



Making a difference...together

REGIONAL WATER SUPPLY COMMISSION

Notice of Meeting on **Wednesday, January 17, 2018 @ 12:30 p.m.**
Board Room, 6th Floor, 625 Fisgard Street, Victoria, BC

M. Lougher-Goodey (Chair)
G. Baird
F. Haynes
R. Kasper
J. Loveday
J. Rogers
L. Szpak
E. Zhelka

G. Orr (Vice-Chair)
C. Coleman
M. Hicks
Z. King
T. Morrison
V. Sanders
L. Wergeland

R. Atwell
B. Gramigna
B. Isitt
G. Logan
D. Murdock
W. Sifert
G. Young

AGENDA

1. Election of Chair and Vice-Chair
2. Approval of Agenda
3. Adoption of Minutes of October 18, 2017 1
4. Chair's Remarks
5. Presentations/Delegations
 - No one has registered to speak.
6. General Manager's Report
 - a) Project Updates
 - Japan Gulch Disinfection Plant
 - Main No. 3 at McKenzie Interchange
 - b) Regional Water Supply 2017 Strategic Plan – CRD Board Adoption
7. Summary of Recommendations from Other Water Commissions
 - No recommendations at this time
8. Greater Victoria Water Supply Area Mining Access Requests
(Report #RWSC2018-01)..... 5
9. Sooke Lake Water Quality – Total Coliform Event – Summer 2017
(Report #EEP 18-04)..... 18
10. Water Watch 33
11. New Business
12. Motion to Close the Meeting
That the Regional Water Supply Commission close the meeting in accordance with the Community Charter, Part 4, s. 90(1) (a) *personal information about an identifiable individual who holds or is being considered for a position as an officer, employee or agent of the municipality or another position appointed by the regional district.*
13. Adjournment

To ensure a quorum, advise Lorrie Siemens at 250.360.3087 if you or your alternate cannot attend.



MINUTES OF A MEETING OF THE REGIONAL WATER SUPPLY COMMISSION
Held Wednesday, October 18, 2017 in the 6th Floor Boardroom, 625 Fisgard Street

PRESENT: Commissioners:, M. Lougher-Goddey (Chair), G. Baird, G. Orr, M. Hicks, C. Coleman, J. Rogers, L. Wergeland, E. Zhelka, F. Haynes, Z. King, B. Isitt, G. Young, T. Morrison, R. Kaspar, W. Sifert, L. Seaton, J. Loveday, V. Sanders, D. Murdock, G. Logan, R. Atwell, B. Gramigna

Staff: T. Robbins, R. Lapham, A. Constabel, I. Jesney, M. McCrank, G. Harris, M. Montague (Recorder)

The meeting was called to order at 12:30 pm.

1 APPROVAL OF THE AGENDA

MOVED by Commissioner Morrison and SECONDED by Commissioner Sifert,
That the Regional Water Supply Commission approve the agenda.

CARRIED

2 ADOPTION OF THE MINUTES OF SEPTEMBER 20, 2017

MOVED by Commissioner Gramigna and SECONDED by Commissioner Haynes,
That the Regional Water Supply Commission adopt the minutes of the meeting held September 20, 2017.

CARRIED

3 CHAIR'S REMARKS

The Chair thanked the Commission members that participated in the budget subcommittee meeting in September, and thanked Commissioner Orr for chairing the subcommittee meeting and the Regional Water Supply Commission meeting in his absence.

4 PRESENTATIONS/DELEGATIONS

There were no presentations/delegations.

5 WATER ADVISORY COMMITTEE

R. Mersereau (not present) submitted a letter stating that the Water Advisory Committee was grateful to have a the opportunity to provide input on the strategic plan and feels the plan reflects the priorities of the Committee and that they recommend that the Regional Water Supply Commission approve the strategic plan as presented.

MOVED by Commissioner Coleman and SECONDED by Commissioner Rogers,

That the Regional Water Supply Commission receive the letter from Water Advisory Committee for information.

CARRIED

6 GENERAL MANAGER'S REPORT

Nothing to report at this time.

7 RECOMMENDATIONS FROM OTHER WATER COMMISSIONS

MOVED by Commissioner Gramigna and **SECONDED** by Commissioner Logan,
That the Regional Water Supply Commission receive the report for information.

