BAHG call #6: Tribal and Cultural Resources, Riparian Vegetation, Overflight Remote Sensing Socioeconomics, Recreation, Hydropower

Roll Call:

* Craig Ellsworth, WAPA
* Craig McGinnis, Arizona Department of Water Resources
* Shane Capron, WAPA
* Jacob Maase, Hopi
* Sinjin Eberle, American River
* Kevin Dahl, NPCA
* Peggy Roefer, Colorado River Commission of Nevada
* Lucas Bair, GCMRC
* Kurt Dongoske
* Jim Strogen
* Cliff Barrett
* Erik Skeie, Colorado Water Conservation Board
* Helen Fairley, GCMRC
* Michael Moran, GCMRC
* Joel Sankey, GCMRC
* Ryan Mann, AZGFD
* Lee Traynham, BOR
* Jan Balsom, GRCA
* Emily Omana Smith, GRCA
* Emily Palmquist, GCMRC
* Scott VanderKooi, USGS-GCMRC
* Tom Gushue, GCMRC
* Paul Harms, NMISC
* Theresa Pasqual, OWS
* Peter Bungart
* Ken Hyde
* Michelle Garrison
* Richard Begay

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* **Tribal Resources:** 
  + Lead researcher:
    - How is work being done helping us meet:
      * Resource goals as described in LTEMP
        + *Maintain the diverse values and resources of traditionally associated Tribes along the Colorado River corridor through Glen, Marble, and Grand Canyons*.
      * Guidance from DOI in the 2019 Petty memo
        + Future research should be tied directly to LTEMP resource goals and objectives
        + TWP and budget should focus on compliance priorities including actions necessary for compliance with the National Historic Preservation Act
      * BO Conservation Measures or PA requirements
      * LTEMP experimentation
      * Status and Trends
      * Knowledge Assessment recommendations
    - Describe how this data might be used to adaptively manage the CRE
    - How long will these studies last?
      * 1-3 years
      * 4-10 years
      * 11-20 years
    - Do we need to monitor every year?
    - Prioritization
      * 1) high priority (important and essential) to implement and/or maintain;
      * 2) medium priority (important but not essential) to implement and/or maintain;
  + **Project Element descriptions (2021-23 TWP Proposal)**
    - *D.1. Cultural Resources Program Administrative Costs*
      * Only line item here in Reclamation bucket\*
    - *D.2. Support to Reclamation for Cultural Resources Compliance*
      * Funding outside expertise for compliance obligations, HPP process. Can’t fund participation/consultation, but can fund technical expertise.
      * May be reduced need: ***however***, PA/HPP implementation likely still shows a need for outside expertise.
      * Might be a good place to bring in an intern: citing engagement of tribal youth in the Program.
      * Likely to evolve\*
    - *D.5. Tribal Associative Values Studies and Mitigation*
      * “*Momentary hybrid*”- placeholder for proposed Tribal projects. Historical property identification, associated values potentially impacted by dam operations, actions to mitigate.
      * Could be one bulk item or broken up by projects, based on preference.
    - *D.6. Cultural Sensitivity Training Development - Tribal Expertise*
      * D.6 and D.7 go together - In current (18-20) TWP, but were unable to make progress.
      * Something we’re committed to with PA, training is primarily to help support researchers/scientists understand and appreciate the cultural resources they engage with/work near.
      * Specific for consultation with tribal elders, others critical for success
    - *D.7. Cultural Sensitivity Training Video*
      * See D.7 *supra*
    - *D.8. Contingency Fund for NHPA Section 106 Compliance*
      * Parallel to NFCF; try to plan for “known work”, but there are always unexpected cases that arise. This is to have some budget in the case of unanticipated needs for mitigation.
    - *D.9. Tribal Resources Monitoring*
      * Each tribe allotted $35k/yr for monitoring, separate from Participation Fund and river trip logistics. Long-term commitment to support monitoring efforts
    - *D.X. Tribal Participation in the GCDAMP*
      * A different funding source from appropriated $’s from federal agencies annually, going to support tribal participation in meetings and planning discussions.
  + **Stakeholder discussion**
    - Kurt- One thing that strikes me is the glaring disparity between PA compliance and BO compliance under ESA. In reviewing the BOR proposition, concerned of lack of process, haven’t answered how they’ll maintain professional staff necessary for compliance. Description seems different from the TWG call: we don’t need novices, we need in-house professionals with knowledge and experience in compliance. “One piece of legislation doesn’t have priority over the other, both need due consideration.”
      * Lee- *regarding PA consultation, part of it involves an annual meeting to discuss implementation. At the March meeting, we discussed whether April should focus on “small group” discussion or a PA meeting of the parties. Consensus was that we’d postpone the PA meeting until later in the year, focus on small group discussion on budget items. Looking forward to bringing SHPO and others in, doing our best in engagement*.
        + Formal vs. informal consultation.
        + Plans to fill the empty position at BOR to increase expertise, have other folks in agencies supporting in interim and reached out to NPS, GCMRC.
      * Kurt- Haven’t had discussions with BOR re PA since last October, missing GCMRC March meeting. If BOR were making PA decisions, I would’ve appreciated a call to forward along information. Doesn’t feel as though I’m a partner: feel like the whole process of distribution has been done without much tribal involvement. Disenfranchised and disappointed that involvement not panning out as anticipated.
        + Craig E- We don’t want stakeholders to feel enfranchised, everyone ought to have a voice.
        + Lee- hard to be responsive if we don’t hear there’s something wrong. Cultural resources meeting prior to TWG is planning to be rescheduled.
      * Peter- Kurt’s points are well-taken; also important to keep in mind that each Tribe has unique perspectives on resources. Making sure we don’t get lumped together, need to recognize both differences and commonalities as we develop projects and TWP.
    - Jan- Tribal resources not just cultural resources, at times it’s a misnomer: putting in a category understates interconnectedness. PA (like BO) exists within its own legal structure: need to recognize and reinforce the difficulty of having meetings.
      * Craig E- *It’s one of our perennial problems: appreciate continued voicing, important that expression of opinion be commonplace, to keep working toward something better*.

