

**2019 Cowichan Lake Pumping
Weekly Report #1
- Pre-Pumping Surveys, Initiation
of Pumping and Monitoring
September 1 – 7, 2019**

Prepared For

Catalyst Paper Corporation
8451 Hay Rd
Crofton, BC V0R 1K5

Prepared By

EDI Environmental Dynamics Inc.
208A – 2520 Bowen Road
Nanaimo, BC V9T 3L3

EDI Contact

Ian Redden
Senior Biologist/Regional Director

EDI Project

19N0163
September 2019



This page is intentionally blank.



AUTHORSHIP

This report was prepared by EDI Environmental Dynamics Inc. Staff who contributed to this project include:

Leo Chira, M.Sc., R.P. Bio..... Primary Author

Ian Redden, B.Sc., R.P.Bio..... Senior Review



TABLE OF CONTENTS

1	INTRODUCTION	1
2	MONITORING	2
2.1	WEIR OPERATIONS.....	2
2.2	WATER QUALITY	3
2.3	FISH AND FISH HABITAT	4
2.4	AQUATIC RESOURCES AND WILDLIFE OBSERVATIONS	6
3	PHOTOS	7
4	REPORT LIMITATIONS	13

LIST OF TABLES

Table 1.	Site visit summary	2
Table 2.	Weekly pump-out checklist for Cowichan Lake based on observations from Aug. 29, Sep. 3 and Sep. 6, 2019.	3
Table 3.	Weekly in-situ water quality variables above and below the Cowichan Lake weir.	4
Table 4.	Water nutrient concentrations and clarity above and below the Cowichan Lake weir prior to pumping (August 28, 2019)	4
Table 5.	Fish impingement observations at the end-of-pipe fish screen on pump intakes in Cowichan Lake.....	4
Table 6.	Cowichan lamprey salvage and stranding observations at nine sites around Cowichan Lake	5



1 INTRODUCTION

Catalyst Paper Corporation (Catalyst) owns and operates a weir at the outlet of Cowichan Lake. Through collaboration and agreements with multiple stakeholders, Catalyst is implementing a water management plan to maintain flows in Cowichan River during the low flow period of 2019. Under a *Fisheries Act* Authorization Catalyst reduced river flow to 4.5 m³/s in June 2019 to extend the available outflow of water from Cowichan Lake before reaching a zero-storage stage in the lake, defined as the point at which flow no longer goes over the weir and thereby stops providing surface water to Cowichan River. By the end of August water storage levels in Cowichan Lake were no longer sufficient to sustain the flow of 4.5 m³/s through to the fall when increased rainfall is expected to naturally maintain flows. Catalyst was issued a Letter of Advice by Fisheries and Oceans Canada, which allows for pumping water from the lake over the weir and into the river to maintain the flow of 4.5 m³/s when the lake enters negative storage. Catalyst also obtained a permit to salvage Cowichan Lake lamprey (*Entosphenus macrostomus*), a species considered threatened under the *Species at Risk Act (SARA)*. Several conditions related to environmental monitoring and salvage of Cowichan Lake lamprey were included in the Letter of Advice and SARA permit. EDI Environmental Dynamics Inc. has been retained by Catalyst to implement the required monitoring and salvage.

This report describes the environmental monitoring observations and lamprey survey/salvage efforts implemented prior to starting the pumping of the lake (August 28) and during approximately the first week of pumping from August 29 until September 7, 2019. Cowichan Lake lamprey salvage efforts, as per the *SARA* permit for the Cowichan Lake Pump-Out Project (the Project), focused on nine sensitive sites determined by Fisheries and Ocean Canada (DFO) based on previous studies on the lamprey population.

Environmental monitoring requirements are provided in greater detail in the *Environment Monitoring Plan for the Pump Out of Lake Cowichan during Drought Conditions*¹ (EMP) including monitoring of water quality, fish and fish habitat, aquatic resources, riparian vegetation, and wildlife.

¹ LGL Limited. 2016. Environmental Management Plan – Supplementing Cowichan River Flows During Drought Conditions by Pumping Water from Cowichan Lake.



