expand mechanical removal efforts in Grand Canyon
    b. Increase monitoring to track smallmouth bass population growth

    c. Implement rapid response when individuals are detected
2. Prevention Through Operations:
    a. Maintain Lake Powell elevations above 3,570 feet to minimize entrainment risk
    b. Implement Cool Mix releases when necessary to disrupt smallmouth bass spawning
    c. Coordinate with Glen Canyon Dam Adaptive Management Program
3. Long-term Solutions:
    a. Study feasibility of fish screens or other infrastructure to prevent entrainment
    b. Develop population models to predict invasion risk under different operational scenarios
    c. Coordinate with National Park Service and U.S. Fish and Wildlife Service on removal strategies

Recommendation 17: Reclamation should study sediment augmentation, while simultaneously protecting tributaries and optimize HFEs.

Recommendation 18: The Final EIS must expand scenario analysis to include sustained mega-drought scenarios with average flows below 8 maf for 10+ consecutive years, based on paleo-climate reconstructions showing historical mega-droughts and tree-ring data indicating droughts worse than any in modern record have occurred.

Recommendation 19: Reclamation should establish a formal annual public review and reporting process that is timely, transparent, and inclusive.

Recommendation 20: Reclamation must fully analyze the feasibility, cost, and environmental implications of constructing new outlet works at or near the river bed level that would allow release of water from Lake Powell at any elevation.

Recommendation 21: Reclamation should conduct a comprehensive assessment of all Colorado River storage project dams, including, but not limited to:

1. Structural Integrity:
    a. Concrete deterioration at Glen Canyon Dam (evidence of seepage, cracking)
    b. Spillway capacity and functionality
    c. Foundation stability
    d. Seismic vulnerability assessment
2. Operational Infrastructure:
    a. River outlet works condition and capacity
    b. Penstock condition and efficiency
    c. Turbine condition and replacement needs
    d. Electrical and control systems modernization
3. Climate Adaptation:
    a. Probable Maximum Flood (PMF) recalculation based on climate change
    b. Spillway adequacy for extreme events
    c. Emergency action plans for dam failure scenarios

4. Deferred Maintenance:
    a. Backlog of repairs and upgrades
    b. Prioritization based on safety and operational criticality
    c. Cost estimates and funding needs

Recommendation 22: Reclamation needs to use its considerable influence with other federal agencies and the states and municipalities to further encourage Upper Basin agricultural and municipal supply resilience programs.

Recommendation 23: Departments of Interior and State should expand U.S.-Mexico cooperations beyond minimum Treaty obligations for environmental cooperation such as habitat values from the border to the Gulf of California, flow to the Cienega de Santa Clara, Colorado River delta restoration, pulse flows, migratory bird habitat management, and also infrastructure investment and funding for Mexican and American water conservation projects. Past pulse flows revealed an excitement for a flowing river, creating local community opportunities for enjoyment of the river and habitat restoration.

Recommendation 24: Given the magnitude of system risk, Reclamation should seek independent review from the National Academy of Sciences, evaluate whether Congressional clarification of authorities is required, and conduct a programmatic review of basin-wide over-allocation rather than limiting analysis to operational adjustments.

The Stakes

We cannot wish away this crisis with optimistic hydrology assumptions or incremental policy changes. We need bold action based on physical reality, scientific evidence, and environmental protection principles.

Neither Reclamation, nor the States can afford to get this wrong. The choice is between accepting difficult but manageable transitions now or risking catastrophic system collapse later.

Sincerely,

Stefan Frutiger

Ken Neubecker

On behalf of the Sierra Club Colorado River Sub Team of the
Water Sentinels Grassroots Network Team

IX. Appendix A - Hydrological Modeling

Sierra Club recommends Reclamation review the hydrological modeling defined in the Maximum Operational Flexibility Alternative and consider a 3-year weighted average versus the suggested 3-year running average. Such a weighting is a simple representation of water residence times in the two primary reservoirs.

