

Glen Canyon Dam Adaptive Management Program
Science Advisor External Review of 2^d
(May 2020) Draft FY2021-23 Triennial Plan

Presentation to the Budget Ad Hoc Group
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Presentation Outline

- Review purposes
- List of projects reviewed
- Review panel selection
- Review panel members
- Review panel instructions
- Overall review findings
- Individual review findings
 - *Webinar discussion by project*

Purposes of Review

- External, expert, independent, neutral-party peer review of draft triennial work plan and budget
 - Science Advisors frequently asked to review draft annual and triennial work plans and budgets
- Reclamation request to Science Advisor (contractor):
 - Review to “provide critical comments regarding the quality of science, integration with other projects, and overall progress toward answering questions about the operation and management of Glen Canyon Dam”

Projects Reviewed

- A:** Streamflow, Water Quality, and Sediment Transport and Budgeting
- B:** Sandbar and Sediment Storage Monitoring and Research
- C:** Riparian Vegetation Monitoring and Research
 - *Includes Reclamation C.7-C.8, Experimental Vegetation Treatment*
- D:** Effects of Dam Operations and Vegetation Management on Archaeological Sites
- E:** Controls on Ecosystem Productivity: Nutrients, Flow, and Temperature
- F:** Aquatic Invertebrate Ecology
- G:** Humpback Chub Population Dynamics
- H:** Salmonid Research and Monitoring Project
- I:** Warm-water Native and Non-Native Fish Monitoring and Research
- J:** Socioeconomic Research
- K:** Geospatial Science, Data Management and Technology Project
- L:** Overflight Remote Sensing in Support of Long-Term Monitoring and LTEMP
- N:** Economic Impacts of Electrical Production at Glen Canyon Dam

Review Panel Selection

- Selection criteria
 - Well-established, demonstrated topical expertise
 - Demonstrated ability as independent, neutral reviewer
 - Ability to review multiple related projects preferred
 - No existing or potential conflicts of interest
 - *Can be challenging: GCMRC scientists collaborate widely*
- Selection process
 - Master list based on professional knowledge; literature; suggestions from Reclamation, GCMRC, previous reviewers
 - Draft list reviewed by GCMRC, Reclamation for potential conflicts
 - Final list ranked and contacted by Sound Science LLC

Review Panel Members

- **Prof. Ellen Wohl**, Department of Geosciences, Colorado State University: Projects A, B
 - **Prof. Mark Dixon**, Department of Biology, University of South Dakota: Projects C, D, and Reclamation Projects C.7-C.8
 - **Prof. Mark Sweeney**, Department of Sustainability & Environment, University of South Dakota: Project D (geology)
 - **Dr. Emma Rosi**, Cary Institute of Ecosystem Studies: Projects E and F
 - **Prof. Julian Olden**, School of Aquatic and Fishery Sciences, University of Washington: Projects G, H, I
 - **Prof. Bonnie Colby**, Department of Agricultural and Resource Economics, University of Arizona: Projects J, N
- (Projects K, L reviewed by Dr. Robert Unnasch, Sound Science)*

Review Panel Instructions

- Conflict of Interest disclaimer
- Review foci
 - Clarity and scientific quality consistent with 2016 LTEMP ROD goals?
 - Meets needs to assess resource status and trends, effects of experimental and management actions, potential other drivers and constraints?
 - Integration with other projects proposed under TWP?
 - Feasibility of accomplishing stated three-year goals?
 - Contributes to adaptive management of resources and experimental and management actions per 2016 ROD?

Review Findings Overall

- Projects with *Few* Reviewer Concerns or Suggestions
 - A, B, E, F, G, H, K, L
- Projects with *More* Reviewer Concerns or Suggestions
 - C, D
- Projects with *Greatest* Reviewer Concerns, Suggestions
 - Reclamation C.7-C.8
 - Project I, Element I.3
 - Project J
 - Project N

Project A

Streamflow, Water Quality, and Sediment Transport and Budgeting

- Science questions appropriate and relevant to assessing resource status and trends, effects of experimental and management actions
- Well integrated with other projects in TWP
- 3-year goals and elements highly feasible
- Contributions central to adaptive management of resources and experimental and management actions prioritized in 2016 LTEMP ROD

Project B

Sandbar and Sediment Storage Monitoring and Research

- Science questions appropriate and relevant to assessing resource status and trends, effects of experimental and management actions
- Well integrated with other projects in TWP
- 3-year goals and elements highly feasible
- Contributions central to adaptive management of resources and experimental and management actions prioritized in 2016 LTEMP ROD