**Archaeological and Cultural Resources**

* + Lead researcher: Joel Sankey, Helen Fairley
    - How is work being done helping us meet:
      * Resource goals as described in LTEMP
        + *Maintain the integrity of potentially affected NRHP-eligible or listed historic properties in place, where possible, with preservation methods employed on a site-specific basis.*
      * Guidance from DOI in the 2019 Petty memo
        + Future research should be tied directly to LTEMP resource goals and objectives
        + The memo also specifically calls out exploring vegetation management to protect vulnerable archaeological sites.
      * NHPA:
        + TWP and budget should focus on compliance priorities including actions necessary for compliance with the National Historic Preservation Act. Long-term lidar monitoring of archaeological sites is identified as a required monitoring activity within the new HPP; results of this monitoring will inform future treatment decisions under the HPP.
      * GCPA:
        + Research and monitoring as required by the Grand Canyon Protection Act – cultural resources are specifically mentioned in GCPA.
      * LTEMP:
        + *Explore vegetation management to benefit high value recreational beaches and protect vulnerable archaeological sites*
      * PA requirements
        + Monitoring plan for the geomorphic condition of archaeological sites is identified as a monitoring activity in the approved and final historic preservation plan. The monitoring program was developed at the request of Reclamation to provide quantitative measurements of the effects of dam operations on archaeological sites and is being used to inform treatment decisions.
      * LTEMP experimentation
        + Experimental riparian vegetation treatments to increase aeolian sand transport to cultural resource sites.
        + Spring and fall HFEs
      * Status and Trends
        + 2017: Moderate concern and declining with high confidence
      * Knowledge Assessment recommendations
    - Describe how this data might be used to adaptively manage the CRE
      * + Determine whether increasing the frequency of HFEs increases the resupply of river sand to archaeological sites in the river corridor and offsets erosion, thus achieving the LTEMP resource goal.
        + Determine if removal of riparian vegetation located between HFE-sediment supplied sand bars and aeolian dunefields containing archaeological sites increases the probability of "preservation in place" and thus achieving the LTEMP resource goal.
        + Provides data for determining future treatment types and effectiveness
    - How long will these studies last?
      * 1-3 years
      * 4-10 years
      * 11-20 years
    - Do we need to monitor every year?
    - Prioritization
      * 1) high priority (important and essential) to implement and/or maintain;
      * 2) medium priority (important but not essential) to implement and/or maintain;
  + Project Element descriptions (2021-23 TWP Proposal)
    - *Project Element D.1. Dam Operations, Vegetation Management, Archaeological Sites*
    - Project Element D.2. Monitoring Landscape-scale Ecosystem Change with Repeat Photography <new>
      * Looks at repeat photography, ecosystem changes
    - Project Element D.3. Cultural Program Administrative History <new>
      * Works on admin history, documenting concepts, literature done before. As people move on/retire, information is getting harder to find: this is a way to improve record of what’s been done in Canyon before.
    - *Project Element D.4. Holocene Map of Fluvial Sediment in the Colorado River Corridor <new>*
    - C.7 Experimental Vegetation Treatment – Grand Canyon
    - C.8. Experimental Vegetation Treatment – Glen Canyon
    - D.3. Cultural Resources Monitoring – Grand Canyon (NPS)
    - D.4. Cultural Resources Monitoring – Glen Canyon (NPS)
  + **Stakeholder discussion**
    - Craig E (to Helen)- How do three new projects (D.2-4) address this LTEMP goal?
      * Helen-
        + *D.2: As explained on TWG call, originally started work in conjunction with documenting vegetation change. Also done as a way to see how landscape has changed, how vegetation affected inland sediment transport and erosion. Continued work with volunteer labor for the past several years, accumulating information to pull together into a more formal report. Pre-dam climatic conditions would be useful, to see representativeness of photos, etc. taken during that period.*
