MokeWISE Program Scope of Work:
Project 7a: PG&E Reservoir Storage Recovery

April 2015

Problem Statement and MokeWISE Stakeholder Interests

Amador Water Agency (AWA) seeks to increase the reliability of its water supply for existing water and contract rights and potential future rights. The capacity of some of the PG&E reservoirs that AWA uses for water supply has been reduced by sediment accumulation. AWA wants to firm up existing water supplies during extended periods of PG&E maintenance on water infrastructure, and also during periods of drought, curtailments by the State Water Resources Control Board, and as adaptation to climate change. Finally, AWA also wants to provide a reliable water supply to accommodate future long-term growth needs created by land use agencies.

A reservoir storage recovery project would increase the flexibility and reliability of AWA's and other water supply entities downstream. For example, the PG&E Regulator Reservoir on Tiger Creek has only 60-70% of its capacity available, because of sediment infilling. A potential project in the Tiger Creek Regulator Reservoir would recover up to the original capacity or up to approximately 209 acre-feet. While this is not a large amount, this additional capacity would add flexibility to reservoir operation that would allow PG&E to work longer on the Regulator and associated facilities without putting AWA's water supply at risk of a water outage.

Removal of silt and accumulated sediment from PG&E reservoirs would be a benefit in restoring previous water storage and may help hydroelectric operations. The project would survey PG&E reservoirs to determine the opportunity, and feasibility, and benefits of removing silt from at least seven reservoirs: Tiger Creek Regulator, Tiger Creek Afterbay, Upper Bear, Upper Blue, Lower Blue, Twin and Meadow. Silt removal would also benefit downstream interests such as East Bay MUD and Lodi. Sediment removal from existing impoundments would reduce the risk of sediment re-suspension during high flow periods and reduce suspended sediment loading deposition in aquatic habitats downstream of the reservoirs, thereby improving the quality and availability of habitat for fish and other aquatic resources. The PG&E Reservoir Storage Recovery project would evaluate the feasibility of restoring lost storage capacity of one or more existing reservoir(s) due to sediment in-filling. It would inform stakeholders and the public of findings and develop a proposal, and would develop a strategy for environmental review under the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA).

Environmental stakeholders in the MokeWISE process would like to avoid construction of new reservoirs. They are concerned that new water storage development may have harmful environmental, social, economic and recreational impacts, particularly related to aquatic resources. They are also concerned that development of new surface storage may create precedent for a new dam building era in California in place of more environmentally appropriate approaches to water supply and water use. They support efforts to use existing resources more efficiently to meet water supply needs as well as a variety of other demand

reduction and reuse actions. One alternative to building new reservoirs is to make more efficient use of existing reservoirs. Restoring lost water storage capacity in existing reservoirs would be more cost-effective and create less impact than constructing new reservoirs.

Environmental stakeholders also have a general interest in assuring that existing water supply and hydropower infrastructure and its operation are safe, reliable, and environmentally sound.

Water agencies have an interest in protecting their water rights, licenses and facility operations in order to assure water supply reliability for their customers and to continue to meet downstream obligations. Water agencies will participate as a part of a broad coalition of interested parties seeking water supply and/or environmental benefit from this project.

Background Information

Amador Water Agency uses some of PG&E's hydroelectric reservoirs and related facilities for the Agency's water supply. Unfortunately, erosion, and sedimentation in the Mokelumne watershed has, to varying degrees, gradually filled PG&E reservoirs with sediment.

The PG&E Regulator Reservoir is important to Amador Water Agency because the new Gravity Supply Line will deliver water from it to the Buckhorn Water Treatment Plant. Sediment has filled this reservoir to a point that only about 60% of the operational capacity remains for water supply purposes.

The Regulator dam is classified as a Slab and Buttress type, 112 feet high, and 470 feet long. It was put in service in 1931. Some water in the reservoir is from the Tiger Creek watershed (~8 square miles), however, most water in the reservoir is delivered through a concrete canal from either Lower Bear River Reservoir or Salt Spring Reservoir, depending on PG&E's operations. The Regulator has a design capacity of 523 acre-feet and is 13 acres in size, but sediment infill is estimated to have reduced usable storage to approximately 313 acre-feet. The largest impacts of this capacity loss are reduction of PG&E's operational flexibility for power operations and reduction of storage to meet AWA's short-term water supply needs when PG&E canals are shut down for maintenance.

