Glen Canyon Dam Adaptive Management Work Group
Agenda Item Information
August 27-28, 2014

Agenda Item

Long-Term Experimental and Management Plan (LTEMP) EIS

Action Requested

Information item only

Presenter

Kendra Russell, Bureau of Reclamation
Rob Billerbeck, National Park Service (NPS)
Glen Knowles, Bureau of Reclamation (Reclamation)
Dr. Mike Runge, U.S. Geological Survey
Kirk LaGory, Argonne National Lab

Previous Action Taken

December 2009: Secretary of the Interior Ken Salazar announced that the development of a Long-Term Experimental and Management Plan (LTEMP) for Glen Canyon Dam was needed. The Secretary emphasized the inclusion of stakeholders, particularly those in the Glen Canyon Dam Adaptive Management Program (GDAMP), in the development of the LTEMP.

November 2011: Public scoping meetings were held in Phoenix, Flagstaff, Page, Salt Lake City, Las Vegas, and Denver. A webcast was also held to capture participation from those that could not attend in person.

April 4-5, 2012: A public workshop was held in Flagstaff, AZ to receive feedback on the preliminary alternative concepts.

April 30, 2012: The Secretary of the Interior responded to a recommendation from the AMWG by stating, "With respect to the report of the Socioeconomic Ad Hoc Group, I appreciate the comprehensive nature of the program and plan proposed, and the support of the AMWG for the implementation of these socioeconomic impact assessment studies. I am directing the interagency team for the Department of the Interior to communicate to the AMWG the specific studies and activities that should be prioritized for utilization as part of the ongoing National Environmental Policy Act process to develop a Long Term Experimental and Management Plan (LTEMP) for Glen Canyon Dam. The Technical Work Group can then identify information needs and research priorities not addressed through the LTEMP process so that the [Grand] Canyon Monitoring and Research Center can refine and develop a work plan."

August 30, 2012: Motion (moved by Larry Stevens and seconded by Ted Rampton): AMWG requests that the February 2013 AMWG meeting agenda include a detailed description of the LTEMP alternatives; time for discussion and identification of issues, questions, and concerns; and possible development of a recommendation from non-DOI AMWG members.