        + *D.3: Would benefit us in the long-term to have easily-accessible resource to show compiled data over years, how dam operations affect tribal/cultural resources, and what we’ve learned from it.*
        + *D.4: Assemble in one place all different information acquired on holocene deposits in river corridor: matrix of embedded sites. Been patchwork over the year, having it in one location would be of long-term value for the Program. “Not reinventing the wheel.”*
      * Craig E- Recognize projects are important for chasing critical information. “This might be a big lever”- from an archeological point of view, do these projects being incomplete keep you up at night?
        + Helen- *Personally yes, feel like we’re losing knowledge of what’s already been learned. Memories tend to change over time, our memories aren’t all perfect or the same. “Have we changed our minds, or do we forget what’s already been discussed?”*
        + Jan- *A lot of value in D.2. We’re so dependent on vegetation components to understand how we’re to mitigate vegetation encroachment. Think we really need to look at priorities and risks: sticking with compliance-related, high-risks priorities*.
        + Rob- *For vegetation work under LTEMP, D.1 is obviously very valuable and most critical of D projects to continue. Think we would lose value. D.2 has value: not an every year need, but being able to do long-term comparison is useful*.
        + Jacob- Keeps Hopi up at night a lot. Cites false dichotomy between natural and cultural resources. “Are they taking care of these resources?” Don’t lose historical information, elders’ stories: with this body of knowledge, concerns exist.
        + Kevin Dahl- Register strong support for vegetation programs: dam has affected vegetation growth in riparian areas. Also thinks it makes sense to do not-so-costly proposed projects.
        + Peter- Hypothesis/theme is that understanding changes and losses helps inform us about the future. In comparing with admin history, does anyone regret this was done? Don’t think so. Accessibility to tribal partners and others, what form that would take is also something to note.
        + Larry- Also supports the array of programs: important to keep tribal/cultural values at forefront of process. Relationship to the natural river system vs. what tribes want to see - unsure of dimensionality there. Riparian veg restoration projects facilitate native vegetation. Lack of tall shrubbery in the river corridor, which is very unproductive for bird life: is that important to Tribes? Curious about prioritization.
        + Craig E- re: D.2-4, do you view these as short-term projects (1-3yrs) or on a longer timeframe?

Helen- Years specified in TWP.

* + - * Craig (for Joel)- could you described site selection for this project? Are there non-Type 1 or 2a in this project?
        + Joel- important to recognize that veg removal experiments and evaluation are due to long record of Lidar monitoring, etc. for over a decade. Sites were selected, suggested based on 1) a long-term data set, 2) places where veg removal made sense to increase supply of HFE sand
    - Craig E- How long do you think it will take you and team to assess experiment in terms of vegetation removal, movement of dune fields? In terms of Work Plans or longer?
      * Joel- We would like to report out on this specific experiment in last year of coming TWP. We’re in position to do this due to 10yrs+ of compiled data, future monitoring is important to discuss erosion at arch sites, ensure data integrity.
      * Leslie-
        + What specifically are HFE sites? (*vegetation being removed on sandbars, not arch sites. Resupplied with sand by HFEs.)*
        + Looking at HFE design/duration: is specific consideration given for the purpose of removing vegetation? (*No.)*
      * Cliff*-* does anyone worry about campers bothering arch sites near camping beaches?
        + Jan*- Not creating “new camping beaches” where they haven’t been in the past. Systemwide approach, but generally trying to keep people at lower levels is more protective.*

