MEETING SUMMARY*
BISHOP CREEK HYDROELECTRIC PROJECT
TECHNICAL WORKING GROUP UPDATES
FERC PROJECT NO. 1394

DATE: November 4, 2020, 10:00 a.m. - 11:30 a.m.
LOCATION: Conference Call/Webinar
Topics: Operations Model

*These meeting notes are documentation of general discussions from the meeting held on the above-noted date. These notes are not a verbatim account of proceedings, are not meeting minutes, and do not represent any final decisions or official documentation for the Project or participating agencies.

1.0 OBJECTIVES

- Review outcomes from the October 13th discussion.
- Review CDFW follow-up notes.
- Arrive at consensus for final changes to be made to Operations Model for use during Protection, Mitigation, and Enhancement (PM&E) discussions.

2.0 ATTENDEES

Relicensing Team Members	Technical Working Group Members
Calvin Rossi, SCE	Chris Shutes, CSPA
Martin Ostendorf, SCE	Tristan Leong, USFS
Matt Woodhall, SCE	Todd Ellsworth, USFS
Seth Carr, SCE	Nathan Sill, USFS
Matthew Harper, Kleinschmidt	Beth Lawson, CDFW
Tyler Kreider, Kleinschmidt	Alyssa Marquez, CDFW
Brandon Kulik, Kleinschmidt	
Finlay Anderson, Kleinschmidt	Facilitation Team
Bret Hoffman, Kleinschmidt	Terra Alpaugh, KW
	Lindsay Tryba, KW

3.0 COMPILED ACTION ITEMS

- **Kleinschmidt** will distribute the Ops Model Comment Response document after this meeting.
- **The Relicensing Team** will follow up on a number of outstanding items related to the CDFW questions; these included:
  - [Ques 6] proposing a way of showing the impact to operations if SCE operates the McGee, Birch, and Green diversions differently, as well as describe the flexibility that exists for changes to the diversions;
  - [Ques 6] looking into quantifying the amount of spill and share the data the group;
  - [Ques 7] running a scenario with three different water year types at a couple locations and see how the outputs would vary to better understand the magnitude of the differences;
  - [Ques 6 & 7] reviewing the scope of the model and it's intended uses to evaluate whether this additional functionality fits within that scope;
  - [Ques 8] considering inclusion of an output tab that shows graphs of the streamflow in each reach, so users can visually see changes between scenarios;
  - [Ques 11] having Model and Sediment leads confer on how to best use the model to answer questions around when/how often there is adequate flow for sediment pulses and identify any limitations of using the model to plan for sediment movement.
- [Ques 7] **CDFW** and others will share red flags related to Bret's proposed approach for addressing the interest in water year type. **All** will plan to discuss red flags at USR meeting; at that point, can determine whether concerns can be addressed in post-processing or whether Bret should consider reconstructing the model structure to allow for varied water year types.

4.0 INTRODUCTION & GENERAL QUESTIONS

Terra Alpaugh, Kearns & West facilitator, welcomed participants and introduced the Kleinschmidt Relicensing Team ("Team"). The purpose of this meeting is to continue the conversation for interested parties and agency hydrologists following the October 13th *Bishop Creek Hydrologists' Operations Model Meeting*. Bret Hoffman, Kleinschmidt, created the operations model and answered attendees' questions. The goal of the meeting is to arrive at consensus for final changes to be made to the Operations Model for use during the Protection, Mitigation, and Enhancement (PM&E) discussions.

5.0 DISCUSSION

After the October 14th meeting on the Operations Model, CDFW submitted a list of eleven questions about the model to the Relicensing Team. The Relicensing Team compiled a table with initial responses to the questions; during the meeting, they walked through each question, explained their response, and answered follow-up questions. CDFW's questions are provided in italics below; the bulleted notes below each question document whether TWG members found the answer sufficient or if follow-up/action items were generated from those exchanges.