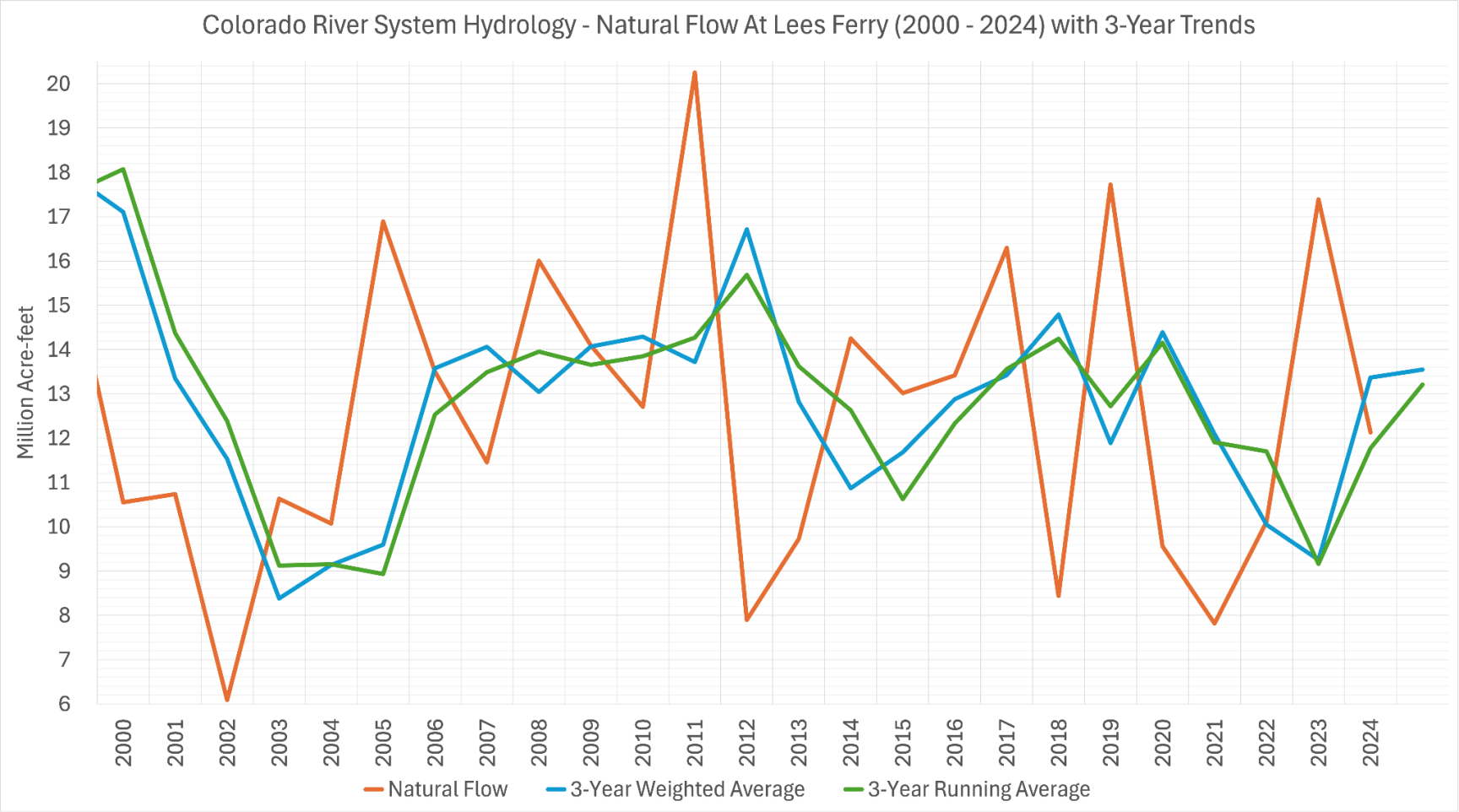

Figure 1: Colorado River System Hydrology - Natural Flow At Lees Ferry (2000 - 2024) with 3-Year Trends (shifted by 1 year to simulate forecasting). The weight distribution is 3x Year-1 (last year), 2x Year-2 and 1x Year-3 and divide by 6 to renormalize.

For the years 2011 to 2013, and also 2019 to 2021, the graph shows that the weighted average (blue line) responds faster to a significant change from wet to dry periods than the running average (green line). As would be expected, the two models perform similarly in years with less variability or more stable, multi-year downwards or upwards trends.

Sierra Club acknowledges that current storage is part of the modeling for the Maximum Operational Flexibility Alternative. Storage acts as an approximately 2 year buffer (based on water residence times). Using a weighted average more closely mimics operational dynamics, responds more quickly to changes in river flow and allows greater forewarning of the impact of changes in river flow dynamics.

X. Appendix B - Hydrology Modeling of Maximum Operational Flexibility Alternative

In this appendix we test (as an example) how the hydrological model presented in the Maximum Operational Flexibility Alternative performs in a series of dry and critically dry years. We are using modeling parameters that replicate a series of past dry years, and applied the shortage guideline presented by Reclamation (see Draft EIS chapters 2.7.1 and 2.7.2).