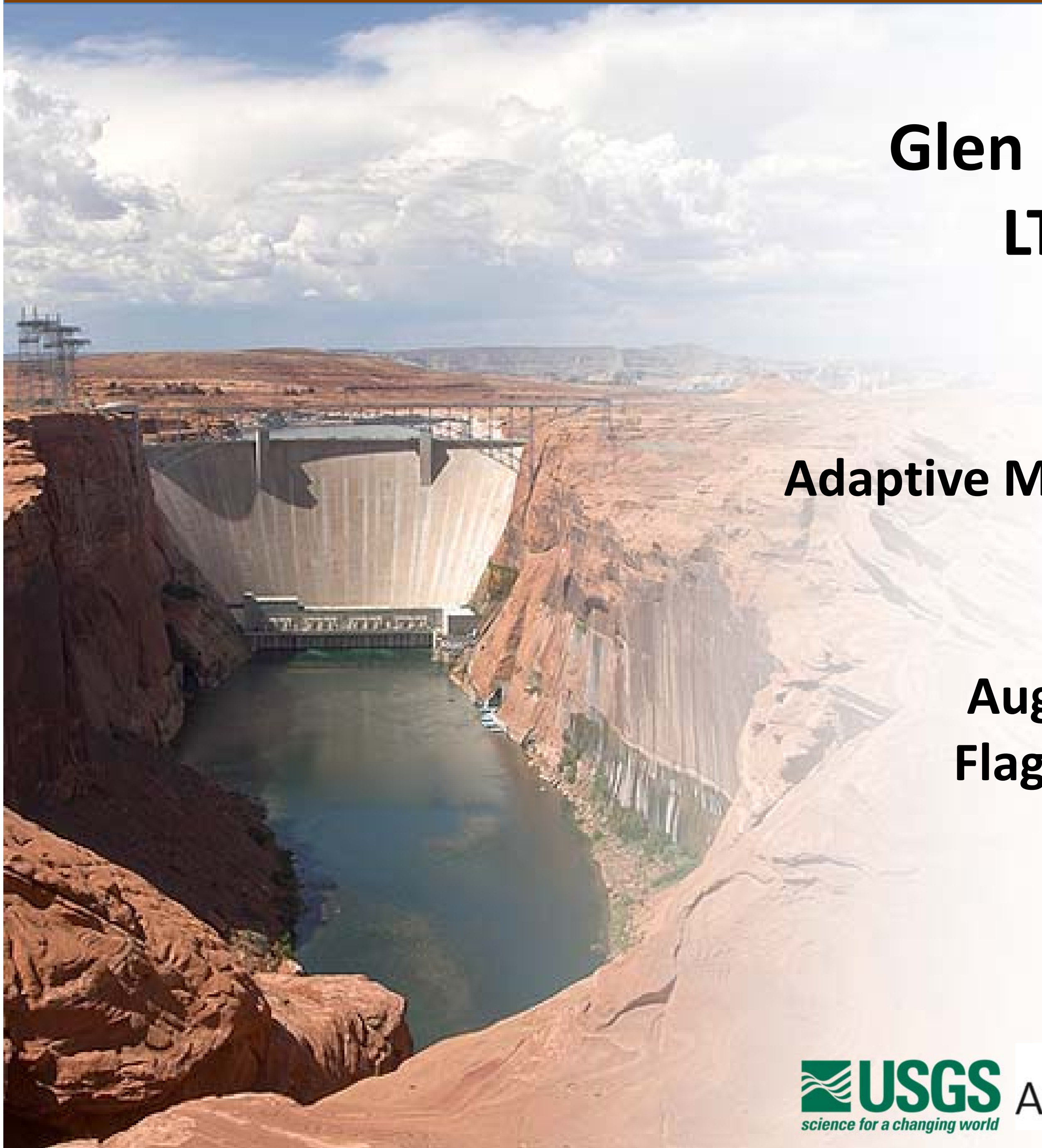
Relevant Science

Science and research completed since the GCDMP was established will be used in the development of the EIS and assessment of impacts.

Background Information

The Department of the Interior (Department), through Reclamation and NPS, is preparing a draft EIS for adoption of the LTEMP for the operation of Glen Canyon Dam. The purpose of the proposed LTEMP is to utilize current, and develop additional, scientific information to better inform Departmental decisions and to operate the dam in such a manner as to improve and protect important downstream resources while maintaining compliance with the Grand Canyon Protection Act (GCPA), the Law of the River, and the Endangered Species Act, among others, and to fully evaluate dam operations and identify management actions and experimental options that will provide a framework for adaptively managing Glen Canyon Dam over the next 15 to 20 years, consistent with the GCPA and other provisions of applicable Federal law.

The LTEMP EIS Team conducted stakeholder workshops August 5-7, 2013 and March 30-April 1, 2014 where results of the analysis of alternatives using resource-specific performance metrics were presented and stakeholders had an opportunity to participate in the LTEMP structured-decision analysis process. The LTEMP Team has now completed modeling of the 6 alternatives with the exception of the power systems analysis which will be completed in November. The LTEMP Team is now in the process of completing a draft document, working to incorporate tribal input, and completing the power systems analysis. A DEIS will be sent to cooperating agencies for review in November, with a public DEIS released in November or December. The LTEMP EIS Team will review progress to date, upcoming planned meetings, and the current schedule for completion of the EIS.



Glen Canyon Dam LTEMP EIS Update

Adaptive Management Working Group

August 28, 2014
Flagstaff, Arizona

USGS science for a changing world · Argonne NATIONAL LABORATORY · NATIONAL PARK SERVICE · U.S. DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION

Topics

- The Hybrid Alternative
- Experimental Design
- Analysis of Climate Change Effects
- Update on Process & Schedule
- NPS Value Survey
- Discussion

Hybrid Alternative

This is a new alternative for LTEMP, which we hope will be able to receive consensus support. This alternative, however, is still under development and analysis. It has not yet been the subject of government-to-government consultation.

Key Modeling Findings

- CDAS and RTCD have similar performance relative to most resource goals
  - Humpback chub (minimum number of adults)
    - Differences can be tied to frequency of HFEs and number of trout
  - Sediment as measured by sand load index and sand mass balance index
    - Differences can be tied to frequency of HFEs, monthly volumes, and fluctuation levels
  - Hydropower (economic value of generation and capacity)
    - Differences can be tied to frequency of HFEs and fluctuation levels

Preliminary Results—Do Not Cite or Distribute

Benefits of Hybrid Alternative Relative to Original Alternatives Considered

- Blends two alternatives (CDAS and RTCD) that were weighted highly by a wide variety of stakeholders in structured decision analysis process
- Uses the monthly volume pattern of RTCD that more closely matches power demand to improve hydropower performance and sediment conservation
- Represents an improvement over CDAS and RTCD in terms of sediment transport and conservation
- Proposes Trout Management Flows (TMFs) to manage the trout population and manage risks related to humpback chub
- Tests a variety of condition-dependent elements to improve sediment and humpback chub conservation

Characteristics of the Hybrid Alternative

Component	Hybrid Alternative	Other Alternatives
Monthly volumes	Lower volume Aug-Oct, relatively even rest of year following CROD	Same as RTCD. More even monthly distribution of flows than all but YRSF.
Daily fluctuations	10 x kaf in June-Aug 9 x kaf in other months Maximum daily range 8,000 cfs	Fluctuation comparable to No-Action. Less than Balanced Resource and RTCD. More than others.
Proactive spring HFEs	Yes	Yes in CDAS and YRSF. No in others.
Spring HFEs	Yes, possible in all 20 years	Same as CDAS, SASF, and YRSF. More than No-Action, Balanced Resource, and RTCD.
Fall HFEs	Yes, possible in all 20 years	Same as CDAS, RTCD, SASF, and YRSF. More than No-Action and Balanced Resource.
Extended duration fall HFE	Yes, up to 250 hr	Yes in CDAS and YRSF. No in others.
Rapid response HFE	No	Test in No-Action and Balanced Resource. Implement in RTCD.
Load-following curtailment	Test before and after fall HFEs	Yes in CDAS (spring and fall) and RTCD (before fall only). No in others.
Trout management flows	Test and implement if successful	Test and implement if successful in most. Test only in No-Action. No in SASF.
Low summer flows	Test possible in years 11-20	Same as RTCD. Test possible in all 20 years in CDAS. No test in others.
Mechanical removal of trout	Yes	Yes in all but SASF.