Table 1. Site visit summary

Date (dd/mm/yy)	Sites Inspected	Lead QEP	Monitoring Activities
28/08/19	Cowichan River Lake Cowichan	Leo Chira, R.P.Bio.	<ul style="list-style-type: none"> - Pre-pumping site visit. - Installed temperature loggers in river and lake. - Collected water samples for lab analysis from river and lake. - Collected in-situ water quality data from river. - Inspected 7 of 9 potential lamprey salvage sites as per DFO.
29/08/19	Catalyst weir Cowichan River Cowichan Lake	Leo Chira, R.P.Bio.	<ul style="list-style-type: none"> - Discussed operational procedures prior to pumps starting. - Observed initiation of pumping. - Inspected remaining 2 of 9 potential lamprey salvage sites. - Collected in-situ water quality data from river.
03/09/19	Catalyst weir Cowichan River Cowichan Lake	Leo Chira, R.P.Bio.	<ul style="list-style-type: none"> - Accompanied by BC Conservation Foundation biologist to review sites where lamprey had been previously found. - Inspected 7 potential lamprey salvage sites as per DFO and BCCF. - Inspected the weir and pumps. - Collected in-situ water quality data from river.
06/09/19	Catalyst weir Cowichan River Cowichan Lake	Leo Chira, R.P.Bio.	<ul style="list-style-type: none"> - Inspected 2 potential lamprey salvage sites as per DFO. - Collected in-situ water quality data from river. - Inspected the weir and pumps.

2 MONITORING

Monitoring of the weir operations and fish/fish habitat sites are conducted in accordance with the EMP for the project at a frequency that allows identification of noticeable changes in fish habitat to inform any salvage activities that would be needed to prevent stranding of lamprey within the littoral zone of Cowichan Lake and that verifies fish are not at risk of being impinged on the pump screens.

2.1 WEIR OPERATIONS

A total of 20 electric water pumps with appropriately sized intake screens have been installed at the lake weir. Pumping began on August 29 at approximately 11:10 AM. Initially, twelve pumps were started to achieve a flow of 4.5 m³/s in Cowichan River as measured at the downstream staff gauge beneath the South Shore Road Bridge. During the ongoing pumping the number of pumps operating has varied between 13 and 14 in order to maintain a relatively constant instream flow. The remaining 6 to 7 pumps were ready to be operated if needed in the event of a pump failure or some other pumping issues.

All pumps are electric, which reduces noise as much as possible. Also, it eliminates the risk of fuel spills to water, generator maintenance, or other hazards associated with using diesel or gas generators for power. The pumps are overseen by staff 24 hours per day and staff has access to an emergency BC Hydro contact number, as per Catalyst’s operational procedures for the lake pump-out. The weekly checklist for the pumps is provided in Table 2.



Table 2. Weekly pump-out checklist for Cowichan Lake based on observations from Aug. 29, Sep. 3 and Sep. 6, 2019.

Item	Good condition	Needs work	Notes
Fish screens clear	X		Fish screens have accumulated some organic materials since pumping began, though it is likely they operate within the standards. Fish screens around the unused pumps seem to have accumulated more organic materials (i.e. algal growth) than the rest. Intake screen maintenance is scheduled for the week of Sep. 8 to 14.
No debris around pump floats	X		No large woody debris.
Pump discharge piping intact	X		
No excess pump noise	X		All pumps are electric.
Pump tethers acceptable	X		
No sediment entrainment	X		No visible discharge of sediments from lake into the river.
Pumps in acceptable water depth	X		
Pump discharge is controlled	X		
No environmental hazards	X		

2.2 WATER QUALITY

In-situ water quality sampling was conducted in the river and in the lake prior to pumping operations commencing and during operations using a calibrated WTW 3410 Multi-meter. Surface water sampling took place near the river staff gauge and at the lake boat ramp upstream of the weir (Table 3).

Two HOBO V2 model temperature loggers were installed at the two sample sites to monitor temperature variations continuously, at 15 minute intervals. Temperature data are downloaded at two-week intervals and the first data set will be provided in the next weekly report.



Table 3. Weekly in-situ water quality variables above and below the Cowichan Lake weir.

