Possible Modifications to the Regulation that Governs STMP Water Releases to Estimate Possible Water Savings if a CWRF were Constructed at Kenney Dam
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Two approaches, both described using a sequential approach, are provided to calculate Kenney Dam release volumes necessary to meet downstream targets below the confluence with the Stuart River. Stated generally, our goal is to ensure that changes to flow and temperature above the confluence that result from changes to the Kenney Dam management regimes, remain within the bounds of the conditions expected below the confluence based on historic observations. These schemes have been developed to estimate water volumes necessary to meet this goal annually during the STMP period in years chosen between 1981 – 1999 at lower water release temperatures. They may form the basis for several possible management schemes that could be chosen should modifications to Kenney Dam take place.

It is our intention to provide a database with estimated daily flows released at a constant but cooler temperature (probably 12^{o}C see NOTE 1) from Kenney Dam (after incorporating a flow from Cheslatta based on the first scenario in the 2004 N_DAM report) for each of 18 years between 1981 and 1999 during the STMP period. A similar database with actual flows and temperatures will also be included.

1) An annual correction factor will be calculated using daily mean accumulated thermal units (ATU's) at Isle Pierre during the STMP (e.g. $ATU_{STMP} = \sum Mn\ T_{daily}$). The IOSRTM model will be run in the minimum release mode (Release Temp=12 ^{o}C) with incremental reductions in the Finmoore target temperature until a new target temperature is found under which $ATU_{STMP}=ATU_{New}$

2) After applying this correction to create a new target at Finmoore, a new set of daily release flows and temperatures will be calculated for each year from 1981 – 1999 and compared to the actual flows to estimate water release savings.

The method described above allows us to provide a look at water savings that may accrue as a result of a CWR using a new Finmoore target temperature. A second method to provide these data using a variable Finmoore target temperature is described below. A second set of daily flows will be calculated using this method to provide a second annual comparison. We suggest as a conservative approach that the method that provides the least amount of water savings be used to provide the predicted CWR flows.

3) IOSRTM with Release Temp. = daily surface water temp of the reservoir to calculate Release Q = necessary Q to achieve daily 20^{o}C target at Finmoore. Potential water savings may occur if releases from Kenney are a more efficient way to operate the STMP. However, a potential overall temperature increase may occur if the more efficient flow release results in a higher mean temperature at

Finmoore and Isle Pierre during the STMP period than currently exist when cooling flows were released from Skins. Therefore a correction factor may be applied to the 20°C target at Finmoore that is derived using the method describe in item "1" but with the Release Temp = daily surface water temp and calculating the ATUs at Finmoore.

4) From the mixing model ($T_fQ_f + T_sQ_s = T_{ip}(Q_f + Q_s)$) we now calculate the function in Finmoore Flow and Temperature that will maintain the Isle Pierre temperature $Q_f(T_f-C_1)=C_2$ Where $C_1 = T_{ip}$ and $C_2 = T_{ip}\ Q_s - T_sQ_s$ are constants calculated from the results obtained in 2

5) IOSRTM iteratively varing Q_{CWR} and T_{CWR} with the objective function Minimize $Q_f = C_2/(T_f-C_1)$.

6) A second set of daily flows will be calculated for each year (1981 – 1999) based on the a 12°C release temperature at Kenney Dam, and a prediction of total water volume released during the STMP period will be compared to actual. This value will, in turn, be compared to the results from Method 1 (steps 1-2 above).

NOTE 1: We expect the T_{CWR} to remain constant during the STMP period and to always exceed a value based on the lowest mean daily temperature recorded below Cheslatta Falls during the STMP period since the beginning of our records. This value is to be formally calculated later but is expected to = 12°C. If temperature variation is desired it is not to fluctuate more than the natural diurnal variation below Cheslatta Falls during a 24 hour period. Additional adaptive research will be required to validate this approach.

NOTE 2: As with the existing STMP policy, it is expected that cooling flows will commence when tributary and atmospheric data forecast temperatures that reach a value 0.4°C below the target temperature. Also, we have not allowed for a step in the procedure that will minimize the potential for increases to diurnal variation that may occur as a result of reduced water volumes throughout the watershed. This effect is not expected to be large or problematic for the biota but deserves further consideration.

NOTE 3: While it doesn't contribute to either of the methods described above, an initial comparison of daily a) Stuart Temp. to b) Finmoore Temp. will allow the query - if a<b any reduction in Finmoore Q that meets the traditional 20 degree target at Finmoore is tolerable (subject to the other environmental constraints to be listed later). If a>b (the more common situation) STMP releases will be required using a modified management protocol. Potential water savings may occur in days/years when Nechako does not act to cool the confluence.