Comox Valley REGIONAL DISTRICT

Staff report

DATE: September 6, 2016

FILE: 5610-04

TO: Chair and directors
Comox Valley water committee

FROM: Debra Oakman, CPA, CMA
Chief Administrative Officer

RE: Comox Lake water treatment options study - recommendation

Purpose
To summarize the water treatment options study process and recommend a path forward to satisfying the revised requirements of the Island Health permit to operate the Comox Valley Regional District (CVRD) water system.

Policy analysis
In November 2007, Island Health, introduced a new drinking water treatment policy aimed at ensuring consistent minimum standards for all surface water supply systems on Vancouver Island. The policy termed the "4321 policy" requires surface water supply systems to maintain the following treatment specifications:

- 4-log (99.99 per cent) removal/inactivation of viruses;
- 3-log (99.9 per cent) removal/inactivation of Giardia cycts and cryptosporidium oocysts;
- Two treatment processes, usually filtration and disinfection; and
- 1 NTU turbidity (maximum) in finished water.

At the February 3, 2015 meeting of the Comox Valley water committee the following motion was passed:

> *THAT the Comox Valley Regional District retain an engineering consultant expert in the analysis and design of municipal water treatment systems to fully analyze Comox Lake source water quality in order to recommend the final treatment option for the Comox Valley water system.*

Executive summary
In January 2015, during a long boil water advisory triggered by the failure of a bank on Perseverance Creek, Island Health withdrew filtration deferral for the Comox Valley water system (CVWS). To better understand the full range of water treatment options available for the CVWS, at their February 3, 2015 meeting the Comox Valley water committee passed a motion recommending that the CVRD engage an expert in the analysis and design of municipal water treatment systems to analyze the Comox Lake source water quality in order to recommend the final treatment option for the CVWS.

In May 2015 the CVRD issued a request for proposal for an engineering study to examine available water treatment technologies that would allow the CVRD to meet Island Health's 4321 surface water treatment requirements. At their September 29, 2015 meeting the Comox Valley water committee approved a motion to award the Comox Lake water treatment options study to Opus DaytonKnight (Opus).

The study work consisted mainly of a technical evaluation including options for water intake and pumping, treatment technologies, siting requirements and water transmission piping. In addition to these technical aspects, a stakeholder engagement process was followed to ensure that the interests of the broader community were well understood and included in the decision making process. In parallel to the public consultation process, staff and the consultant consulted directly with the K'ómoks First Nation (KFN).

Opus performed the work in late 2015 and the first half of 2016. Based on the combination of technical, financial, environmental and social factors described in their four technical memos and summarized in the final project definition report dated August 12, 2016, Opus recommends:

Project Component	Estimated Cost*
Deep water lake intake near the existing deep water sampling station sized for full system buildout to 2069	$11.0M
Raw water pumping station located on the lake shore sized for easy expandability for full system buildout to 2069	$10.7M
Conveyance of raw water from the pump station to a water treatment plant (WTP) located on or near Site A near the intersection of Bevan Road and Lake Trail Road	$11.8M
Direct filtration and UV disinfection of the raw lake water and discharge to a clear well on the WTP site, located at the optimal elevation to maximize gravity distribution of water throughout the CVWS	$47.1M
Conveyance of treated water down the BC Hydro penstock right of way to tie into the CVWS near the existing chlorination station	$25.2M
Total Project Costs	**$105M**

** Cost estimates developed to Class B or +/- 20% accuracy*

Opus concluded that the benefits of extracting water from the lake and operational savings from having the WTP at a higher elevation outweighed the higher capital costs when compared to the least capital cost option (to satisfy the Island Health requirement for filtration) of a WTP near the existing chlorination station at the bottom of the BC Hydro penstock. The estimated additional $16 M in lifecycle costs for a deep water intake must be weighed against the difficult to quantify risks of staying with a river intake described in the Opus memo attached as Appendix B, the most significant of which are:

- Risk of contamination of source water at or near the logging bridge over the mouth of the Puntledge (identified in the regional water supply strategy as the highest risk to water quality).
- In extreme drought conditions, the water level in Comox Lake could drop to the point where water would stop flowing down the Puntledge River.
- Increased frequency of turbidity from Browns River will increase the solids loading to the plant. Resulting residuals are assumed to be higher with less consistent water quality.

An analysis of the impact of the recommended option on the bulk water rate for a range of possible grant funding contributions was performed, attached as Appendix C and summarized below:

		Rates projected for 2020			
Water rates	2016	0% grant	25% grant	50% grant	75% grant
Bulk water rate	$0.66	$1.20	$0.97	$0.80	$0.71
Courtenay flat rate	$370	$503	$477	$459	$416
Comox flat rate	$327	$518	$436	$378	$337

The range of projected impacts to the regional bulk water rates and municipal rates summarized above highlights the importance of securing a significant portion of grant funding from senior levels of government. Feedback to date from funding agencies has been that the project is fundable but must improve project readiness to maximize the opportunities for funding. An assessment of the full range of potential funding sources, including the massive federal government commitment to infrastructure spending, and the increase in the maximum federal contribution for a project to 50 per cent would suggest that 50 per cent grant funding is realistic but that more, or less are obviously also possible outcomes.

