



# **Cowichan Lake Water Management Rule Curve & Rule Band April 7, 2011**



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# Cowichan Lake Level and River Flow

## Summary

- **Background and Definitions**
- **How are river flow and lake level managed?**
- **How can water be better managed?**
- **Rule Curve / Rule Band**
- **Example Years**



# Cowichan Lake Weir



## History / Background

Constructed in 1956 by BCFP to supply water for Crofton Pulp/Paper Mill

Catalyst operates weir on behalf of many users:

- Industry
- Municipal treated sewage dilution
- Water supply
- Fisheries
- Cultural values
- Recreation

Ad-hoc Committee provides input to in-season water management decisions.



# Some things to keep in mind...

**When inflow  $>$  outflow lake level increases.**

**When inflow  $<$  outflow lake level falls.**

**Weir normally controls spring/summer lake levels by:**

- 1. Decreasing outflow in spring to store water**
- 2. Releasing water in summer to maintain summer baseflows**



## Some definitions

**Full Storage Level (FSL) – water level at top of the weir**

**Zero Storage Level (ZSL) – below this lake level, river flow would drop below 7 m<sup>3</sup>/s & quickly diminish**

**Control period – Typically Apr. 1 to Sept./Nov. depending on rain**



# Water levels at the Weir during typical year

**Full Supply**

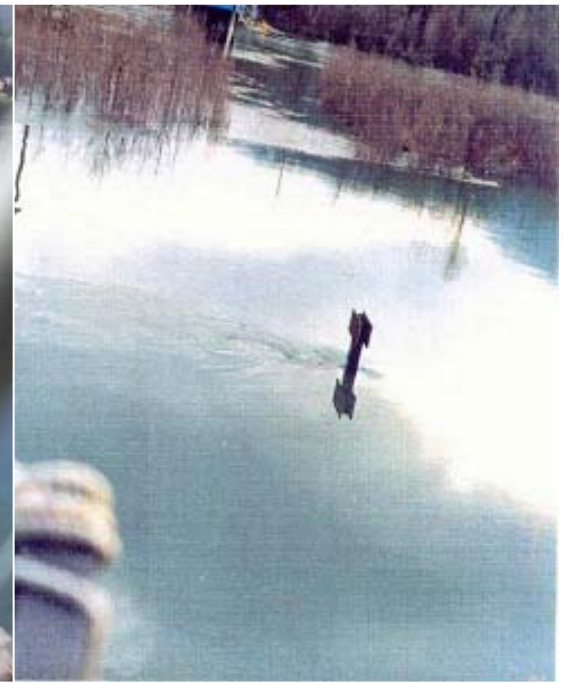