Whenever PG&E does maintenance on either the Regulator Dam or the canal that delivers water to it, the incoming canal water is turned off. This is done in the spring and in the fall every year; occasionally PG&E must make unplanned outages as well. The reservoir level in the Regulator drops during canal outages. Restoring the original reservoir capacity to 523 acre-feet would make additional water available to the AWA Gravity Supply Line, which operates as a syphon, during these outages and in periods of extended drought, State Water Board curtailments, and climate change.

Not only is the capacity reduced by the volume of sediment in the Regulator, but the operational capacity is reduced during periods when the water level in the Regulator reservoir is low. The inflow from Tiger Creek picks up turbidity as it passes through the sediment deposited in the upper end of the reservoir, creating high turbidity throughout the reservoir. This turbidity can plug AWA filters, mask contaminants, make sterilization more difficult, and adversely affect PG&E operations downstream. PG&E has removed sediment from the Regulator in the past and has indicated that it is interested in a project to remove sediment once again. PG&E has periodically removed sediment from the small diversion reservoir on Cole Creek.

Restoring the original capacity of the PG&E Regulator, as well as possibly other PG&E reservoirs, is technically feasible providing environmental issues can be resolved. There have been similar projects in other regions. Part of the assessment process would include surveying and analyzing any local conditions, including potential trace-metal contamination in the sediment, which would constrain or prevent sediment removal at individual reservoirs.

Dams and reservoirs trap sediment that would otherwise be transported downstream. Cleaning out reservoirs would not provide sediment to downstream reaches unless the project is designed to reintroduce suitably sized sediment to downstream reaches during high flows. EBMUD has had success with gravel augmentation to benefit salmon spawning in the Mokelumne River downstream of Camanche Reservoir. The option for reintroduction of desirable sediment to downstream river reaches is an option that could be considered as an element of one or more alternatives, depending on feedback received from the public during the initial Scoping for the project and on technical issues clarified during the study.

Decrease in reservoirs capacities is partially caused by the cumulative effect of numerous small erosion and sediment delivery sources to the Mokelumne River and its tributaries. A logical companion to this proposal to recover storage capacity is the MokeWISE Project 1g, "Mokelumne Water Quality, Soil Erosion, and Sedimentation Inventory/Monitoring" project.

Project Information

Project Description

This project will assess the feasibility of and potential environmental effects of removing sediment from seven PG&E reservoirs in the upper Mokelumne watershed. **Table 1** lists each of the seven reservoirs with areas, capacity and potentially recoverable volume of water.

Table 1: Seven Candidiate Reservoir Characteristics

Name	Reservoir Area (acres)	Gross Capacity (acre-feet)	% Sediment	% Useable	Recoverable Water Supply (acre-feet)
Regulator	13	523	30	60	209.00
TC Afterbay	105	3,960	75	25	2,970.00
Upper Bear	149	6,818	30	70	2,045.40
Upper Blue	354	7,576	30	70	2,272.80
Lower Blue	157	4,300	10	90	430.00
Twin Lakes	114	1,300	10	90	130.00
Meadow Lake	142	5,160	20	80	1,032.00
TOTAL	**1,034**	**29,637**	--	--	**9,089.20**

Source: Reservoir areas (acres) and gross capacities (acre-feet) from the Dam Inventory of the California Division of Dam Safety. Estimates of sediment in-filling is stated as a percent reduction of reservoir capacity and are from estimates made in consultation with PG&E.

