



Ministry of Forests, Lands
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Water Management of the Okanagan Lake Regulation System

November 16, 2016

Presented to the Drought Trigger Guidelines for Okanagan Mainstem Lakes Workshop

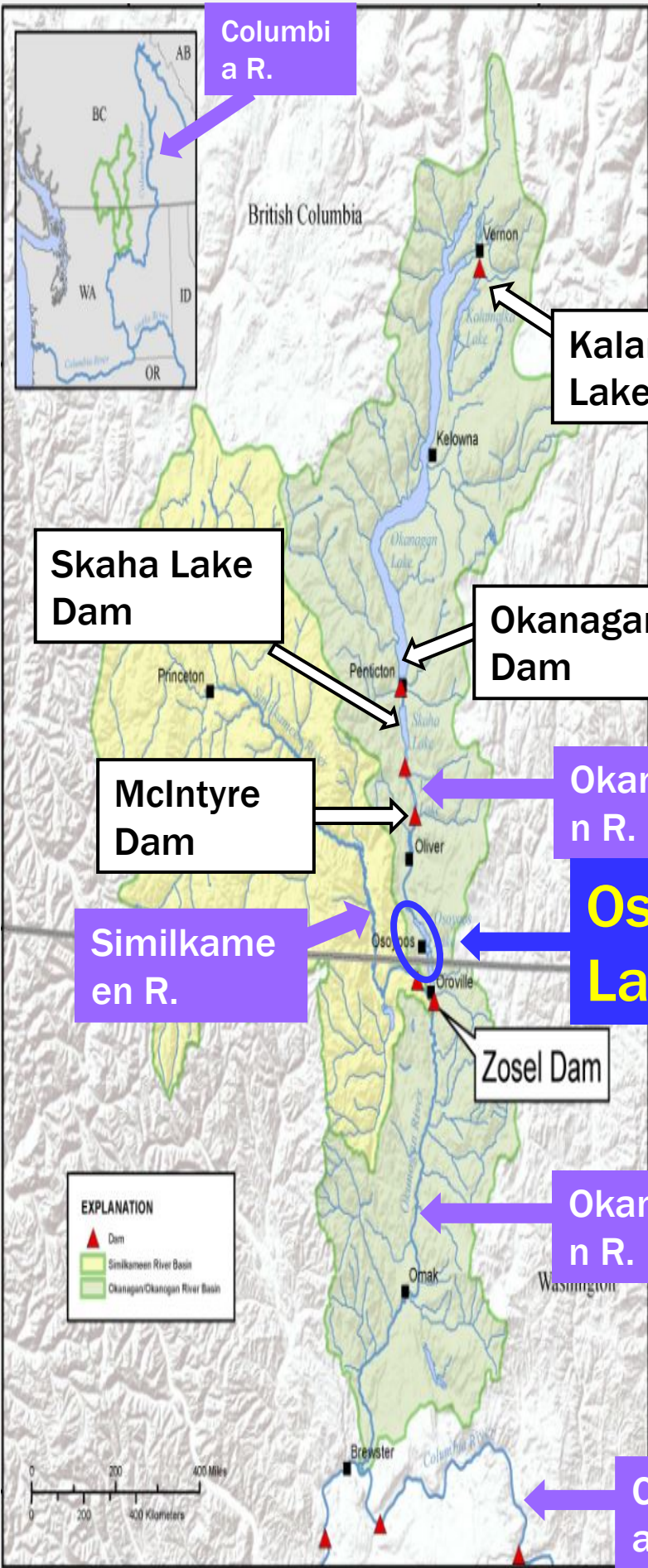
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Natural Resource Operations
Penticton**



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Watershed Description

- **Tributary to Columbia River**
- **Okanagan Basin Drainage area = 8,200 km² (in Canada)**
- **Main stem lakes:**
 - **Kalamalka/Wood (3520 ha; 8700 acre)**
 - **Okanagan (34075 ha; 84200 acre)**
 - **Skaha (2023 ha; 5000 acre)**
 - **Vaseux (243 ha; 600 acre)**
 - **Osoyoos (2318 ha; 5728 acre)**



Columbia R.

