Modeling the Truckee River Operating Agreement as a Basis for Stakeholder Negotiation

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Abstract

The Truckee River Operating Agreement (TROA) is the result of a nearly 30-year process of negotiation and litigation for operations that allow more flexibility for the stakeholders of TROA to use their water. The TROA Operations and the TROA Planning RiverWare© models are used to study the potential benefits and drawbacks of TROA flexibility to stakeholders and their interests. This paper discusses and highlights the outcomes, and the potential benefit of the models that have been vetted by all stakeholders in mitigating disagreements and promoting consensus on operations beneficial to stakeholders. A case study demonstrates how TROA’s provision for exchanging credit water in Truckee Basin reservoirs enables a TROA Party to meet environmentally beneficial and recreational preferred flow and storage targets throughout the basin. The case study is based on a Water Year 2016 negotiated operations between three parties in the Truckee basin.

Operations under TROA to establish and exchange of credit water require cooperation between individual TROA Parties and other signatory parties. Some of these operations support other party’s goals, while others do not. The operations that do not, potentially require negotiation with the affected party to find an acceptable resolution. TROA provides a basis for these mutually beneficial negotiations, whereas under previous agreements, the negotiations or the operations may not have occurred. When these potentially contentious operations are proposed by a TROA party, the RiverWare© TROA Operations and TROA Planning models can simulate basin conditions with and without the proposed operation action. The RiverWare© models, which are reviewed and available for use by all stakeholder groups, can objectively show the true impacts to a proposed operation, often overcoming preconceived ideas of negative impacts that exist in the absence of this objective information. This may occur when a party is familiar with the broad assumptions and requirements within TROA but may overestimate a potential impact that is disproved with modeling of the river basin. With the basin’s TROA Operations and TROA Planning RiverWare© models, parties have the ability to negotiate based on consistent results from a reliable and shared resource.

Introduction

Truckee River Basin

The Truckee River flows from Lake Tahoe through California, into Nevada and terminates into Pyramid Lake. The total length of the river is 120 miles which starts in the Sierra Nevada mountains and terminates in the high desert of Nevada. The total area of the Truckee River Basin is approximately 3,000 square miles. The hydrology of the basin is mainly driven by snow
fall with annual amounts of over 30 inches of precipitation in the mountains, but drier portions of the basin may see less than 5 inches of precipitation during the year.

The headwaters of the Truckee River Basin lie in California and the Truckee River begins in the Lake Tahoe Basin. The Lake Tahoe basin is approximately 500 square miles with the Lake Tahoe comprising approximately 40% of that area. Lake Tahoe is a naturally occurring lake with an outlet on the northwestern portion of the lake with an approximate maximum depth of 1,650 feet and is the 10th deepest lake in the world. A dam exists at the outlet that regulates the outflow of water stored behind the dam. The naturally occurring rim of 6,223.0 feet above sea level is the base of the dam, which rises 6.1 feet and provides a maximum storage capacity of approximately 744,600 acre-feet at an elevation of 6,229.1 feet (Rieker, 2010). When the water surface level is below 6,223.0 feet, no water flows out of the outlet of Lake Tahoe.

Downstream of the Lake Tahoe outlet the Truckee River meets Donner Creek at a confluence near Truckee, California. Downstream of that confluence, the confluence of Martis Creek and Prosser Creek contribute to the river close to the same area. The Little Truckee River confluence is slightly further downstream and from there the river generally flows in an easterly direction, through the town of Floriston, California and into Nevada. The Little Truckee River is the largest sub basin downstream of Lake Tahoe and includes the Independence Creek basin and a trans-basin diversion to the Sierra Valley in a neighboring watershed.

Upon entering Nevada, municipal and agricultural diversions deplete water from the Truckee River through the Truckee Meadows and smaller tributaries add water to the river which includes the effluent from the Truckee Meadows Water Reclamation Facility near the confluence with Steamboat Creek.

The Truckee River flows from the Truckee Meadows and through the Vista Reefs and into Truckee Canyon, until 18 miles downstream of Vista, Derby Dam diverts water from the Truckee River into the Truckee Canal to supply water to the Bureau of Reclamation’s Newlands Project. Water in the Truckee Canal is used to supplement water from the Carson River and water flows into Lahontan Reservoir. Water is released from Lahontan Reservoir for downstream use in the Newlands Project, wildlife refuges, and municipal uses.