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* **Riparian Vegetation**
  + Lead researcher: Emily Palmquist, Brad Butterfield, Joel Sankey
    - How is work being done helping us meet:
      * Resource goals as described in LTEMP
        + *Maintain native vegetation and wildlife habitat, in various stages of maturity, such that they are diverse, healthy, productive, self-sustaining, and ecologically appropriate.*
        + *Restore, to the extent practicable, ecological patterns and processes within their range of natural variability, including the natural abundance, diversity, and genetic and ecological integrity of the plant and animal species native to those ecosystems.*
      * Guidance from DOI in the 2019 Petty memo
        + Future research should be tied directly to LTEMP resource goals and objectives
        + Explore vegetation management to benefit high value recreational beaches and protect vulnerable archaeological sites
      * BO Conservation Measures or PA requirements
      * LTEMP experimentation
        + Experimental riparian vegetation treatments

Non-native/invasive native species removals on camping beaches

Native species replantings

* + - * Status and Trends
        + 2017: Moderate concern and unchanged with medium confidence
      * Knowledge Assessment recommendations
    - Describe how this data might be used to adaptively manage the CRE
    - How long will these studies last?
      * 1-3 years
      * 4-10 years
      * 11-20 years
    - Do we need to monitor every year?
    - Prioritization
      * 1) high priority (important and essential) to implement and/or maintain;
      * 2) medium priority (important but not essential) to implement and/or maintain;
  + **Project Element descriptions (2021-23 TWP Proposal)**
    - Project Element C.1. Ground-based Riparian Vegetation Monitoring
      * Ben- is Project C.2 to remove vegetation from campsites?
      * Request from river guides to work with NPS on targeting specific places/reaches that would benefit camping. Certain places where we could be more time-efficient in targeting where campers would want to set up.
        + Jan- were looking at that, but we’ll look and circle back.
    - *Project Element C.2. Mechanistic Experiments with Plant Species of Interest <new>* 
      * Seth- Noting this as ‘experiential learning’ -should this not happen, is there robust literature to pull from?
        + Brad- some aspects of hydrograph influencing vegetation may be difficult to parse out.
        + Element is also a good “bang for your buck”

Emily- A lot of literature focuses on cottonwoods, other willows; but arrowweed and other understudied species are dominant.

* + - * Seth- recall different model used during LTEMP days than what’s contemplated here. How is this approach perhaps more superior than modeling approaches taken then?
        + Amount of quantitatively-relevant data collected over the last two TWPs was really substantial.
        + Emily- Not incredibly familiar with those models, but understands they were very general in what they were modeling. Hopefully climatic/hydrological data from other systems could improve our modeling capabilities.
      * Larry- Could Emily briefly summarize our C.2 experiments?
        + Emily (on Pilot)- *ran last summer for ~3mo. Had arrowweed exposed to different flooding levels, measured response. Arrowweed flooding for longer at greater depths was more stressed out, did worse off. None did so poorly that they died: even flooded arrowweed did quite well. “How long of a high flow would reduce arrowweed cover?”*
        + Brad (on next TWP)- *Pilot was super valuable, but we would change some things. Good infrastructure is already in place. More work on arrowweed in this generation to reflect flooding and drought stress. Also adding more treatments to cut plants back, relevant to Active Management paradigm, and assessing regrowth capacity. Work on Goodding's Willow in the canyon, important for avian habitat; most plantings have been unsuccessful. Bacarus is becoming dominant and acts weird in the canyon, which is unusual in most river systems: many aspects of its biology are understudied.*

*Clonal plants with extensive root systems store high amounts of energy: what are regrowth and storage capacity limits? What is actually limiting its distribution?*