**Zero Storage**

**No Control**

**April to Early July**

**End of  
October**

**November**



**Direction of Flow<sup>6</sup>**

# How are lake levels & river flows managed?



# How is water managed?

**Ideally in normal average year:**

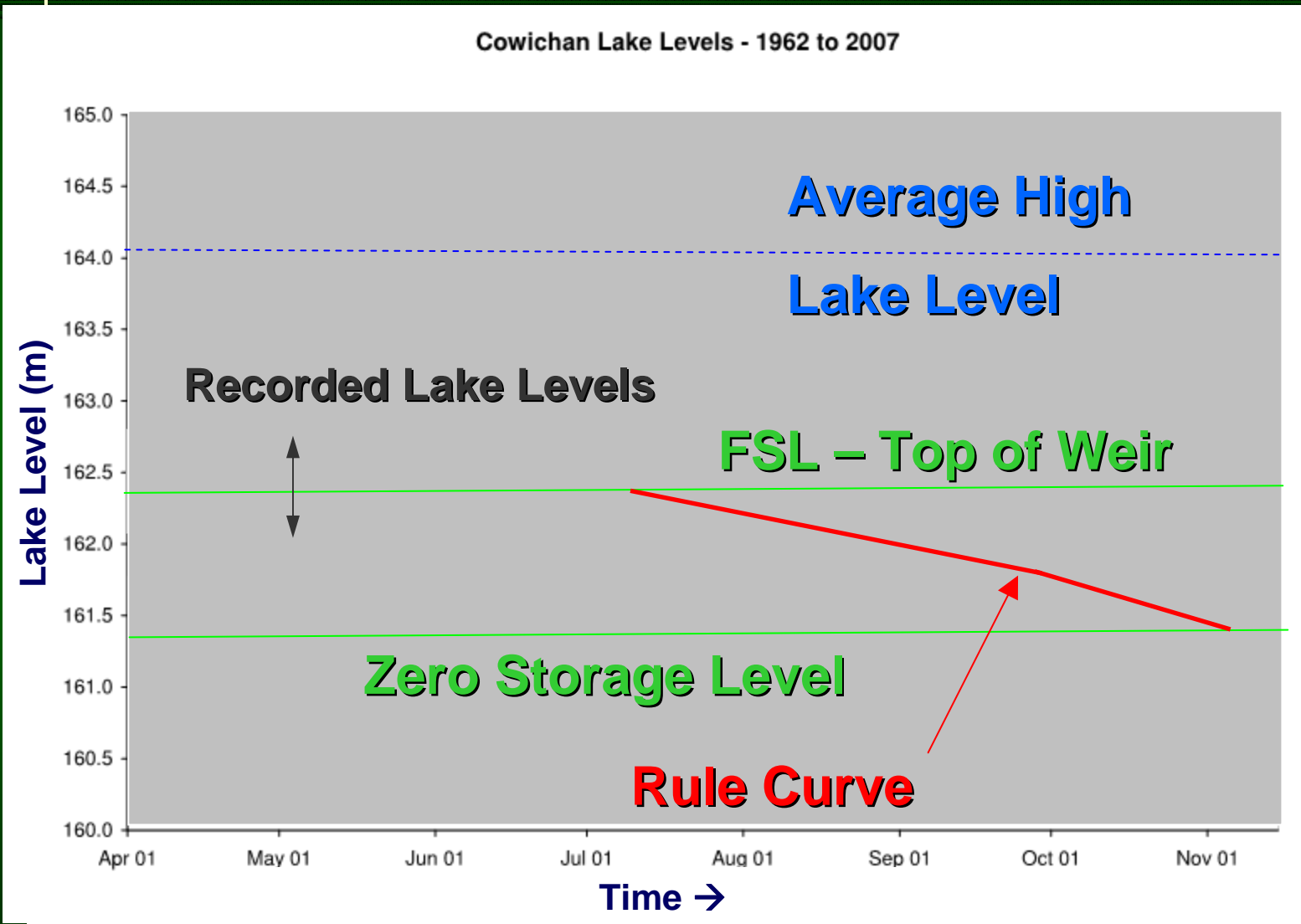
- 1. Spring flows: 25 m<sup>3</sup>/s & 15 m<sup>3</sup>/s before June 15<sup>th</sup>.**
- 2. River flow 7 m<sup>3</sup>/s from June 15<sup>th</sup> until fall rains (late Sept. - early Nov.)**
- 3. To support this at FSL on July 9<sup>th</sup>**
- 4. Lake level drawn down by end of control season**

**However depends on inflow (wet or dry).**





# How is water managed? Rule Curve



Ideally lake level at FSL July 9 then falls along Rule Curve



# How is water managed now: Rule Curve cont'd

**What happens when lake levels don't follow rule curve because inflow is below or above normal?**

**Ad hoc committee makes recommendation to MoE seeking approval to:**

- Reduce river flows when W/L below rule curve to maintain storage or,
- To increase flows when W/L above rule curve to avoid risk of flood

**Rule Curve does not indicate how far the lake level needs to be above or below the curve before river flows are changed.**