Preliminary Results—Do Not Cite or Distribute

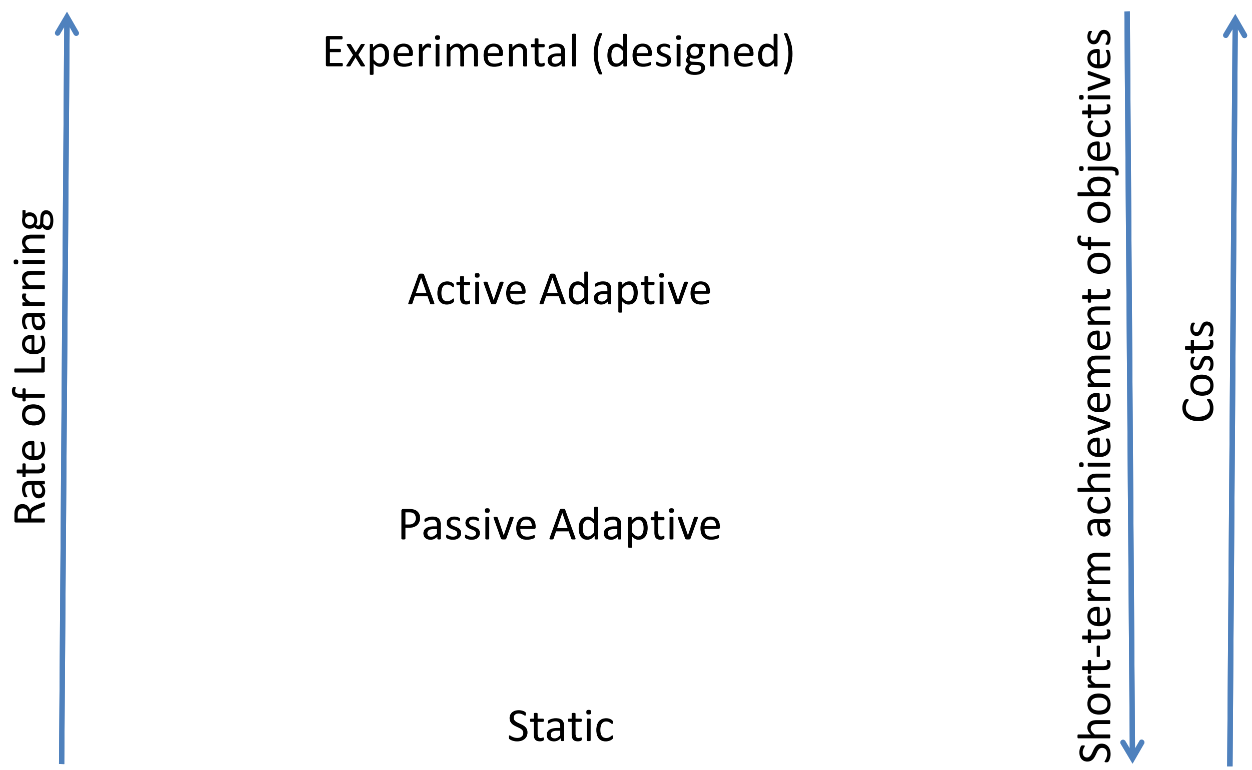
Experimental Design

Preliminary Results—Do Not Cite or Distribute

Adaptive Experimental Framework for the Hybrid Alternative

- Purpose: Implement experimental treatments adaptively to identify best practice management actions related to sediment conservation, humpback chub, food base, and vegetation control while minimizing unintended adverse effects on other resources

Active Adaptive vs. Experimental Management



Considerations

- Value of information
  - Is the uncertainty targeted by the design important? Will its resolution change future management practices?
- Feasibility of the design
  - Is the design likely to be implemented as planned? Do you control all the variables?
- Power of the design
  - Is the design likely to reduce the uncertainty very much? How large is the sample size?
- Direct costs of implementation
- Risks associated with implementation
  - What other resources of concern might be affected?
- Flexibility to adapt to surprise
  - Can the design adapt to unanticipated information?

