Hells Canyon Complex
Operations Modeling
(E.1-4, Chapter 3)

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Contracted by the
Oregon and Idaho Bureau of Land Management
November 4, 2002

I. Introduction

An operations model was developed for and configured to the Hells Canyon Complex to simulate project operations by the applicant. This model uses a set of model input constraints to reflect real operating parameters. The operations model can produce output for several different probable project operations and link to other integrated models. By comparing these outputs, the applicant can assess changes to resource conditions. (Page 1, Paragraph 1)

The CHEOPS model will be used by the applicant to evaluate physical and operational changes at the Hells Canyon Complex. The model developed by Duke Engineering & Services has been custom configured for the Hells Canyon Complex. The model was designed to emphasize long-term simulations of project operations.

"The physical configuration of the Hells Canyon Complex allows the model to link the three projects together; it therefore preserves the coordination between each of the projects' operations. Brownlee Project discharges and Wildhorse River flow become inflows to the Oxbow Project. Similarly, Oxbow Project discharges, along with Oxbow Bypass flows and Pine Creek flow, become inflows to the Hells Canyon Project." (Page 2, Paragraph 3)

"The CHEOPS modeling system comprises two separate, yet linked, modules: the Rule Curve module and the Energy module. The Rule Curve module uses daily average inflow, target elevations, plant capacity, and minimum flow requirements for the Hells Canyon Complex to calculate daily average project outflows. These daily project outflow calculations are then input to the Energy module to produce the detailed 15-minute water releases within the defined operational constraints. Using a defined load shape, the Energy module shapes these daily flows. The load shape is used to define a typical daily response to energy load demand." (Page 2, Paragraph 4)

"The model-generated output will be ultimately used to compare scenarios relative to each other, rather than assessing absolute model-generated values." (Page 3, Paragraph 2)

II. Conclusions

1. "The model's configuration represents the physical characteristics of the three-dam complex. The physical setting inputs to the model include the following: (1) reservoir curve, (2) tailwater curve, and (3) spillway curve." (Page 4, Paragraph 1)

Response: The BLM agrees with these facts.

2. "The applicant used the following historical data (specific to each year) for model boundary conditions: (1) Brownlee Reservoir target elevations (COE flood control), (2) unit maintenance for each project, and (3) fall chinook program discharge flows, including minimum spring flows below Hells Canyon Dam until fry emergence." (Page 4, Paragraph 3)

Response: The BLM agrees with these facts.

3. "The model always attempts to schedule the most efficient operation, given the available inflow and project constraints.".... "Figure1. illustrates the load shapes used in the CHEOPS model. Load shape defines the volume of water to be discharged through each project." (Page 5, Paragraph 2)

Response: The BLM agrees with these facts.

4. "....super-peak flow schedule occurs only on weekdays in the model. This addition to the basic load shape comprises a brief four- or six-hour period that captures the peaking operations that have historically occurred below Hells Canyon Dam." (Page 5, Paragraphs 3-5)

Response: The BLM agrees with these facts.

5. "If the heavy-load period is increased or decreased, then the same volume of water must be discharged under a longer or shorter time period."...."Historically, the length of duration of actual load shape on a given day adjusts to daily variations in system demand or conditions. The model cannot predict those changes." (Page 6, Paragraphs 1-2)

Response: The BLM agrees.

6. "We also compared actual and modeled power generation for calendar years 1992 and 1997, which were extreme low and extreme high water years, respectively (Table 6). The differences between actual and modeled power generation for each project are very small considering the real-time variability of operations." (Page 6, Paragraph 6)

Response: The BLM agrees. The fact that the numbers do not coincide exactly is typical of the difference between models and actual operation efficiencies.

7. "Calibration results presented in this chapter reveal that the CHEOPS model produces output that represents Hells Canyon Complex project operations. It is also apparent that matching the output of the CHEOPS model exactly to historical operations is difficult or impossible. However, the model can represent 1) typical daily outflow below the project on a 15-minute basis and 2) reservoir elevations for each of the three projects within the complex." (Page 9, Paragraph 1)

<u>Response</u>: The BLM agrees with this statement.

8. "The calibration and verification of the operations model is complete. Results show that this model has been successfully calibrated for the purposes of comparing various operational scenarios against a baseline condition. Therefore, the model can be used to compare operational scenarios used for resource evaluations, as presented in Section 4." (Page 9, Paragraph 2)

<u>Response:</u> The BLM agrees with this statement.

9. "A wide array of potential scenarios can be simulated using this [CHEOPS] integrated modeling approach."(Page 9, Paragraph 3) .... The two scenarios used for relicensing the Hells Canyon Complex are proposed operations and full pool run-of-the-river.... "Figure 27 through Figure 32 present detailed results of typical summer operations, fall chinook program operations, and winter operation of the projects, as well as full pool run-of-river operations for comparison. Subsequently we used these detailed output data in various resource models to compare effects to the resources for the two operational scenarios."(Page 14, Paragraph 3)

<u>Response:</u> The BLM agrees with these statements.

III. Study Adequacy

Based on the study the BLM believes the CHEOPS model is adequate for the purpose of comparing proposed flow scenarios. The CHEOPS model has been used to simulate hydropower flow scenarios on other projects.

IV. BLM Conclusions and Recommendations

<u>Conclusions</u>

The model appears to be adequate for comparing flow scenarios that will be modeled during the relicensing process.

<u>Recommendations</u>

1. BLM personnel should consider output numbers produced by the model to be only useful in comparing the relative impact of flow scenarios to each other.

2. The numbers produced by the model do not represent absolute or real flow values, even though they may approximate the flows that would be expected from any given scenario. All model outputs are estimates used for comparative purposes.

3. The BLM should request the applicant develop a run-of-the-river flow scenario with a smooth ramping rate. Smoother ramping rates should benefit aquatic organisms, fish, and riparian vegetation establishment. A Washington Department of Fisheries study recommended ramping rates of less than two inches per hour (Hunter, 1992).