

Jordan River Water Use Plan

Monitoring Programs and Physical Works Annual Report: 2007

- **Fish Index: Lower Jordan River**
- **Lower Jordan River Inflow Monitoring**
- **Lower Jordan River Salmon Spawning Assessment and Enumeration**
- **Diversion Reservoir Fish Indexing**
- **Monitoring Surfing Quality below the Jordan River Generating Station**
- **Water Release Mechanism at Elliot Dam**

For Water Licences FL117999, FL118000, FL118001, FL118004 and FL 118005

BC Hydro Jordan River Project Water Use Plan Monitoring Programs and Physical Work Annual Report: 2007

1 Introduction

This document represents a summary of the status and the results of the Jordan River Water Use Plan (WUP) monitoring programs and physical work to 31 October 2007, as per the Jordan River Order under the *Water Act*, dated 20 July 2004. There are five monitoring programs and one physical work:

- Fish Index: Lower Jordan River
- Lower Jordan River Inflow Monitoring
- Lower Jordan River Salmon Spawning Assessment and Enumeration
- Diversion Reservoir Fish Indexing
- Monitoring Surfing Quality below the Jordan River Generating Station
- Water Release Mechanism at Elliot Dam

2 Background

The water use planning process for BC Hydro's Jordan River project was initiated in April 2000 and completed in November 2001. The conditions proposed in the WUP for the operation of the project reflect the February 2002 recommendations of the Jordan River WUP Consultative Committee.

In February 2002, the Jordan River WUP was submitted to the Comptroller of Water Rights (Comptroller).

On 20 July 2004, BC Hydro was ordered to implement the conditions proposed in the Jordan River WUP and prepare the monitoring programs and physical work terms of reference (TOR).

On 10 June 2005, the Jordan River WUP monitoring programs TOR were submitted to the Comptroller for review and approval. Revised TOR costs were submitted on 28 June 2005. On 30 June 2005, the monitoring programs TOR were accepted by the Comptroller.

On 31 May 2006, BC Hydro sent a letter to the Comptroller requesting a one year delay in the commencement of minimum flow until 30 June 2007 in order to collect two years of pre-flow release field data. On 20 July 2006, the Comptroller approved the delay.

On 31 May 2006, the Jordan River WUP physical work TOR was submitted to the Comptroller for review and approval. On 14 July 2006, the revised TOR was submitted to the Comptroller as the construction schedule would be delayed one year until spring 2007. On 18 September 2006, the revised TOR for the water release mechanism at Elliott Dam were accepted by the Comptroller.

On 28 May 2007, revised TOR for the Lower Jordan River Inflow Monitoring was approved for a study cost increase.

On 16 July 2007, a TOR revision for a cost increase and completion date change to the water release mechanism at Elliott Dam were submitted to the Comptroller. On 24 July 2007, approval was received for the cost increase and for the delay in minimum flow commencement until 15 October 2007.

On 2 October 2007, a letter was sent to the Comptroller to inform of a delay in construction completion of the water release mechanism at Elliott Dam and to request approval for a delay in commencement of minimum flow. Approval was received 29 October 2007 for minimum flow commencement delay until 30 January 2008.

As outlined in the Jordan River WUP, the Jordan River Consultative Committee recommended a review of this WUP after six years of its implementation. A review may be triggered sooner if scientific data or significant new risks are identified that could result in a change to operations.

3 Status

The following table outlines the status and schedule for the Jordan River WUP monitoring programs and physical work.