Project C (+)

Riparian Vegetation Monitoring and Research

- Well thought out
- Strong conceptual foundation and excellent integration of elements
- Should result in better prediction of vegetation responses to flows and management under a wider range of conditions than sampled recently in CRe
- Multiple data sources and predictive models will help inform the non-flow vegetation plans and actions

Project C (–)

Riparian Vegetation Monitoring and Research

- Proposal should address historical, current, or future remote sensing methods or products that could help support modeling and guide monitoring
- Project should address plant species age structure and demography (recruitment niches) in analyses of monitoring data, meta-analysis of regional data, and construction of hierarchical models
- Proposal should address groundwater dynamics as possible influence on riparian vegetation
- Proposal should more fully address how project relates to the LTEMP experimental flows

Reclamation Projects C.7,C.8 (+)

Experimental Vegetation Treatment

- Proposal solid and well thought-out, scientifically well supported
- Basic vegetation management objectives clearly described
- Rests on “excellent start” on metrics to prioritize reaches and sites for management
- Appropriate adoption of adaptive management framework to inform restoration actions across life of program
- Close collaboration with Tribes and GCMRC will help to make the projects relevant to stakeholder concerns (including protection of cultural resources)

Reclamation Projects C.7,C.8 (–)

Experimental Vegetation Treatment

- Adaptive management process requires explicitly identifying hypotheses/questions and discussing how they will be addressed – missing from proposal
- Proposal should address how C.7-C.8 restoration, monitoring link to GCMRC Projects B, C, D, L
- Proposal should differentiate reach-based vs. site-based criteria to identify Priority Treatment Areas
- Different vegetation management objectives may warrant different prioritization criteria
- Budget information confusing; not sufficient for review

Project D (+)

Effects of Dam Operations and Vegetation Management on Archaeological Sites

- Well written
- Reasonable hypotheses informed by previous research
- Identifiable goals
- Scientific quality high, using proven methods (such as LiDAR) to address primary research questions
 - E.g., whether HFEs and resultant sandbar building increase eolian sand transport to dune areas, resulting in higher preservation potential for archaeological sites and cultural artifacts
- New and older repeat photos will help assess vegetation change over time

Project D (–)

Effects of Dam Operations and Vegetation Management on Archaeological Sites

- Proposal needs more clarity on dune types and sites representing pre- and post-dam river flows and altered eolian sediment connectivity
- Element D.1 needs more clarity on whether the project addresses (1) dunes associated with modern fluvial sources (MFS), (2) dunes associated with pre-dam Colorado River flows (relict fluvial sources; RFS), or (3) both
- Alternative hypotheses possible for importance of dune, sandbar vegetation management to eolian dynamics
- Proposal needs to clarify lack of budgeting for Element D.4 given importance of the element

Project E

Controls on Ecosystem Productivity: Nutrients, Flow, and Temperature

- Project well grounded in previously collected data and understanding of the system
- Project seeks to maintain existing datasets and advance understanding
- Project will fill clearly identified knowledge gaps, with well-conceived, doable approaches, including for aquatic macrophyte investigations (commended)
- Proposed outcomes and budget appropriate and well justified in the plan

Project F

Aquatic Invertebrate Ecology

- Project addresses crucial data needs for GCDAMP
- Projects E, F well linked; combination can provide new insights into how food web base responds to dam operations and long-term changes in the river
- Project makes maximal use of older data, continues important citizen science, continues important study of “bug flow” impacts, and aligns well with AMP needs
- Budget reasonable given proposed work; adequate to accomplish project goals

Project G

Humpback Chub Population Dynamics

- Project will continue important monitoring activities mandated by Biological Opinion associated with 2016 LTEMP ROD
- Project clearly identifies its scientific questions, follows robust methods; findings will be relevant to address BiOp Conservation Measures
- Project might consider future investigations of parasite composition beyond Asian tapeworm
- Proposed products and budget appropriate

Project H

Salmonid Research and Monitoring Project

- Project uses a robust combination of field, modeling, and laboratory techniques to evaluate the response of rainbow trout and brown trout to experimental flows, other management actions
- Proposal for Element H.2 appropriately identifies how budget constraints unfortunately will reduce number of reaches with mark-recapture sampling from 3 to only 1 with FY2022
 - Loss of replication will reduce quality/strength of inference important to AMP goals. Can this be avoided?