CARRIED

8 REGIONAL WATER SUPPLY - 2017 STRATEGIC PLAN

T. Robbins introduced the Regional Water Supply - 2017 Strategic Plan and provided a brief summary of the material distributed. He stated that the strategic plan is based on stakeholder feedback and serves as a guiding document for service delivery suitable for public consumption. He noted that progress and outcomes will be tracked and that staff will report back to the Commission on an annual basis to ensure the ongoing commitments and actions are being achieved.

MOVED by Commissioner Baird and **SECONDED** by Commissioner Wergeland,
That the Regional Water Supply Commission:

1. Approve the Regional Water Supply - 2017 Strategic Plan as presented; and
2. Direct staff to forward the Regional Water Supply - 2017 Strategic Plan to the CRD Board for information and make the Plan available for public distribution.

CARRIED

9 2018 SERVICE PLANS REVIEW PROCESS

T. Robbins spoke to the report. He noted that the service and financial planning process are integral to providing ongoing service delivery, and that the departmental service plans set out key trends and issues, service levels, divisional initiatives, performance objectives, and budget implications. Service plans are presented to appropriate standing committees to provide a detailed assessment of service delivery and programs.

MOVED by Commissioner Baird and **SECONDED** by Commissioner Logan,

That the Regional Water Supply Commission recommend to the Capital Regional District Board:

That the attached service plans be approved as presented.

CARRIED

10 REGIONAL WATER SUPPLY SERVICE - 2018 OPERATING AND CAPITAL BUDGET

Commissioner Orr thanked the budget subcommittee for their participation on the budget review and he thanked staff that were in attendance and noted that the sub-committee discussed surplus funding.

T. Robbins spoke to the report and noted that staff met with Regional Water supply Commission's Budget Subcommittee on September 20, 2017 to review the proposed 2018 Regional Water Supply Budget in order to make budget recommendations to the Regional Water Supply Commission. He stated that the draft 2018 Regional Water Supply Service budget has been prepared in consideration of the CRD Board's 2018 service planning and financial expectations and gave a presentation which summarized

the key budget factors influencing the 2018 budget. He stated that surplus funding is considered when establishing the annual budget and rates and the Commission would need to provide direction to offset future rate increases.

A brief discussion took place about rate based models.

A brief discussion took place about capital contributions and debt servicing costs.

MOVED by Commissioner King and **SECONDED** by Commissioner Sifert,

That the Regional Water Supply Commission:

That the Regional Water Supply Commission recommends that the Capital Regional District Board:

1. Approve the 2018 Capital Budget and the Five Year Capital Plan;
2. Approve the 2018 Operating Budget;
3. Approve the 2018 wholesale water rate of \$0.6644 per cubic metre; and
4. Approve the 2018 agricultural water rate of \$0.2105 per cubic metre.

CARRIED

11 **GREATER VICTORIA WATER SUPPLY AREA MINING ACCESS REQUESTS**

A. Constabel spoke to the report and stated that she has followed up with the Ministry of Energy and Mines and that the applicant only has rights to conduct mining on the non-reserved areas within the claims as shown in report, and the applicant has no rights to mine within the Sooke Water supply portion of the claims and the CRD has no obligation to provide access to the non-reserved claim areas.

MOVED by Commissioner Kasper and **SECONDED** by Commissioner Zhelka,

That the Regional Water Supply Commission authorize access and special use to Chad Bartlett to access placer tenures #1046940 and #1047461 in the Leech Water Supply Area from October 18, 2017 to April 30, 2018, with the conditions required in the Access Agreement.

CARRIED

12 **2017 WILDFIRE SEASON - GREATER VICTORIA WATER SUPPLY AREA**

A. Constabel spoke to the report. She noted that the 2017 wildfire season was characterized by an extremely wet winter and spring followed by an extremely dry summer. High temperatures resulted in many days in extreme fire danger and in general an increase in the number of extreme and high danger. She noted that there were no wildfires in the Greater Victoria Water Supply area, that staff training and fuel management progressed as planned, and crews could be supplied to assist the province with wildfire season.

MOVED by Commissioner Logan and **SECONDED** by Commissioner Rogers,

That the Regional Water Supply Commission receive the staff report for information.

CARRIED

13 WATER QUALITY REPORT FOR SOOKE LAKE RESERVOIR – MAY-AUGUST 2017

MOVED by Commissioner Gramigna and **SECONDED** by Commissioner Morrison,

That the Regional Water Supply Commission receive the Sooke Lake Reservoir monitoring result for May-August 2017 for information.