**The percentage of usable capacity is 100% minus the sediment percentage, except for the Regulator Reservoir, which is based on the operational limitation of turbidity generated at low water level.*

The study would evaluate the costs and environmental effects of a range of alternatives, and propose a preferred alternative to interested stakeholders and the public. The final report will produce sufficient environmental information and analysis necessary for NEPA and CEQA environmental documentation that will be necessary for the project(s) if it is determined that a project is feasible. This will include, but may not be limited to, identifying and discussing impacts to the biological, social, and environmental, and water supply aspects. In coordination with the stakeholder group, a qualified consultant will prepare a written analysis of the level of review needed under both federal and state statutes. The study will seek to define a project design that avoids undesirable impacts on the environment, including on current operations of PG&E's Project 137. AWA would be the lead sponsor and would seek PG&E's cooperation and stakeholder participation in this effort.

Sediment removal from reservoirs could be beneficial, especially if the larger size fractions of these sediments could be repurposed downstream to provide augmentation to locations

within the river/tributary corridors for gravel replenishment. Benefits may need to be assessed based on presence/absence of mercury, and the relative risks of removal/disposal or methylation if left in place. Mercury and other trace metal risks are thought to be generally lower in the Upper Mokelumne than lower down in the watershed around the Motherlode mining belt.

The project would enhance water supply by restoring reservoir capacity and retaining more cold water. This could be beneficial for aquatic species as well as humans, particularly during periods of extended drought as climate change introduces additional uncertainties to the water supply.

An evaluation of the feasibility of sediment removal in and of itself provides no biological benefit to the watershed. Benefit from such an action would be a result of the actual implementation of sediment removal and the associated increase in water storage.

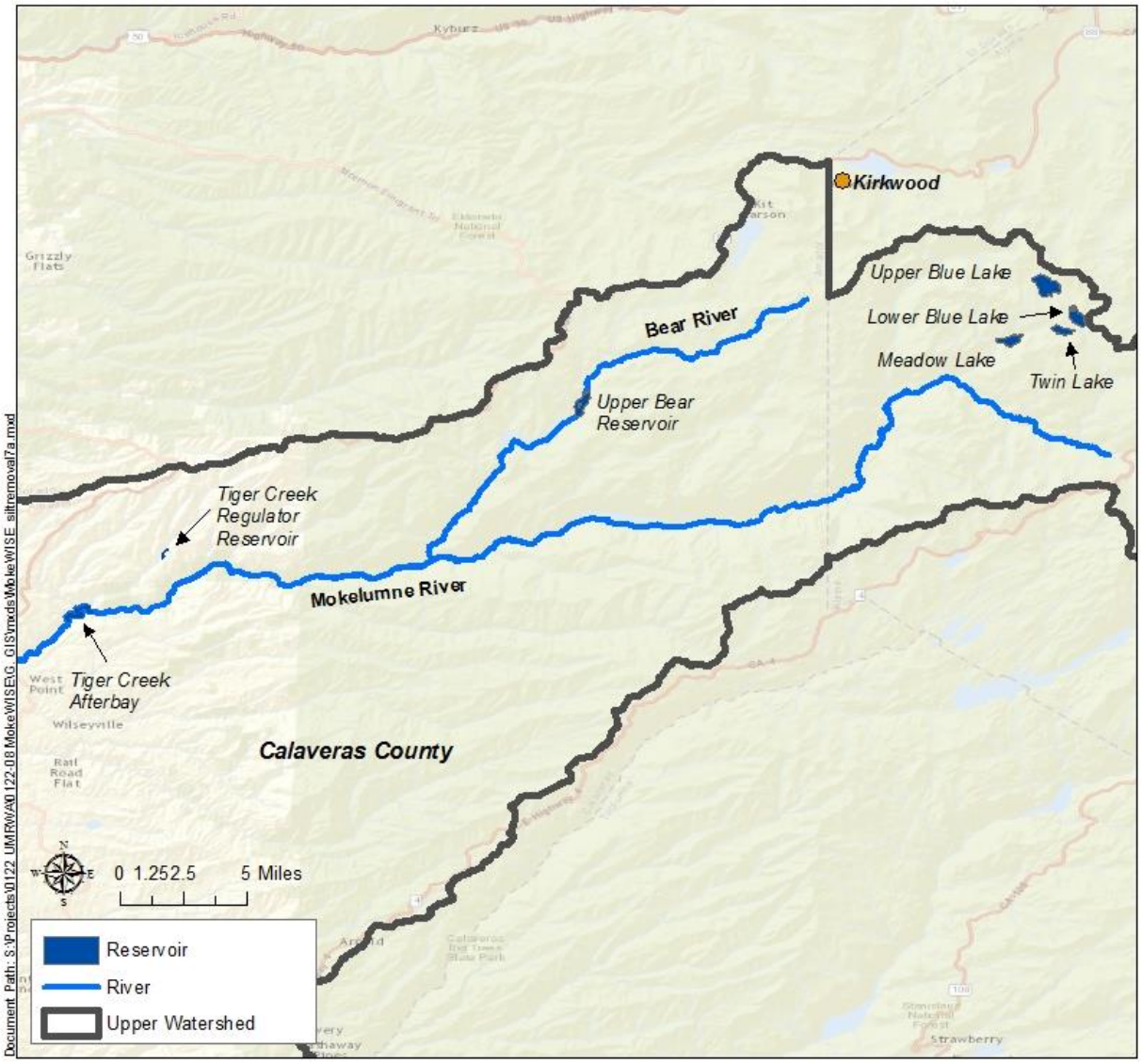
The study will evaluate the cost-benefit ratio of restoring existing reservoirs. It will also evaluate the feasibility and benefits of screening reservoir sediments and using those that fall within a prescribed range for gravel augmentation projects in other areas of the river corridor.