Should the Comox Valley water committee support the recommendation to proceed with detailed design of the preliminary design prepared by Opus, a competitive procurement process to select an engineering firm is the next step, starting with release of a request for proposals (RFP) in the fall of 2016. In parallel with the detailed design of the infrastructure, CVRD staff and consultants will be working to move forward with or prepare for the following important tasks:

- Consult with KFN to obtain their support for the project
- Develop an environmental assessment application and submit to the BC Environmental Assessment Office (EAO) for review and approval
- Work with the BC Ministry of Forests, Lands, and Natural Resource Operations (MoFLNRO) to submit a "change of works" application for relocation of intake from the Puntledge River to Comox Lake
- Negotiate a revised water use agreement with BC Hydro and submit to MoFLNRO for review and approval
- Negotiate an agreement with BC Hydro for use of their penstock property for the treated water pipeline
- Identify and apply for all possible appropriately scaled grant funding opportunities

Recommendations from the chief administrative officer:
THAT the Comox Valley Regional District proceed with property acquisition, permits and approvals, detailed design, and grant funding applications for the deep water lake intake and direct filtration treatment as recommended by Opus DaytonKnight in their Water Treatment Options Study – Project Definition Report dated August 12, 2016 immediately to progress the project and maximize opportunities for grant funding.

Respectfully:

D. Oakman

Debra Oakman, CPA, CMA
Chief Administrative Officer

Background/current situation

In November 2007, Island Health, introduced a new drinking water treatment policy aimed at ensuring consistent minimum standards for all surface water supply systems on Vancouver Island. The policy termed the "4321 policy" requires surface water supply systems to maintain the following treatment specifications:

- 4-log (99.99 per cent) removal/inactivation of viruses;
- 3-log (99.9 per cent) removal/inactivation of Giardia cycts and cryptosporidium oocysts;
- Two treatment processes, usually filtration and disinfection; and
- 1 NTU turbidity (maximum) in finished water.

For many surface water systems the 1-NTU turbidity requirement is difficult to achieve without the installation of a water filtration plant. The Island Health policy includes a provision (termed filtration deferral) for water systems with access to high quality source water, whereby a system may be permitted to operate without filtration provided the following requirements can be met:

a. Daily average source water turbidity = 1-NTU or less (95 per cent of days) and not above 5-NTU on more than two days in a 12 month period.
b. Escherichia coli = 20 colony forming units (cfu)/100ml or less in 90 per cent of source water samples.
c. Two primary disinfectants are provided, which together achieve a 4-log removal/inactivation of viruses and 3-log reduction in Giardia and Cryptosporidium.

Filtration deferral

To analyze the potential for filtration deferral the CVRD constructed a continuous water quality sampling station from a potential deep water intake location on Comox Lake to determine if the turbidity and E.coli criteria for filtration deferral could be met. The continuous water quality sampling station was commissioned in November 2011 and has been operational ever since. Following approximately one year of sampling, the data revealed that water quality for the deep water location came close to meeting Island Health's filtration deferral criteria and in April 2013 the CVRD submitted an application to Island Health for filtration deferral. Island Health approved the CVRDs application and on September 20, 2013 provided a revised operating permit authorizing filtration deferral and updated the CVRDs timeline to meet Island Health's 4321 policy criteria.

At their November 19, 2013 meeting the Comox Valley water committee approved the following recommendation:

> *THAT the Comox Valley Regional District work towards meeting the requirements of VIHA's revised operating permit for the Comox Valley water system dated September 20, 2013 and move forward with the planning and engineering required for the installation of a deep water intake and ultraviolet light treatment plant as well as watershed protection planning.*

In 2014 the CVRD advanced the above work by awarding the development of phase II and III of the Comox Lake watershed protection plan to Aqua-Tex Scientific consulting Ltd. of Victoria BC. That plan was subsequently completed in late summer 2015 and referred to the local municipalities and provincial government in September 2015.

On October 27, 2014 in response to increasing source water turbidity from the Puntledge River, the CVRD issued a boil water advisory for the CVWS. The advisory was in place for a total of 10 days before source water turbidity reduced to acceptable levels. Again on December 11, 2014 in response to high source water turbidity levels the CVRD issue a second boil water advisory.