Question #1: *Although the R2 values for these charts are high, the daily, 3-day and 5-day inflow comparisons have lower accuracy at higher daily inflows. The report should explain in more detail the genesis of this source of error and whether it has been corrected for in the modeling. And if not corrected how does this affect the results of the water balance? The report states in the next paragraph that*

"Additional correction factors were applied to bring the average monthly model-calculated inflow within a tenth of a percent." Were those additional factors used to make up for ungauged inflow?

- **Answer:** Bret explained that he has identified the potential sources of error, but that there is no additional information/data that could more accurately refine those potential contributions. Regression equations were applied as "correction factors" to all flow contributions, but bias still remains in the highest flows.
- **For consideration:** CDFW and USFS suggested that SCE make note of the fact that there will be greater uncertainty in using the model for analysis of high flows. This will be important acknowledge when the model is being used to test alternatives; the agencies were comfortable moving forward with the Model as long as the bias in the model is documented.
- **Action:** Kleinschmidt will distribute the Ops Model Comment Response document after this meeting.

Question #2: *The initial study report states that: "While much of the logic imbedded is complex, formulae are visible and can be traced to determine both inputs (precedents) and effects (dependents) in other cells." Although the model may be designed this way, only a locked version of the model has been provided to date, and so precedents and dependent cells cannot be easily traced in Excel.*

- **Answer:** Finlay stated that SCE has now provided an unlocked version, and it has been downloaded by agency staff.

Question #3: *Can unimpaired hydrologic data sets be provided to the licensing participants in DSS or Excel format? CDFW requested a copy of dataset with regression factors applied so that they can compare unimpaired hydrology (calculated) to regulated flow at any point in the system.*

- **Answer:** Finlay clarified that that all unimpaired data is available in the Hydrology tab; the Ops Model Comment Response document provides details on what is provided.

Question #4: The ISR states that "A simple multiplier was applied to each inflow point, then adjusted until the average monthly inflow matched historical gauge totals." Where are these multipliers listed?

- **Answer:** Finlay explained that an explanation of where to look in the Hydrology tab is provided in the Ops Model Comment Response document.

Question #5: *The ISR states that: "System outflows were modeled using average reservoir operations for the period reflective of the existing license. Changes to these operations can be made by adjusting target storage levels in each reservoir at the start of each month, for each year designation (wet, dry, or normal)." Where can those be modified? Are these supposed to be modified in the "storage" tab? If so, this would be good to add to the inputs tab. This would be good to add a description of this option to AQ 2 as well.*

- **Answer:** Edison sets reservoir goals every year in compliance with FERC requirements. To learn more about how the model manages this, please reference the instructions in the Ops Model Comment Response document.

Question #6: *McGee Creek Diversion, Birch McGee Diversion and Green Creek Diversion do not have active modeling. There is no way to operate the diversion differently. If this is something stakeholders may want, that functionality should be added to the operations modeling.”*

- **Answer:** The diversion structures are accounted for in the inflows within the model, but changes in operations with respect to those diversions are not accounted for in the model, because there is limited data available downstream. SCE has a record of the gage data and can simulate the dataset that is missing by taking averages of the calendar days from previous years.
- **For consideration**: Bret could look at times when there is spill to identify that SCE is not accounting for excess water in minimum instream flows (MIFs) during those spill times. For example, another column of calculation could subtract the spill times to make sure that SCE is not accounting for meeting MIFs (i.e., SCE would not apply a MIF on days when it is spilling). If it has gone above the gage, SCE could make an assumption that there is no need to apply MIFs.
- **Action Item:** The Relicensing Team will propose a way of showing the impact to operations if SCE operates the diversion differently, as well as describe the flexibility that exists for changes to the diversions.
- **Action Item**: The Relicensing Team will look into quantifying the amount of spill and share the data the group.