CARRIED

14 WATER WATCH

MOVED by Commissioner Zhelka and **SECONDED** by Commissioner Rogers,

That the Regional Water Supply Commission receive the report for information.

CARRIED

15 NEW BUSINESS

Commissioner Kasper requested staff to provide an analysis on the different types of water rate models.

16 ADJOURNMENT

MOVED by Commissioner Kasper and **SECONDED** by Commissioner Sifert,

That the Regional Water Supply Commission meeting be adjourned at 1:55 pm.

CARRIED

Chair

Secretary

**REPORT TO REGIONAL WATER SUPPLY COMMISSION
MEETING OF WEDNESDAY, JANUARY 17, 2018**

SUBJECT **GREATER VICTORIA WATER SUPPLY AREA MINING ACCESS REQUESTS**

ISSUE

To seek Regional Water Supply Commission approval for placer and mineral tenure holders to access the Leech Water Supply Area under Greater Victoria Water Supply Area Protection Bylaw No. 2804.

BACKGROUND

Under Greater Victoria Water Supply Area Protection Bylaw No. 2804, the General Manager will seek approval for access and special use of the Greater Victoria Water Supply Area from the Regional Water Supply Commission. By Policy and Procedure (*Water Supply Area Access and Special Use Request and Approval Policy and Procedure* approved by the Regional Water Supply Commission May 2016), all access requests, except those under prescribed situations, are forwarded to the Regional Water Supply Commission. Mining access and special use is not a prescribed situation under the Procedure and the requests are therefore presented to the Regional Water Supply Commission for approval.

Mining tenures are issued by the BC Ministry of Energy and Mines under the *Mineral Tenures Act*. The registered holder(s) of the tenure is required to give private land owners a minimum of 8 days' notice prior to entering their lands to access the tenures. Further, the *Mining Right of Way Act* gives the registered holder(s) of a mining tenure the right to use existing roads on private land to access their tenure for mining purposes.

"Special use" is defined in Bylaw No. 2804 as "an activity not included in the operations of the CRD that is carried on in the water supply area by persons who are not employees or contractors of the CRD". Requests for special use must be received in the form of a completed External Applicant Access and Special Use Request application. Staff evaluate the request based on the information provided and submit a report to the Regional Water Supply Commission outlining the request, the implications and a recommendation for the Commission's consideration. The Commission may approve or not approve the request and may set conditions with approval. Upon Commission approval, the General Manager will sign the Access Agreement setting out conditions and authorizing the tenure holder access to the Leech Water Supply Area.

2018 Leech Water Supply Area Mining Access Application

The following table lists a tenure holder that has recently applied for access to the Leech Water Supply Area to conduct mining activities on a placer tenure in 2018. The tenure was acquired through sale from the previous holder Kenneth Jamieson on September 21, 2017. The redacted access application and proposed Access Agreement are attached.

Table 1. Mining Access Applicants

Tenure Holder	Accompanying Persons	Placer Tenure	Mineral Tenure	Date Tenure Acquired*	Tenure Renewal Date*	Tenure Size* (ha)
John Halusiak		1044020		2017-09-21	2019-02-22	21.4
1 Applicant		1 Placer Tenures	0 Mineral Tenures			

* Information from the provincial Mineral Tenures Online database

The applicant has \$3 million liability and \$1 million firefighting insurance through membership with the Vancouver Island Placer Miners' Association. The applicant has submitted evidence of vehicle insurance, permission to transit through TimberWest private forest lands, has signed an Access Agreement that provides the CRD with a liability waiver, and sets out the conditions for access (Attachment 2). No access is permitted during extreme fire danger.

ALTERNATIVES

Alternative 1

That the Regional Water Supply Commission authorize access and special use to the mining tenure holder listed in Table 1 for the valid mining tenures held now and during January 17, 2018 to April 30, 2019, with the conditions required in the Access Agreement.

Alternative 2

That the Regional Water Supply Commission authorize access and special use to the mining tenure holder listed in Table 1 for the valid mining tenures held now and during January 17, 2018 to April 30, 2019, as described in the access application, with additional conditions.