Kalamalka Lake Dam

Skaha Lake Dam

Okanagan Lake Dam

McIntyre Dam

Okanagan R.

Osoyoos Lake

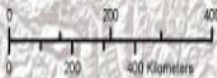
Similkameen R.

Zosel Dam

Okanagan R.

Columbia R.

EXPLANATION	
	Dam
	Similkameen River Basin
	Okanagan/Okanagan River Basin





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Okanagan Lake Regulation System

- **System extends from Kalamalka Lake to north end of Osoyoos Lake**
- **4 dams (Kalamalka, Okanagan, Skaha & Vaseux Lakes)**
- **17 vertical drop structures**
- **38 km of engineered channel, including 68 km of dikes**
- **4 sediment basins**



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Construction of the Okanagan Flood Control System

A Joint Board of Engineers:

- Appointed in 1943 to report out after a major 1942 flood;
- Recommended the construction of dams, vertical drop structures, and river channelization, as well as the establishment of operating ranges;
- Recommendations were implemented after a “Memorandum of Agreement” was signed in 1950 between the Federal and Provincial governments;
- Project was completed between 1950 & 1958;
- Costs of the construction and maintenance were shared equally.



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Okanagan Basin Implementation Agreement

In 1976, the Okanagan Basin Implementation Agreement was signed by the Federal and Provincial Governments;

It set out seasonal targets for main stem lake elevations and river flows. These targets take into account:

- Anticipated flood and prolonged drought conditions;
- Water requirements for Sockeye and Kokanee
- Some infrastructure was upgraded and repaired (1976-1981);
- Under this agreement, the Province became the operators of the Okanagan Flood Control System.



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Range of Flows and Lake Levels

Okanagan Lake operational range: 1.15 m

- 341.34 m to 342.48 m geodetic;
- Under prolonged drought conditions (successive years <247 Million m^3), lake may be drawn down to 340.4 m;

Average inflow into Okanagan Lake: 530 Million m^3 (1.5 m on lake);

How are decisions made??



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Okanagan Lake Regulation System- Lake Level Targets			
Month	Volume Forecast M cu. m.	Okanagan Lake Elevation (metres)	Flow at Oliver (cu. m/s)
Jan.		341.74 by month end	5 to 28.3
Feb.	< 430	As High as Possible	5 to 28.3
	> 430	341.54 by month end	5 to 28.3
Mar.	< 620	As High as Possible	5 to 28.3
	> 620	341.49 by month end	5 to 28.3
Apr.	<250	As High as Possible	5 to 28.3
	370 to 500	341.44 by month end	5 to 28.3
	> 620	341.34 by month end (major flooding expected)	> 45
May	Lake Filling	342.48 by month end	> 6.5
Jun.		342.44 by month end	> 6.5
Jul.		342.24	> 8.2
Aug.		342.04	10.6 to 28.3
Sep.		342.04 on Sept 1	9.2 to 28.3
		341.95 on Sept 15	9.9 to 15.6
		341.89 on Sept 30	
Oct.		341.84 by Oct 15	9.9 to 15.6
Nov,		341.84 by month end	5 to 28.3
Dec.		341.84 by month end	5 to 28.3