Table 3-1: Status and Schedule of Jordan River WUP Monitoring Programs and Physical Work Implementation

Monitoring Programs	2005	2006	2007	2008	2009	2010	2011
	WLR YR1	WLR YR2	WLR YR3	WLR YR4	WLR YR5	WLR YR6	WLR YR7
Lower Jordan River Inflow Monitoring	✓	✓	u/w	■	■	■	
Fish Index: Lower Jordan River	✓	✓	u/w	■	■	■	
Lower Jordan River Salmon Spawning Assessment and Enumeration	✓	✓	u/w	■	■	■	
Diversion Reservoir Fish Indexing	✓	✓	u/w	■	■	■	
Monitoring Surfing Quality below the Jordan River Generating Station		✓	✓	■	■	■	■
Physical Works							
Water Release Mechanism	✓	x	u/w				

Legend:

- = Program to be undertaken/initiated in identified year
- u/w = Project is underway
- ✓ = Program completed for the year
- x = Program started, but encountered operational or hydrological delays

4 Summary of Monitoring Program

The following section outlines the status of the Jordan River WUP monitoring programs as per the Jordan River order under the *Water Act*, dated 20 July 2005. The following table summarizes the monitoring program results according to the key monitoring indicators for each program.

Table 4-1: Summary of Jordan River WUP Monitoring Programs Results

Study	Monitoring Indicator	Bio-Standard or Base-Line	2005	2006	2007	2008	2009	2010	2011
			WLR YR1	WLR YR2	WLR YR3	WLR YR4	WLR YR5	WLR YR6	WLR YR7
Lower Jordan River Fish Indexing	Rainbow Fry Density (fish/100m ²)	N/A	3.7 ⁹	4.9					
	Rainbow Parr Density (fish/100m ²)	N/A	1.4 ⁹	1.6					
	Rainbow Trout Condition Factor	1.05 ²	1.07	1.13					
Lower Jordan River Inflow Monitoring	% Diff from WUP MAD (1.51cms) ³	0	Incomplete Data	Reporting Underway					
Lower Jordan River Salmon Spawning Assessment and Enumeration	Salmon (coho and/or chum) escapement	N/A	4 CO	13 CM 1 CO					
	Egg to fry survival (%)	80% ³	76% (97%) ⁷	0% ⁸ (95%) ⁷					
Diversion Reservoir Fish Indexing	Rainbow CPUE (Floating + Sinking)	N/A	12.9 ⁶	13.8					
	Rainbow Trout Condition Factor	1.05 ²	1.10	1.10					
Monitoring Surfing Quality Below the Jordan River Generating Station	% Surfers Not Affected by Operations	< 50% ⁴	Not studied	82%	66% ⁵				

1. Salmonid Enhancement Program biostandards for Vancouver Island (Quinsam River) transplanted eggs (March 1997)
2. R. Ptolemy, Ministry of Environment, Victoria, personal communication.
3. Water Use Plan hydrology summary - see Taylor, 2001
4. Drafted as a threshold below which it may be determined that further operational constraints are required.
5. Based on a single survey not necessarily representative of typical surfers. To be reviewed at end of review period.
6. Previously recorded from West Basin only (CPUE = 9.6RB/hr), revised for both sampling sites.
7. Assessment between 350-450 ATUs. Note that 2005 data did not include Site 3 data (potential water quality issues).
8. Incubation cassettes were all lost due to extreme inflows to Jordan River March 2007
9. Reported densities in 2005 (10.2fry/unit 1.9parr/unit) were incorrectly summarized - geometric means are being used from now on.

Jordan River WUP Monitoring Programs

This section outlines the status of the Jordan River WUP monitoring program as per the Order under the *Water Act*, dated 20 July 2004.

4.1 Fish Index: Lower Jordan River

4.1.1 Overview

The objective of this monitoring program is to assess the biological benefits of the key WUP decision to increase flows in the lower Jordan River from leakage/local inflows to $\geq 0.25 \text{ m}^3\text{s}^{-1}$ using stock abundance and fish condition as performance measures.

The Jordan River WUP Consultative Committee recommendation to release a $0.25 \text{ m}^3\text{s}^{-1}$ flow was based, in part, on estimates of increased weighted usable area for rearing rainbow trout. To address this decision, the Jordan River Consultative Committee recommended a monitoring program to detect an increase in the standing stock of rainbow trout.

Monitoring Indicators a): Rainbow trout (juvenile) density.

b): Rainbow trout (juvenile) condition factor.