IMPLICATIONS

Risk/Implication	Access Factors	Mitigation / Impact
Environmental – Fire	<ul style="list-style-type: none"> Varied fire danger throughout the year 	<ul style="list-style-type: none"> Condition: No access during extreme fire danger rating or at other times of special concern Requirement to carry firefighting tools in vehicles during fire season Air and ground patrol monitoring Fire suppression insurance
Environmental – Contamination Sediment Pathogens	<ul style="list-style-type: none"> Vehicles, people/tools working in or near water Access and activities outside of current drinking water catchment 	<ul style="list-style-type: none"> Condition: No pets allowed Ground patrol monitoring
Safety/CRD Risk	<ul style="list-style-type: none"> Potential for miner to be injured on CRD property 	<ul style="list-style-type: none"> Condition: Radio required for travel on Greater Victoria Water Supply Area roads. Condition: Watershed orientation Condition: Access Agreement indemnification and waiver Condition: Vehicle and liability insurance
Economic	<ul style="list-style-type: none"> Administration effort 	<ul style="list-style-type: none"> Ground patrol field time
Inter-Governmental	<ul style="list-style-type: none"> Entry/access required under provincial Acts 	<ul style="list-style-type: none"> Condition: Valid tenure held by the applicant and Free Mining Certificate up-to-date

CONCLUSION

The CRD has received an access application to conduct placer mining activities on a tenure held in the Leech Water Supply Area. Given the applicants' rights to access the Leech Water Supply Area under the *Mineral Tenures Act* and *Mining Right of Way Act*, CRD approval is not required to enable the tenure holder access to the Greater Victoria Water Supply Area however, reasonable conditions may be imposed on access through the CRD's access authorization process.

RECOMMENDATION

That the Regional Water Supply Commission authorize access and special use to the mining tenure holder listed in Table 1 for the valid mining tenures held now and during January 17, 2018 to April 30, 2019, with the conditions required in the Access Agreement.

Submitted by:	Robert Walker, Manager Wildfire, Security & Emergency Response
Concurrence:	Annette Constabel, MSc, RPF, PMP, Senior Manager, Watershed Protection
Concurrence:	Ted Robbins, BSc, CTech, General Manager, Integrated Water Services
Concurrence:	Robert Lapham, MCIP, RPP, Chief Administrative Officer

RW/AC:so

Attachments:

1. Redacted Access and Special Use Request Application Form
2. Redacted 2018 Access Agreement

TYPE I PLACER MINER

ACCESS TO: LEECH WATER SUPPLY AREA



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Integrated Water Services, Watershed Protection Division
**EXTERNAL APPLICANT ACCESS
AND SPECIAL USE REQUEST
GREATER VICTORIA WATER SUPPLY AREA**

Application No. 00:00527

Please Fill Out All Applicable Sections

Primary Contact

Applicant's Name: John Halusiak Name of Agency: VIPMA

Applicant's Title: _____ Phone: _____

Applicant's Supervisor: _____ Phone: _____

Agency Street Address: _____

City/Prov: _____ P. Code: _____

Agency Email: _____ Agency Fax: _____

Other Agency Numbers (cell, pager): _____

Agency Emergency Contact: Name: _____ Phone: _____

Note: If Applicant is representing a group or work crew that will be using a single vehicle and working in the same location at all times, only one full application form is required. Provide contact information for all of the other workers in the crew on an *Additional Applicants Access Request* form. Orientation is required for the entire group.
* If Applicant is not representing a group or agency, indicate 'Individual'.

Personal Contact Information (See Privacy Statement below.)

Home Address: Street: _____ City: _____ Prov. _____ P. Code: _____

Home Phone: _____ Cell Phone: _____

Email: _____ Other: _____

Personal Emergency Contact: Name: _____ Phone: _____

Privacy Statement

Personal information contained on this form is collected under the authority of the Local Government Act and is subject to the Freedom of Information and Protection of Privacy Act. The personal information will be used for purposes associated with the security of infrastructure and personnel within the Greater Victoria Water Supply Area. Enquiries about the collection or use of information in this form can be directed to the Manager of Wildfire, Security and Emergency Response at 250-391-3566. The form may be shared with the Regional Water Supply Commission with some personal identifiers redacted.

Project / Purpose / Proposed Activity

Project Name / Purpose of Application (please provide supporting documents) / Proposed Activity:
Hand Panning and Metal Detecting for Gold

Note: Research Applications must be coordinated through the Watershed Protection Division. Please attach a copy of the research proposal and or work plan.