Variable	Aug 28	Aug 29	Sep 3	Sep 6
Temperature (°C)				
Above weir (lake site)	22.5	22.0	22.4	-
Below weir (river site)	20.1	21.8	22.1	19.8
Dissolved oxygen (mg/L)				
Above weir (lake site)	9.64	8.98	9.04	-
Below weir (river site)	8.69	8.87	8.86	8.76

Water samples for laboratory analysis were also collected from the two locations prior to pumping operations commencing (Table 4). Both the lake and river have similar nutrient and clarity qualities. Additional laboratory analysis will be conducted in future weeks during the pumping.

Table 4. Water nutrient concentrations and clarity above and below the Cowichan Lake weir prior to pumping (August 28, 2019).

Variable	River (Sample 1 – Sample 2)	Lake (Sample 1 – Sample 2)	Reporting Detection Limit (RDL)
Nutrients			
Nitrate(mg/L)	0.0081 – 0.0046	0.0085 – 0.0057	0.0020
Nitrate + Nitrite (mg/L)	0.0081 – 0.0046	0.0085 – 0.0057	0.0020
Nitrite (mg/L)	<0.0020 – <0.0020	<0.0020 – <0.0020	0.0020
Orthophosphate (mg/L)	<0.0010 – <0.0010	<0.0010 – <0.0010	0.0010
Clarity			
Total suspended solids (mg/L)	<4.0 – <4.0	6.1 – 5.6	4.0

2.3 FISH AND FISH HABITAT

The pump setup was inspected visually during the site visits to ensure the fish screens function properly and the risk for fish impingement remains low. While some organic matter was observed on the screens it did not seem to hinder their function: it did not visibly increase localized velocities and no impinged fish were observed. A more thorough, underwater inspection of the fish screens as well as cleaning activities are scheduled for the week of Sep. 8 to 14 and the results of the inspection will be available for the next weekly report.

Table 5. Fish impingement observations at the end-of-pipe fish screen on pump intakes in Cowichan Lake.

Date	Reason	Observations
28/08/19	Installation	12 pumps operating, small amount of debris buildup on pump screens. No risk to fish.
03/09/19	Operations	13 pumps operating, small amount of debris on screens; no issues to fish.
06/09/19	Operations	14 pumps operating; debris accumulated on screens, especially on the unused pumps. Schools of fish noted swimming around the screen boxes – they may provide cover. Little to no risk for fish impingement.



Previously determined sites where Cowichan Lake lamprey were observed (free swimming forms and ammocoetes) – as per DFO and BC Conservation Foundation (BCCF), were inspected prior to and during pumping operations. On August 28, with the exception of the Miracle Creek and Shaw Creek, all other stream outlets encountered were devoid of surface flow. Also, on August 28, the lake water level was below what was previously identified as primary spawning and rearing habitats for lamprey at Shaw Creek, Nixon Creek, and Robertson Creek. Given the observed low water level, topography of the lake shoreline, and observed habitat characteristics at the lake surface level, the stranding risk for free swimming lamprey forms was considered to be low prior to pumping commencing (August 29, 2019) – Table 6. No free swimming forms were observed during the site assessments.

Previous surveys of sites by BCCF staff found Cowichan Lake lamprey at Shaw, Nixon, and Robertson creeks in May 2019 (J. Damborg, Pers. Comm.). During the same survey, BCCF conducted extensive sampling at Meade Creek, though no lamprey larvae were found. The same sites were sampled on September 3 and 6, 2019 using the digging method and again no lamprey larvae were found. Furthermore, no larval lamprey were found at any of the nine preestablished sites. The sampling effort at each site varied from 25 minutes to 90 minutes based on the habitat quality and previous lamprey observations. Available habitat at Miracle, Sutton, and Utility creeks has been determined as poor for rearing Cowichan Lake lamprey larvae due to high compaction and large gravel and cobble substrate (Sutton Creek), or a substrate composition dominated by organic materials (Miracle and Utility creeks). The available habitat at Hawes Creek was either suboptimal (shallow substrate dominated by sand) or poor (substrate composition dominated by cobble).