During the heavy rains and flooding, staff from the CVRD and the City of Courtenay were able to survey Comox Lake from an RCMP helicopter. The helicopter flew up the Puntledge River to Comox Lake, and then up a number of tributaries to Comox Lake including Perseverance Creek. During the flight, significant amounts of sediment could be seen entering Comox Lake as a result of a bluff failure along upper Perseverance Creek (the Spillway).

Following the first, and during the second advisory the CVRD met with VIHA to debrief on the advisories and turbidity situation and to discuss source water quality from the proposed deep water intake location on Comox Lake.

Although source water quality from the deep water intake sample station has historically come close to meeting Island Health's requirements for filtration deferral, the intake location was unable to meet the turbidity requirement in both 2012 and 2014. In fact, in 2014 the CVWS was on a boil water notice for a total of 33 days, and in 2015 a total of 35 days.

On January 21, 2015 the CVRD received a letter from Island Health advising that recent water quality information from the proposed deep water intake location no longer supported the objectives stated in Island Health's 4321 policy. The letter stated that *"filtration deferral can no longer be supported and plans must be made to work towards installing filtration in the near future"*. The current Island Health permit to operate is attached as Appendix A.

Water treatment options study process

In order to better understand the full range of water treatment options available for the CVWS, at their February 3, 2015 meeting the Comox Valley water committee passed a motion recommending that the CVRD engage an expert in the analysis and design of municipal water treatment systems.

In May 2015 the CVRD issued a RFP for an engineering study to examine available water treatment technologies that would allow the CVRD to meet Island Health's 4321 surface water treatment requirements. At their September 29, 2015 meeting the Comox Valley water committee approved a motion to award the Comox Lake water treatment options study to Opus.

The study work consisted mainly of a technical evaluation including options for water intake and pumping, treatment technologies, siting requirements and water transmission piping. In addition to these technical aspects, a stakeholder engagement process was implemented to ensure the interests of the broader community were well understood and included in the decision making process. The stakeholder engagement process was designed to support effective community engagement and provide opportunities for all stakeholders to be included. In addition, and parallel to the public consultation process, staff and the consultant consulted directly with KFN.

The following table summarizes the points of contact between project team and stakeholders since project initiation:

Date	Event
January 18	1st workshop at Westerly
January 19	Water Committee • Presentation • Tech Memo 1 draft
March 01	Water Committee • Presentation • Tech Memo 2 draft

March 02	2nd workshop at Westerly
April 12	Water Committee • Presentation
April 28	Water Advisory • Tech Memo 3
May 9, 2016	KFN Chief and Council
May 17	Water Committee • Presentation
May 26	Water Committee • Tech Memo 4 ranking exercise 3rd workshop at Westerly
June 14	Water Committee • Presentation • Tech Memo 4

Water treatment options study deliverables

Opus started study work in late 2015, and summarized their work in four technical memos delivered in the first half of 2016, and a final project definition report delivered on the same water committee agenda as this staff report. The Opus technical memos and key outcomes are summarized below:

- **Tech Memo-1:**
  Reviewed previous work, regulatory landscape, water demands, water quality, and site mapping and reconnaissance for conceptual treatment and conveyance options. Two days of site visits and project kick off meetings with government and regulatory stakeholders also informed the work of this technical memo. The key outcome from this work included selection of a lake intake as the highest ranked water source.
- **Tech Memo-2:**
  Performed in parallel with Tech Memo-3, this memo delivered additional analysis to inform treatment technology selection, including a range of process options for pre-treatment, filtration, disinfection, and residuals management. The key outcome from this work was selection of direct filtration, membrane filtration, and slow sand filtration as the highest ranked water treatment options.
- **Tech Memo-3:**
  Performed in parallel with Tech Memo-2, this memo took a closer look at the infrastructure of the lake intake, raw water pumping station, and the raw and treated conveyance piping between the lake and the existing CVRD water system. Key outcomes from this work were selection of Site A, located on the north side of Lake Trail Road, where Bevan Road intersects with Lake Trail Road as the optimal WTP site; and the BC Hydro penstock option for alignment of the treated water pipeline from the WTP to the CVRD water system.
- **Tech Memo-4:**
  This memo summarized key license, permit and approval requirements and agencies involved for withdrawing water directly from Comox Lake; presented the total capital and lifecycle costs for the treatment options selected in Tech Memo-2; and described the final evaluation of the three water treatment technologies. The key outcome from this work was a recommendation to proceed with direct filtration as the preferred treatment technology for finalization of the preliminary design.
- **Project definition report:**
  This report presented the major findings and recommendations of the Opus water treatment options study. The four technical memos prepared throughout the project were attached to this report. In addition to the memos, three additional investigations were conducted and

included as appendices to the report, as well as a summary of public engagement undertaken throughout the study.