Placer Miner Application - Attach claim location map and Claim Number: # 1044020

Sponsoring Integrated Water Services (IWS) Division or other CRD Department (check one):

Infrastructure Operations Infrastructure Engineering Watershed Protection

Water Quality Other CRD Department: _____

No CRD Sponsor

Name of Water Services Access Sponsor (Division Representative): Rob Walker

Name of Water Supply Area Co-Sponsor (Project Manager): _____
(If Required)

Vehicle, Equipment and Transporting Dangerous Materials Information

Vehicle Make: _____ Model: _____ Colour: _____

Vehicle Marking (Logo etc.): _____ License Plate Number: _____

Transporting Other Equipment (i.e. Heavy Equipment, Boat)? Yes No

If yes, what is it? _____

Transporting Fuel, Lubricants⁽¹⁾, Chemicals or other Hazardous or Dangerous Material? Yes No

If yes⁽²⁾, what is it and how much? _____

Transporting Dangerous Goods Certification Required? Yes No

Transporting Dangerous Goods Certification Number: _____

⁽¹⁾ Over and above that normally found in the vehicle or piece of equipment. ⁽²⁾ Please attach MSDS for each product

Access Requirements To be filled out in consultation with Sponsor

Location of Work or Activity (be specific and note all locations): Claim 1044020

Access Dates: From: Jan 1, 2018 To: Dec 31, 2018

Monday to Friday Times: _____ Weekend Times: Dawn to Dusk
 Statutory Holidays Which ones? _____ Times: Dawn to Dusk

Equipment Requirements To be filled out in consultation with Sponsor

The following equipment is required; please indicate if you are requesting a loan.

VHF Radio - CRD Water Frequencies ⁽¹⁾ Loan Requested? Yes No

Emergency Spill Kit Loan Requested? Yes No

Wildfire Equipment Loan Requested? Yes No

⁽¹⁾ If requesting approval to program personal radio to CRD Water Frequencies, please provide the following information:

Industry Canada File and License Number: N/A

On Site Safety Considerations

Applicable Safety Plan provided? (details) _____

First Aid certif. / equip. to be provided: _____

Insurance

Proof of Insurance Provided:

Vehicle: Yes No Firefighting (April 1 – October 31) Yes No

General Liability Yes No VIPMA

Permission to Transit Adjacent Private Property

Permission Granted: Yes No N/A Written Permission Attached: Yes No

Note: By signing here the Applicant declares (and declares on behalf of group applicants), that the information provided is true and accurate.

Applicant's Signature: J. Holmink Date: Nov 8, 2017

IWS Sponsor Signature: [Signature] Date: Nov 20, 2017

WSA Co-Sponsor: _____ Date: _____
(If Required)

For Internal CRD Use Only

Initial Risk Review

- Contaminants (Hazardous material amounts, boat, heavy equipment) _____
- Pathogens (Sani facilities, animals) _____
- Wildfire (Blasting, grinding, welding) _____
- Sediments / Nutrients PLASTER MINING ACTIVITIES.
- Cultural / Environmental _____
- Safety (Training & Equip., Appropriate Plan / Procedures) IN ORGANIZATION.

Initial Comments: _____

Conditions and Restrictions: _____

Risk Mgmt. Plan _____

Assessed Overall Risk to Water Quality or Other Values

Comments: _____
 Low Medium¹ High¹

¹ Any application deemed a Medium or High Risk must be reviewed by the Senior Manager, Watershed Protection or Access Review Committee. Attach rationale for Medium or High Risk designation and recommendations on course of action.

Fire Danger Rating

Expected fire danger rating during access dates Very Low Low Moderate High Extreme → RANGE SITING DOWN

Inspections

Does the applicant require inspections or other action upon entry?
 No Yes Provide Details: _____

Insurance

Proof of Insurance Provided:
Vehicle: Yes No Firefighting (April 1 – October 31) Yes No UIPMA
General Liability Yes No UIPMA

Security Chargehand Comments

Previous Issues / Application Checks NEW APPLICANT

Initial Determination

- Recommend approval of the application
- Do not recommend approval of the application (be specific): _____
- Recommend approval of the application with requirements / restrictions as above and in addition: _____
- Refer to Sr. Manager, or ARC (Medium or High Risk) _____
Results of Further Risk Review: _____