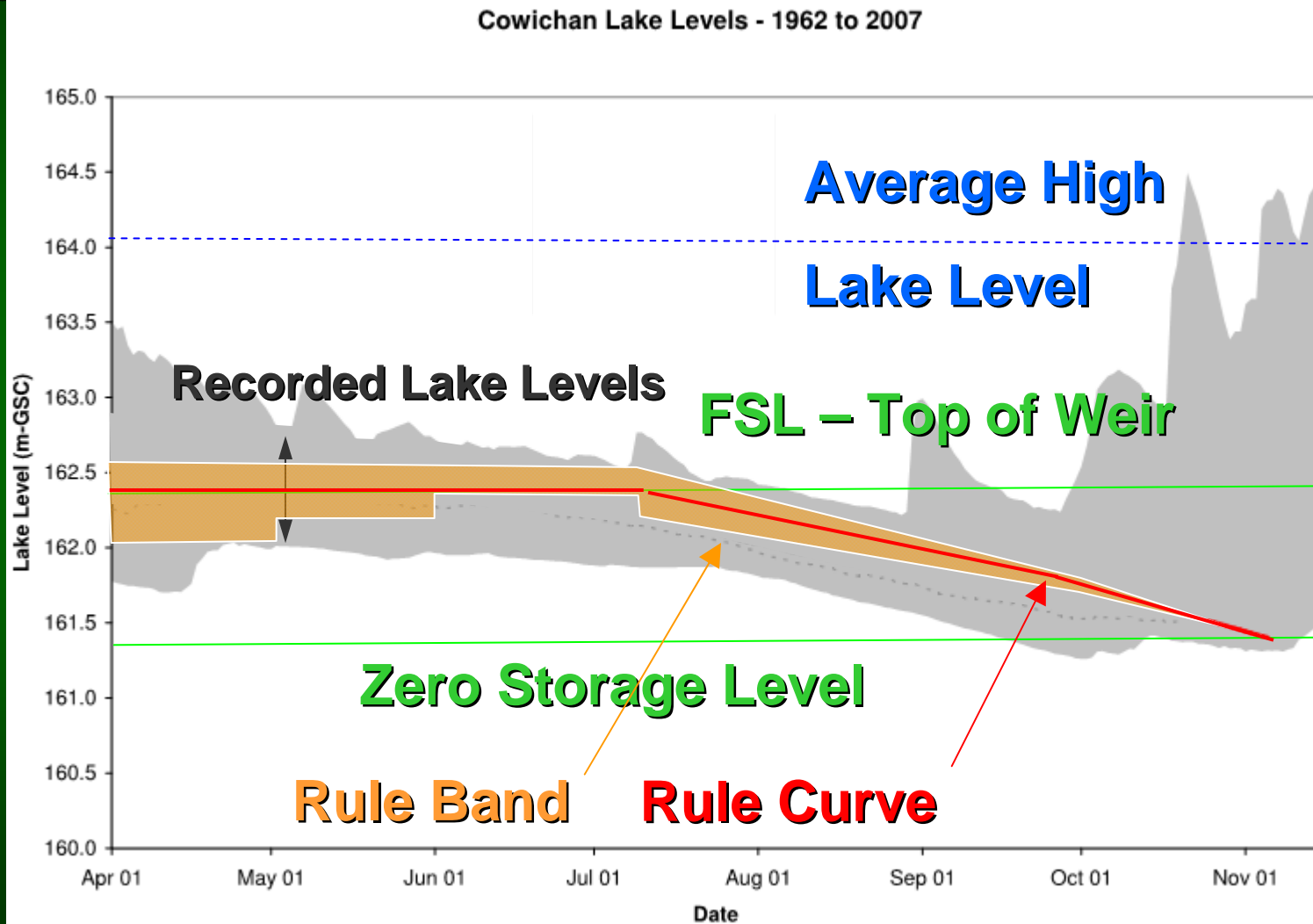
## Concerns with Rule Curve Approach?

1. Current tool (rule curve) developed in the 1960s to manage water for mill.
2. Now must consider many other factors:
  - a. Fisheries
  - b. Other uses (wastewater dilution, cultural values, recreational values, etc.)
  - c. Average spring/summer inflow down ~ 36% since mid-80s

**Rule curve Approach not flexible enough**



# How can water be better managed? Rule Band



Ideally lake level at FSL July 9 then falls along Rule Curve



### Rule Band Approach cont'd

#### Rule Band

- Considers wet and dry year scenarios rather than just average year.
- Allows lake levels to vary within a specified band depending on inflow.
- Only if lake levels fall outside the band, would river flows be changed.
- **Provides clear guidance on when to change river flows.**