Water treatment options study recommendations

Based on the combination of technical, financial, environmental and social factors described in Opus technical memos 1 through 4 and summarized in the project definition report, the Opus project definition report provides the following recommendations:

Project Component	Estimated Cost*
Deep water lake intake near the existing deep water sampling station sized for full system buildout to 2069	$11.0M
Raw water pumping station located on the lake shore sized for easy expandability for full system buildout to 2069	$10.7M
Conveyance of raw water from the pump station to a WTP located on or near Site A near the intersection of Bevan Road and Lake Trail Road	$11.8M
Direct filtration and UV disinfection of the raw lake water and discharge to a clear well on the WTP site, located at the optimal elevation to maximize gravity distribution of water throughout the CVWS	$47.1M
Conveyance of treated water down the BC Hydro penstock right of way to tie into the CVWS near the existing chlorination station	$25.2M
Total Project Costs	**$105M**

** Cost estimates developed to Class B or +/- 20% accuracy*

While the Opus analysis considered all major capital and lifecycle cost factors, there will be other savings to the reconfigured CVWS that result from a shift to a deep water intake and high elevation WTP, including decommissioning of booster pump stations and associated operational and lifecycle savings, and the potential for energy recovery at certain lower elevation pressure reducing valve locations.

Why a deep water intake on Comox Lake?

Opus technical memo one, which includes a summary of the analysis into options for source water extraction, concluded that the benefits of extraction of water from the lake and operational savings from having the WTP at a higher elevation outweighed the higher capital costs when compared to the least capital cost option (to satisfy the Island Health requirement for filtration) of a WTP near the existing chlorination station at the bottom of the BC Hydro penstock. The memo attached as Appendix B from Opus dated June 20, 2016 provides an update on the previous analysis and a summary of the more difficult to quantify benefits of a deep water intake.

Described by Opus as Option 1, construction of a membrane filtration plant near the existing chlorination station is the least capital cost option. However, when the higher lifecycle costs associated with membrane filtration and round the clock pumping of treated water into the CVWS are considered, the difference narrows. The following table illustrates this comparison:

Option	Direct filtr./UV	Membrane	Slow sand filter	Option 1
Water extraction	Comox Lake intake			River intake
WTP location	Site "A", near intersection of Bevan and Lake Trail			Chlorination station
Capital costs	$105 M	$105 M	$99 M	$76 M
Lifecycle costs	$119 M	$126 M	$109 M	$103 M

The additional $16 M in lifecycle costs for a deep water intake must then be weighed against the difficult to quantify risks of staying with a river intake, the most significant of which are summarized below:

- Risk of contamination of source water at or near the logging bridge over the mouth of the Puntledge (identified in the regional water supply strategy as the highest risk to water quality)
- In extreme drought conditions, the water level in Comox Lake could drop to the point where water would stop flowing down the Puntledge River
- Increased frequency of turbidity from Browns River will increase the solids loading to the plant. Resulting residuals are assumed to be higher with less consistent water quality.
- Water availability in drought years will increase the number of days when the penstock might not be available. These are most likely to occur during summer peak flows wherein the resulting actual lifecycle costs would be higher (summer flows versus average annual flows) – so actual savings is potentially less.

Moving away from the river intake will also remove our reliance on BC Hydro infrastructure (including associated maintenance shutdowns) and shift the focus away from the instantaneous withdrawal rate constraint that currently governs our water use agreement with BC Hydro to the total annual withdrawal allowed under our water license.

Impact on water rates

At the June 23, 2016 sewer advisory meeting the members highlighted that a crucial piece in communicating the outcome of the Opus water treatment study and the recommended path forward was the impact of the recommended option on the bulk water rate. CVRD staff performed an analysis of the impact of the recommended option on the bulk water rate for a range of possible grant funding contributions, attached as Appendix C and summarized below:

Required Bulk Water Rate					
Budget Year	**2016**	**2017**	**2018**	**2019**	**2020**
75% Funding	0.66	0.71	0.71	0.71	0.71
50% Funding	0.66	0.71	0.71	0.80	0.80
25% Funding	0.66	0.71	0.74	0.97	0.97
0% Funding	0.66	0.71	0.78	1.13	1.20

CVRD staff worked with the municipal directors of finance to understand the impact that these estimated increases to the bulk water rate would have on the rates paid by property owners in Courtenay and Comox. These results are summarized below:

Courtenay	Current	2020 no grant	25% grant	50% grant	75% grant
Flat rate	$369.59	$502.65	$477.37	$459.32	$415.98
Metered rate					
$/m^3	$1.28	$1.75	$1.66	$1.60	$1.45

Comox	Current	2020 no grant	25% grant	50% grant	75% grant
Flat rate	$327	$518	$436	$378	$337
Metered rate					
Minimum/yr	$180	$252	$228	$192	$180
$/m^3	$1.04	$1.78	$1.52	$1.33	$1.20

Opportunities and likelihood of funding

The range of projected impacts to the regional bulk water rates and municipal rates summarized above highlights the importance of securing a significant portion of grant funding from senior levels of government. Feedback to date from funding agencies has been that the project is likely to receive grants, but must improve project readiness to maximize the opportunities for funding.