Adaptive Experimental Framework for the Hybrid Alternative

- A condition-dependent adaptive approach was chosen rather than a formal experimental design because of
  - Difficulties in controlling for specific conditions in a system as complex as the Colorado River
  - Wide variability in temperature and flow conditions that are important drivers in ecological processes
  - Inherent risk of some experimentation to protected or sensitive resources, in particular, endangered humpback chub
  - Conflicting multiple use values and objectives
  - Low expected value of information for the uncertainties that could be articulated, and around which a formal experimental design would be established
  - Need for a flexible and adaptive program that is responsive to learning

Preliminary Results—Do Not Cite or Distribute

Experimental Treatments for the Hybrid Alternative

- Sediment-conservation experiments
  - Triggered spring and fall high flow experiments using the HFE protocol
  - Proactive spring HFEs
  - Load-following curtailment before and after fall HFEs

Preliminary Results—Do Not Cite or Distribute

Experimental Treatments for the Hybrid Alternative

- Aquatic resource-related experiments
  - Trout management flows
  - Mechanical removal of trout
  - Low summer flows
  - Sustained low flows for benthic invertebrate production

Experimental Treatments for the Hybrid Alternative

- Vegetation control experiments
  - On-ground, adaptive vegetation restoration project related to:
    - Clearing encroaching vegetation
    - Invasive species (target around campgrounds)
    - Targeted removal in wind-driven sand source areas
    - Gooding's willow restoration

Experimental Treatments for the Hybrid Alternative

- For all experimental treatments, identify:
  - Trigger conditions and objectives
  - Implementation considerations
  - Off-ramp conditions
  - Information needs
  - Adaptive response to information generated by experiment
  - Implementation of multiple tests and avoidance of confounding effects to the extent practicable

Experimental Treatments—Hybrid Alternative

Treatment	Included in Hybrid Alternative	Conditions
Spring HFEs	Possible in all 20 years using HFE protocol	Sediment-triggered
Proactive spring HFEs	Yes	Equalization years (>10 maf)
Fall HFEs	Possible in all 20 years using HFE protocol	Sediment-triggered
Extended-duration fall HFEs (up to 250 hr depending on sediment availability)	Start with a conservative increase in duration to avoid potential adverse effects	Maximum duration determined by sediment input
Load-following curtailment	Test before and after fall HFEs	Tested with fall HFEs
Rapid response HFE	No	--
Increase turbidity below Paria River	No	--
Trout management flows	Tests starting immediately to identify most effective approach, triggered afterward	Initial tests would be implemented regardless of trout number; if TMFs effective, implementation would be triggered by high trout recruitment
Low summer flows	Test possible in years 11-20 if temperatures have been cold, and determined to be necessary and appropriate	Triggered when release temperatures are sufficient to achieve temperature of > 14^{o}C only if drop to low flow
Mechanical removal of trout	Yes, model and test triggers	Use BO triggers as starting point
Sustained low flows for benthic invertebrate production	Yes	Not triggered
Riparian vegetation restoration experiments	Yes	Not triggered

Information Needs

- The value of the adaptive experimental design depends on being able to monitor key variables and resolve key relationships
- To that end, the adaptive experimental design needs to be coupled with an appropriate monitoring and research program

- The adaptive experimental framework for the hybrid alternative includes the identification of information needs related to:
  - Sediment-related experimental treatments
  - Aquatic resource-related experimental treatments, including
    - Trout management flows
    - Mechanical removal of trout
    - Low summer flows

Climate Change Effects on Evaluation of the Alternatives

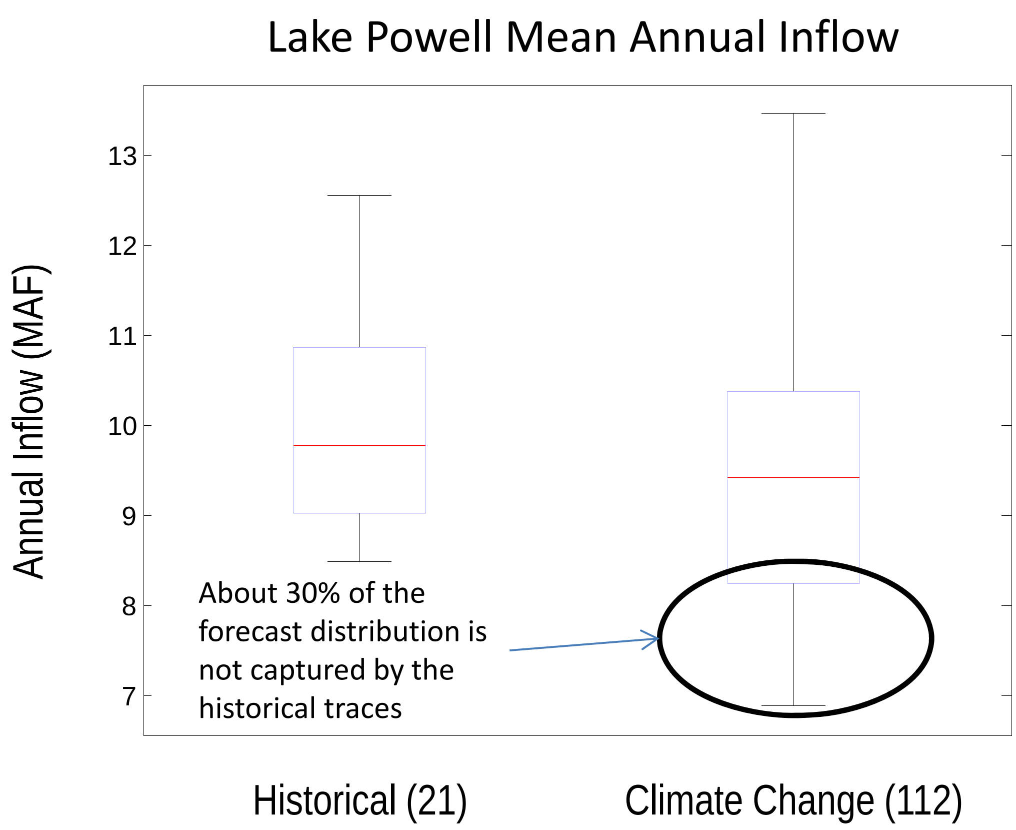
Thanks to Jim Prairie, Alan Butler, Mike Runge