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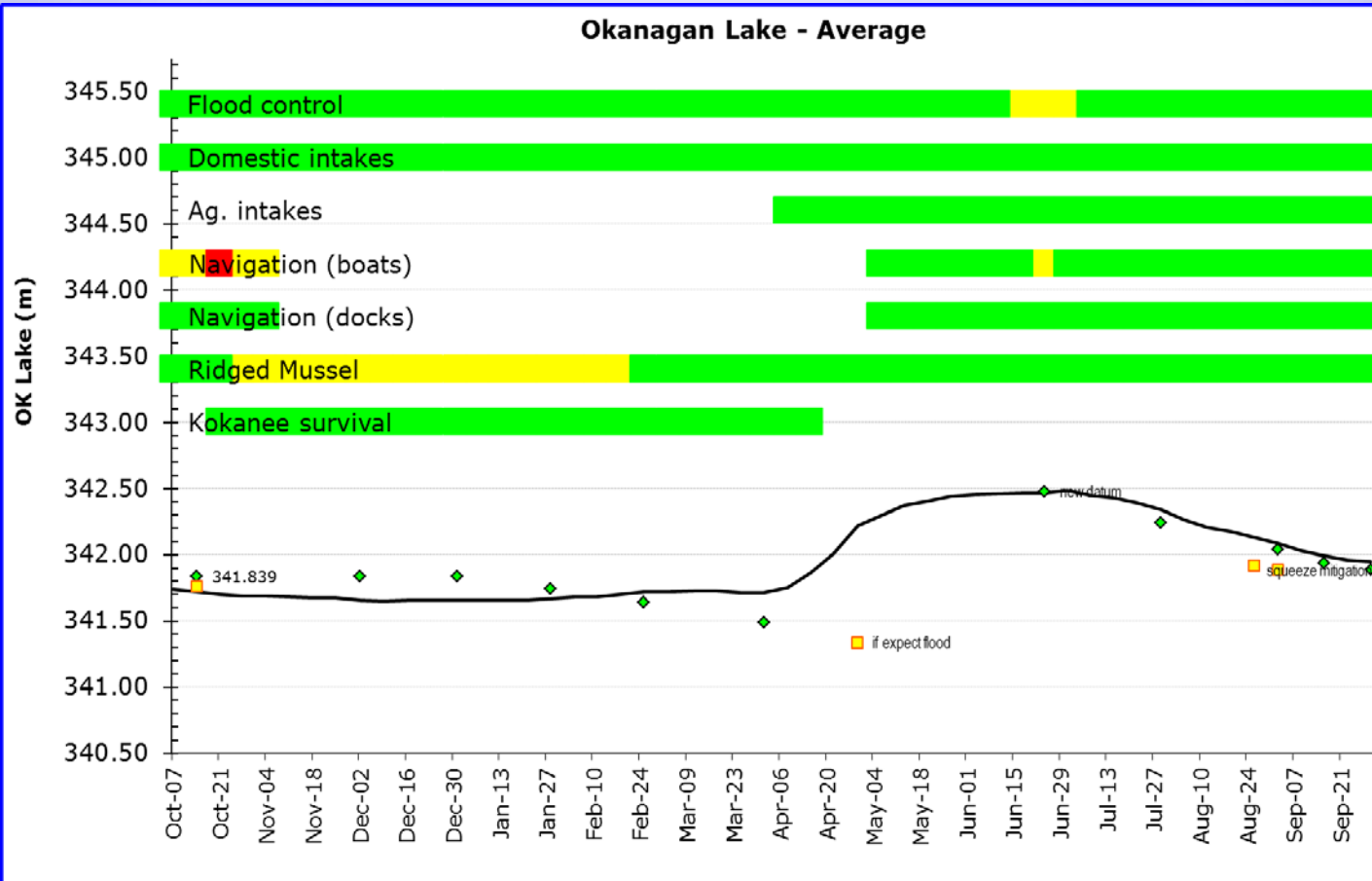
Fish Water Management Tool

- **Computer Model used for decision making support;**
- **Forecasts Okanagan Lake and River levels based on inflow forecasts from River Forecast Centre (Victoria) and a Release Schedule from Okanagan Lake.**
- **Uses peak spawning dates and temperature data to inform the water manager of fish hatching and emergence;**
- **Seasonal or monthly target levels conform to those developed under the Okanagan Basin Implementation Agreement.**
- **Partners include Douglas County PUD (US), DFO, ONA, FLNRO.**



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Fish Water Management Tool Output