This monitoring program involves three components:

- Establish sampling protocol expected to provide statistical power to detect changes in standing stock (expected change $\geq 100\%$);
- Collect initial estimates of standing stock, physical habitat changes and fish size and condition for rainbow trout, and;
- Analyse data to compare increases in size, condition and standing stock between pre and post $0.25 \text{ m}^3\text{s}^{-1}$ flow release.

4.1.2 Status

This monitoring program was initiated in September 2005 and will be carried out over six years. The second year program report was received in December 2007. The third year field work started in August 2007 and is currently underway.

4.1.3 Interpretation of Data

Results of the program will be compared between years to determine the level of response as defined by monitoring indicators above. It is anticipated that all six years of data collection will be required to make this determination; however rainbow trout fish condition observed in Year 1 is comparable to Vancouver Island biostandards (Ptolemy, pers. comm.¹)

¹ Ptolemy, Ron. Fish Biologist, Aquatic Ecosystems Science Section, BC Ministry of Environment, Victoria, BC.

To date, there is insufficient data to determine whether instream flow provisions are a driver in Lower Jordan River fish productivity.

4.2 Lower Jordan River Inflow Monitoring

4.2.1 Overview

The objective of this monitoring program is to assess the performance of the key WUP decision to increase flows in the lower Jordan River from leakage/local inflows to $\geq 0.25 \text{ m}^3\text{s}^{-1}$ using instream flow measurements as the performance measure.

The Jordan River Consultative Committee's recommendation to release a base flow was based, in part, on estimates of weighted usable rearing area. The Jordan River Consultative Committee has recommended that more accurate river discharge and local inflow contributions be assessed.

Monitoring Indicator a): Percentage difference from assumed (Jordan River WUP, Taylor, 2001²) mean annual discharge.

This monitoring program involves monitoring instream flow at three locations in Lower Jordan River through the combination of water level monitoring and rating curve (flow-water surface elevation relationship) development.

4.2.2 Status

This monitoring program was initiated in November 2005, and will be carried out over six years. The first year program report was received in November 2006. A storm event in November 2006 resulted in major flooding which compromised all of the hydrometric stations. New more robust stations were installed in 2007. During 2007 the implementing contractor could not complete the project due to health reasons. A new contractor has been retained to complete the remainder of the six year program. BC Hydro will be submitting a revision shortly notifying the Comptroller of the change to the terms of reference. The second year program report is expected March 2008. The third year field work started in November 2007 and is currently underway.

4.2.3 Interpretation of Data

At the time of reporting, there was inadequate data to report on the monitoring indicator above. Due to program delays and issues with data collection, an update on this measure will be provided in the upcoming second year program report.

The monitoring indicator will provide both the context of the Jordan River Water Use Plan recommendations and the flow response of the water release, for consideration in future planning processes.

² Taylor, Lara, 2001. Inter-office memo: Jordan River Projects – basin hydrology. Prepared for Eric Wiess, BC Hydro Operations, Burnaby, BC.

4.3 Lower Jordan River Salmon Spawning Assessment and Enumeration

4.3.1 Overview

The objective of this monitoring program is to assess the performance of the key WUP decision to increase flows in the lower Jordan River from leakage/local inflows to $\geq 0.25 \text{ m}^3\text{s}^{-1}$ using spawning success (number of returns to outmigrants) as the performance measure. Effective spawning and incubation habitat will also be measured.

Spawning success in lower Jordan River is limited by the cumulative impacts of flow reductions, mine operations, and log sort operations in the Lower Jordan River. Fisheries and Ocean Canada and some members of the Consultative Committee, however, hypothesised that improvements to the base flow in the lower reaches may be adequate to A) improve effective incubation habitat and B) dilute dissolved metal levels (Cu) sufficiently to reduce chronic toxicity. To address this hypothesis the Jordan River Consultative Committee recommended a program to monitor for successful signs of spawning and rearing in the Lower Jordan River following the base flow release.

Monitoring Indicators a): Salmon escapement (coho + chum).
b): Spawning success (egg to fry survival).

This monitoring program involves repeated snorkel surveys, incubation tests where observations of significant spawning warrant follow-up and analysis of flow information.