Since being elected in late 2015 the new federal government has implemented several measures which bode well for funding of the project:

- Increase of the maximum federal contribution for eligible projects and costs from 33 per cent to 50 per cent
- Rolled out phase one of the Clean Water and Wastewater Fund with $2 billion for capital infrastructure spending, including $225 M for British Columbia, for projects that will be complete by March 2018
- Committed to a much larger investment in phase 2 of their capital infrastructure spending program, targeting projects that will be complete in subsequent years

An announcement from the BC and Canadian governments about an agreement for identifying and funding projects in BC under the Clean Water and Wastewater Fund is expected this September. As well as outlining program requirements and timelines, the agreement will describe the proportion of funding to be provided by the provincial government. Whereas the existing Building Canada Fund has the province and federal government contributing one third each, this program will be more heavily weighted to a federal contribution. Other sources of potential funding include the Union of British Columbia Municipalities strategic priorities fund, Federation of Canadian Municipalities green municipal fund, and the existing Building Canada Fund. An assessment of these potential funding sources would suggest that 50 per cent grant funding is realistic but that more, or less are obviously also possible outcomes.

Next steps and schedule

Should the Comox Valley water committee support the recommendation to proceed with detailed design of the preliminary design prepared by Opus, a competitive procurement process to select an engineering firm is the next step, starting with release of an RFP in the fall of 2016. In parallel with the detailed design of the infrastructure, CVRD staff and consultants will be working to move forward with or prepare for the following important tasks:

- Undertake a value engineering process to identify opportunities for potential cost saving changes to the preliminary design
- Consult with KFN to obtain their support for the project and set the framework for KFNs future participation in the CVWS
- Develop an environmental assessment application and submit to the BC EAO for review and approval
- Work with MoFLNRO to submit a "change of works" application for relocation of intake from the Puntledge River to Comox Lake
- Negotiate a revised water use agreement with BC Hydro and submit to MoFLNRO for review and approval
- Negotiate an agreement with BC Hydro for use of their penstock property for the treated water pipeline
- Identify and apply for all possible appropriately scaled grant funding opportunities

Options
The committee has the following options to consider:

1. Proceed with property acquisition, permits and approvals, detailed design, and grant funding applications for the deep water lake intake and direct filtration treatment concept recommended by Opus DaytonKnight immediately to progress the project and maximize opportunities for grant funding
2. Focus on grant funding and proceed property acquisition, permits and approvals, detailed design, and grant funding applications for the deep water lake intake and direct filtration treatment concept recommended by Opus DaytonKnight only once grant funding has been secured

The CVWS permit to operate requires the CVRD to have filtration in place by September 2019. All indications from funding agencies relating to this project and others are that given the deadlines inherent to grant funding programs, high project readiness is a key success factor for obtaining grant funding, i.e. we are not likely to receive funding for a project that isn't ready to build. The unprecedented level of grant funding available over the coming years makes it very likely that the project will receive a significant level of funding. As such, only option no. 1 is recommended.

Financial factors
Implementation of water treatment for the CVWS is an expensive project which will have a significant impact on water rates for property owners within all service areas served by the system. Depending on the level of grant funding achieved for the project, required borrowing ranges from nothing for the 75 per cent grant funding scenario, to over $70 M if the project is not successful in attracting grants.

Legal factors
None.

Regional growth strategy implications
The regional growth strategy contains several goals and objectives applicable to the operation and upgrade of the CVWS. This includes reducing energy consumption and greenhouse gas emissions. These targets will be incorporated into any future infrastructure upgrades required to meet the Island Health 4321 drinking water policy.

Intergovernmental factors
The CVWS is governed by the Comox Valley water committee whose membership includes representatives from the City of Courtenay, the Town of Comox and the CVRD Electoral Areas 'A', 'B' and 'C'.

Interdepartmental involvement
The engineering services branch is leading this work.

Citizen/public relations
In parallel to the technical memos, a public engagement process was undertaken to inform the public about the study and options being considered; receive input from the community to inform selection and weighting of evaluation criteria for screening of water treatment options; and feedback on the draft recommendations for water intake and pump station location, water treatment technology, and WTP location. The engagement process included three rounds of activities between November 2015 and June 2016.

Initial feedback from the public influenced weighting and selection of the project components, and feedback from attendees at the last workshop was generally supportive of the draft recommendations for pump station and WTP location, and treated water forcemain alignment parallel to the BC Hydro penstock. Workshop three attendees ranked water treatment technologies with membrane filtration highest (in line with the focus of earlier consultation on treated water quality and resilience to decrease in source water quality), direct filtration second and slow sand last.