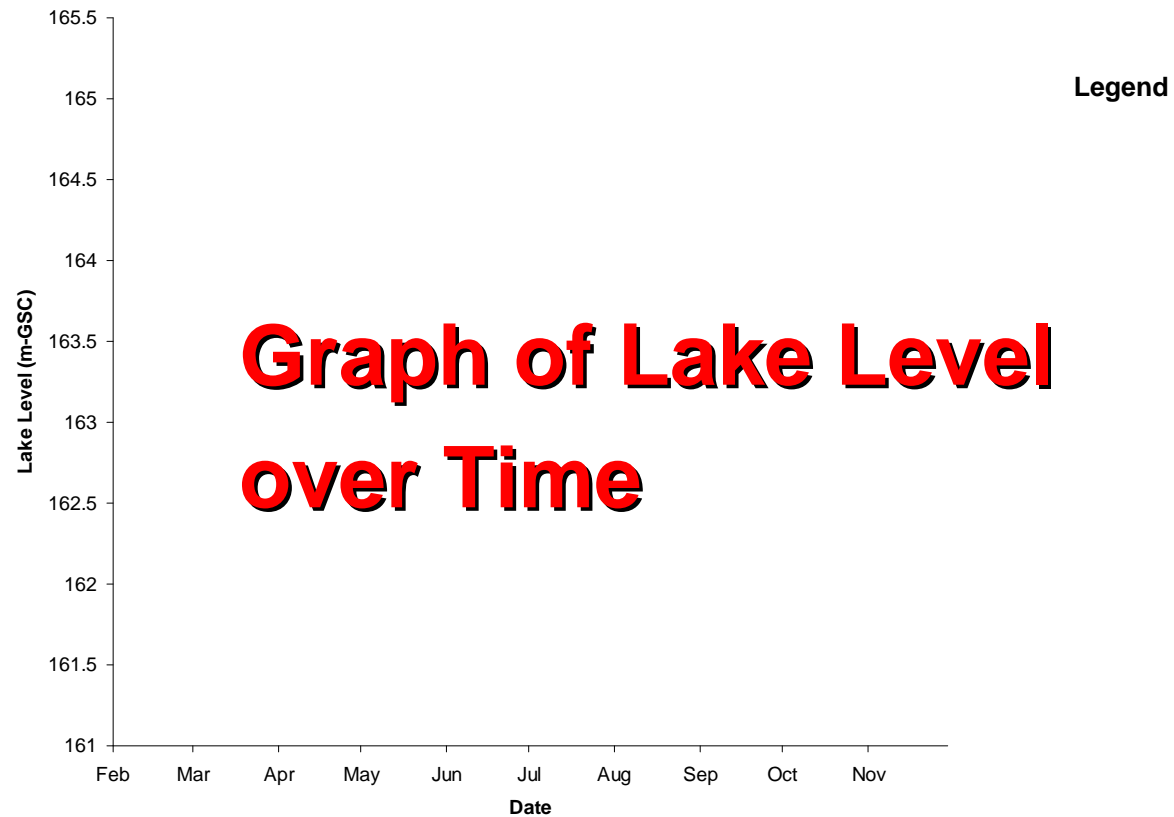
# EXAMPLE YEARS

- **2006 – Average Year**
- **2003 – Dry Year**  
**(Apr to Oct Inflow about 70% of average with little snowpack)**
- **1999 – Wet Year**  
**(About 160% of average with significant snowpack)**



