1.80 David Lass

I filled out the survey. Attached are a few tools **1) an aquatic monitoring protocol for permitting requirement,** 2) strategic plans, and 3) branding guidelines.

Monitoring Plan: Truckee River Fish Habitat Improvement Project

A. Function(s) of Impacted Water Resources

The Middle Truckee River flows out of Lake Tahoe at Tahoe City to the California-Nevada state line, with a number of tributaries contributing streamflow upstream of the project reach. The larger tributaries include Bear, Squaw, Donner, Trout, and Martis Creeks. Prosser Creek flows into the Truckee River immediately below the project reach, and the Little Truckee River flows into the Truckee River roughly 3 miles downstream of the SFFCC. The contributing watershed area at the project site is approximately 640 square miles, including the Lake Tahoe basin.

The Middle Truckee River has a history of repeated glaciation, most recently in the late Pleistocene (from about 250,000 to 15,000 years ago). Glaciers moved large amounts of material from surrounding peaks to the valleys where it was deposited as till and glacial outwash. Geologic mapping compiled by Saucedo (2005) indicates that the reach of the Truckee River between the Town of Truckee and Boca is largely confined within the glacial outwash features. Much of the glacial outwash features were derived by glacial outburst floods ('jokulhlaups' of Birkeland, 1964), which left behind large boulders that now control the locations of riffles and pools in the system. As a result, the Truckee River at this location takes on a sinuous channel form created roughly 20,000 years ago, with very limited or no active channel migration or meandering occurring since that time.

Channel bed material appears to have a bi-modal grain size distribution, with steeper boulder riffles separated by lower-gradient gravel and cobble reaches that exhibit a more dynamic riffle-and-pool morphology within the confines of the channel. Channel gradient varies from 1.2 percent in the steeper boulder riffles and 0.6 percent in the gravel and cobble reaches. Scour pools have formed in gravel and cobble substrate at the tail of boulder riffles, as well as around very large immobile boulders, where localized scour may occur. In many boulder riffles, cobbles and small boulders have become arranged to form step pools, natural weir structures, while very large immobile boulders have induced localized scour.

Channel migration throughout much of this section is limited by bank material composed of very coarse outwash deposits, as well as infrastructure such as embankments and abutments for the Union Pacific Railroad and I-80 crossings. The railroad maintenance roads and embankments do not appear to be maintained for sediment and erosion control; in many places, the railroad is essentially built within the channel, with dry gravel and exposed sediment readily available for transport and deposition. The gravel-cobble reaches appear to be more dynamic than the boulder riffles and follow a somewhat predictable form (i.e. riffle-pool-glide).

Streamflow from Lake Tahoe, Donner Creek, and Martis Creek, and Prosser Creek is controlled by major dams or impoundments, with the timing of releases and streamflows guided by a number of court decrees, agreements, and regulations that govern the flow rate from California to Nevada. With 3 dams in place upstream of the project site, wood transport in this portion of the Truckee River is considered to be limited.

Until recently, the Truckee River has been operated according to the Truckee River and Reservoir Operations Model. Recently, the Truckee River Operating Agreement (TROA) has been put into effect, and has the potential to change the operations of the Truckee River system to accommodate multiple beneficial uses for drought supply, endangered and threatened fish species, water quality, California water use, and storage. In addition, operations under TROA have the potential to enhance riparian habitat, reestablish river canopy, enhance reservoir releases, and improve recreational pools in reservoirs.

B. Project purpose and goals

This project would evaluate and quantify the efficacy of glacial outwash river restoration (i.e. Truckee, Carson, Walker) at improving physical aquatic habitat and benefiting aquatic species and ecosystem condition compared with pre-restoration monitoring, to inform future restoration design, and as a basis for ongoing adaptive management. The project will accomplish this through the implementation of on the ground monitoring of physical habitat characteristics and aquatic ecosystem species assemblage and productivity in a small section of the Truckee River, CA., slated for restoration beginning in October 2016.