The results of the engagement process reflect the strong feedback and weighting in favour of a deep lake intake, avoiding sensitive environmental areas, and ensuring long term security of water supply for the regional system. The engagement process and feedback received is summarized in appendix L of the Opus project definition report, attached to a separate report on this water committee agenda.

Prepared by:	Concurrence:
K. La Rose	*M. Rutten*
Kris La Rose, P.Eng. Senior Manager of Water and Wastewater Services	Marc Rutten, P.Eng. General Manager of Engineering Services Branch

Attachments: Appendix A – "Current VIHA permit to operate Comox Valley water system"
Appendix B – "Opus memo assessing cost and benefits of a lake intake"
Appendix C – "Water treatment impact on bulk water rates"

VANCOUVER ISLAND health authority

HEALTH PROTECTION

PERMIT

to OPERATE

A WATER SUPPLY SYSTEM

Water System Name:	**COMOX VALLEY REGIONAL DISTRICT WATER SYSTEM**
Premises Number:	1410212
Premises Address:	600 Comox Road Courtenay, BC V9N 1Y4
Water System Owner:	Comox Valley Regional District

Comox Valley Regional District is hereby permitted to operate the above potable water supply system and is required to operate this system in accordance with the Drinking Water Protection Act and in accordance with the conditions set out in this operating permit and conditions established as part of any construction permit.

The water supply system for which this operating permit applies is generally described as:

Service Delivery Area:	Comox Valley Regional District
Source Water:	Comox Lake/Puntledge River
Water Treatment methods are:	None
Water Disinfection methods are:	Chlorine
Number of Connections	301-10,000 Connections - DWT

Operating conditions specific to this water supply system are in Appendix A.

Date: July 27, 2008

Issued By: _____
Environmental Health Officer

This permit must be displayed in a conspicuous place and is not transferable

Place Decal Here

APPENDIX A
WATER SYSTEM OPERATING CONDITIONS FOR
COMOX VALLEY REGIONAL DISTRICT WATER SYSTEM
600 Comox Road
Courtenay, BC, V9N 1Y4

Compliance with these Operating Permit Terms and Conditions do not relieve the operator of other legislated responsibilities and obligation.
The specific items and conditions of this operating permit are listed below as:

1.) Treatment Specifications

The Water System Owner shall provide two treatment processes acceptable to the Island Health, to achieve a 4-log removal/inactivation of viruses; a 3-log removal/inactivation of Giardia cysts and Cryptosporidium oocysts, and produce finished water with less than 1 NTU turbidity.

• Complete turbidity event management procedure.	Completed
• Issue RFP for update to watershed protection plan for Comox Lake and award contract.	Completed
• Provide progress report on actual watershed protection activities and planned and/or ongoing watershed protection initiatives.	On-going September 30 annually
• Complete watershed protection plan	September 15, 2015
• Complete a study to determine treatment options to meet BC Drinking Water Treatment Objective (Microbiological) for Surface Water Supplies in British Columbia.	November 15, 2015
• Determine preferred treatment option.	December 15, 1015
• Complete land acquisition for preferred treatment option.	June 1, 2017
• Obtain a Construction Permit for Island Health Public Health Engineer. This Construction Permit is for the construction of a water filtration plant, disinfection processes and all works necessary to meet the BC Drinking Water Treatment Objectives (Microbiological) for Surface Water Supplies in British Columbia.	September 30, 2017
• Complete construction and commissioning of the water filtration plan and all works necessary to meet the BC Drinking Water Treatment Objectives (Microbiological) for Surface Water Supplies in British Columbia	September 30, 2019

Date: July 16, 2015

Environmental Health Officer

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TO	Kris La Rose, CVRD
COPY	Marc Rutten, CVRD Mike Herschmiller, CVRD
FROM	Timothy Phelan
DATE	August 19, 2016
FILE	D-13119D.00
SUBJECT	Option Verification - Revisit of Option 1

PURPOSE

This memo revisits Option 1 of TM-1 as further verification that the selected approach in TM-4 remains the preferred approach. Specifically, Option 1 was modified to assume that the penstock could still be used for 75 percent of the year.

Motivation for this is the better understanding of potential risks around the land use for conveyance and issues around the water license if moved to Comox Lake.

LIFECYCLE COSTS

Table 1 compares an updated cost for Option 1 of TM-1 to the 3 treatment options evaluated in TM-4. The original Option 1 of TM-1 assumed pumping 356 days a year from the Puntledge River. However, if the BC Hydro penstock remains in operation, the present supply from that source could remain in place to supply a new filtration plant (pressure cartridge membrane) near the existing chlorination station.

