



Update on Status of Draft Performance Metrics for the Long-Term Experimental and Management Plan

**Technical Work Group Meeting
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Presentation Outline

- **Project Overview**
- **Stakeholder Reviews**
- **Summary of Revised Metrics by Goal**
- **Next Steps**

Project Overview (Purpose and Need)

- **LTEMP defines 11 Goals**
 - **How do we know if Goals are being achieved?**
 - **Need to define performance metrics**
- **Section 6.1(c) of the LTEMP ROD***

“The DOI, in consultation with the AMWG, will develop monitoring metrics for the goals and objectives using those in Appendix C as a starting point.”

(Note: Appendix C = performance metrics developed by Runge et al. (2016) to help select the preferred LTEMP alternative.)
- **FY 21-23 TWP, Reclamation Project C.12**

* Department of Interior, 2016, Record of Decision for the Glen Canyon Dam Long Term Experimental and Management Plan Final Environmental Impact Statement, December 2016. Bureau of Reclamation, Upper Colorado River Region, Salt Lake City, Utah and National Park Service, Intermountain Region, Lakewood, Colorado.

Monitoring & Metrics

Monitoring & metrics serve a variety of purposes.

Principal types and reasons for monitoring include:

- **Effectiveness (or Performance) Monitoring**

1. To assess effectiveness of policy, plans, or legislation
2. To evaluate progress towards achieving management objectives or regulatory standards

- **Surveillance Monitoring**

3. To detect incipient trends (“early warnings”)
4. To determine resource status in order to decide appropriate management actions

- **Validation Monitoring**

5. To increase our understanding of resource dynamics
6. To develop and refine models or predictions

This Metrics Project

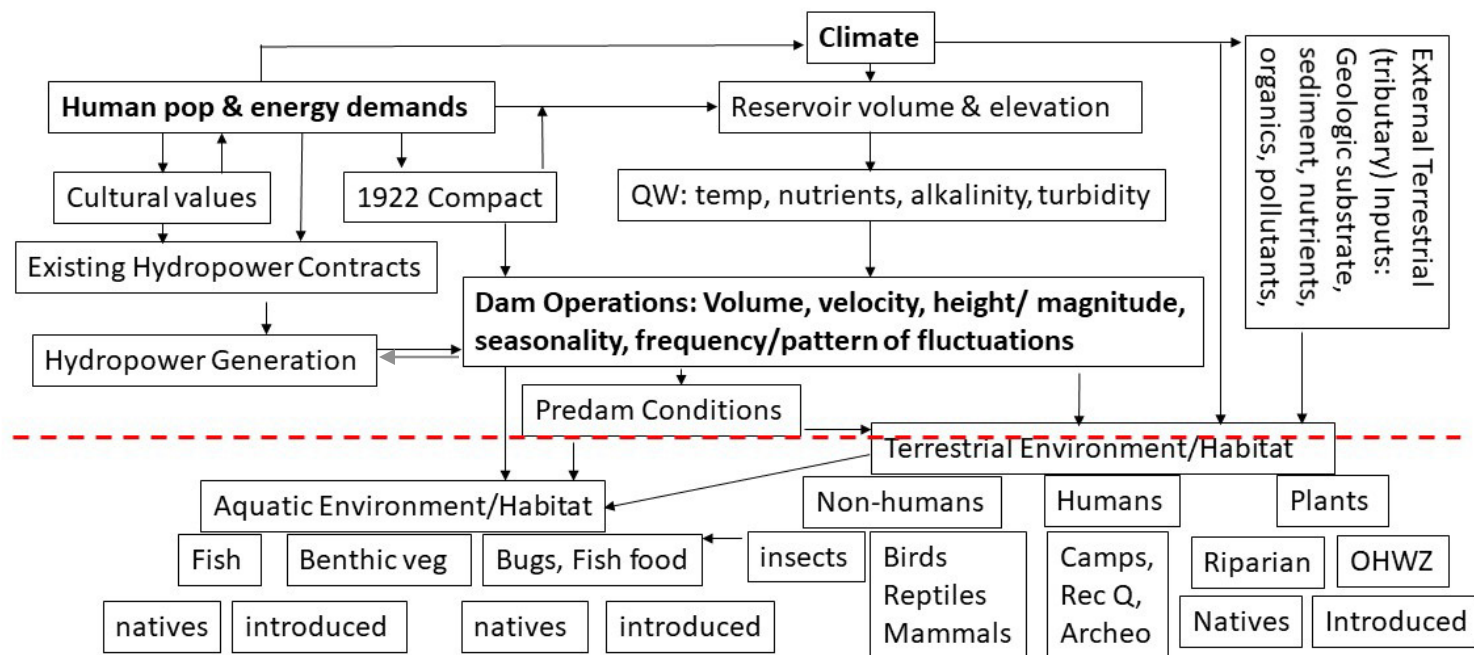
- Focus is on defining performance metrics for LTEMP goals (i.e., Are we achieving the 11 LTEMP Goals?)
- Specific focus is on defining metrics for tracking achievement of LTEMP Goal OUTCOMES
 - *For example, while sediment on the riverbed is important to monitor because it impacts fish habitat and serves as the “savings account” for HFEs, the desired sediment outcome is to “increase & retain sediment . . . above average base flow.”*
 - *Therefore, performance metrics for sediment focus on measuring sediment above 8000 cfs (~average base flow)*
- Performance metrics tell us “achieving / achieved” or “not achieved” -- not why

LTEMP Goals

- Most goals focus on specific resource categories, e.g., **humpback chub, sediment, riparian vegetation**
- Most define a general desired directional trend in resource condition but not specific targets, e.g.,
 - “Increase and retain fine sediment volume, area, and distribution . . . above the elevation of average base flows”
 - “Minimize or reduce the presence and expansion of aquatic nonnative invasive species.”
- Some level of interpretation is required in some cases, i.e. “Restore, to the extent practicable, ecological patterns and processes within their range of natural variability . . .”