Question #7: *Is it possible to include the ability to have water year types for other release locations in the project?*

- **Action item:** CDFW and others will share red flags related to Bret's proposed approach to addressing the interest in water year type.
  - Initial red flags included the concern that Bret's approach of considering a single year in isolation does not reflect the impacts of several dry years on reservoir storage or if water year types vary (e.g. from dry to below normal to dry).
- **Action Item:** Bret will run a scenario with three different water year types at a couple locations and see how the outputs would vary to better understand the magnitude of the differences; plan to share at the USR.
- **Action Item**: All will plan to discuss red flags at USR meeting; at that point, can determine whether concerns can be addressed in post-processing or whether Bret should consider reconstructing the model structure to allow for varied water year types.
  - As part of that discussion, review the scope of the model and its intended uses to evaluate whether this additional functionality fits within that scope.

Question #8: *Hydrograph output for each stream reach as an additional output tab would be helpful to aid stakeholders in using the model to understand how rivers may be affected by project operations.*

- **Answer:** Bret clarified that the "hydrograph output" for each reach is already available in the model under Bishop 3-4, Outflow cfs. This reflects the water in that stream reach under the given scenario.
- **For consideration**: CDFW suggested that a helpful addition to the model would be an output tab that shows graphs of the streamflow in each reach, so users can visually see changes between scenarios.

Question #9: *Where are the definitions for "wet", "normal," and "dry" years located?*

- **Answer:** Bret explained that the definitions will be in the final report and ware also available in the "snowpack tab."
- **Next step:** If CDFW or others have any questions about those definitions or think additional information should be added to the final report, they will notify the Relicensing Team.

Question #10: *If possible, it would be good to have Chandler Decree and existing FERC required flows listed in some way in the input tab, or a separate tab in the model.*

- **Answer**: These are provided in the "Input & Summary" tab under K5, "Baseline existing cfs target" for each location and season/year type (when applicable). These are reflected in the baseline macro values in the model when you reset it to its initial settings.
- No next steps unless CDFW has further questions upon review.

Question #11: *Is there any way to include ramping rates or geomorphic pulse flows below project facilities?*

- **Clarification:** USFS clarified that their interest was in knowing whether it is feasible to do a sediment pulse in a given year. For instance, what is the water budget for a year and is a pulse flow achievable (at what volume, for how long)? And how many times in the period of record did those opportunities occur?
- **Action Item**: Bret and Tyler will touch base to assess those questions, how best to answer them, and understand the limits of the information the model is providing in planning for sediment movement.

Comment Number	Report	Page or Other Location	Comment	PROPOSED RESOLUTION
1	AQ 2	Figures 2-6 through 2-8	Although the R^2 values for these charts are high, the daily, 3-day and 5-day inflow comparisons have lower accuracy at higher daily inflows. The report should explain in more detail the genesis of this source of error and whether it has been corrected for in the modeling. And if not corrected how does this affect the results of the water balance? The report states in the next paragraph that "Additional correction factors were applied to bring the average monthly model-calculated inflow within a tenth of a percent." Were those additional factors used to make up for ungauged inflow?	This was discussed with CDFW on October 13, 2021, and SCE agreed to provide clarification. **SCE Response:** **Short response**: Identified potential sources of undercalculating higher inflows include: • Prorating gauged inflows to ungauged contributions by direct drainage area ratio that may non-linearly vary under a range of flows and antecedent conditions, • Inaccuracy of storage and streamflow gages, and • Synthesized inflow contributions from North Fork Bishop Creek and Coyote Creek. However, the model accurately reflects the water balance as demonstrated by calculated vs gaged comparisons over the hydrologic record. The high-flow data tail is relatively insignificant as compared to the overall dataset. We did explore changing the polynomial from the 2nd order to a 6th order to see if we could adjust for the bias – the change not result in a meaningful change in the R^2 **Expanded response:** The correction factors were incorporated to more closely align average inflows from all points of contribution, both gaged and