It’s possible but not confirmed that a naturally low lake water level may explain the lack of observed lamprey larvae in August/September 2019. The rearing habitat – as identified by BCCF in the spring of 2019, has become either dry or about to dry out, which could have forced the larvae to move to other habitats within the lake earlier in the year, i.e. prior to pumping commencing.

Table 6. Cowichan lamprey salvage and stranding observations at nine sites around Cowichan Lake.

Site	Aug 28, 2019 (pre-pumping)	Sep 3 and 6, 2019 (during pumping)
Meade Creek (N)	Good lamprey habitat – small gravels and organics. No risk for stranding due to steep lake banks. No swimming lamprey observed.	Sampled for lamprey larvae – none found. Receding water line did not expose different habitat type nor created isolated pools or increased risk for stranding fish.
Miracle Creek	Poor lamprey habitat – compact or organics dominated. Low risk for stranding – gently sloped banks; no isolated pools. No swimming lamprey observed.	Sampled for lamprey larvae – none found. Receding water line did not expose different habitat type nor created isolated pools or increased risk for stranding fish.
Sutton Creek	Poor lamprey habitat – compact or organics dominated. Low risk for stranding – gently sloped or steep lake banks. No swimming lamprey observed.	Sampled for lamprey larvae – none found. Receding water line did not expose different habitat type nor created isolated pools or increased risk for stranding fish.
Robertson Creek	Good lamprey habitat – small gravels and organics. Little risk for stranding – steep banks, one lake area that may become isolated. No swimming lamprey observed.	Sampled for lamprey larvae in areas where they were previously observed – none found. Receding water line did not expose different habitat type nor created isolated pools or increased risk for stranding fish.



Site	Aug 28, 2019 (pre-pumping)	Sep 3 and 6, 2019 (during pumping)
Utility Creek	Poor lamprey habitat – compact or organics dominated. Low risk for stranding due to gentle slope; no isolated pools. No swimming lamprey observed.	Sampled for lamprey larvae – none found. Receding water line did not expose different habitat type nor created isolated pools or increased risk for stranding fish.
Hawes Bay	Sub-optimal/poor lamprey habitat– sand/organics and cobbles dominated. Low risk for stranding due to gentle slope; no isolated pools. No swimming lamprey observed.	Sampled for lamprey larvae – none found. Receding water line did not expose different habitat type nor created isolated pools or increased risk for stranding fish.
Shaw Creek	Good lamprey habitat on the lake shoreline, small gravel and organics. Low risk for stranding in a pool near the confluence with Shaw Creek. No swimming lamprey observed.	Sampled for lamprey larvae in areas where they were previously observed along the shoreline and pool at risk for isolation but still connected – none found. Receding water line did not expose different habitat type nor created isolated pools or increased risk for stranding fish.
Nixon Creek	Good lamprey habitat on the lake shoreline, small gravel and organics. Low risk for stranding, steep banks. No swimming lamprey observed.	Sampled for lamprey larvae in areas where they were previously observed – none found. Receding water line did not expose different habitat type nor created isolated pools or increased risk for stranding fish.
Nixon Float House	Mostly poor and suboptimal lamprey habitat on the lake shoreline near and behind the float house – organics dominated. Good lamprey habitat found closer to Nixon Creek. No risk for stranding – steep banks. No swimming lamprey observed.	Sampled for lamprey larvae – none found. Receding water line did not expose different habitat type nor created isolated pools or increased risk for stranding fish.

2.4 AQUATIC RESOURCES AND WILDLIFE OBSERVATIONS

Monitoring of the riparian vegetation, aquatic plants, and erosion/bank stability issues was also conducted during the monitoring of the nine sites along the Cowichan Lake shoreline.

Notable wildlife observations include a herd of Roosevelt elk near Nixon Creek on August 29, 2019.

It is likely the riparian vegetation along the lake shoreline has been exposed to drier conditions than typical; however, no significant signs of stress or die-off in trees or shrubs were observed to date.