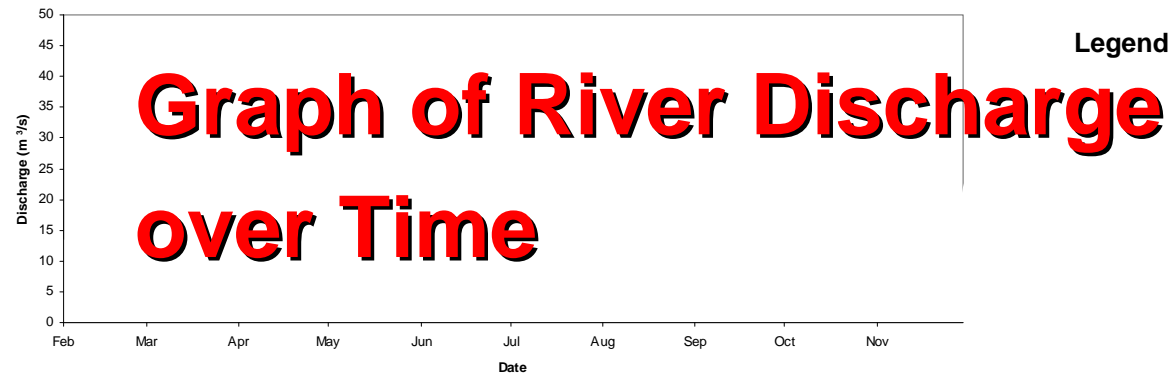
Range of Recorded Lake Levels

Cowichan Lake Water Levels



Range of Recorded Discharges

Cowichan River Discharge at Lake Cowichan



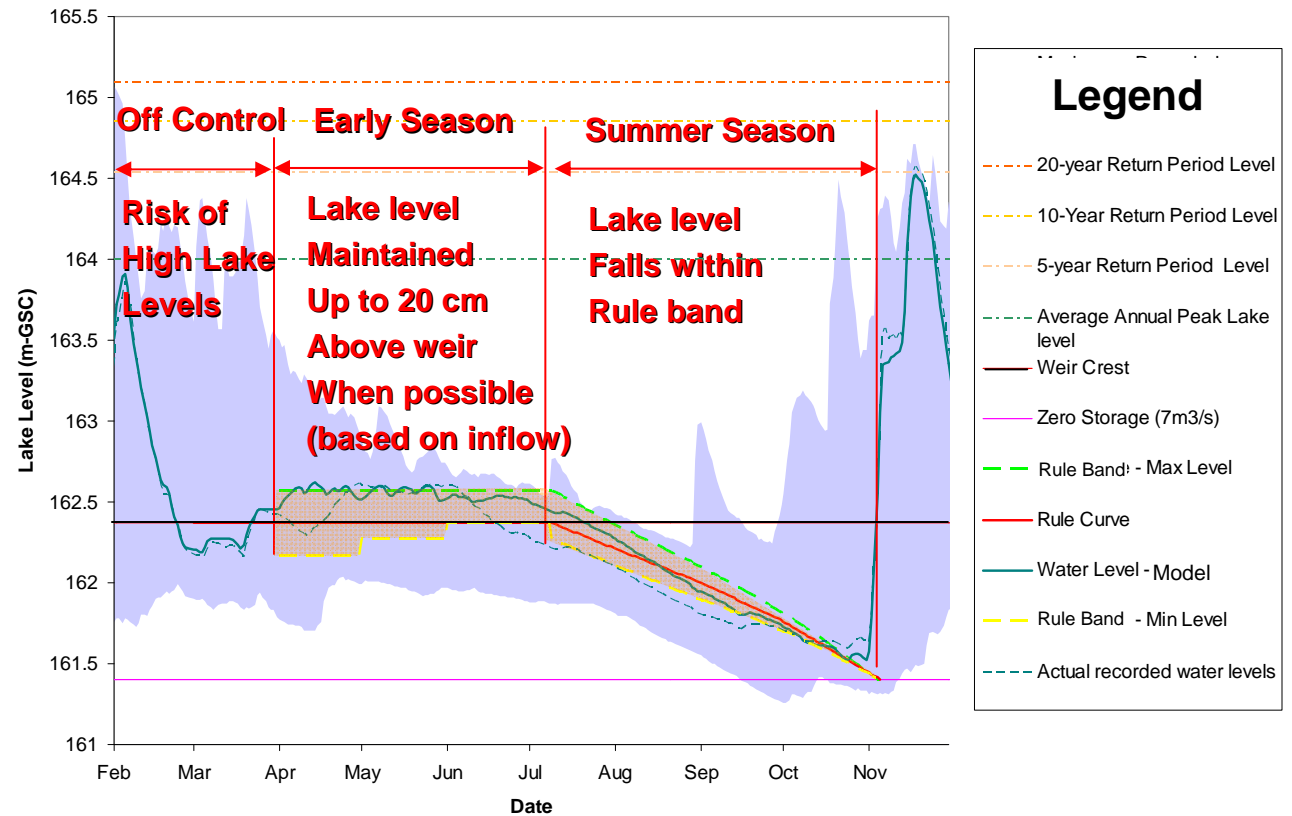


# 2006 – Normal / Avg. Year

- Lake level  
maintained above  
FSL until July 9<sup>th</sup>

- Minimum Flow (7  
m<sup>3</sup>/s) maintained  
until end of October  
and return of fall  
rains

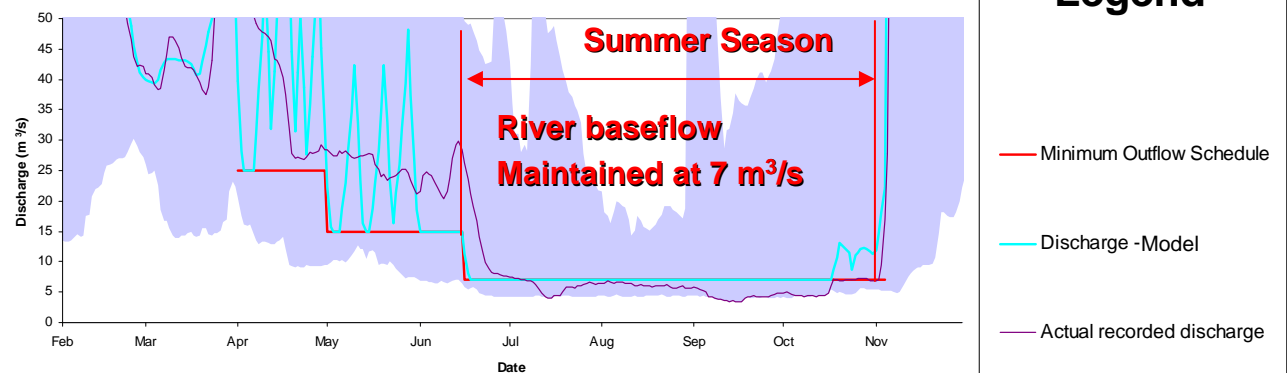
Cowichan Lake Water Levels  
2006 - Average Typical Year



## Legend

- 20-year Return Period Level
- 10-Year Return Period Level
- 5-year Return Period Level
- Average Annual Peak Lake level
- Weir Crest
- Zero Storage (7m<sup>3</sup>/s)
- Rule Band - Max Level
- Rule Curve
- Water Level - Model
- Rule Band - Min Level
- Actual recorded water levels