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				ungauged. The correction factor table references appear in formulae where inflows are added in each Power House (PH) tab. The methods of synthesizing contributions were detailed in the Memorandum Re: Bishop Creek Operations Model Structure, December 21, 2018. Bias in all flows has been corrected by applying monthly regression equations at each inflow contribution formula within the model. The 5-day average inflow data subsets were sorted for developing second-order regression equations. The application of these regression equations was applied to all flow contributions throughout the model as a corrective measure, not just ungauged contributions. The additional correction factors were incorporated to closely align average inflows from all points of contribution, but gaged and ungauged. The correction factor is also applied to all inflow contributions throughout the model. Bias in the high end flows shown on the upper portion of the graph represent a very small number of days. Even after corrective measures, the bias exists. The water balance for 30 years has a gaged sum of 2.221 MAF. The unbiased sum is 2.112 MAF, the regression corrected is 2.170 MAF, and the additional factor increases it to 2.222 MAF. On an annual basis, the final total is overpredicted by 50 acre-feet, or 0.007 cfs.

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2	ISR	Page 100	The initial study report states that: *While much of the logic imbedded is complex, formulae are visible and can be traced to determine both inputs (precedents) and effects (dependents) in othercells.* Although the model may be designed this way, only a locked version of the model has been provided to date, and so precedents and dependent cells cannot be easily traced in Excel.	This was discussed with CDFW on October 13, 2021, and SCE has since provided an unlocked version. CDFW agrees that SCE will keep the "master" version for documenting model runs.
3	ISR	Page 90	Can unimpaired hydrologic data sets be provided to the licensing participants in DSS or Excel format? CDFW requested a copy of dataset with regression factors applied so that they can compare unimpaired hydrology (calculated) to regulated flow at any point in the system.	This was discussed with CDFW on October 13, 2021, and SCE agreed to provide clarification. **SCE Response:** SCE believes these data are already available, but stakeholder would benefit from an overview of how to access: The calibration process resulted in second order polynomial values used throughout the model, tabulated in the Hydrology tab under CA35 cell heading "Monthly Adjustments." Setting the factor input values (next comment) below cell CE50 equal to 1, setting the second and first order coefficients in the Monthly Adjustments table equal to 1, and the zero-order coefficients equal to 0 eliminates all multiplier and regression effects on inflow contributions throughout the model.

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				The net inflow daily gage-calculated and model-predicted values are provided, which was the basis of the calibration. With the Monthly Adjustments and factor inputs changed, these will revert the model-predicted values to the unimpaired dataset.
4	ISR	Page 107	The ISR states that "A simple multiplier was applied to each inflow point, then adjusted until the average monthly inflow matched historical gauge totals." Where arethese multipliers listed?	This was discussed with CDFW on October 13, 2021 Similar to the Monthly Adjustments, these simple multipliers are located on the Hydrology tab under CA50 cell heading "Multiplier Adjustments." The "factor input" values were iteratively adjusted until the average monthly inflow ratio was within 0.1%. SCE agreed to provide clarification in the final AQ 2 report.
5	ISR	Page 108	The ISR states that: "*System outflows were modeled using average reservoir operations for the period reflective of the existing license. Changes tothese operations can be made by adjusting target storage levels in each reservoir at the start of each month, for each year designation (wet, dry, or normal).*" Where can those be modified? Are these supposed to be modified in the "storage" tab? If so, this would be good to add to the inputs tab. This would be good to add	This was discussed with CDFW on October 13, 2021, and SCE agreed to provide input on where those modifications could be made. **SCE Response:** Daily storage target values are interpolated based on historic monthly start storage values. These are tabulated under "Storage Targets at Beginning of Month for Year Type" cell AF2 on the "Storage" tab for year type for both reservoirs. Adjustment to model operations would be performed by adjusting target storage values (in acre-feet) in this table. As the model prioritizes storage for planned allocation, adjusting these values may not significantly impact results, although no sensitivity