Project I (+)

Warm-water Native and Non-Native Fish Monitoring and Research

- Project priority, overall design, and proposed products all appropriate

Project I (–)

Warm-water Native and Non-Native Fish Monitoring and Research

- Project should also address negative impacts of competition with invasive fish species
- Proposal discussion of invasive species management is outdated. GCDAMP should comprehensively review literature and conduct formal modeling to identify gaps in knowledge on invasive species management
- Monitoring trip plan for Element I.1 will introduce gaps in knowledge due to skipped surveys in some reaches. Could other Element budgets be reduced to ensure all monitoring trips maintained for I.1?
- Proposal needs to address eDNA problems with inflated false absences and inaccurate estimates of abundance
- Proposal should strongly consider stable isotope or fatty acid analyses to determine diet composition, to complement and address limitations in conventional gut content analysis
 - This would also help identify potential competition between native and invasive fishes, in addition to predation

Project J (+)

Socioeconomic Research

- Project is an essential component of overall Work Plan
- Project provides a valuable opportunity to build on existing GCDAMP socio-economic approaches and models
- Improved understanding of socio-economic implications of flow experiments is essential to good working relationships among participating federal agencies, stakeholders, and elected officials
- Element J.1 has clear objectives and appropriately chooses cost-effectiveness analysis over cost benefit analysis

Project J (–)

Socioeconomic Research

- Project should address regional economic impacts, e.g., changes in employment and business activity as linked to GCD operations and flow experiments. Changes in recreation activity linked to themes explored in project could have ‘ripple effects’ on the regional economy.
 - Earlier phases of the GCDAMP included regional economic impact studies. Why are these not included in this or other recent work plans?
- Proposal for Element J.2 should more explicitly address integration of economic findings with Element J.1 and vice versa:
 - Both will assess cost-effectiveness in strategies to support native fish and should be “... analyzed in a comparable manner and integrated to identify optimal combinations of actions.”
- Element J.3 should seriously consider alternative metrics and alternative survey approaches “... along the lines of contingent valuation instruments”
 - Earlier phases of the GCDAMP included state-of-the-art valuation research. Why are these not included in this or other recent work plans?

Project K

Geospatial Science, Data Management and Technology Project

- Project addresses foundational needs of GCDAMP to manage and share data, crucial for adaptive management
- Proposal background statement clearly highlights need to maintain existing information while providing guidance and support to implement new technologies for data acquisition on long-term projects
- Review commends GCMRC leadership within USGS in using cloud-based resources to effectively manage, archive, and share data
- Project team is very collaborative and works effectively with a diversity of researchers within GCMRC and its partners. This is not easy given great diversity of information managed, but team is managing these challenges well

Project L

Overflight Remote Sensing in Support of Long-Term Monitoring and LTEMP

- Plan and budget well-thought-out
- Will produce imagery critical to research and monitoring in canyon
- Crucial to repeat overflight in next 2-3 years
- Project team has great experience with this work
- Greatly improved satellite imaging over next few years will likely provide same 20 cm. resolution expected from 2021 overflight. Team should plan to address this in *next* generation of Project (for FY2024-2026)

Project N (+)

Economic Impacts of Electrical Production at Glen Canyon Dam

- Project is an essential component of the Work Plan
- Hydropower and Energy Resources are central elements in the regional economy
- Improved understanding of socio-economic implications of experiments in GCD operations is essential to good working relationships among participating federal agencies, stakeholders, and elected officials
- Proposed work provides opportunities to further refine approaches and models to estimate economic effects of operational changes at GCD
- Proposed operational metrics are well-suited to assessing effects of operational changes on the economic value of hydropower

Project N (–)

Economic Impacts of Electrical Production at Glen Canyon Dam

- Proposed financial metrics, while “...central, and commonly used in decision frameworks related to hydropower production and dam operations,” “... are not a complete measure of the economic value to society of changes in cost and availability of hydropower and energy resources”
 - A complete suite of metrics would include changes in consumer and producer surplus, measured in \$/MW and \$/MWh, associated with changes in GCD operations
- Project should consider including “... a complete economic evaluation [of] changes in regional energy costs with changes in GCD operations, and the associated changes in consumer and producer surplus”
- Proposal “... does not include work related to regional economic impacts” such as “... changes in employment and business activity” with changes in GCD operations “... through ‘ripple effects’ in the regional economy”
 - Review notes, as with Project J, that regional economic impact studies related to GCD operations were important features of earlier phases of the GCDAMP. Why are these not included in this or other recent work plans given the understandable interests of Reclamation and many regional stakeholders?



Final Discussion