Cost for the pump station was assumed to be the same. A small allowance was added to replace the intake screens but there is no marine pipeline. The site at the Puntledge River Pump Station and Chlorination Building is much smaller than the proposed site at Lake Trail Road, and a clearwell sized at 10 ML cannot be built there. A largest possible clearwell assumed is 5 ML which provides at most one hour of operational storage for the WTP. To offset the loss in operational storage, the capacity of the WTP must be increased to meet peak hour demand peaking (flow rates 2.0 to 2.4 higher than maximum day demand). A minimum increase in membrane capacity of 40% would be necessary (with the 5 ML clearwell) which is directly reflected in the capital costs. Updated capital costs are shown in Table 1.

Additional future storage, both for system storage requirements and for future WTP expansion, would have to be constructed elsewhere in the system at other reservoir sites since there would no space remaining at the Option 1 site.

Table 1: Conceptual Construction Costs Comparison

Estimate Source (2016 $Milion)				
Item Description	Opus DF/UV	Opus SM	Opus SSF	Option 1 TM-1
Raw Water				
Intake and Marine Pipeline	$4.64	$4.64	$4.64	1.0
Pump Station	$4.50	$4.50	$4.50	4.5
Water Treatment				
Filtration & Disinfection	$23.90	$23.65	$21.30	37.7 [a]
Clearwell/Reservoir (10 ML)	$5.30	$5.30	$5.30	3.0 [b]
Pipelines				
Raw Water Pipeline	$4.40	$4.40	$4.40	0
Treated Water Pipeline	$13.50	$13.50	$13.50	1.2
Tie-In	$0.70	$0.70	$0.70	0.7
Sewer	$2.50	$2.50	$0.10	0.3
Subtotal - Direct Cost (Comparable Items)	$50.94	$50.69	$48.34	
Subtotal - Direct Cost (Additional Items)	$8.50	$8.50	$6.10	
Subtotal - All Direct Cost	$59.44	$59.19	$54.44	39.9
Contractor Indirect Cost (10%)	$5.94	$5.92	$5.44	4.0
Contingency (30%)	$17.83	$17.76	$16.32	12.0
Subtotal - Construction Cost	**$83.22**	**$82.87**	**$76.22**	**$55.9**
Indirect Costs				
Land Cost – PS [c]	$0.40	$0.40	$0.40	0
Land Cost – WTP [c]	$0.50	$0.50	$4.00	0
Environmental Assessment & Water License	$0.20	$0.20	$0.20	0
BC Hydro Service Extension	$1.50	$1.50	$1.50	0.2
CVRD Indirect Costs (4%)	$3.33	$3.31	$3.05	2.2
Engineering and CM (15%)	$12.48	$12.43	$11. 43	8.4
Escalation to mid-point (2%)	$3.75	$3.73	$2.29	1.1
Subtotal - Indirect Cost	**$22.16**	**$22.07**	**$22.87**	**$11.9**
Total Project Cost	**$105.38**	**$104.94**	**$99.09**	**$76.3**

Notes:

a) Pressure membrane system is assumed based on space and using residual head from the BC Hydro penstock. Capital cost of $26.9M from TM-2 is increased by 40% to make-up for reduced clearwell volume available.

b) Based on maximum possible size of 5 ML clearwell due to site constraints – provides virus CT plus one hour storage at MDD, plus emergency storage.

c) Land use agreement with BC Hydro still required.

Option 1a TM-1 was the original assumption that a new Puntledge Pump Station would pump all the time. A new Option 1b TM-1 assumes that the penstock is available 75% of the year – thus reducing the operating cost. Table 2 below compares these two options with the other 3 from TM-4. For lifecycle cost the average annual water flow was used.

Table 2: Total Life Cycle Cost of Options

Item Description	Opus DF/UV	Opus SM	Opus SSF	Option 1a TM-1	Option 1b TM-1
Capital Cost	**$105.38**	**$104.94**	**$99.09**	**$76.3**	**$76.3**
30 Year Present Worth Costs	$13.5	$21.2	$9.7	$37.9	$26.4
Total Project Life Cost Comparison	**$118.88**	**$126.14**	**$108.79**	**$114.2**	**$102.7**

Figure 1 compares the lifecycle costs.