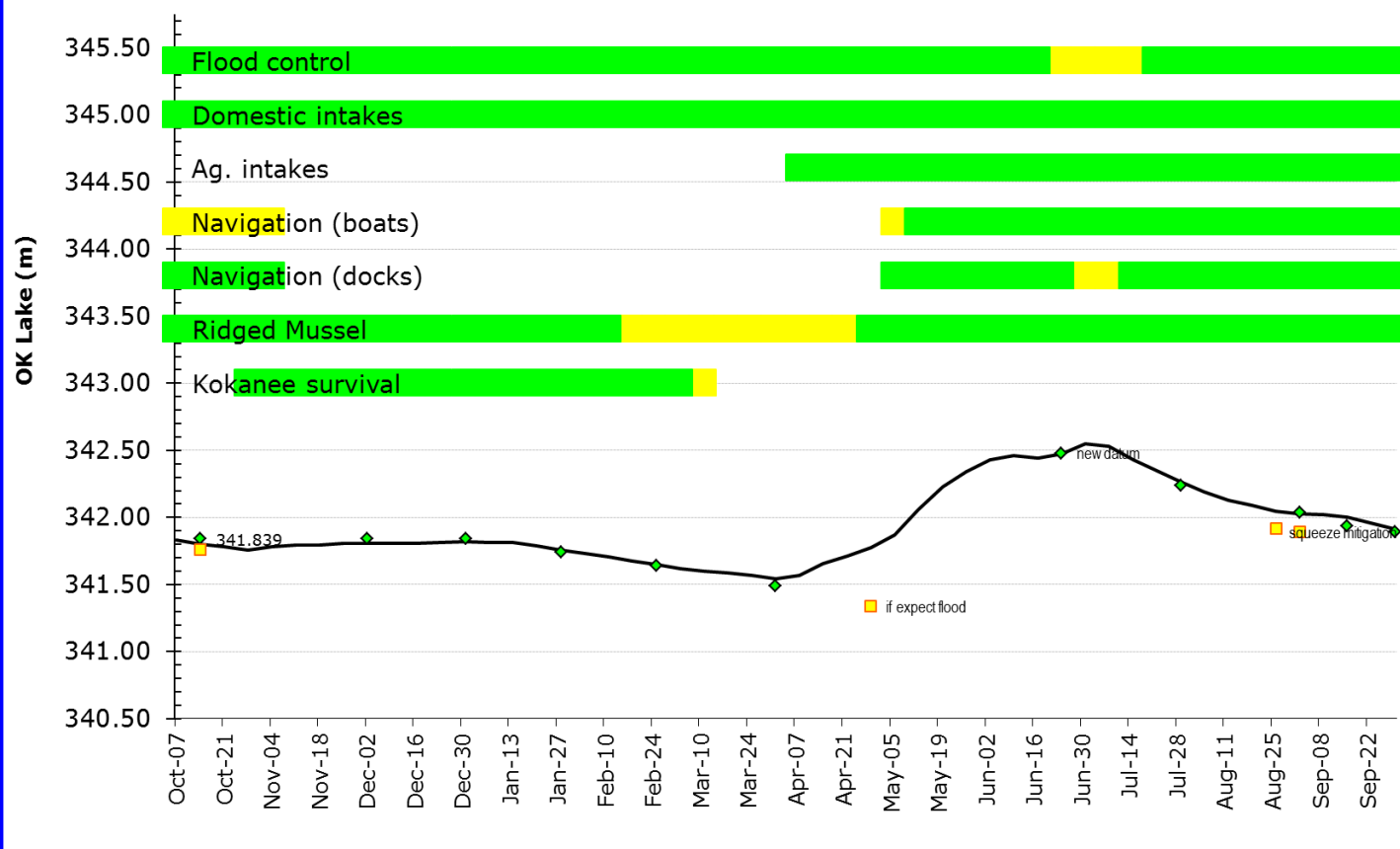


2016



Fish Water Management Tool Output

Okanagan Lake - Average



2013



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Management Constraints

Okanagan River Design Flows range from 60 m³/s in Penticton to 96 m³/s south of Oliver;

Net difference of 40 m³/s (inflow - outflow) on Okanagan Lake = 1 cm/day.