CRD Signatures

Security Chargehand, Watershed Protection

Manager, Wildfire, Security & Emergency Response

(If Required)

Senior Manager, Sponsoring IWS Division (or Water Supply Area Co-Sponsor)

(If Required)

Senior Manager, Watershed Protection Division

NOV 10 2017

Date

Nov 20/17

Date

Date

Jan 2, 2018

Date

Approval for Access and Special Use Provided by Regional Water Supply Commission

Yes Date: _____

No, not required

General Manager, Integrated Water Services

Date

Access Times and Keys

Annual (Expires Jan 31) 2019 Date From: 2018-01-01 Date To: 2019-01-31

7am - 4:30pm 24/7 Monday to Friday Weekends Statutory Holidays

Autogate Access: Goldstream Sooke

Gate Key Requirements: (refer to Water Supply Area Access Control Maps)

Gates: Specify: CRA66 GATE.

Facilities: Specify: _____

Refundable Key Deposit

Contract Holdback (none)

Other (\$500)

Radio Frequencies

Permission to Program

File Number Checked

Licence Number Checked

Ongoing

Long Term (> 1 year)

Short Term

Expiry: _____

Orientation and Key Loans

Key Deposit Paid

Orientation Complete

Date: 2017-11-16

Photo ID Card

Autogate Active

Dashboard ID Card

Key(s) issued / No(s): _____

Access Info. Folder

Return Date: _____

Security Chargehand or Alternate (Initials): AS

Applicant Declaration

By signing here the Applicant confirms completion of orientation; declares that they are going to an approved worksite(s) within the GVWSA to carry out work authorized by the CRD IWS or its representatives; understands and agrees to adhere to applicable Bylaws, policies and procedures; are not currently ill with a known waterborne communicable disease; will use the sanitary facilities provided, and; will follow the instructions of CRD IWS personnel when required.

The Applicant confirms equipment loans as listed above and understands that any keys or equipment issued remain the property of CRD IWS. The applicant declares (and declares on behalf of their group or work crew as required), that the keys or equipment will be surrendered upon notice, that keys must not be copied or loaned to others and that they will return keys and equipment on the due date or make arrangements for the renewal of borrowing privileges.

J. Halusich

Applicant

Nov 16, 2017

Date

Routing

Applicant / Water Services Access Sponsor

Security Chargehand, Watershed Protection

Manager Wildfire, Security and Emergency Response

Senior Manager WP (and ARC - If Required)

If Required, Sr. Manager, Sponsor Div. / WSA Co-Sponsor

If Required, General Manager

Data Entry Date: _____

NOV 10 2017

Initials: AS

This AGREEMENT made in duplicate as of: Day: 16 Month: Nov Year: 2017

BY AND BETWEEN:

CAPITAL REGIONAL DISTRICT
625 Fisgard Street
Victoria, BC V8W 1R7
(Hereinafter called the "CRD")

AND:

Name: John Halusiak
Street Address: [REDACTED]
City: [REDACTED]
Province: [REDACTED]
Postal Code: [REDACTED]
(Hereinafter called the "Licensee")

Access to: - List all claims owned or co-owned that you require access -

Placer Claim Tenure Number(s)

1044020

Mineral Claim Tenure Number(s)

RECITALS

- A. The CRD holds title to the area described as the Greater Victoria Water Supply Area (the "GVWSA"). It is the intention of the CRD to manage the GVWSA to provide for water supply for the residents of Greater Victoria. As such, the CRD manages the GVWSA in the general interest of protecting and enhancing environmental values and specifically, minimizing risk to water quality from stressors such as wildfire, erosion and introduction of hazardous materials or pathogens. In addition, the CRD conducts all operations in the interest of ensuring safety of employees and other Water Supply Area users authorized for access.
- B. The Licensee holds Placer Claim Tenure Number(s) – as listed above – and Mineral Claim Tenure Number(s) – as listed above –, (the "Claims") granted by the Province of BC. The Licensee intends to access and operate the Claims, which are located within the GVWSA.