* + - * Larry- Suggests looking at root structure. Looking at these structures, how it roots, depth is unique for each species. Some plants also emit oxygen through root systems: whether arrowweed does that is a good question, might take additional experimentation.
        + Emily- *agree, was stunned/alarmed. Some sandbar spots have eroded enough with Bacarus to see runners between plants*.
      * Larry- looking for AMWG-level policy discussions to clarify long-term vegetation goals.
        + Brad- *We need stakeholder input with respect to precise vegetation conditions they would be interested in seeing*.
      * Leslie (on modeling): we have LTEMP/ROD, operating under ROD, required operations under ROD doing as anticipated: if we’re embarking on different models, would we be able to reach certainty in the meeting of their objectives?
        + Reminder that this project was built in as an integral part of the selected alternative for mitigation of dam operations on vegetation. “*to the best of our ability, maintain or improve natural state*.”
        + Model outputs are vegetation goals as outlined in the ROD: modeling approach addresses resource characteristics, helps to judge whether they’re being accomplished in a nuanced way.
    - *Project Element C.3. Predictive Modeling of Vegetation Responses to Dam Operations* 
      * Seth- After this task were to be completed, would we have an actual model run to predict veg response?
        + Brad- *Yes, with caveat that model won’t be perfect and some parts may be guesswork. But this work plan is geared towards this type of model development. “Putting the Grand Canyon in context”.*
      * Seth- totally support development of a predictive model of this nature. DId not hear that prior approach did not get a lot of consideration, would encourage closer look at what was done before, not “recreate the wheel”. Interpreting resource goals is also critical: what will the model forecast out?
        + Larry- if model only based on current conditions, etc., won’t be able to get an understanding of potential for wildlife supporting habitat. Part of the objective is precisely to identify more precisely the mechanisms excluding particular species, identifying scenarios supportive of those vegetation types.
    - Project Element C.4. Vegetation Management Decision Support
    - *Project Element L.1. Overflight Remote Sensing (see below)*
* Data sets derived from remote sensing overflights are essential to most of the past and present research projects conducted by GCMRC (*Table 1*)
  + - * Overflight conducted at the end of May 2021, ~1yr period to build “image mosaic”: visually consistent dataset of images from Dam to Pearce Ferry published, incorporated into online GIS mapping. Mapping of sediment, vegetation, river channel, etc.
* LTEMP planning was based on research which relied heavily on data from previous overflights
* LTEMP ROD implementation will rely on data from past and future overflights
* GCMRC’s Scientific Monitoring Plan: LTEMP ROD “*calls for a comprehensive, decadal-scale assessment of the impact of dam operations*” on multiple resources
* LTEMP Resource Goals: Imagery and derivative data products from overflight remote sensing are used either directly or indirectly by nearly every GCDAMP TWP science project to address every resource goal
* A scientific effort that has both an immediate and a longer-term payoff:
  + LTEMP implementation
  + Decadal-scale changes to resources system-wide
  + **Stakeholder discussion**
    - Craig E- since it’s a “big ticket item”, it’s not a “will you lose sleep?” but “how much sleep?”
      * Joel- *we have put this off since last overflight in ‘13. Time is now to do it, I would lose quite a bit of sleep*.
      * Jan- *Agree, aerial flights have been so important; concern is less availability of funds in the future. Better shot at funding it now than 3yrs from now, would be a good time to get it going.*
      * Seth- *Support need of imagery*
    - Seth- thinking it is so important for long-term, are there less-expensive acquisition techniques in play? Satellite imagery, etc.?
      * Joel- *haven’t jumped over it, there were different analyses. Looking at this question in the 2000s, the answer at the time was no. Since then, more work has been done to keep up with satellite imagery, etc. Even did work evaluating satellites/sensors with most promise. Not at the point of getting data compatible with aerial imagery.* 
        + Seth- encourage thinking that more frequent collections may be more valuable, based on characteristics we want to know. Want to recreate “gold standard” imagery, but may not be necessary.
    - Erik- Do any nearby projects need to do imagery in the similar timeframe?
      * Joel- *nationwide program exists, overseen by USGS, with the goal of securing chunks of airborne lidar data for the entire country this decade. One of the remaining places to image is the Grand Canyon*. Coordination of acquisitions at the same time for imagery might show promise.

