

The purpose of this assessment has been to carry out forecasting of Cowichan Lake water levels and flow releases for 2019 low flow season. This memo presents the results of the third forecast for the 2019 low flow season.

Initial water level conditions

Water levels and flow releases have been forecast from June 17 2019. Records for 2019 were provided by Catalyst Paper

Assumed Inflow Conditions

The assumed inflow conditions are based on analysis of historical Cowichan Lake inflow calculated from historical discharge and water level records for the entire period of record from 1953 to 2017 (65 years). Previous forecasts used only years with low SWE for forecasts. However, now that recorded SWE is at zero the entire period of record has been used to include the full range of potential summer weather conditions based on past climate. No specific seasonal weather forecasting has been included in the analysis.

The inflow conditions have been developed by developing a time-series of the 10th-percentile inflow, 20th-percentile inflows and 30th-percentile inflows for each day. These are intended to represent a very dry year conditions (one in ten years on average), dry year conditions (one in 5 years on average) and below average conditions (about one in three years on average)

For context with past conditions, the assumed inflow conditions have been compared with recorded inflows from previous years (see Figure 1).

Flow Release Option

For all three inflow conditions, the flow is assumed to be released or pumped into the Cowichan River at a constant flow of 4.5 m3/s until such time as lake levels rise sufficiently to go "off-control" with lake level and flow rising in accordance with the uncontrolled Cowichan Lake outlet rating curve.

Results

The results for are summarized in the table below. Forecast lake levels and flow release are included in the attached Figure1.

Table 2 - Summary of Results

Outflow Release Scenario	Assuming 4.5 m3/s flow release/pumping				
	Date Lake Level Below Zero Storage Level (161.4 m)	First Day of Pumping (Lake level < 161.29 m)	Number of Days of Pumping	Last Day of Pumping	Lowest Lake Level (m)
1 - 10th-percentile inflow (Very dry conditions)	Jul 26	Aug 7	118	Dec 2	160.66
2 - 20th-percentile inflow (dry conditions)	Aug 7	Aug 27	79	Nov 8	160.96
3 - 30th-percentile inflow (below average conditions)	Aug 22	Sep 9	45	Oct 25	161.17

Note: Inflow conditions based on calculation of daily percentile Cowichan Lake inflows from the entire period of record (1953 to 2017 or 65 years)

Limitations of forecast/first day of pumping

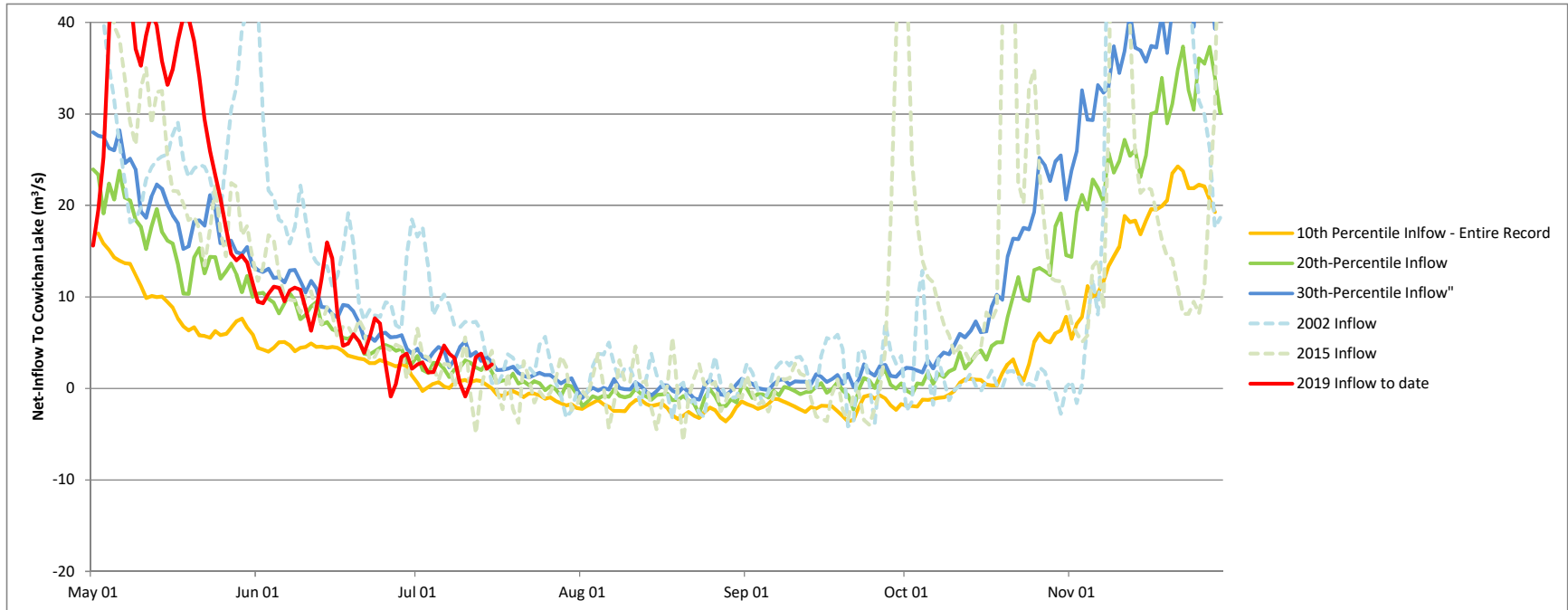
Lake level at which pumping is required is based on previous computer hydraulic modelling analysis. The analysis was carried out in 2004 using data collected at the time. Changes in outlet channel geometry since the analysis will influence this level. Therefore, careful monitoring of flows and lake levels below the zero storage level will be essential in determining actual start date of pumping.