The CRD and Licensee, in consideration of their mutual duties and responsibilities to one another as hereinafter set forth, enter into an agreement on the following terms (the "Agreement"):

ARTICLE 1 – ACCESS

- 1.1 The CRD hereby grants the Licensee access to the Claims by way of – name gate(s) accessing – Cragg Main Gate
(Each licensee will be given a prescribed gate to enter and road to access their claim), for a period of one year, commencing on the date of signing this Agreement. The granted access does not include access for the purposes of general prospecting.
- 1.2 The CRD reserves the right to temporarily lift the permission or make alterations to the route for access granted under Article 1.1 in the event of emergency, fire hazard or other operational reason.
- 1.3 Nothing in this Agreement shall be construed as permitting use of lands or waterbodies within the GVWSA for any activities outside of permitted mining activities on the claim(s) referenced above or for permitted access to the claim(s) referenced above.
- 1.4 Nothing in this Agreement shall be construed as permitting access across any lands not held by the CRD. If crossing the lands of a third party is required in order to access the Claims, it is the responsibility of the Licensee to obtain all necessary permissions for access directly from the third party.

ARTICLE 2 – PROCEDURES

- 2.1 The Licensee hereby covenants and agrees that prior to entry onto the GVWSA, the Licensee will:
- a) On an annual basis apply to the CRD Watershed Protection Division ("**Watershed Protection**") by completing an External Applicant Access Request Form for the GVWSA.
 - b) Attend an orientation session in which the Security Chargehand or designate will review the GVWSA Policies and procedures including the following:
 - Use of keys/radios and roads
 - Health and sanitation
 - GVWSA entry and registration procedures
 - Use of petroleum products, transportation of hazardous goods
 - Spill response
 - Preventing and responding to wildfires
 - Reporting vandalism, trespass or other threats to water quality
 - General conduct and conditions
 - c) Obtain a Dashboard Advisory Card from the CRD, which the Licensee shall display in plain sight on the dashboard of any vehicle the Licensee uses while parked on GVWSA lands.
 - d) Abide by the following restrictions:
 - The Dashboard Advisory Card is valid only for the mining purposes of the Licensee. Keys and Dashboard Advisory Cards are **non-transferable** and may not be loaned to a third party.

- Keys must not be duplicated. Licensees are responsible for the security of their keys. Lost keys or Dashboard Advisory Cards must be reported to the CRD immediately and may not be replaced.
 - Gates must be kept locked at all times, with the exception of the Goldstream gate which is kept open during business hours (07:00 to 16:30 Mon-Fri).
 - Vehicles used by the Licensee require a VHF radio with CRD Watershed Road Direct Frequency Channel 4.
- e) Provide a deposit for any keys to be issued and proof of insurance subject to Article 6. Key deposits are refundable, subject to the key and any other equipment being returned to Watershed Protection in good working condition.

ARTICLE 3 – ROAD USE

- 3.1 The Licensee will use the roads in a manner that does not interfere with the CRD's use of the roads, and will advise the CRD at least two days in advance of any equipment movement on the roads.
- 3.2 The CRD reserves the right to fully close road access in the event of high or extreme fire hazard and/or other extreme weather conditions.
- 3.3 The CRD does not assure vehicle access to the Licensee at all times. Vehicle access may be blocked for indefinite periods as a result of storms (e.g. snowfall, windfall, etc.) or for the operational requirements of the CRD.
- 3.4 The Licensee will under no circumstances alter, modify, repair, maintain, extend or construct roads on the GVWSA without the prior written approval of the CRD.
- 3.5 The Licensee will compensate the CRD for any Licensee caused damaged to GVWSA roads or roaded infrastructure including culverts, bridges and signs. All damage must be immediately reported to the CRD.
- 3.6 Radio call-in procedures must be followed when using roads in the GVWSA.

ARTICLE 4 – GENERAL CONDITIONS

The Licensee agrees to adhere to the following requirements:

- 4.1 To attend a thirty (30) minute orientation seminar (Article 2.1(b)) prior to entering the Lands, unless accompanied by Watershed Protection staff.
- 4.2 To adhere to the CRD Water Supply Protection Bylaw #2804 at all times while in the GVWSA.
- 4.3 The Licensee and any accompanying persons must comply with and be bound by the CRD's Watershed Policies and Procedures, which are provided in the orientation session. An 'Additional Applicants Application' Form will be required for each accompanying person.