The Truckee River flows from Derby Dam east and then north where it enters the Pyramid Lake Indian Reservation and passes through several diversion structures before flowing into the delta of Pyramid Lake. The lake terminates in Pyramid Lake, which is home to two native and protected fish species, the Lahontan Cutthroat Trout and Cui-ui.

The Carson River flows from the headwaters through Carson City, the city of Dayton, and into Lahontan Reservoir. A map of the Truckee and Carson Basins is shown in Figure 1.
TROA is the result of years of negotiation and litigation between parties in the Truckee River basin (Basin) and is a result of an assortment of agreements, policies, and regulations that were put in place on the Basin to meet the many conflicts and demands of the limited amounts of water. The following includes a list of agreements and decrees that form the basis of TROA:
• The *Truckee River General Electric Decree* (1915) granted the US Bureau of Reclamation (Reclamation) an easement to operate Lake Tahoe Dam with the requirement that year-round flow (known as Floriston Rate because of the former gage at Floriston California that has been replaced by the Farad Gage) be released for downstream users.

• The *Truckee River Agreement* (1935) is the result of an agreement between Reclamation, the Sierra Pacific Power Company (the predecessor to the Truckee Meadows Water Authority (TMWA)), the Truckee-Carson Irrigation District, the Washoe County Conservation District, and Federal and State of Nevada represented parties to operate reservoirs in the upper Basin to meet modified Floriston Rates for irrigation, municipal, and hydropower uses.

• The *Orr Ditch Decree* (1944) specified the water rights of users in Nevada and ensured that the Federal Water Master enforces the intention of the decree.

• The *Alpine Decree* (1980) specified the Carson River water rights in California and Nevada and defined the specifics of duty and consumptive use for the Newlands Project. The Alpine Decree is also administered by the Federal Water Master.

• *Public Law 101-618*, among other items, required negotiation of new operating agreement which resulted in the TROA. When TROA was implemented in 2015, the Interstate allocation between California, Nevada, and the United States for diversion and use volumes in each state in the Lake Tahoe and Truckee River basins became effective.

TROA is an agreement that was negotiated by all TROA parties to operate the reservoirs in the Basin in a coordinated way that benefits the TROA Parties and is more flexible than the agreements previously put in place. The Mandatory signatory parties for TROA include United States, TMWA, the Pyramid Lake Paiute Tribe (PLPT), and the states of California and Nevada (DOI and State of California 2008). TROA ensures the terms and conditions set forth by the previous agreements in the Basin are met and also provides for flexible and coordinated operations in an effort to meet all of the parties' goals through the benefit of instream flows below reservoirs, improve municipal drought supplies, enhance reservoir levels for use, and improve water quality throughout the main stem of the Truckee River.

TROA was negotiated for better and more efficient coordination between parties in the Basin. Since inception in 2015, parties have more successfully communicated and coordinated on operations and strategies to achieve their own goals. This has become more feasible with the use of technical RiverWare© models of TROA that have been designed for the use by the administrators who distribute the models and any coordinating or signatory party involved with the scheduling. The use of a common model platform for TROA has limited the need for parties to construct or build their own set of technical tools and allowed for discussion about basin policy as opposed to navigating potential arguments over specific party tools. This saves the parties effort and money while allowing for a continual improvement to the tools that are used by all parties.

**Models of the Truckee River Operating Agreement**

The Truckee Carson TROA Operations and Accounting (TROA Operations Model) and Planning Models (TROA Planning Model) were developed through a collaborative effort of the TROA signatories, including Reclamation, TMWA, PLPT, the Federal Water Master, and the departments of Water Resources of California and Nevada. The models are considered as the operational guidelines for the basin and are available for use by all parties. The TROA
Operations and the TROA Planning RiverWare© models are used to study the potential benefits and drawbacks of TROA flexibility to stakeholders and their interests.