The study will address any legal issues and alternative operational scenarios in the context of existing uses, licenses, and permits. It will include an economic evaluation of the short-term and long-term costs and benefits of the project and include a consultation process with interested stakeholders and the public. It will provide environmental information suitable to develop NEPA and CEQA documentation.

Project Location

This study covers areas located within Amador and Alpine counties as shown in Error! Reference source not found..

Figure 1: Location of Seven Potential Candidate Reservoirs for Storage Recovery



Project Sponsor

Amador Water Agency is the lead sponsor of this study.

Scope of Work

Task 1. Determine Candidate Reservoirs for Assessment

Subtask 1.1 Surveys

This subtask will measure sediment accumulation in the seven candidate reservoirs for potential storage recovery. The seven candidates were developed after consultation with a PG&E representative. Existing information will be reviewed on these seven reservoirs. Based on this review, bathymetric sounding measurements will be taken as necessary to produce contour maps in the areas of sediment accumulation for each candidate reservoir. Cross sections will be drawn in selected places on each to enable locations and estimates of accumulated sediment for potential removal.

Subtask 1.2 Determine Potential Storage Recovery Projects

This subtask will determine the potential volume of storage that can be recovered based on the results of Subtask 1.1. The potential candidates for storage recovery will be ranked. A preliminary engineering feasibility assessment will be conducted on each candidate sufficient to complete an economic evaluation. A cost-benefit economic analysis will be then conducted on each of the seven candidates. A list of potential projects will be produced from those that have a favorable economic value.

Subtask 1.3 Collect Environmental Information & Make Preliminary Assessment

This subtask will collect existing information on physical and biological resources. This will include early consultation with the United States Forest Service and other agencies. Additional on-site information will be collected based on the preliminary engineering design of the project. This will include sampling of sediment deposits in the reservoir for chemical analyses for above background heavy metals and organic compounds. A preliminary assessment of environmental impacts will be conducted on the list of potential projects in Subtask 1.2.

Subtask 1.4 Candidate Reservoirs for Storage Recovery Assessment

This subtask will conduct a second engineering and economic review of the list of candidate reservoirs for storage recovery produced from Subtask 1.3. It will follow a "left side NEPA Triangle" process, similar to that often used by the United States Forest Service, to engage the public and refine a final list of potential candidates for storage recovery. This process will seek to identify project improvements and modifications that address stakeholder concerns while there is still opportunity to refine the project.

Task 2. Develop Alternatives

This task includes developing a range of alternatives, including a no action alternative. Each alternative will be field verified for feasibility. Constraints and opportunities associated with each alternative will be identified. The public and interested stakeholders will be engaged in developing alternatives. Project alternatives will be designed to be economically, socially, and environmentally acceptable.