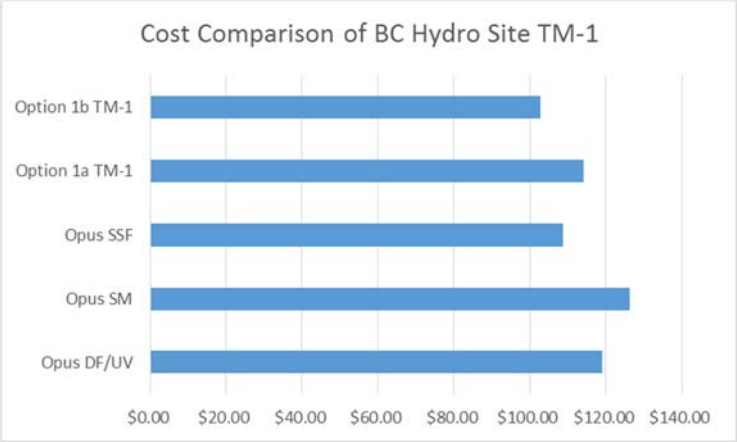

Figure 1

DISCUSSION

On a total lifecycle basis, this shows a potential savings of about $16 million dollars, or roughly 15 percent, for Option 1b. However, the risks from water availability and contamination for river intake options were the original reasons that this option was not advanced and those remain unchanged. These aspects, together with others, are listed below:

- Risk of contamination of source water at the logging bridge was identified in the Regional Water Supply Strategy as the highest risk to water quality.
- Increased frequency of turbidity from Browns River will increase the solids loading to the plant. Resulting residuals are assumed to be higher with less consistent water quality.
- Water availability in drought years will increase the number of days when the penstock might not be available. These are most likely to occur during summer peak flows wherein the resulting actual lifecycle costs would be higher (summer flows versus average annual flows) – so actual savings is potentially less.
- There is no guarantee the BC Hydro will be available 75% of the year.
- The larger capacity of the plant would increase the maintenance cost which is not accounted.
- In an extreme condition, water availability would limit or prevent any release of water from the lake to the river.

SUMMARY

The departure from a deep lake intake introduces a departure from all studies and outlooks to date in terms of overall source protection and reliability. But ultimately, the downside risk of having no water if the lake level were to drop below elevation 130 metres (historical lake minimum is 130.23 metres) to the sill elevation of 128.9 metre is considered unacceptable for the CVRD water system.

Bulk Water Rate Review

75% Funding					
Budget Year	**2016**	**2017**	**2018**	**2019**	**2020**
Revenue					
Required Water Sales Revenue	-5,081,033	-5,566,715	-5,602,873	-5,639,383	-5,676,244
Required Bulk Water Rate	0.66	0.71	0.71	0.71	0.71
Finances Acquired					
Grants			-43,500,000	-31,500,000	
Development Cost Charges			-750,000		
Long Term Debt					
Transfer fr Reserves		-2,000,000	-11,514,734	-8,250,163	
Transfer fr Operating	-1,180,000	-60,000	-2,235,266	-2,249,837	-360,000
Finances Applied	1,180,000	2,060,000	58,000,000	42,000,000	360,000

50% Funding					
Budget Year	**2016**	**2017**	**2018**	**2019**	**2020**
Revenue					
Required Water Sales Revenue	-5,081,033	-5,566,715	-5,602,690	-6,339,959	-6,395,768
Required Bulk Water Rate	0.66	0.71	0.71	0.80	0.80
Finances Acquired					
Grants			-29,000,000	-21,000,000	
Development Cost Charges			-750,000	-250,000	
Long Term Debt			-8,940,000	-14,509,999	
Transfer fr Reserves		-2,000,000	-17,466,757	-3,990,164	
Transfer fr Operating	-1,180,000	-60,000	-2,300,455	-2,249,837	-360,000
Finances Applied	1,180,000	2,060,000	58,000,000	42,000,000	360,000

25% Funding					
Budget Year	**2016**	**2017**	**2018**	**2019**	**2020**
Revenue					
Required Water Sales Revenue	-5,081,033	-5,566,715	-5,831,744	-7,660,817	-7,693,029
Required Bulk Water Rate	0.66	0.71	0.74	0.96	0.96
Finances Acquired					
Grants			-14,500,000	-10,500,000	
Development Cost Charges			-750,000	-250,000	
Long Term Debt			-23,047,977	-25,009,999	
Transfer fr Reserves		-2,000,000	-17,466,757	-3,990,164	
Transfer fr Operating	-1,180,000	-60,000	-2,235,266	-2,249,837	-360,000
Finances Applied	1,180,000	2,060,000	58,000,000	42,000,000	360,000

0% Funding					
Budget Year	**2016**	**2017**	**2018**	**2019**	**2020**
Revenue					
Required Water Sales Revenue	-5,081,033	-5,566,715	-6,124,677	-8,976,711	-9,596,086
Required Bulk Water Rate	0.66	0.71	0.78	1.13	1.20
Finances Acquired					
Grants					
Development Cost Charges			-750,000	-250,00	
Long Term Debt			-37,547,977	-35,509,999	
Transfer fr Reserves		-2,000,000	-17,466,757	-3,990,164	
Transfer fr Operating	-1,180,000	-60,000	-2,235,266	-2,249,837	-360,000
Finances Applied	1,180,000	2,060,000	58,000,000	42,000,000	360,000