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* **Socioeconomics** 
  + Lead researcher: Lucas Bair
    - How is work being done helping us meet:
      * Resource goals as described in LTEMP
      * Guidance from DOI in the 2019 Petty memo
      * BO Conservation Measures or PA requirements
      * LTEMP experimentation
      * Status and Trends
      * Knowledge Assessment recommendations
    - Describe how this data might be used to adaptively manage the CRE
    - How long will these studies last?
      * 1-3 years
      * 4-10 years
      * 11-20 years
    - Do we need to monitor every year?
    - Prioritization
      * 1) high priority (important and essential) to implement and/or maintain;
      * 2) medium priority (important but not essential) to implement and/or maintain;
  + **Project Element descriptions (2021-23 TWP Proposal)**
    - *Project Element J.1. Predictive Models for Adaptive Management* <new>
      * Lucas- Potential for TMF implementation, analyzing trout survival, observational uncertainty, other aspects pertinent to adaptive management. Also extend work for modeling specific to HBC over to sediment; how to integrate with hydropower, effectively meeting goals.
    - *Project Element J.2. Brown Trout Incentivized Harvest* <new>
      * Support NPS with incentivized harvest implementation; working with Kim at GCRA, see who’s participating (additional, existing anglers). Also collaborating with AZGFD, CREEL data component. Follow-up surveys: take IH program data to get an idea of perception, types of incentives to best facilitate participation.
  + **Stakeholder discussion**
    - Jim Strogen- are you looking to pinpoint ideal IH reward as part of your study?
      * *Yes, working with Ken and ideally we use a mix of fixed payments and raffle payment to develop an effective and cost-effective program*.
        + Costs of Boat ramp vs. walk-in fishery taken into consideration.
      * Ken- *First few years would see the same prices, hoping for only few BNT down in that area because they could kick downriver. Would turn in heads without adjusting payment to where they were caught*.
      * Lucas- other programs involve only a handful of anglers being the most productive pieces of the program. Don't want to promote cheating or changing characteristics of the fishery that would impact others.
    - Jim- Is the tribal component also involved?
      * *not a specific element, but survey work with tribal participants could be implemented.*
    - David Rogowski- hope we’re looking at efficiency of regular anglers compared to tribal anglers, what would get the “most bang for your buck”.
      * Ken- *we’re keeping track, trying to keep costs reasonable. In PA preparations, especially involving youth angling trip participation, it’s important to also have tribal elders on trips to share traditional practices and knowledge in the process*.
        + temporal tournaments vs. year-long incentive/reward.
      * Plan on collecting data cards with participants, making it available to AZGFD for incorporation into CREEL data. Split river into sections for purposes of quantifying data.
    - Jim- Are we planning to increase monitoring/supervision re: IH efforts?
      * Ken- for the first few months. It’s a good consideration, something to think about. With no idea on the amount of future interest, will be in the background in the case of busier weekends.

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* **Recreation**
  + Lead researcher: Lucas Bair
    - How is work being done helping us meet:
      * Resource goals as described in LTEMP
        + *Maintain and improve the quality of recreational experiences for the users of the Colorado River Ecosystem. Recreation includes, but is not limited to, flatwater and whitewater boating, river corridor camping, and angling in Glen Canyon.*
      * Guidance from DOI in the 2019 Petty memo
        + Future research should be tied directly to LTEMP resource goals and objectives
        + Explore vegetation management to benefit high value recreational beaches and protect vulnerable archaeological sites
        + Explore the feasibility of conducting a spring HFE, along with modeling for improvements and efficiencies that benefit natural, cultural, recreational, and hydropower resources
      * BO Conservation Measures or PA requirements
      * LTEMP experimentation
        + Spring and Fall HFEs (2012, 2013, 2014, 2016, 2018)
        + Experimental riparian vegetation treatments