Aquatic plants at Utility and Miracle creeks were completely exposed to air prior to pumping beginning. Stress in plants has been observed at the two locations. Some aquatic plants have completely emerged at Robertson Creek since the pumping started, but the extent of affected habitat was very small (approximately 1 m²).

Photographs of a selection of sites inspected are provided in Section 3 below.



3 PHOTOS



Photo 1. Looking west at the Cowichan Lake shoreline near Nixon Creek. Aug 29, 2019.



Photo 2. Looking west at the Cowichan Lake shoreline near Nixon Creek. Sep 3, 2019.



Photo 3. Looking east at the Cowichan Lake shoreline near Nixon Creek. Aug 29, 2019.



Photo 4. Looking east at the Cowichan Lake shoreline near Nixon Creek. Sep 3, 2019.



Photo 5. Isolated pool on the lake shoreline near Nixon Cr. Sep 3, 2019.



Photo 6. Substrate dominated by organics near the Float House – Nixon Cr. Sep 3, 2019.



Photo 7. Looking southwest at the lake shoreline near the Nixon Creek float house. Aug 29, 2019.



Photo 8. Looking southwest at the lake shoreline near the Nixon Creek float house. Sep 3, 2019.



Photo 9. Looking southwest at the lake shoreline near the Nixon Creek float house. Aug 29, 2019.



Photo 10. Lake section that may become isolated on the lake shoreline near the Shaw Creek. Sep 3, 2019.



Photo 11. Looking east at the lake shoreline near Shaw Creek. Aug 28, 2019.



Photo 12. Looking east at the lake shoreline near Shaw Creek. Sep 3, 2019.



Photo 13. Looking west at the lake shoreline near Robertson Creek. Aug 28, 2019.



Photo 14. Looking west at the lake shoreline near Robertson Creek. Sep 3, 2019.



Photo 15. Looking east at the lake shoreline near Robertson



Photo 16. Looking east at the lake shoreline near Robertson



Creek. Aug 28, 2019.



Photo 17. Sampling for Cowichan lamprey on the lake shoreline near Robertson Cr. Sep 3, 2019.

Creek. Sep 3, 2019.



Photo 18. Looking south at the vegetated lake shoreline near Robertson Creek. Aug 28, 2019.



Photo 19. Looking north at the lake shoreline near Meade Creek. Aug 28, 2019.



Photo 20. Looking north at the lake shoreline near Meade Creek. Sep 3, 2019.





Photo 21. Looking east at the lake shoreline near Utility Creek. Aug 28, 2019.



Photo 22. Looking east at the lake shoreline near Utility Creek. Sep 3, 2019.



Photo 23. Looking west at aquatic plants in exposed mud flats on the lake shoreline near Utility Creek. Aug 28, 2019.



Photo 24. Looking west at aquatic plants in exposed mud flats on the lake shoreline near Utility Creek. Sep 3, 2019.



Photo 25. Looking west at the lake shoreline - mud flats and riparian vegetation near Miracle Creek. Aug 28, 2019.





Photo 26. Looking west at the lake shoreline - mud flats and riparian vegetation near Miracle Creek. Sep 6, 2019.



Photo 27. Looking west at the lake shoreline near Sutton Creek. Aug 28, 2019.



Photo 28. Looking west at the lake shoreline near Sutton Creek. Sep 6, 2019.



Photo 29. Looking east at the lake shoreline near Sutton



Photo 30. Looking east at the lake shoreline near Hawse



Creek. Aug 28, 2019.	Creek. Aug 28, 2019.
<p>Photo 30. Looking west at the lake shoreline near Hawse Creek. Aug 28, 2019.</p>	<p>Photo 30. Looking west at the lake shoreline near Hawse Creek. Sep 3, 2019.</p>

4 REPORT LIMITATIONS

This report was prepared exclusively for Catalyst Paper Corporation. The quality of information, conclusions and estimates contained herein is consistent with the level of effort expended and is based on: i) information available at the time of preparation; ii) data collected by EDI Environmental Consulting Inc. and/or supplied by outside sources; and iii) the assumptions, conditions and qualifications set forth in this report. This report is intended to be used only by Catalyst Paper Corporation. Any other use or reliance on this report by any third party is at that party’s sole risk.