Seasonal constraints include maximum flow of 28.3 m³/s (1000 cfs) in Okanagan River at Oliver until Sockeye eggs hatch and emerge from gravel;

This constraint overridden for large snowpacks;

Tributary flow downstream of Penticton means that this flow may be much less out of Okanagan Lake Dam.

Guideline 1: Do not fill Okanagan Lake above 342.69 metres.

Guideline 2: Avoid drawing down Okanagan Lake below 341.44 metres.

Guideline 3: Minimise the drawdown of Okanagan Lake between the time of peak kokanee shore spawning and the date of 100% fry emergence (~March/April). i.e., minimise de-watering of kokanee eggs and fry subject to guidelines 1 (above), and 8 and 9 (described below).

Guideline 4: Do not exceed $65 \text{ m}^3 \cdot \text{sec}^{-1}$ releases at Okanagan River, Penticton, to minimise the number of buildings flooded at and downstream of Penticton.
(Note: Okanagan Lake dam at Penticton is capable of water releases upwards of $78 \text{ m}^3 \cdot \text{sec}^{-1}$ under flood elevations. The $60 \text{ m}^3 \cdot \text{sec}^{-1}$ design level has been exceeded several times in the past).

Guideline 5: Provide summer flows for river recreation if possible (i.e., maintain flows of $20\text{-}30 \text{ m}^3 \cdot \text{sec}^{-1}$ in July through August), subject to satisfying ALL other guidelines.

Guideline 6: Adult sockeye migration—maintain flows at Oliver between $8.5\text{-}12.7 \text{ m}^3 \cdot \text{sec}^{-1}$ during Aug 1-Sept 15 to allow "easy" passage, subject to guidelines 1 and 2.

Guideline 7: Adult sockeye spawning—maintain flows between $9.9\text{-}15.6 \text{ m}^3 \cdot \text{sec}^{-1}$ during September 16-October 31 to maximise "good" spawning habitat, subject to guidelines 1 and 2.

Guideline 8: Sockeye egg and alevin incubation—keep flows between $5.0\text{-}28.3 \text{ m}^3 \cdot \text{sec}^{-1}$ between November 1 and the anticipated date of 100% emergence (~ April/May). i.e., incubation flows must be greater than or equal to 50 % of spawning flows & must not exceed $28 \text{ m}^3 \cdot \text{sec}^{-1}$ to avoid redd desiccation & scouring (respectively), subject to guidelines 1 and 2.

Guideline 9: Sockeye fry emergence and migration—maintain flows between $5.0\text{-}28.3 \text{ m}^3 \cdot \text{sec}^{-1}$ during February 16–April 30, subject to guidelines 1 and 2.

Guideline 10: Maintain adequate sockeye rearing habitat in Osoyoos Lake—under drought and early onset of temperature/oxygen "squeeze", provide average August or September inflows above $10 \text{ m}^3 \cdot \text{sec}^{-1}$ to avoid high mortality of rearing fry, subject to guideline 2.



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River Constraints

Okanagan River summer flows generally kept above 8 m³/s for irrigation.

- **Volume flow more important in providing depth of water over intakes rather than volume for withdrawals;**
- **Difference between 6 m³/s and 8 m³/s would be 4 cm on lake over 80 days.**
- **Economic value of lowering intakes??**



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Similkameen River Impacts

- **Similkameen River enters Okanogan River below Zosel Dam;**
- **High Similkameen flow (> 10000 cfs) slows the Okanogan River (backwaters) or even reverses flow northward and potentially increases Osoyoos Lake levels;**
- **Okanagan River releases at Okanagan Lake Dam have been reduced in the past to reduce the impact of high peaks on the Similkameen.**



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Questions?