Site specific monitoring in this system would be implemented with the goals of: a) establishing baseline aquatic habitat and species conditions as the basis for post project monitoring, b) quantifying restoration effects on aquatic biota, including native and introduced fish communities, amphibians, and benthic marco-invertebrates as a basis for additional restoration actions and ongoing adaptive management, and c) contributing to the broader efficacy of glacial outwash river restoration by providing a template for collaborative, science-driven restoration of aquatic function on private lands.

C. Measurable Performance Standards

1. To implement pre-project aquatic system monitoring (ongoing) and a 2-year post-project aquatic system monitoring for the Truckee River Fish Habitat Improvement Project.
2. To quantify fish response to restoration actions (including native trout, mountain whitefish non-target native species such as tahoe suckers, redside shiners, and speckled dace, and introduced invasive or competitor species such as rainbow trout and brown trout) through repetition of a previously designed and tested coupled monitoring and hydrologic modeling methodology
3. To quantify effects of restoration on physical habitat attributes critical for aquatic systems and species (including temperature, flow, dissolved oxygen, turbidity, conductivity, and extent and diversity of physical habitat) through implementation of a previously designed and tested coupled monitoring and hydrologic modeling methodology.
4. (Based on 1-3) To make recommendations for additional restoration actions, and ongoing adaptive management needs

5. To provide a template for quantifiable, science driven glacial outwash river restoration that can be applied to other planned projects in the region.

These actions will increase the conservation benefits of glacial outwash restoration projects, collect and analyze much needed supporting data on the methods and outcomes of restoration efforts, and improve the overall ecosystem benefits of river restoration, by informing their ongoing design and application to the benefit of native fishes and aquatic systems.

D. Monitoring Parameters and Protocols

Monitoring is an essential component to any successful restoration project, providing critical information about a system that allows managers, researchers, and practitioners to identify problems, define and quantify successes, and make informed decisions about adaptive management. Building a cohesive monitoring design that is repeatable, provides scientifically credible data, and meets the critical information needs of a given project is a difficult task that requires considerable investment in planning and design.

Based on an in depth review of mountain stream and river restoration projects across California, informed by our backgrounds in aquatic ecosystem analysis and restoration, our team developed detailed monitoring approach to quantify physical and biological effects from stream and meadow restoration, and to better understand the potential of that restoration to positively benefit aquatic systems and species.

Breakdown of our Monitoring Protocols

1. In order to **establish pre-restoration baseline conditions**, **and post-project conditions** of a) fish community, b) sensitive aquatic species c) physical habitat complex, and d) ecosystem condition, we will design and execute a monitoring program including:
    - Monitoring physical stream habitat parameters within the restoration area including, temperature, stream discharge, groundwater level, water quality parameters (DO, specific conductivity, turbidity).
        - To occur on a quarterly basis starting January 2017 and to run over the course of a two year period.
    - Monitoring sensitive aquatic species distribution and abundance by reach within the restoration area, as well as indicators for aquatic ecosystem productivity.
    - Performing a field habitat typing analysis (see attachment Stream Inventory Handbook) of the restoration site to quantify area of specific habitat types by stream reach, post restoration.
        - To occur during low flow and then be combined with an existing hydraulic model to quantify available habitat at the range of flows occurring over the period from initial design through restoration completion and subsequent to the conclusion of our two year project period.

2. In order to **quantify (temporally, spatially) the effects of the restoration efforts** in the restoration reach, we will perform analysis of pre and post project data including:
    - Relating pre and post project results from monitoring to quantify restoration effect in terms of:
        - Changes in physical habitat conditions under different flow regimes
        - Changes in nature and extent available habitat
        - Changes in distribution and abundance in fish species
    - Analyzing fish distribution by species relative to specific habitat type and modeled under a range of flow regimes for multiple potential hydrologic scenarios in order to evaluate:
        - The impacts of specific restoration actions on species distribution and abundance, as a function of habitat
        - The relative benefits of the larger restoration methodologies, in the context of pre-project conditions and the specific needs of native fish
        - Conducted through e-fishing methods once per year during low flow periods.