Preliminary Results—Do Not Cite or Distribute

Uncertainty about Hydrology and Sediment Inputs

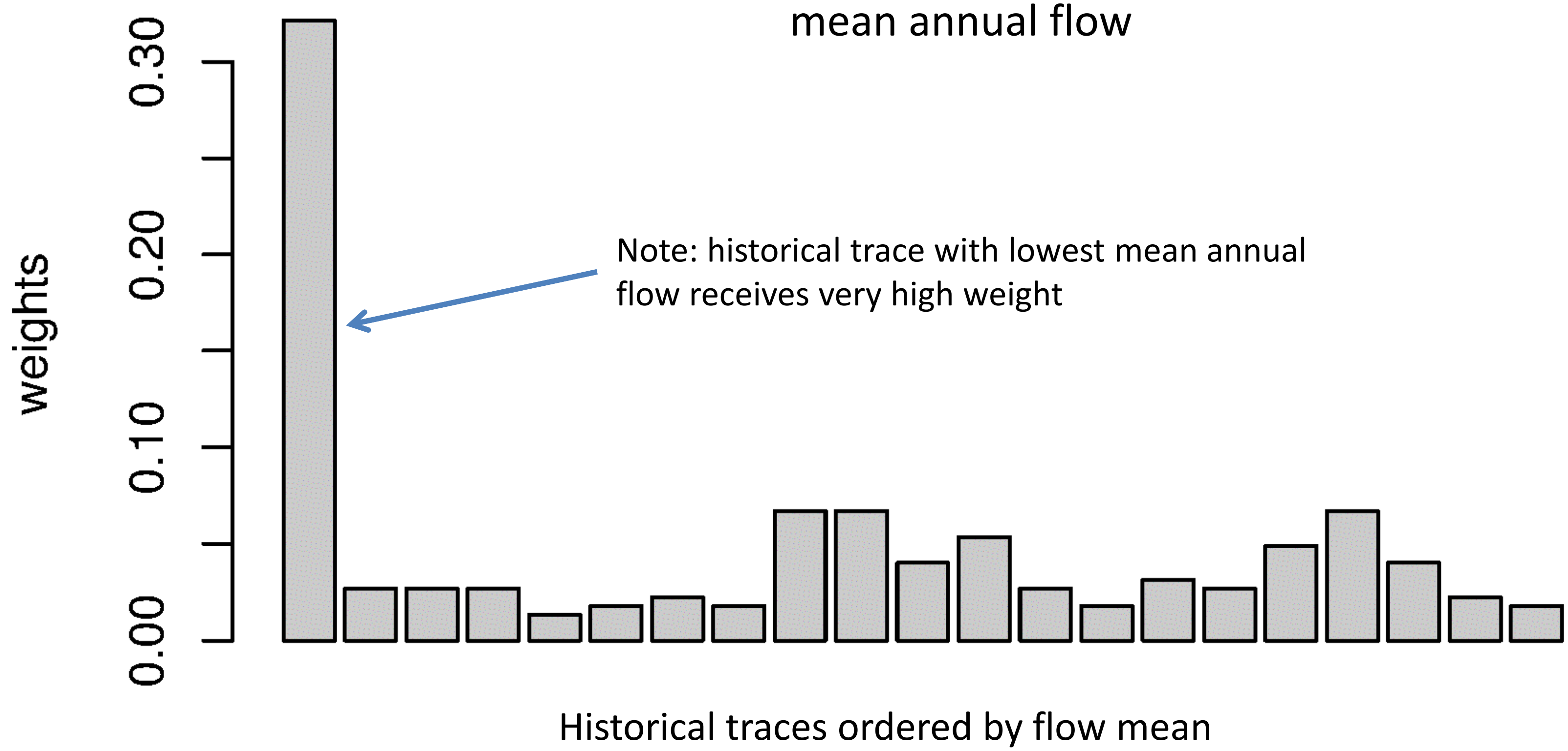
- You can examine the hydrological and sediment traces and ask whether resolution of that uncertainty would lead you to choose a different alternative
  - The value of information for resolving all sediment and hydrological uncertainty ranged between 0.0 and 5.0% improvement in performance (depending on how the objectives were weighted)
  - Almost all of that value was driven by the hydrological input, not sediment
  - In comparison to a range of 0.0 to 0.5% for the “critical uncertainties” associated with chub and trout
- Suggests that uncertainty about hydrological input might be something to consider