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			a description of this option to AQ 2 as well.	on this has been performed.
6	Model	Model Logic	McGee Creek Diversion, Birch McGee Diversion and Green Creek Diversion do not have active modeling. There is no way to operate the diversion differently. If this is something stakeholders may want, that functionality should be added to the operations modeling.	This was discussed with CDFW on October 13, 2021, and SCE agreed to provide input on where those modifications could be made. **SCE Response:** SCE understands that there is new interest in looking at flows in Birch and McGee creeks to address some potential for managing meadows lower in the creek. These management goals were not part of the original scoping of the study program or the operations model. We see difficulties in building this in at this point (as explained below) but believe there is a good workaround to provide agencies with necessary information to understand the system. From a practical standpoint, the physical extent of the model was limited by data adequacy, much like the period of record and the temporal resolution. Where datasets are significantly lacking, simulating flow in abundance introduces error and may curtail or eliminate the calibration. Where daily storage records for Lake Sabrina and South Lake were limiting factors in selecting the start of the model period, the diversions' gage datasets and concerns about limitations in measurement capacity were not adequate for fully extending the model without introducing additional error. Adjustments to these diversions would impact the

Comment Number	Report	Page or Other Location	Comment	PROPOSED RESOLUTION
				net flow contributions to the model and would effectively be daily reductions. These have not been incorporated into the model due to lack of gage records and limitations on measurements. **As an alternative to incorporating these**, a simple addition to flow allocation could be artificially added to all bypassed reaches in the model. While it would not account for times of excess flow availability, it would provide some relative impact on the results. Trying to accurately incorporate changes to these flow into model as independent adjustable variables would be very difficult given the data limitations, and generally stated, are not significant in magnitude for the system.
7	Model	Model Logic	The model logic does not allow variation in water year types other than at Intake Number 2. Is it possible to include the ability to have water year types for other release locations in the project?	This was discussed with CDFW on October 13, 2021 – CDFW was interested in storage year types based on different [water] year type classification. SCE agreed to provide input on which of the types of water year types would/could be included, which could allow relicensing participants to decide which year typing would be appropriate for other instream flows, if considered. **SCE Response:** This would require significant additional structural changes to the model, and likely impact schedule, and it's unclear that this type of granularity is needed given what we understand as management objectives for Bishop Creek. As an alternative, we propose putting alternate flows in for locations of interest, then

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				observing results as tabulated for the specific year types on the "Input & Summary" tab, columns O, P and Q below row 5.
8	Model	Model output	Hydrograph output for each stream reach as an additional output tab would be helpful toaid stakeholders in using the model to understand how rivers may be affected by project operations.	We need clarification of this request, to understand the output metric of interest. Is it looking at what percent of time specific flows are met at each reach? Flow exceedance curves at each reach?
9	Model	Model input	Where are the definitions for"wet", "normal," and "dry" years located?	Discussed during meeting Will verify this is clarified in final report. Under the "Snowpack" tab, comment in cell H5 for "Year Type." Comment reads "set as +/- 25% of average, matches determination from license article 105 for Int. Res. 2 release requirement."

Comment Number	Report	Page or Other Location	Comment	PROPOSED RESOLUTION
10	Model	Model input	If possible, it would be good to have Chandler Decree and existing FERC required flows listed in some way in the input tab, or a separate tab in the model. Using the model alone, it's hard to reference how much each of the flow variables can be toggled within/compared to the existing requirements.	**SCE Response:** These are provided in the "Input & Summary" tab under K5, "Baseline existing cfs target" for each location and season/year type (when applicable). If this does not address CDFW's need, we can discuss further.
11	Model	Model input	Is there any way to include ramping rates or geomorphic pulse flows below project facilities?	**SCE Response:** Addition of geomorphic pulse flows and ramping rates would be well beyond the scope of this model or any resource questions identified during FERC's scoping process and SCE is not aware of any new information that would warrant expanding this model to include this capability. From a feasibility standpoint, these modifications would not be feasible without significant additional data collection and modeling including bathymetry, measurements of stage-discharge relationships. SCE would like to know if there is a specific need that has been identified that would warrant a discussion about how to develop necessary information. *NOTE: See clarification of comments in subsequent attachment*