Multiple External Factors Affect LTEMP Goal Outcomes

Socio-ecological drivers of CRe conditions



LTEMP Performance Metrics: Criteria

- Reflects the expected performance outcome of each LTEMP goal, not the underlying “means objectives”
- Quantifiable, replicable (metric = measurable)
- Technically & financially feasible to measure (e.g., sustainable to monitor over a long period of time)
- Relevant to the metrics used to select LTEMP preferred alternative

Draft Reports & TWG Reviews

- First draft report on metrics sent to TWG June 9, 2022; discussed at June 22022 TWG meeting
- Reviews on June draft received from AZ, CO, CA, NM, TWG chair, and WAPA
- Draft revised and sent to TWG Oct. 2, 2022; discussed at Oct. TWG meeting
- Additional reviews received after Oct. TWG meeting from UT, NM, CREDA, WAPA, GCWC, Navajo Nation
- Draft revised and additional metrics added Dec-Feb. March '23 draft currently in review by DOI agencies.
- **THANKS** to everyone who provided comments!!!

Summary of Changes since Oct. 2022

- Goal 1 (archaeological resources): **metrics added (3 metrics)**
- Goal 2 (natural processes): **3 new flow metrics added; substantial revision of text and graphics (7 metrics total)**
- Goal 3 (Humpback Chub): no major changes (3 metrics)
- Goal 3 (Hydropower): no major changes (1 metric)
- Goal 5 (Other Native Fishes): no major changes (5 metrics)
- Goal 6 (Recreation Experience): no major changes (1 metric)
- Goal 7 (Sediment): **metrics added (5 metrics)**
- Goal 8 (Tribal Values & Resources): **no metrics defined**
- Goal 9 (Rainbow Trout Fishery): no major changes (2 metrics)
- Goal 10 (Nonnative Invasive Species): no changes (10 metrics)
- Goal 11 (Riparian Vegetation): no major changes (3 metrics)

Current total of 41 metrics,; 20 are specific to fish.

Tribal Resources Goal

Goal 8. “Maintain the diverse values and resources of traditionally associated Tribes along the Colorado River corridor through Glen, Marble, and Grand Canyons.”

What if this goal instead stated:

“Maintain the diverse values and resources of all non-tribal GCDAMP stakeholders along the Colorado River corridor through Glen, Marble, & Grand Canyons.”

- **Could non-tribal stakeholders collectively define how to measure maintenance of their diverse values & interests in a few metrics?**
- **How can a few metrics adequately capture the many intangible values and sense of cultural importance that individual Tribes attach to Grand Canyon and the Colorado River?**

New Appendix: Surveillance Metrics

(Physical “drivers” of goal outcomes; important to monitor but NOT = performance metrics)

Metric Name	Measurement	Location(s)	Frequency	Method	Relevant Goals
Daily/monthly/annual releases	m3/sec (cfs)	GCD, LF, Phantom, DC	15 min increments	auto sample	All
Daily range (magnitude of fluctuations)	m3/sec (cfs)	GCD, LF, Phantom, DC	15 min increments	auto sample	All
Water Temperature	Degrees C (F)	GCD, -8 mi, LF, 5 sed gages	15 min increments	auto sample	2,3,5,6,9,10
Turbidity	fnu	6 mainstem sed gages	15 min increments	auto sample	2,3,5,6,7,9,10
Dissolved Oxygen	mg/L	GCD, -8 mile, LF	15 min increments	auto sample	2,3,5,9,10
Ph	unitless	GCD, LF	monthly	grab sample	2,3,5,9,10,11
Phosphorus (SRP, TDP, TP)	mg/L	GCD, LF, Paria	monthly	grab sample	2,3,5,9,10,11
Nitrogen (TN, NO23, NH4, TDN)	mg/L	GCD, LF	monthly	grab sample	2,3,5,9,10,11
Available Sunlight (Canyon shading)	PPFD $\mu\text{mol m}^{-2} \text{s}^{-1}$	Entire Cre- Yard et al. 2005	instantaneous	modeled	2,3,5,9,10,11
Sediment mass balance (inputs/export)	metric tons	6 mainstem gages	15 min increments	auto sample/modeled	1,2,6,7,11
Weather/climate parameter: Air Temperature	Degrees C (F)	LF, 11mi, 24.5, 70, 125, 223mi	4 min increments	auto sample	2,6,11
Weather/climate parameter: Wind intensity	km/hr	6 weather stations	4 min increments	auto sample	1,6,7,11
Weather/ climate parameter: Wind direction	degrees	6 weather stations	4 min increments	auto sample	1,6,7,11
Weather/climate parameter: precip.intensity	mm/hr	6 weather stations	4 min increments	auto sample	1,6,7,11
Weather/climate parameter: precip.amount	mm/hr	6 weather stations	4 min increments	auto sample	1,6,7,11
weather/climate parameter: humidity		6 weather stations	4 min increments	auto sample	6,11

Next Steps

- **May 2023:** Meet with DOI agencies to review & discuss March draft; receive additional input
- **June 2023:** GCMRC will revise draft report per DOI input and share final draft with TWG
- **Summer-Fall 2023:** Pilot “Metrics Dashboard” on BOR website
- **July-December 2023:** GCMRC staff will work on producing and updating actual metrics and graphics for presentation at January 2024 ARM

Questions?