4.3.2 Status

This monitoring program was initiated in October 2005 and will be carried out over six years. The second year program report will be available January 2008. The third year field work started in September 2007 and is currently underway.

4.3.3 Interpretation of Data

As observed in 2001 (Benvar³) and 2006⁴, salmon escapement to the Lower Jordan River is very low, with a total of 1 coho, 13 chum and 2 steelhead adults observed over their respective spawning periods in 2006. Results from incubation assessments conducted in 2006-2007 were compromised due to extreme inflows March 2007. Partial assessments (at the hatching stage) show that water quality conditions adjacent to an old copper tailings pond may be affecting spawning success in the area..

To date, there is insufficient data at this time to determine whether increasing instream flows will influence escapement or spawning success.

³ Benvar Holdings, 2001. Jordan River salmonid swim survey. Prepared for BC Hydro's Jordan River Water Use Plan Project, Burnaby, BC.

⁴ Roy, Thomas, 2006. Jordan Salmon Spawning Assessment/Enumeration. Prepared for BC Hydro Water License Requirements Program, Victoria, BC.

4.4 Diversion Reservoir Fish Indexing

4.4.1 Overview

The objective of this monitoring program is to evaluate the effects of extensive drawdown on Diversion Reservoir, using rainbow trout fish condition as the performance measure.

The Jordan River WUP Consultative Committee recommended an operational change that was hypothesised to elicit biologically significant measurable responses in the resident fish populations in Diversion Reservoir. It was hypothesised that the decrease in seasonal and daily reservoir fluctuation and bulk decrease in pelagic volume would increase both the establishment of an effective littoral zone and mitigate against reducing rainbow trout condition factors.

Monitoring Indicators a): Rainbow trout catch per unit effort (CPUE; sinking + floating gillnet).

b): Rainbow trout condition factor.

This monitoring program involves repeated gill-net and gee-trap surveys set at index sites in the reservoir in late-August/early-September every year, coinciding with typical low-reservoir operations.

4.4.2 Status

This monitoring program was initiated in September 2005, and will be carried out over six years. The second year program report was received in March 2007. The third year field work started in September 2007 and the report is expected March 2008.

4.4.3 Interpretation of Data

The 2005 and 2006 study results were comparable with historic assessments in 1994 (Griffith 1996)⁵ and 2002 (Stewart et. al.)⁶ except that 1994 CPUE estimates were biased higher presumably due to lower reservoir elevations than in 2002 and 2005. These data will be compiled with annual results collected during the monitoring program and a final assessment of whether constrained Diversion Reservoir drawdown conditions will improve fish productivity and health as defined by the monitoring indicators above.

At this time there is insufficient data to determine whether reservoir operations are limiting rainbow productivity in Diversion Reservoir.

⁵ Griffith, R.P. 1996. Biophysical Assessment of fish production within the Jordan River drainage 1994. Final Report. R.P. Griffith and Associates, Sidney, BC for BC Hydro and Power Authority, Burnaby, BC.

⁶ Stewart, S.M., R. McHale, A. Francis (Three Rivers Consulting), 2002. Limnological assessment of two Jordan River reservoirs (Phase II). Prepared for Royal Roads University, Sooke, BC.

4.5 Monitoring Surfing Quality below the Jordan River Generating Station

4.5.1 Overview

The objective of this monitoring program is to assess the performance of the WUP decision to constrain maximum discharge opportunistically during the surfing season, using surf quality as the performance measure.

Jordan River is one of the most popular surf locations on Vancouver Island. A surfing survey conducted over the WUP indicated that surf conditions are also affected by Jordan River Generating Station discharge. In some conditions high discharges may flatten waves and make it more difficult for surfers to catch waves against the current.

Monitoring Indicators a): Surfers not affected by operations.

This monitoring program involves on-site observations of surfing use proximal to the mouth of the Jordan River under constrained and unconstrained conditions, and a surfing survey of Jordan River recreationalists under constrained and unconstrained conditions.

4.5.2 Status

This monitoring program was initiated in March 2006 and will be carried out over six years. The second year program report was received in December 2007.