Modeling Parameters

Historical Hydrology / Natural Flow (Model Input):

- 3-year history: 3x dry
- 3-year avg: 8 maf/yr

Shortage Guideline:

- Shortage Curve: S5 (from Draft EIS Table 2-5)
- Release Curve: R3 (from Draft EIS Table 2-6)

Categorization of Natural Flow at Lees Ferry:

- Wet year: 14 maf / year
- Normal year: 11: maf / year
- Dry year: 8 maf / year
- Extremely dry year: 5 maf / year

Total CR system storage: ~60 maf
System loss per year: estimated at 18% - due to evaporation, seepage, banking, and riparian vegetation[9]

Reference: Average Natural Flow at Lees Ferry:

- 1922 Compact period: ~18 maf / year
- Historic average (1906 - 2024): ~14.6 maf / year

[9] Based on suggested system losses in “An Historical Perspective on the Accounting for Evaporation and System Losses in the Lower Colorado River Basin” (pages 16-18, link)

- Previous average (1975 – 1999): ~15.5 maf / year
- Recent average (2000 - 2024): ~12.4 maf / year
- 20% reduction since 2000

Measured Flow at Lees Ferry is the actual, regulated volume of water passing the gauge below Glen Canyon Dam, heavily influenced by dam operations, storage, and upstream usage. Natural Flow is a calculated estimate of what the river's volume would be without human interference, such as upstream dams and diversions.

Model Output in a Sequence of Dry and Critically Dry Years

Colorado River System Storage (Current Year)		Next Year Shortage Adjustment		Resulting storage change if next year is dry (8 maf)			Resulting storage change if next year is extremely dry (5 maf)		
		Shortage [maf]	Lake Powell Release [maf]	Storage increase after dry next year	Storage at end of next year [maf]	Gain/loss compared to prev. year	Storage increase after dry next year	Storage at end of next year [maf]	Gain/loss compared to prev. year
full	100.00%	0.00	11.00	-5.0%	77.0%	-23.0%	-10.0%	72.0%	-28.0%
	90.00%	0.00	10.25	-3.8%	70.1%	-20.0%	-8.8%	65.1%	-25.0%
	80.00%	0.00	9.50	-2.5%	63.1%	-16.9%	-7.5%	58.1%	-21.9%
	70.00%	0.50	8.50	-0.8%	56.6%	-13.4%	-5.8%	51.6%	-18.4%
	60.00%	1.00	7.25	1.3%	50.5%	-9.6%	-3.8%	45.5%	-14.6%
half	50.00%	3.00	6.00	3.3%	44.3%	-5.7%	-1.7%	39.3%	-10.7%
	40.00%	3.50	5.25	4.6%	37.4%	-2.6%	-0.4%	32.4%	-7.6%
	30.00%	4.00	5.00	5.0%	29.6%	-0.4%	0.0%	24.6%	-5.4%
	20.00%	4.00	5.00	5.0%	21.4%	1.4%	0.0%	16.4%	-3.6%
	10.00%	4.00	5.00	5.0%	13.2%	3.2%	0.0%	8.2%	-1.8%
empty	0.00%	4.00	5.00	5.0%	5.0%	5.0%	0.0%	0.0%	0.0%

Findings

Key finding for dry years: The hydrological model presented in the Maximum Operational Flexibility Alternative demonstrates that the Colorado River storage can be stabilized at around 28% in a series of 4+ dry years at ~8 maf/yr natural flow at Lees Ferry.

Key finding for critically dry years: The hydrological model presented in the Maximum Operational Flexibility Alternative demonstrates that the Colorado River storage **can not be stabilized with extremely low natural flows** at Lees Ferry of ~5 maf/yr and that additional shortage measures by the Water Master are required.

XI. Appendix C - Glossary

Acre-Foot (AF)
A unit of volume equal to the amount of water required to cover one acre of land to a depth of one foot (approximately 325,851 gallons).

Adaptive Management
A structured, iterative decision-making framework incorporated into dam operations that allows operational adjustments over time based on monitoring results, modeled performance, and resource condition assessments.

Affected Environment
The section of an Environmental Impact Statement describing the existing environmental, hydrologic, ecological, cultural, and socioeconomic conditions that may be impacted by a proposed federal action.

Alternative (EIS Context)
A defined operational strategy evaluated in a Draft EIS that establishes release criteria, shortage criteria, reservoir operational tiers, and implementation triggers under modeled hydrologic conditions.

Anthropogenic Climate Change
Long-term climate change is primarily attributable to greenhouse gas emissions, influencing basin hydrology through reduced runoff efficiency, diminished snowpack, and altered flow timing.

Basin States
The seven states allocated Colorado River water pursuant to interstate compact and federal law: Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming.