Submission

Should you have any questions related to the forecasting please contact undersigned at 250-294-8024.

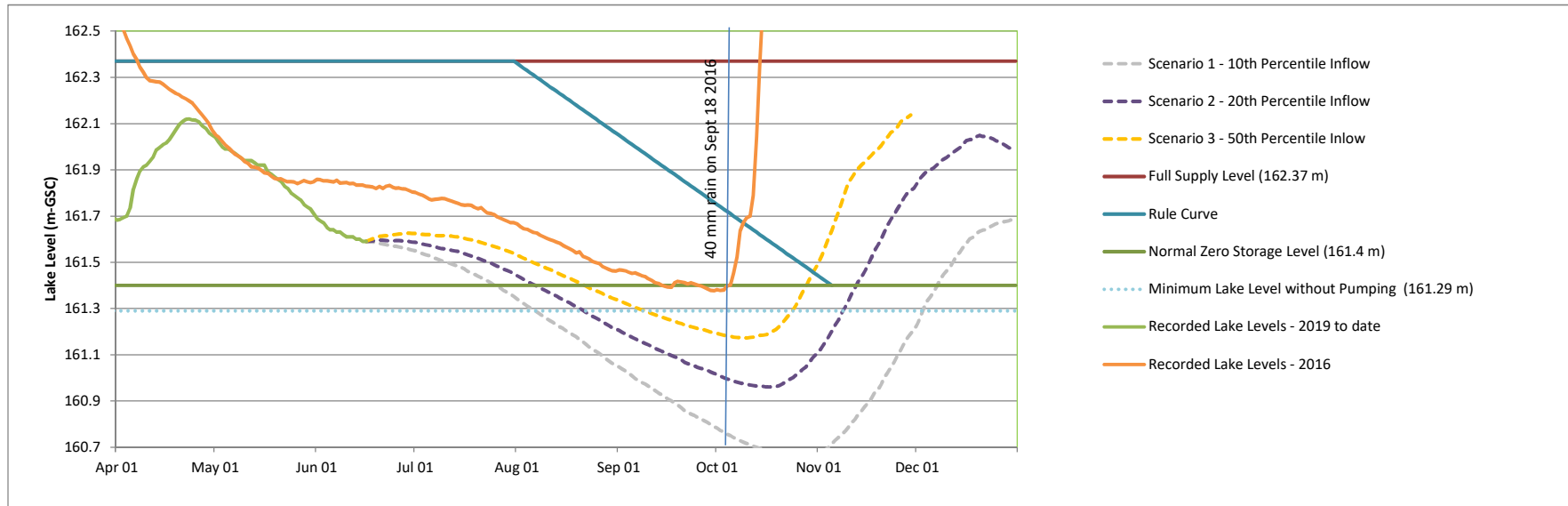
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Figure 1 - Assumed Inflow Conditions for Cowichan Lake



Cowichan Lake 2019 Forecast
 DRAFT - 2019 - Cowichan Lake Low Flow Season Forecasting
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Figure 1 - Forecast Cowichan Lake Water Levels



Note: Normal Zero Storage Level is the minimum lake level at which 7 m³/s can be maintained in Cowichan River
 Minimum Lake Level without pumping is the lowest lake level at which 4.5 m³/s can be maintained in Cowichan River without pumping
 Projected lake levels below the minimum assume pumping at a rate of 4.5 m³/s.