The TROA Operations Model and TROA Planning Model are daily-time step water management simulation models built in the RiverWare© modeling environment. The models simulate Basin water management operations under TROA, including operations of all major dams and reservoirs in the Truckee and Carson River basins: Lake Tahoe, Donner Lake, Independence Lake, Boca Reservoir, Prosser Creek Reservoir, Stampede Reservoir, Derby Diversion Dam, and Lahontan Reservoir. The model also includes all of the major diversions in the system for municipal and industrial uses, as well as agriculture including the Truckee Canal, Lahontan Reservoir, and the Newlands Project. Water is allocated to users with a prioritized water right structure. Current flow and regulatory standards in the basins are included as constraints in the model, including the 1997 Adjusted OCAP, 1935 Truckee River Agreement, 1944 Tahoe Prosser Exchange Agreement, and TROA. The models receive regular review and refinements from regional stakeholders in anticipation of operational changes or their use for future planning studies.

The TROA Operations model is used by the Federal Water Master to model the operations and accounting of the Basin parties with both a forward and backward focus. The backward-looking accounting portion uses real operations to account and charge parties for their use of water based on the policy of the Basin and requests from the parties. The Federal Water Master oversees this process and provides the information to parties through web portals and by distributing the model. The forward-looking operations and accounting use forecasted inputs to the model (hydrology), input scheduled operations requested by parties, and models the Basin for the remainder of the short-term forecast period (up to 15-months).

The TROA Planning model is used for studies and analyses that require a longer than short-term outlook for planning and study purposes. The TROA Planning model can be run for any period of time and is generally limited in length by the historical or generated hydrology to which a party has access. The operational guidelines and scheduling for party operations in the model are determined by logic that consider the Basin conditions and forecast. The logic that determines those guidelines was developed in coordination with individual parties to ensure that operations and forecasts for each party reflect current policy.

**Stakeholder Use and Negotiation of the TROA Models**

**Availability and Use of the TROA Operations and Planning Models**

The Truckee River Operations and Planning models are available to all coordinating parties. Parties use the model, and if changes to the model are required as a result of a study to enhance a party’s operations, they are documented, and model improvements are made as necessary by the housing agency.

The TROA Operations model is distributed to the coordinating parties on a weekly basis by the Federal Water Master and is available for use by any of the receiving parties. The scheduling inputs to the model for TROA specific operations and guidelines are requested by coordinating parties and input by the Federal Water Master. Parties meet monthly to go over coordinated operational results to review the short-term forecasts.
The TROA Planning model is distributed by Reclamation to all the basin parties, not solely to signatory parties. Parties use the TROA Planning model for studies of their particular operations to evaluate potential future use, future demand, or potential future hydrology for their interests. Parties will use the model to evaluate various operation scenarios to help produce reports that may be distributed to the other parties in the basin.

**Basis of Negotiation**

The modeling and studies produced by the TROA Operations and Planning models are used by each party in the Basin and can influence discussion on policy guiding the models. Individual parties request specific operations that benefit them in their stored water or instream flow targets. Some of these operations support other party’s goals, while some do not. The operations that do not, potentially require negotiation with the affected party to find an acceptable resolution. TROA provides a basis for these mutually beneficial negotiations, whereas under previous agreements, the policy was much more prescriptive allowing little opportunity for collaborative operations. When controversial operations are proposed by a TROA party, which often occurs when a party is familiar with the broad assumptions and requirements within TROA but may overestimate a potential impact, the RiverWare© TROA Operations and Accounting and TROA Planning models can simulate Basin conditions with and without the proposed operation action and to quantify the potential impact assumed by the disputing party. The ability for party discussion to focus on policy and not on the modeling tool itself allows for the parties to have more productive and meaningful discussions that guide the operations of the Basin. This saves on time and money for each of the parties and benefits the operations for the entire Basin. The models, which are reviewed and available for use by all stakeholder groups, can objectively show the impacts to a proposed operation, often overcoming preconceived ideas of negative impacts that exist in the absence of this objective information.

**2016 Operations and Party Negotiation**

Water Year 2016 was the first Water Year TROA operations were in effect. 2016 followed one of the driest five-year periods in the Truckee Basin. The hydrology in 2016 was considered almost average for flows into the basin but the dry starting conditions meant that by early September 2016, the system would experience a shortage in meeting the Floriston Rate at the Farad Gage near the border of California and Nevada. The Truckee Basin is somewhat unique in that a daily flow target to meet the Floriston Rate is in place and is the basis of daily flow in the Truckee River. The Nevada water rights holders are assumed to be satisfied as long as the Floriston Rate is met each day. In some years, as in 2016, the Floriston Rate storage in the reservoirs plus the inflow hydrology for the year, is not enough to meet the Floriston Rate for the entire year. Not all users that rely on Floriston Rate water would have been satisfied after the Floriston Rate was no longer met in early September 2016.