Task 3. Analyze Alternatives

An extensive alternatives analysis process will be documented in order to determine the most optimal alternative. The alternatives analysis will consider, at a minimum:

- Estimated cost
- Operational constraints
- Legal feasibility
- Institutional feasibility
- Engineering feasibility
- Benefits or impacts to plants, fish, and wildlife, and other relevant resources
- Benefits or impacts to consumptive water use
- Consistency with existing licenses and agreements
- Extended drought
- Climate change

Subtask 3.1 Impacts and Constraints

This subtask will assess the potential environmental, engineering, water supply, economic, recreational, and legal effects of each alternative defined Task 2. The assessment will include an assessment of how each alternative could impact threatened or endangered species, sensitive and other aquatic and terrestrial species, and resources in the surrounding area and their habitat, behavior, or populations. The results of the assessment will be reviewed to determine which potential project, if any, provides necessary supply reliability enhancements, while avoiding or mitigating impacts, including future climate change impacts to wildlife, plants, and recreation.

Any design or mitigation measures that could eliminate or minimize impacts will be incorporated.

Subtask 3.2 Economic Analysis

This subtask will estimate construction costs for each alternative to identify budget-level costs needed to develop the project. This subtask will conduct an economic evaluation of the short-term and long-term costs of the projects.

Subtask 3.3 Technical & Financial Feasibility

This subtask will provide a summary of the technical analyses for each alternative and provide clear information for determining the technical feasibility of each. The summary will provide an overall project plan and timeline including interrelationships between steps, key decision points, and system operations. Funding strategies and criteria will be identified in the summary to maximize the potential for state and federal opportunities. The assessments will be completed in conjunction with a stakeholder group comprised of interested former members of the Mokelumne Collaborative Group (MCG) as well as other interested public and stakeholders. Based on the findings, the collaborative group will identify recommended next steps.

The study shall identify one or more ways in which any new water supply will be shared; and one or more ways the costs of the project will be shared. Following the study, but before the utilities make further legal commitments, financial commitments, funding applications, or permit applications associated with sediment removal, the utilities will identify water supply and cost sharing options acceptable to the utilities.

Task 4. Legal Analysis

This task will conduct a legal analysis of what new or revised agreements and permits may be needed for this project with PG&E. The legal analysis will also define the legal issues that might be related to single or joint execution of any project, including legal responsibility for project execution and project governance. The legal analysis will also define regulatory requirements for the project, including those required by FERC, United States Forest Service, California Department of Fish and Wildlife, U.S. Fish and Wildlife Service, Department of Safety of Dams, and Army Corps of Engineers, Regional Water Quality Control Board, State Water Resources Control Board, and Alpine County.

Task 5. Agency Coordination and Stakeholder Engagement

This task will include a strategy to involve interested public and a stakeholder group including former members of the MCG and other interested stakeholders, notably the Project 137 Ecological Resources Committee. Stakeholder concerns and interests will be identified at the outset of the study, such that the assessment may answer questions and issues. Coordination meetings will be held with water agencies, PG&E, environmental interests, recreation interests, state and federal agencies, and other interested members of the public.

Task 6. Environmental Review

This task will produce sufficient environmental information and analysis necessary for the project under NEPA and CEQA. This will include, but may not be limited to, identifying and discussing impacts on biological resources, public services, recreation, utilities, and water

supply. In coordination with the stakeholder group, a qualified consultant will prepare a written analysis of the level of review needed under both federal and state statutes.

Budget

Based on the level of information, extent of investigation, modeling, legal feasibility, analysis, and high degree of involvement and coordination required, this study will cost approximately $350,000. The costs can be broken down as follows:

- Task 1: $150,000
- Task 2: $15,000
- Task 3: $50,000
- Task 4: $35,000
- Task 5: $50,000
- Task 6: $50,000
- **Total Project Costs: $350,000**

References

California Division of Dam Safety Dam Database. Available at: http://www.water.ca.gov/damsafety/damlisting/.