4.5.3 Interpretation of Data

The 2007 study applied similar methods to those utilized in 2001⁷ and 2006⁸ with results varying year to year presumably due to varying surf conditions over the 2007 survey. In terms of monitoring indicators, 66% of surfers were not affected by operations, compared to 82% in 2006 and 57% in 2001. These results are preliminary and based on small sample sizes.

Due to the fact that an assessment of compiled observations of surfing during both constrained and unconstrained operations cannot be undertaken until the end of the review period, there is insufficient data at this time to determine whether WUP recommendations have improved surf quality at Jordan River.

5 Summary of Jordan River WUP Physical Work

This section outlines the status of the Jordan River WUP physical works as per the Jordan River Order under the *Water Act*, dated 20 July 2004.

⁷ RRL (Recreation Resources Limited), 2001. Jordan River surf users. Prepared for BC Hydro's Jordan River Water Use Plan Project, Burnaby, BC.

⁸ RRL, 2006. Jordan River surf users 2006. Prepared for BC Hydro Water License Requirements Program, Victoria, BC.

5.1 Water Release Mechanism at Elliot Dam

5.1.1 Overview

The objective of this physical work includes the design and construction of a water release mechanism at Elliott Dam in order to ensure a minimum base flow of $0.25 \text{ m}^3\text{s}^{-1}$ from the dam.

During the Consultative Committee process the committee agreed to an objective to maximize fish populations in the Lower Jordan River below Elliott Dam. Currently no base flows are provided below the dam and therefore the committee considered a number of alternatives for releasing base flows. It was agreed to release a base target flow of $0.25 \text{ m}^3\text{s}^{-1}$ year-round through the dam. It is expected that the increased base flow will result in improved ecosystem condition and an increase in habitat for fish from the mouth of the river, up to and including the river 300 m below Elliott Dam.

5.1.2 Status

The implementation phase of the physical works was initiated in October 2006 and will be completed in January 2008. The physical works report is expected in April 2008.

Phase I of the Water Release Mechanism was completed in 2004, prior to the receipt of the Order. Phase II of this physical work was scheduled to be completed by July 2007 but was delayed for the following reasons: 1) the access road to the site was damaged and impassable as a result of winter storms; 2) specialized drilling equipment was unavailable; and 3) construction procedures were altered where the drilling through the dam occurred from the inside of the gallery out to the dam face. Costs increased as a result of changes in the detailed designs and construction.

Construction of Phase II began in October and is now near completion. The final testing and commissioning of the mechanism is scheduled for mid January. The $0.25 \text{ m}^3\text{s}^{-1}$ minimum flow release from Elliott Dam is scheduled to commence in January 2008 prior to the ordered date of 30 January 2008.

6 Jordan River WUP Monitoring Programs and Physical Work Costs

The following table summarizes the Jordan River WUP monitoring programs and physical works costs approved by the Comptroller on 30 June 2005 and 18 September 2006, respectively, and the actual costs to 30 November 2007.

Table 6-1: Jordan River WUP Monitoring Programs and Physical Work Costs

Description		Costs Approved by Comptroller of Water Rights	Actual Costs to 30 November 2007
Monitoring Programs			
Fish Index: Lower Jordan River	Direct Management	\$51,935	\$10,423
	Implementation	\$123,988	\$51,450
Lower Jordan River Inflow Monitoring	Direct Management	\$55,693	\$12,152
	Implementation	\$103,726	\$54,444
Lower Jordan River Salmon Spawning Assessment and Enumeration	Direct Management	\$57,454	\$10,474
	Implementation	\$87,440	\$33,979
Diversion Reservoir Fish Indexing	Direct Management	\$60,028	\$4,098
	Implementation	\$61,515	\$32,288
Monitoring Surfing Quality below the Jordan River Generating Station	Direct Management	\$45,734	\$4,326
	Implementation	\$19,628	\$4,433
Physical Work			
Water Release Mechanism	Direct Management	\$20,461	\$13,418
	Implementation	\$655,521	\$225,055