One of the users that rely on Floriston Rate water is TMWA. TMWA uses Floriston Rate water to meet their daily demand and in times of missed Floriston Rate, can rely on stored sources of water. In 2016, a portion of the storage in Donner Lake, which is part of TMWA’s privately owned stored water, was to be used to supplement demand not met by the Floriston Rate. An additional amount of TMWA’s water in Donner Lake needed to be exchanged to another reservoir before Floriston Rate were no longer being met. In a normal year, when the storage of Donner Lake is not needed to supplement demand, the Donner Lake water can be exchanged.
Exchanges move water from one reservoir to another by releasing water from one reservoir in lieu of a release from another reservoir, then converting water from the other reservoir to the water released (Figure 2). In 2016, TMWA planned to exchange their Donner stored water, not needed for supplemental Floriston Rate flows, to Boca Reservoir using a Floriston Rate release. Since Floriston Rates were due to not be met after Labor Day, TMWA planned the exchange on Floriston Rate Releases prior to Labor Day, thus lowering the level of Donner Lake in the process.

Donner Lake homeowners have an agreement with TMWA, called the 1943 Donner Lake Indenture Agreement, that requires the level in Donner Lake to remain at a certain storage limit throughout the summer months. The limit that is agreed upon prior to Labor Day is an agreed upon level but is not the preferred limit for many of the homeowners. The Department of Water Resources (DWR) in California has a request to keep Donner Lake higher, at the Preferred level, than the Donner Lake Indenture Agreement level for as long as possible, or until Labor Day, to satisfy the requests of the homeowners on Donner Lake.

The proposal for TMWA to release their water with an exchange to Boca Reservoir prior to Labor Day did not meet the preferred storage of California DWR. California DWR requested that the exchange occur after Labor Day, which was difficult because the exchange with a Floriston Rate release was not possible. The exchange of water out of Donner Lake would be possible as long as it was done with a demanded release, other than Floriston Rate releases.

The Pyramid Lake Paiute Tribe has inflow targets at Pyramid Lake for flows from the Truckee River, measured at the Truckee River at Nixon Gage, and has storage in the Truckee Basin River that can be released to supplement those target flows. In 2016, PLPT had a demand from Prosser Creek Reservoir after Labor Day that was to be used to meet Truckee at Nixon target flows as well as draw Prosser Creek Reservoir down to the winter storage levels that are specified for flood control purposes during the winter. That demand could facilitate the exchange of TMWA’s water after Labor Day, but Prosser Creek Reservoir was not a good destination of water for TMWA because of the drawdown that required all stored waters to be released from Prosser by November 1st, meaning TMWA would need to attempt to exchange their water from Prosser to another reservoir before this date to keep it in upstream storage.

To solve the issue, the parties used the TROA Operations Model to simulate various strategies and developed a solution that met downstream flows while allowing TMWA to move the portion of the Donner Lake storage not necessary to supplement for TMWA demand to Boca Reservoir.
The operation to do this included an exchange of water in Prosser Creek Reservoir that would be used to meet Target Flows at Nixon was exchanged to Boca Reservoir in lieu of a Floriston Rate release prior to Labor Day. This moved the water stored to meet PLPT Targets, from Prosser Creek Reservoir to Boca Reservoir, drawing Prosser Creek Reservoir down prior to when it originally would have. After Labor Day, when the demand of water that would have originally come from Prosser Creek Reservoir to meet target flows in the Truckee River at Nixon, that water was scheduled to be released from Boca Reservoir. TMWA used that demanded release to exchange their water to Boca Reservoir in lieu of the release to meet the Nixon targets and stored their water in Boca.