Non-native/invasive native species removals on camping beaches

Native species replantings

* + - * Status and Trends
        + 2017: Significant concern and declining with strong confidence
      * Knowledge Assessment recommendations
    - Describe how this data might be used to adaptively manage the CRE
    - How long will these studies last?
      * 1-3 years
      * 4-10 years
      * 11-20 years
    - Do we need to monitor every year?
    - Prioritization
      * 1) high priority (important and essential) to implement and/or maintain;
      * 2) medium priority (important but not essential) to implement and/or maintain;
  + **Project Element descriptions (2021-23 TWP Proposal)**
    - *Project Element J.3. Recreation Monitoring and Research* <new>
      * Surveys in previous TWP to update/expand on work done long ago on flow preferences, economic values on trips. No specific M&R in this TWP: thought best, most cost-effective way to compile recreational information was surrounding flow experiments. Identify with help of stakeholders specific attributes that might impact recreation, do small but focused surveys to collect information.
  + **Stakeholder discussion**
    - Jim- are Bug Flows in this bucket?
      * Lucas- *haven’t assumed so, but any sort of experiment we can identify as having potential for data collection is fair game*.
    - Craig E- “How has bug flows affected recreational fishing in this area?” type of questions in this project?
      * *Yes, add specifics to what they’ve experienced, also questions to identify other flows, preferences to other experimental flows*
    - Jim- Important to know which experimental flows they experienced.
      * Collective decision on important questions to ask. Idea that there’s a lot of survey oversight, but that you can do some general approval processes but they need to be specific and not extremely lengthy.
    - Will this be for development with the CAHG?
      * J.3 as approved would be further developed during the work plan, not necessarily prior.

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* **Hydropower and Energy (Project N)**
  + Lead researcher: Lucas Bair
    - How is work being done helping us meet:
      * Resource goals as described in LTEMP
        + *Maintain or increase Glen Canyon Dam electric energy generation, load following capability, and ramp rate capability, and minimize emissions and costs to the greatest extent practicable, consistent with improvement and long-term sustainability of downstream resources.*
      * Guidance from DOI in the 2019 Petty memo
        + Future research should be tied directly to LTEMP resource goals and objectives
        + The Department of Interior has recently prioritized the responsible development and production of renewable energy on federal lands. The GCDAMP is encouraged to work within the LTEMP framework to seek ways to improve the value of the hydropower resource.
        + Maintaining dam releases consistent with applicable laws
        + Consider impact to hydropower as part of the development of LTEMP experiments and study plans
        + Continue to utilize operational flexibility in response to varying hydrological and other resource-related conditions
      * BO Conservation Measures or PA requirements
        + none
      * LTEMP experimentation
        + none
      * Status and Trends
        + 2017: Moderate concern and declining with high confidence
      * Knowledge Assessment recommendations
    - Describe how this data might be used to adaptively manage the CRE
    - How long will these studies last?
      * 1-3 years
      * 4-10 years
      * 11-20 years
    - Do we need to monitor every year?
    - Prioritization
      * 1) high priority (important and essential) to implement and/or maintain;
      * 2) medium priority (important but not essential) to implement and/or maintain;
  + **Project Element descriptions (2021-23 TWP Proposal)** (proposed change)
    - Development of GCD operational experiments during WY 2021 – 2023
      * Bug Flows
      * Trout Management Flows (TMF)
      * High Flow Experiments
    - Hydropower Improvement Experiments <new>
  + **Stakeholder discussion**
    - Lucas- Project N was a new, more general project under current TWP to conduct modeling with external partners to add value on our knowledge of GCD, hydropower generation. ARM presentation on renewables, integration of hydropower into matrix; some WAPA work might be too premature re: emissions, interests in hydrograph designs associated with LTEMP experiments. Given the limited budget for N, can only work on so many aspects of modeling: hydrograph design and impacts (overlap with J), etc.
    - Larry- This gets at overall AMP LTEMP directions recommended previously, don’t seem to gain much traction on. Perhaps this is the first step in that process.
      * Leslie- Some elements of the rewrite were specifically metrics that DFC group has established back in those days. Proposed using old metrics.
    - Erik- more clarification on hydropower improvement experiments. LTEMP didn’t contemplate these, how does this interact with ROD?
      * Lucas- think there’s been strong requests (CREDA) for more creativity within constraints of ROD to consider opportunities for improvement of the hydropower resource and long-term capacity. Participating in modeling may also promote opportunities to manage hydropower for improvement.
        + Leslie- *comporting with ROD objectives to ‘maintain or improve’. Recognize preferred alternative, current regime does not improve, but trying within the constraints to find ways to meet that ROD objective*
        + Cliff- *another goal is to also look at impacts from existing and planned experiments as part of Project N.*
        + Shane- *Think we’re leaving the door open to exploring options that may be interesting to propose in future with additional NEPA work, mitigation attached.*
    - Ben- In preparing for comments due Wednesday, saw cost breakdown by project. Is there a shared document that has these specifically to look at?
      * *Yes, Lee sent out new tables broken down by project element. Email’s out there, can have Craig forward them if unable to find*.