Cowichan River Discharge  
at Lake Cowichan



## Legend

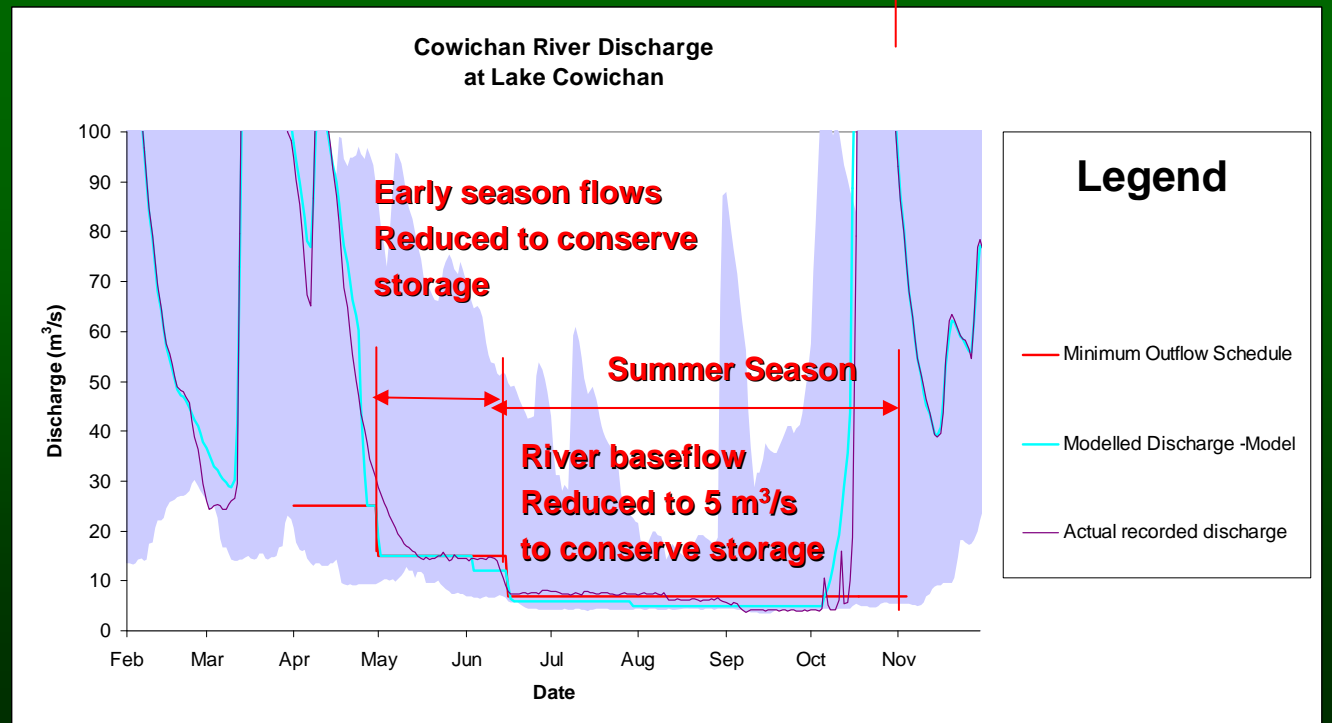
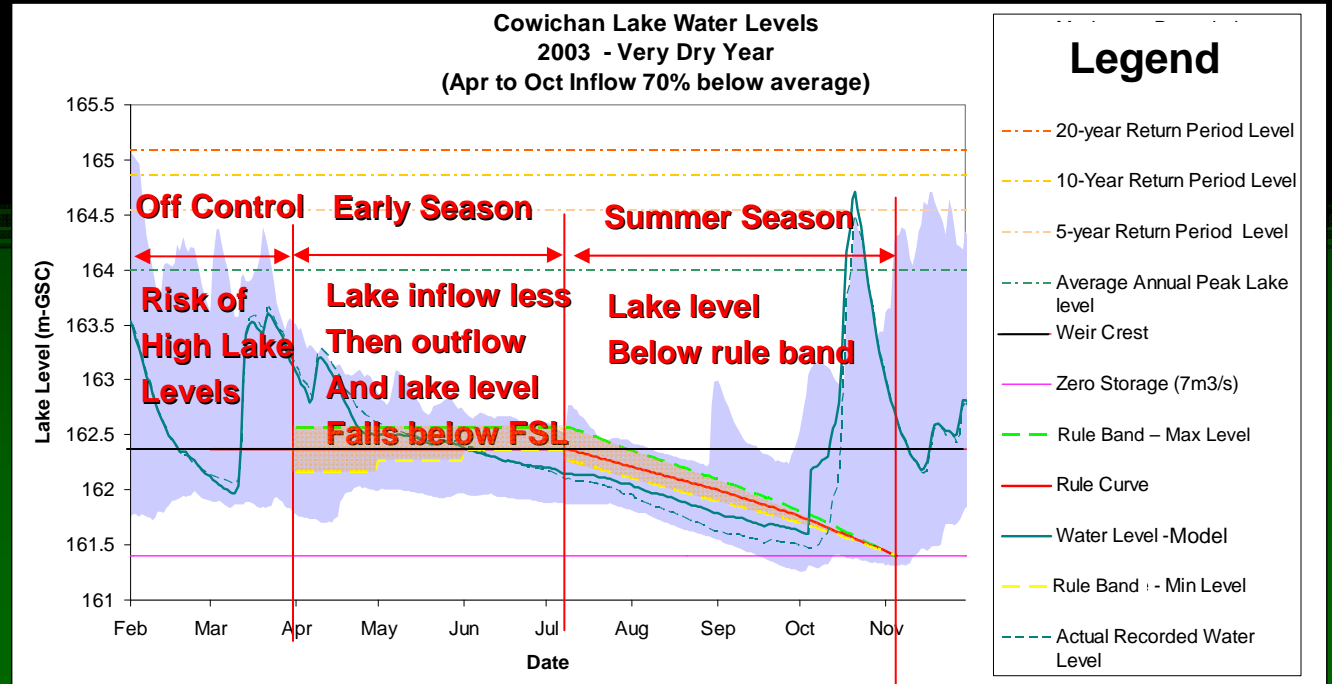
- Minimum Outflow Schedule
- Discharge - Model
- Actual recorded discharge