Beneficial Use
The application of water to an authorized purpose under state or federal water law, such as irrigation, municipal supply, or industrial use, consistent with the doctrine of prior appropriation or the intended purpose of a federal reserved water right.

Bureau of Reclamation (Reclamation)
The federal agency within the Department of the Interior responsible for Colorado River dam operations, reservoir management, implementation of operational criteria, and preparation of the Environmental Impact Statement pursuant to NEPA.

Canyon Minimum Operating Level (CMOL)
The reservoir elevation at Lake Powell below which Glen Canyon Dam can no longer generate hydropower.

CAP – Central Arizona Project
A canal and pumping system delivering Colorado River water to central and southern Arizona, operated by the Central Arizona Water Conservation District to support municipal, industrial, and agricultural water use.

Climate Scenario Analysis
Hydrologic modeling that incorporates long-term warming trends, runoff reductions, drought, and/or sustained low-flow conditions to evaluate system performance under reasonably foreseeable future hydrologic conditions.

Colorado River Basin Project Act (1968)
Federal statute establishing coordinated long-term operating criteria for Lake Powell and Lake Mead and authorizing the Secretary of the Interior to manage releases to protect water deliveries and hydropower production.
Colorado River Compact (1922)
The interstate agreement dividing the Colorado River Basin into Upper and Lower Basins and apportioning 7.5 million acre-feet annually to each basin.
Compact Compliance
The obligation of the Upper and Lower Basin states, as interpreted and implemented by Reclamation, to operate the Colorado River system and manage consumptive uses to satisfy delivery requirements under the Colorado River Compact of 1922, relevant Supreme Court decrees, federal statutes, and treaty obligations, including ensuring the Upper Basin meets its 7.5 maf/10-year delivery obligation at Lees Ferry and the Lower Basin receives its apportioned allocations while accounting for system losses, variability in natural flow, and operational constraints.
Consumptive Use
The portion of water diverted from the Colorado River that is not returned to the system, including water lost to evaporation, irrigation, or other uses, as accounted for in operational modeling.
Critically Dry Condition
A modeled hydrologic condition characterized by significantly below-average natural flow at Lees Ferry, evaluated to assess system reliability and storage resilience.
Cumulative Impacts
Effects on resources that arise from the combined incremental influence of the proposed action together with other past, present, and reasonably foreseeable future actions.
Dead Pool
The reservoir elevation at which water can no longer be released downstream through existing outlet works because the intake structures are below the water surface.
Deferred Maintenance
The accumulated backlog of infrastructure repair or rehabilitation that may affect safety, functionality, efficiency, or capacity.
Demand Management
Programs or operational measures intended to reduce consumptive use to protect reservoir storage levels and/or assist in maintaining Compact compliance. While primarily focused on storage and legal obligations, such measures can also produce secondary benefits for downstream ecological conditions.
Drought Contingency Plan (DCP)
An interstate agreement establishing additional shortage reductions and operational tiers triggered by declining reservoir elevations to reduce risk of critical storage conditions.
Environmental Consequences
The section of the EIS analyzes the direct, indirect, and cumulative impacts of each alternative on hydrology, power production, ecological resources, recreation, cultural resources, and socioeconomics.

Environmental Impact Statement (EIS)
A detailed environmental analysis prepared pursuant to the National Environmental Policy Act evaluating the environmental effects of proposed federal actions and alternatives.
ESA Section 7 Consultation
The process under Section 7 of the Endangered Species Act requires federal agencies to ensure actions are not likely to jeopardize listed species or adversely modify designated critical habitat.
Evapotranspiration
Combined water loss from surface evaporation and plant transpiration, incorporated into modeled system loss estimates.
Federal Reserved Water Rights
Water rights reserved by the federal government for Tribal reservations, national parks, wildlife refuges, or other federal purposes, with priority dates corresponding to reservation establishment.**Glen Canyon Dam**
The federal storage and hydropower facility creating Lake Powell and regulating releases to the Lower Basin pursuant to Secretarial authority.
High Flow Experiment (HFE)
A controlled, short-duration high-volume release from Glen Canyon Dam conducted under adaptive management protocols to enhance sediment redistribution and downstream habitat conditions.
Hydrologic Modeling Framework
The analytical system used in the Draft EIS to simulate inflows, storage, evaporation, release criteria, shortage criteria, and resulting system storage trajectories under various alternatives.
IID – Imperial Irrigation District
A California water district that manages irrigation and municipal water delivery in the Imperial Valley, holding one of the largest allocations of Colorado River water in the Lower Basin.
Lake Mead
The Lower Basin storage reservoir receives regulated releases from Lake Powell and serves domestic delivery and treaty obligations.
Lake Powell
The Upper Basin storage reservoir operated to support Compact compliance, hydropower generation, and coordinated system operations.
Law of the River
The collective body of compacts, federal statutes, Supreme Court decrees, treaties, contracts, regulations, and Secretarial decisions governing Colorado River allocations and operations.
Lees Ferry
The legal and hydrologic division point between the Upper and Lower Basins used for Compact accounting and natural flow measurement.
Maximum Operational Flexibility Alternative
An alternative analyzed in the Draft EIS that adjusts Lake Powell release volumes in response to evolving reservoir elevations and modeled hydrologic conditions.
Minimum Power Pool
The reservoir elevation below which hydropower generation becomes infeasible.