Climate Forecasts

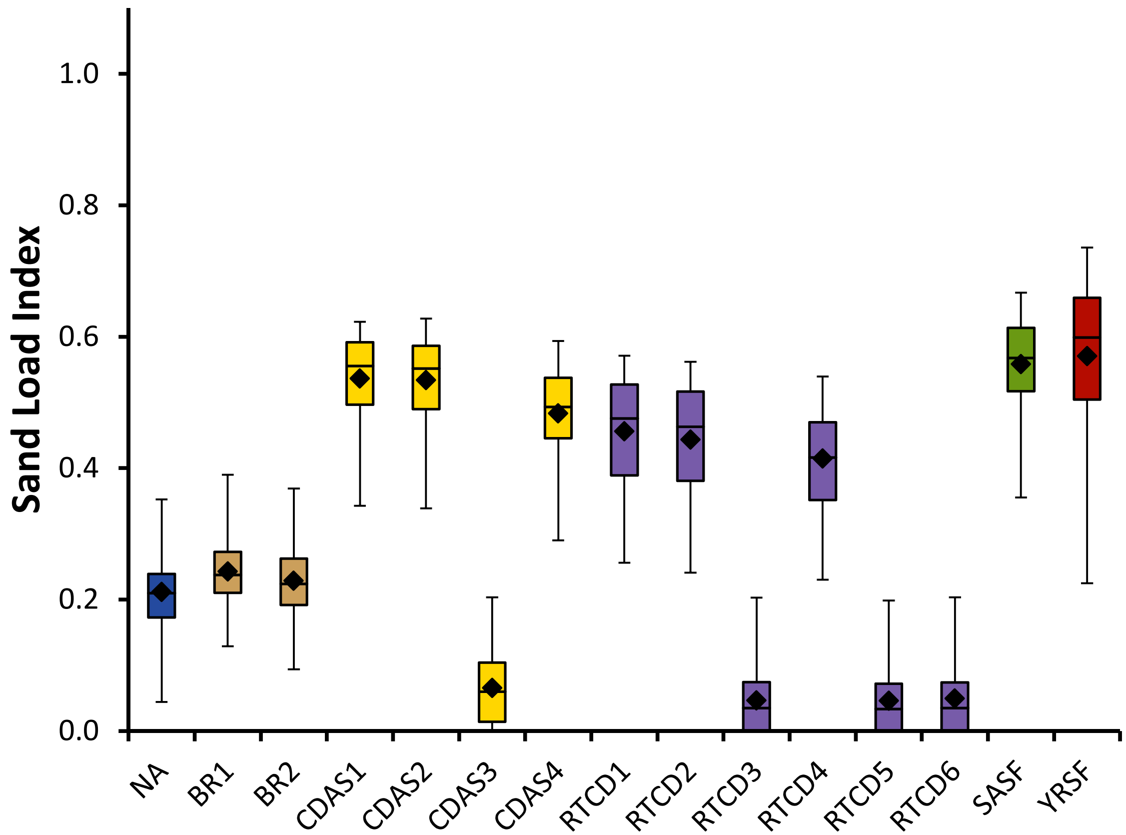


Climate Change Trace Weights

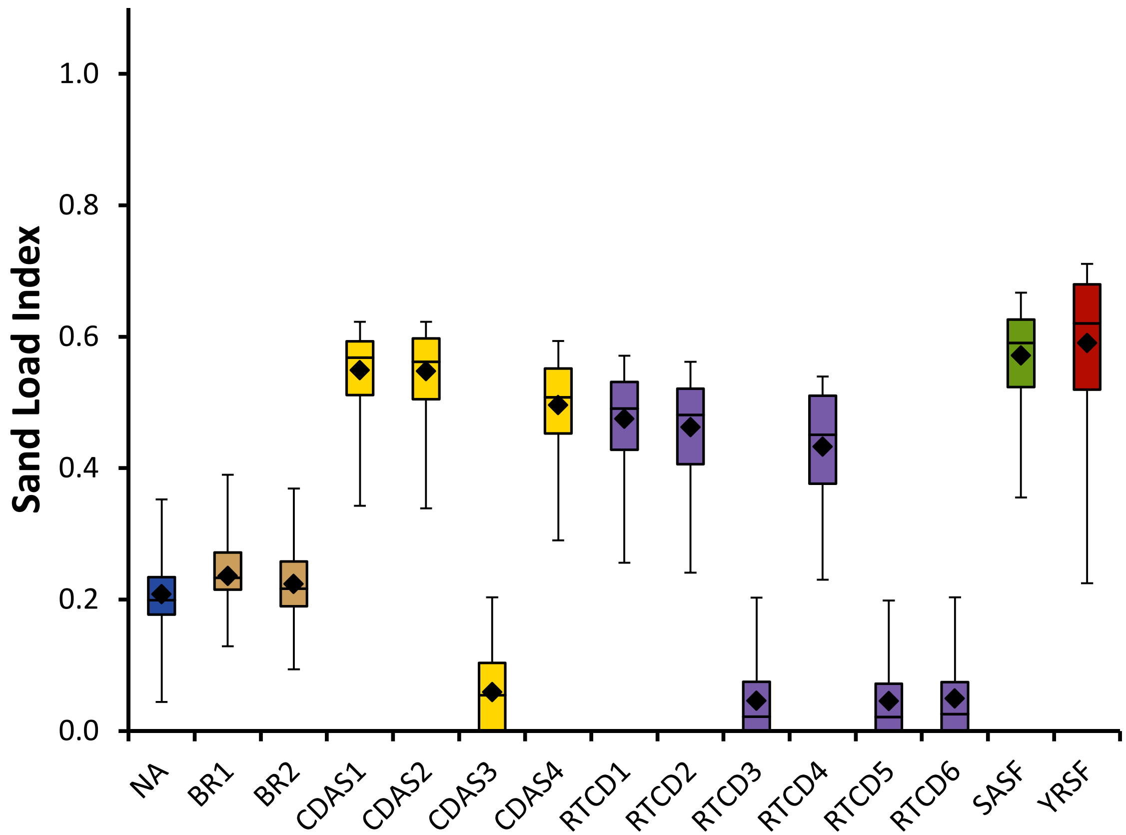
Derived from comparison of historical traces to climate traces (CMIP3), mean annual flow