# 2003 – Dry Year (70% of average)

- Low lake inflow results in lake level dropping below FSL early in year
- River flows reduced to conserve storage

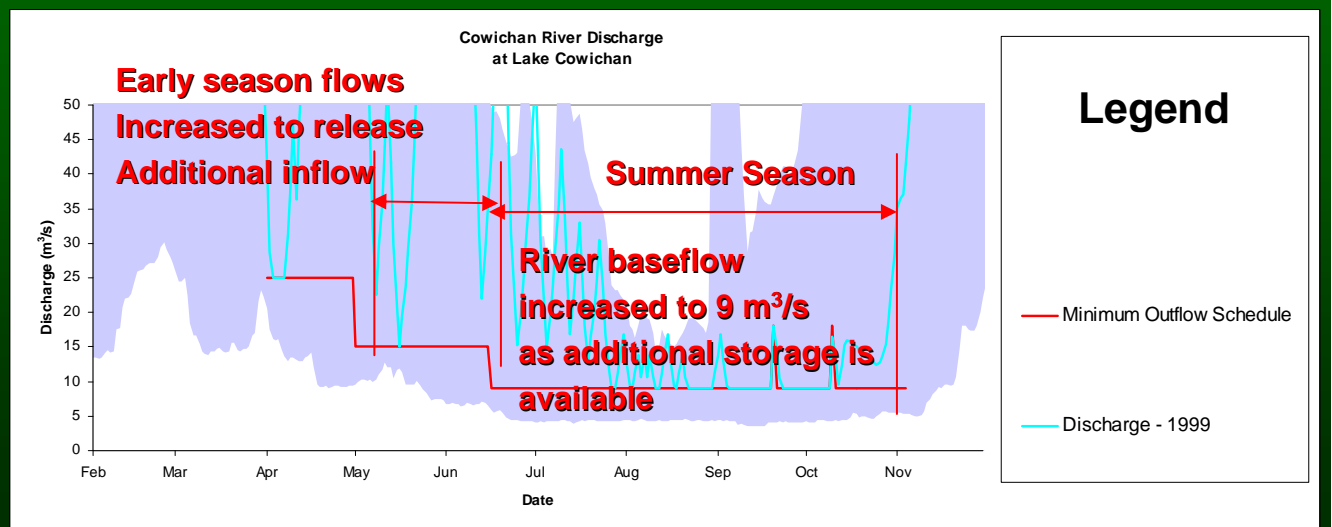
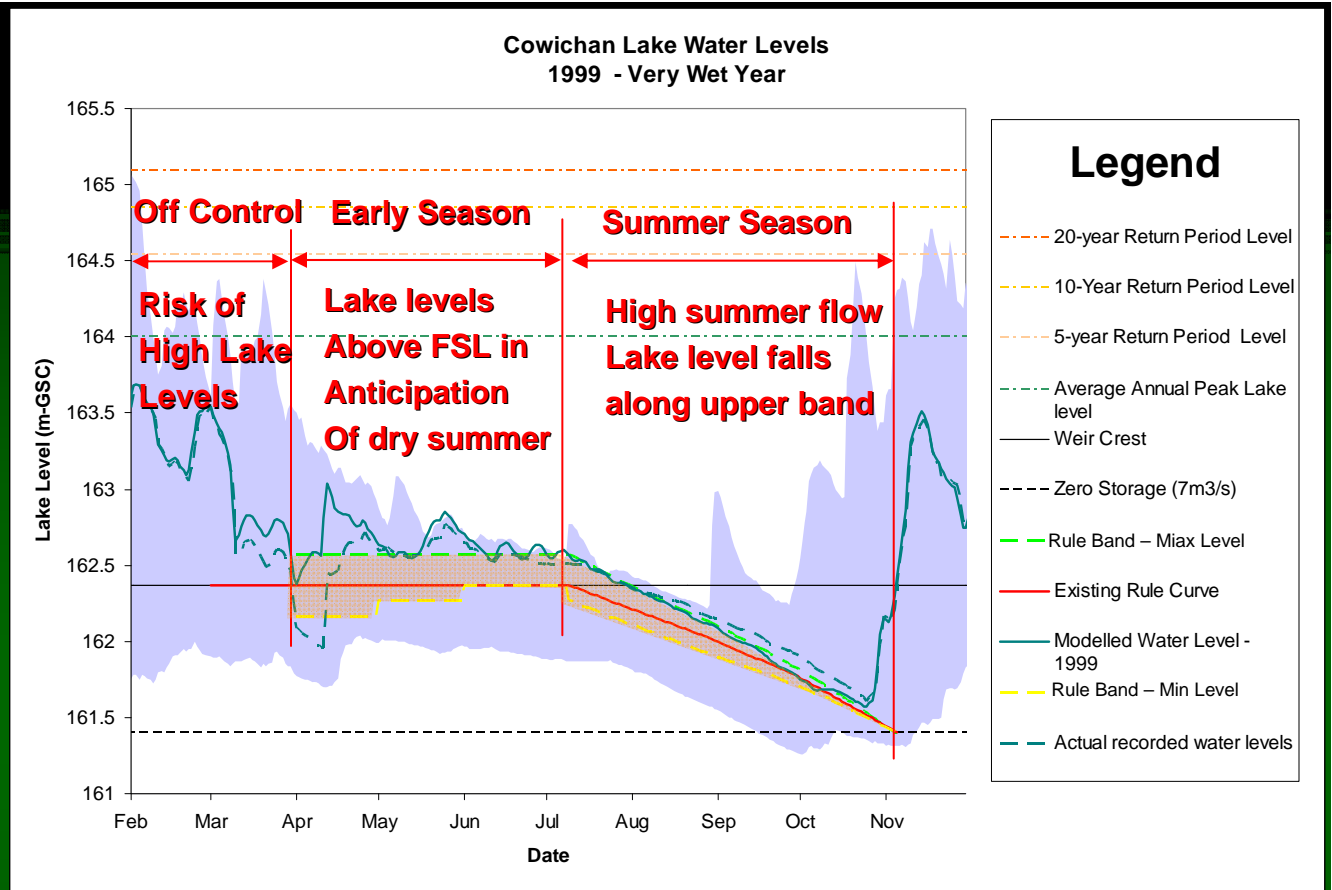




# 1999 – Wet Year (160% of avg.)

-Large snowpack  
and wet summer  
results in high  
inflow

- River flows  
increased as  
sufficient storage is  
available





# Summary

**Rule Band allows variation of lake level within specified range (depending on inflow):**

- 1. During normal (average) year lake level would still roughly follow the rule curve.**
- 2. During a **wet spring**, lake levels could be up to 20 cm above weir prior to July 9<sup>th</sup> and fall to full supply level by end of July.**
- 3. During a **dry spring**, river flows would be reduced to conserve storage if lake levels fall below band.**
- 4. During a **wet summer**, lake levels could be up to 20 cm above current rule curve until Sept 1. then river flows would be increased to draw lake level down to current rule curve.**
- 5. During a **dry summer**, river flows could be reduced if lake level falls 20 cm below current rule band. Also would allow for capture of summer rainfall within the**



# Summary

- 1. Rule band would be used by Ad-hoc Committee to make in-season flow management decisions.**
- 2. Only if water levels fall outside band would MoE need to be contacted.**
- 3. Lake levels would be managed within the range that has been seen in the recent past.**
- 4. Part of a suite of water management tools. Includes snow pack/ inflow monitoring and inflow forecasting.**
- 5. Allows for better use of existing infrastructure.**

**THANK – YOU**