In the monthly coordination meeting of July 2016 this operation was recognized and negotiations for a coordinated multi-party operational agreement for this commenced. The August 2016 coordination meeting had results of modeling analysis and Figure 3 to Figure 6 show the difference in operations from each of the three reservoirs to accomplish this operation. Each Figure shows the range of future possibilities based on an ensemble of inflow forecasts that are modeled through the TROA Operations model. The ensemble of inflow forecasts is produced by the California Nevada River Forecasting Center (CNRFC).
Figure 3. Prosser Creek Reservoir Storage and Outflow Ensemble Operational Comparison from the August 2016 TROA Coordination Meeting. Prosser Creek Reservoir is Proposed to be drawn down prior to the baseline dates with higher outflows in August.
Figure 4. Donner Lake Storage, with Storage Targets, and Outflow Ensemble Operational Comparison from the August 2016 TROA Coordination Meeting. Donner Lake Storage was preserved over the preferred Homeowner Limit for a longer period of time than was originally planned with lower outflows prior to Labor Day.
Figure 5. Ensemble Range of Flow at the Truckee River at Nixon Gage Based on Changed Operations from the August 2016 TROA Coordination Meeting. The Range of flows at the Nixon gage were slightly impacted due to the proposed operation but were always above the flow target in the Truckee River at the Nixon Gage.

Figure 6. Ensemble Range of Total TMWA Storage Based on Changed Operations from the August 2016 TROA Coordination Meeting.

As a result, the flows in the Truckee River at the Nixon Gage were met for the same period between both operations, Figure 5, and the total stored water for the parties that moved water (TMWA and PLPT) resulted in losses that were modeled to be less than 0.1% of their total stored waters in deterministic modeling results (Table 1).

In the ensemble modeling results that give data for Figure 3 to Figure 6 the range of output showed that the median PLPT storage in the upper Truckee basin resulted in higher storage at the end of the Calendar Year and a decrease in overall TMWA Storage. The maximum
difference in storage from any of the ensemble modeling was a loss of less than 1% of the total storage (Table 2).

<table>
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<th>Quantity</th>
<th>Baseline (Acre-Feet)</th>
<th>Proposed (Acre-Feet)</th>
<th>Difference (Acre-Feet)</th>
<th>% Change</th>
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<tbody>
<tr>
<td>Prosser Storage</td>
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<td>6,480</td>
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<td>Donner Storage</td>
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<td>3,571</td>
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<td>Total TMWA Storage</td>
<td>39,391</td>
<td>39,352</td>
<td>-39</td>
<td>-0.10%</td>
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<tr>
<td>Total PLPT Storage</td>
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<td>70,269</td>
<td>-27</td>
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<td>Nixon Volume to Date</td>
<td>196,028</td>
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<table>
<thead>
<tr>
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</thead>
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<td>Nixon Volume to Date</td>
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<td>-172</td>
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Overall the operation achieved the following results for each party.

- TMWA was able to exchange their water from Donner Lake to Boca Reservoir in the amount that was not necessary to meet the demand that the Floriston Rate could not meet.
- PLPT was able to meet their flow demands in the Truckee River at the Nixon Gage and resulted in a storage in the upstream Truckee basin reservoirs equal to the storage otherwise +/- 1%.
- California DWR was able to guarantee that Donner Lake storage levels would be as high as possible for a longer period of time in 2016 than they would have been otherwise.

All of this is the result of party negotiation that was based on the modeling of the Truckee Basin with regard to the Truckee River Operating Agreement.

**Conclusion**

The Truckee River Operating Agreement allows for the signatory parties of the agreement to have more flexibility in their operations. The TROA Operations Model and TROA Planning Model are tools for the parties to better understand their flexibility in operations under the agreement to better utilize their water for the benefit of their stakeholders. The common
modeling platform, that has been vetted by each party, allows for party discussion and negotiation over operations that may be complimentary or conflicting. The results of modeling efforts can be discussed with confidence that the use of a common modeling platform represents party interests and saves each party time and money. Through the use of the RiverWare© modeling tools, parties can more easily communicate and collaborate to meet their various complimenting and competing needs and achieve their objectives. The TROA parties have better negotiation and discussion power due to a common modeling platform, which saves time, money, and understanding the policy in the Basin.

In 2016, the first year of TROA implementation, a complex and beneficial operation, that was not possible before TROA implementation, was conducted where three parties negotiated an operation that satisfied each of the party’s goals. The result was a satisfactory operation with one party incurring slightly higher evaporative losses as an impact. The operation was the result of parties using a commonly vetted model and coming to an agreement on the operation. This was the first of many operations allowed by TROA, negotiated by parties, and modeled to come to a satisfactory and agreed upon results that may not otherwise occur without a common model and a basin agreement.

References