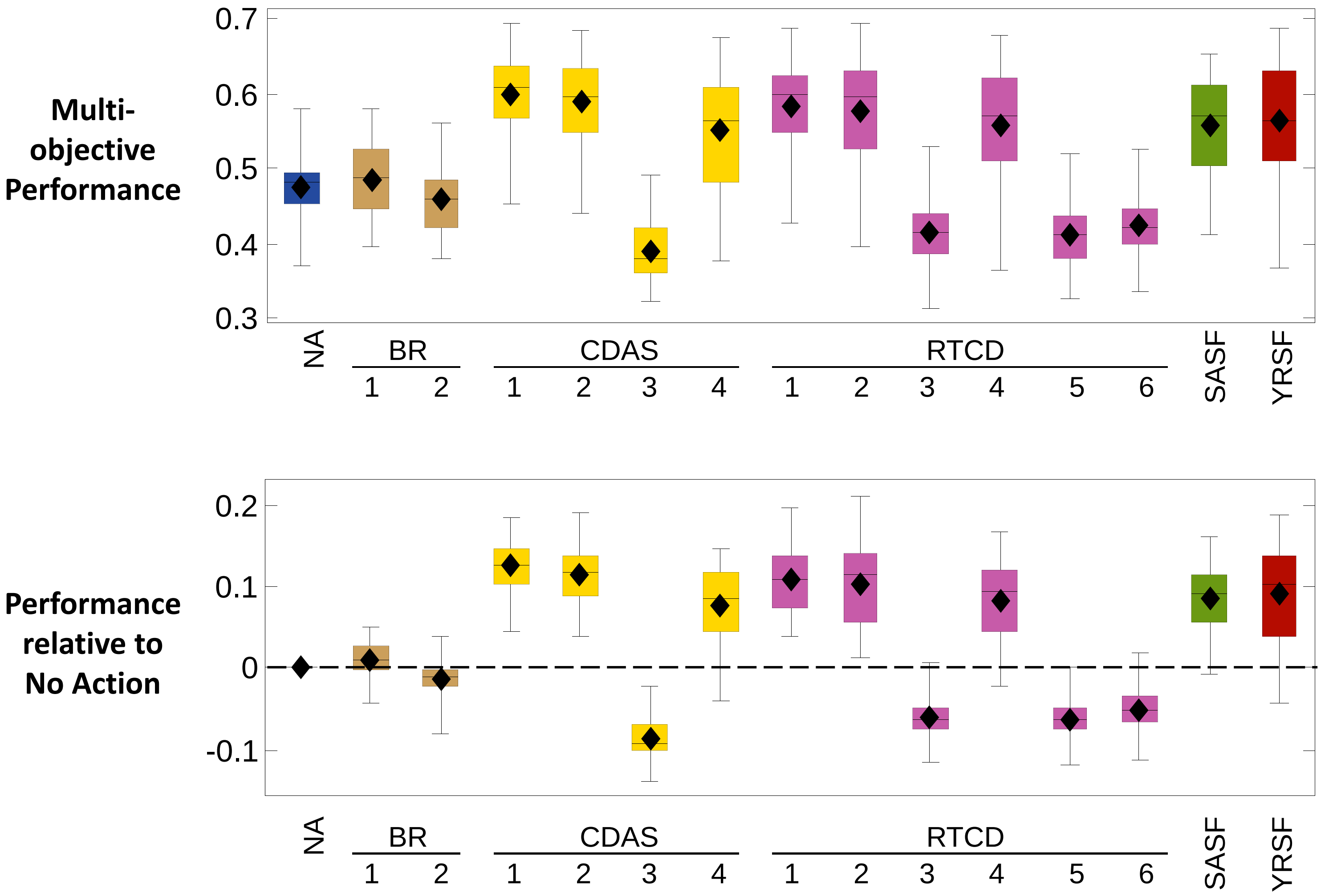
Sand Load Index, historical weights



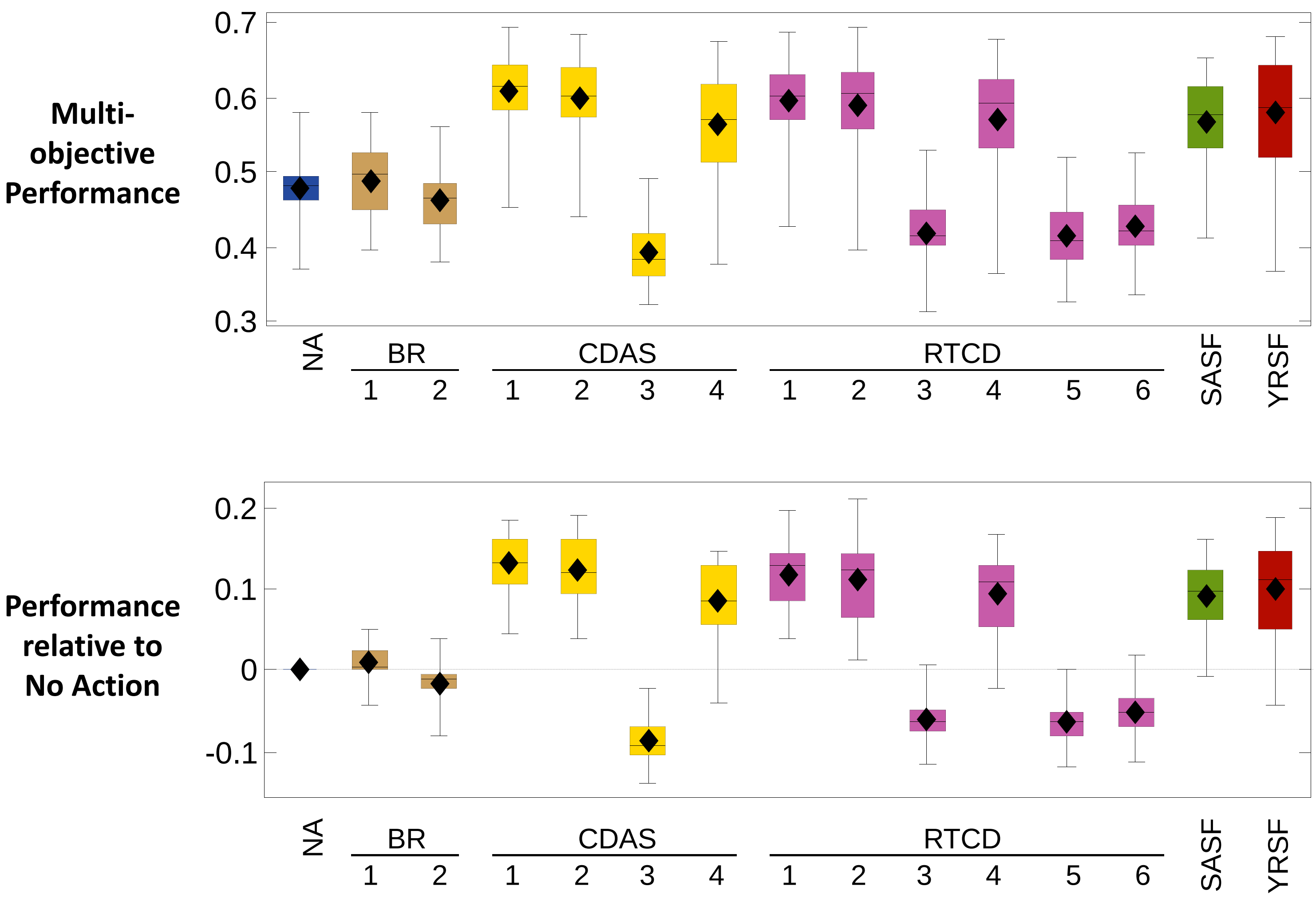
Sand Load Index, climate weights



Joint-lead (historical weights)



Joint-lead (climate-change weights)



Climate Change

- Analysis is underway
- As compared to the critical uncertainties, the hydrological traces, and hence climate change, appear to have a stronger influence on the ranking of the alternatives
  - The effect, however, is still quite small
  - Effect of sediment uncertainty was much smaller than hydrological uncertainty
- The historical traces, however, do not fully capture the range of hydrological input expected from the climate models
- There may be benefit to having the capability to adaptively respond to climate change

Process & Schedule

Current Schedule

Task	Date
Administrative Draft EIS	October 10
Complete Hydropower Analysis	November 7
CA Draft Distributed	December 1
CA Review Complete (15 business days)	December 22
Public Draft	January 30