Modeled Hydrology
The inflow sequences, runoff adjustments, evaporation assumptions, and hydrologic scenarios used in system simulations to evaluate performance of each alternative.
Modeled Storage Trajectory
The projected path of combined system storage under specified inflow sequences and operational criteria.
Million Acre-Feet (maf)
One million acre-feet; the standard unit for reporting basin inflows, releases, and reservoir storage volumes.
MWD – Metropolitan Water District of Southern California
A regional wholesaler of water in Southern California, importing Colorado River water and other supplies to serve member agencies, with operational and contractual obligations under the Law of the River.
National Environmental Policy Act (NEPA)
Federal statute requiring environmental review and public disclosure prior to implementation of major federal actions.
Natural Flow at Lees Ferry
The modeled estimate of river flow that would have occurred absent upstream regulation or depletions, used in Compact accounting and operational modeling.
Paleo climate Reconstruction
The use of proxy data such as tree-ring records to reconstruct historical hydrologic variability, including multi-decadal droughts.
Paper Water
Water that is legally allocated under compacts, contracts, or decrees but may not actually be physically available in the river system under current hydrologic conditions. In contrast, wet water refers to the physically available water supply.
Prior Appropriation/Priority System (First in Time, First in Right)
The doctrine under which senior water rights are satisfied before junior rights during shortages.
Probable Maximum Flood (PMF)
The largest flood event considered physically possible under meteorologic modeling, used to assess spillway adequacy and dam safety.
Protection Pool Elevation
A reservoir elevation identified in operational analyses as necessary to preserve minimum release capability or infrastructure functionality.
Pulse Flow
A short-duration, high-volume release intended to achieve ecological restoration objectives such as habitat improvement or channel reconnection.
Reasonably Foreseeable Future Conditions
Projected hydrologic, climatic, and demand conditions used in EIS analyses to evaluate long-term impacts of proposed alternatives.
Record of Decision (ROD)
The formal decision document issued by the Secretary of the Interior identifying the selected alternative following completion of the Final EIS.

Release Criteria
Operational rules defining annual Lake Powell release volumes based on storage levels, projected inflows, and defined operational tiers.
Return Flow
The portion of diverted water that re-enters the river system following use.
River Outlet Works
Low-elevation dam structures that allow water release independent of hydropower turbines.
Secretary of the Interior (Secretary)
The federal official with statutory authority to administer Colorado River operations and implement operating criteria under applicable law.
Shortage Condition
A reservoir elevation-based condition requiring reductions in Lower Basin deliveries consistent with adopted shortage criteria.
Shortage Criteria
Operational guidelines specifying the magnitude of delivery reductions at defined Lake Mead trigger elevations.
Structural Integrity
The capacity of dam structures and foundations to safely withstand hydraulic, thermal, seismic, and operational stresses.
System Loss
Water lost from the system due to evaporation, seepage, bank storage, and riparian vegetation consumption, as incorporated in modeling assumptions.
System Storage
The combined active storage in Lake Powell and Lake Mead, typically expressed in maf or as a percentage of total capacity.
Treaty Deliveries
Annual water deliveries to Mexico required under the 1944 Water Treaty, subject to shortage provisions consistent with binational agreements.
Trigger Elevation
A defined reservoir elevation at which operational adjustments or shortage tiers are implemented under adopted criteria.
Upper Basin Delivery Obligation
The requirement that sufficient cumulative flow pass Lees Ferry to satisfy Compact requirements over a specified accounting period.
Water Residence Time
The average duration water remains stored within a reservoir prior to release, relevant to forecasting and operational modeling.
Weighted Moving Average (3-Year Weighted Model)
A forecasting approach assigning greater weight to the most recent hydrologic year to better reflect operational responsiveness under changing inflow conditions.
Wet Water
Water that is physically available for diversion or use, as contrasted with “Paper Water,” which represents legal entitlements that may not be available under current hydrologic conditions.