3. In order to **capture and disseminate the information** above, as well as additional restoration and adaptive management recommendations based on findings, a final report and annually reporting to the State Water Board will be assembled and disseminated to project stakeholders that includes:
    - Spatial analysis of pre and post-project habitat extent and sensitive species distribution and abundance.
    - Assessment, based on quantitative analysis of (initial) restoration effects on habitat, species, and ecosystem condition
    - Prioritized recommendations for additional restoration actions
    - Prioritized recommendations for ongoing adaptive management and monitoring

    Additionally, findings will be incorporated into a broader analysis of trends in glacial outwash river restoration impacts on native fish to be submitted for publication in a peer reviewed scientific journal at the conclusion of the project (if appropriate).

Additional Monitoring

Over the past twenty years, a range of mountain stream and river restoration methodologies has become increasingly common as approaches to restore critical riverine functions including bolstering upper elevation water retention, resulting in flood peak attenuation and delayed runoff. Changes to hydrology and geomorphology as a result of restoration, including increased aquatic habitat heterogeneity, improved river-floodplain connectivity, increased groundwater retention, and elevated baseflows, also have the potential to provide a broad range of benefits, for aquatic and riparian species. For native fish and amphibians, specifically, potential benefits include improvements to total habitat area and in-stream conditions, habitat diversity capable of supporting higher densities of organisms and a broader array of life history stages, ecosystem productivity and prey density, availability of thermal refugia during low flow periods or under climate warming scenarios, and predator avoidance as a function of increased cover

and in-stream structure. Building a geomorphic restoration design that addresses the specific needs of aquatic and riparian species over the long-term, requires an initial aquatic assessment approach that is a) sensitive to the diverse range of taxa specific physical and ecological habitat needs, b) framed in terms of the existing geomorphic processes driving habitat condition, c) replicable, transferable, and comparable with other systems, and d) able to serve as a baseline for post project monitoring to track ecosystem response to restoration and inform adaptive management.

We have developed an aquatic habitat assessment methodology that achieves these criteria through the following specific actions:

1. **Aquatic habitat typing**

Aquatic habitat, both seasonal and perennial will be surveyed and typed. Habitat will be classified based on the methodology described in the USFS Stream Inventory handbook (Level 1/ Level 2, 2010) with the addition of meadow and floodplain specific enhancements developed by TU and our Restoration Team partners on past projects (California Trout, UN Reno and UC Davis). The enhanced protocol allows habitat typing results to be consistent and comparable with other applications of the USFS methodology, while also capturing more detailed aquatic habitat attributes, specific to river-floodplain systems.

2. **Aquatic sensitive species and ecosystem condition surveys**

Based on the combined results from the habitat typing and geomorphic classification, a sub-group of specific habitat sites will be selected to represent the diversity within the project area. Those habitats will then be surveyed for sensitive species and key ecosystem attributes including:

Sensitive species
- Distribution, abundance, and diversity of fish taxa
- Distribution, abundance and diversity of amphibians

Ecosystem attributes
- Distribution, abundance, and diversity of macro-invertebrates
- Water quality (temperature, pH, dissolved oxygen, turbidity)

3. **Identification of critical habitat areas**

Based on the surveys we will identify critical habitat areas. These can then be related to specific restoration design elements or adaptive management proposals to help understand potential ramifications and prioritize actions.

The Aquatic Habitat Assessment methodology and results will, together provide a baseline and template for future meadow restoration actions, allowing restoration effects to be

quantified in terms of change in available habitat (in terms of diversity, by type, and by species), species distribution and abundance, and ecosystem condition. Additionally, habitat and ecosystem data collected will enable evaluation and comparison of different restoration alternatives using the Meadow Restoration Fish Analysis Tool (MRFAT) developed by Trout Unlimited and our Meadow Restoration Team partners.

E. Timeframe and Responsible Party

Timeframe for the monitoring plan is July 1st, 2016 - December 31st, 2018. Trout Unlimited is the responsible party for implementing the monitoring plan for the Truckee River Fish Habitat Improvement Project, and we have a robust set of volunteers and full-time staff to execute this work over the next two years.

F. Appropriate Monitoring Schedule

Pre-project monitoring has already begun for the project and the monitoring plan will continue to December 31st, 2018. Please see the monitoring protocol section above for the specific timelines and frequency of each action.