- 4.4 The Licensee must ensure that any persons accompanying the licensee must comply with the following conditions: be identified to CRD; sign a CRD waiver, and; hold insurance coverage the same as described in Article 6 below.
- 4.5 If the Licensee's interest in the Claims is transferred, cancelled, forfeited, or otherwise found to be invalid, this Agreement will be rendered null and void.
- 4.6 No firearms will be brought onto the GVWSA. For the purposes of this section, 'firearm' has the meaning set out in the *Firearm Act* (British Columbia), and includes any gun using, as a propellant, compressed air, explosives or gas.
- 4.7 The Licensee is prohibited from erecting any temporary or permanent shelters within the GVWSA and shall not overnight on GVWSA lands, except in pre-existing cabins or shelters that have been expressly permitted by the CRD.
- 4.8 The Licensee is prohibited from erecting any temporary or permanent shelters within the GVWSA and shall not overnight on GVWSA lands. The CRD may, upon application, provide written authorization for specific overnight stays for mining purposes only. Application must be made well in advance of the dates of planned activity.
- 4.9 No waste of any type can be discharged into streams, or onto watershed lands.
- 4.10 Domestic animals are not allowed within the GVWSA at any time.
- 4.11 The Licensee is responsible for all damage incurred to the CRD's property or facilities.
- 4.12 If, prior to the expiry date of this agreement, the CRD and the Licensee enter into another access agreement, the terms of that agreement shall govern in the event of any conflict of terms.
- 4.13 This Agreement may be cancelled by either party for any reason with 30 days written notice to the other party.

ARTICLE 5 – RELEASE AND INDEMNITY

- 5.1 The Licensee covenants and agrees that the CRD, its employees, officers, contractors and agents, will not be liable to the Licensee or any person or entity for incidental, consequential, resulting or special loss or damage of any kind whether foreseeable or not, however caused, arising out of or in any way connected with this Agreement or the Licensee hereby granted.
- 5.2 The Licensee covenants and agrees to indemnify and save harmless the CRD, its employee, officers, contractors and agents, from and against all losses, liabilities, claims, damages, costs, fines, fees or expenses of any kind or nature whatsoever made or brought against the CRD, arising from the Licensee's exercise of its rights under this Agreement.
- 5.3 The CRD is under no obligation to facilitate or otherwise assist the Licensee in accessing their claims through the GVWSA.

ARTICLE 6 – INSURANCE

The Licensee will obtain and maintain throughout the term of this Agreement:

- (i) Public liability insurance and property damage insurance in the minimum amount of \$3,000,000.00 with respect to death or injuries to persons or property caused by or arising out of or attributable to the exercise of the rights granted hereunder, and firefighting expenses liability insurance in which the limit of liability shall not be less than \$1,000,000.00.
- (ii) Automobile liability insurance covering bodily injury (including passenger hazard) and property damage arising from the operating of owned and non-owned vehicles on the Lands, with inclusive limits of not less than \$2,000,000.00 for any one accident.

Proof of insurance must be received by the CRD prior to entry onto the GWWSA.

ARTICLE 7 – CONTACTS

1. For the Licensee:

Name: *John Halusiatz*
 Street Address: [REDACTED]
 City: [REDACTED]
 Province: [REDACTED]
 Postal Code: [REDACTED]
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2. For the CRD:

Annette Constabel, Senior Manager
 Watershed Protection
 Telephone: (250) 391-3556
 Email: aconstabel@crd.bc.ca

-Or-

3. For the CRD:

Security Chargehand
 Watershed Protection
 Telephone: (250) 391-3551
 Email: nprenger@crd.bc.ca or
nboyne@crd.bc.ca

Signed and Delivered by or on behalf of
 the Licensee (or authorized signatory of
 the Licensee)

Signed and Delivered by or on behalf of
 the Capital Regional District

J Halusiak
Signature

John Halusiak
Name - Printed

Nov 16, 2017
Date

Ted Robbins, ASCT
General Manager, Integrated Water
Services

Date

Capital Regional District
625 Fisgard Street
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**REPORT TO REGIONAL WATER SUPPLY COMMISSION
MEETING OF WEDNESDAY, JANUARY 17, 2018**

SUBJECT **Sooke Lake Water Quality – Total Coliform Event – Summer 2017**

ISSUE

To report out on the high total coliform bacteria event observed in Sooke Lake Reservoir during the summer of 2017.

BACKGROUND

The Capital Regional District (CRD) manages the regional water supply system from source water through treatment and distribution. The Sooke Lake Reservoir provides the majority of the source water with the Goldstream Reservoir system providing a limited back-up supply. The reservoirs provide unfiltered raw water to the Japan Gulch and Sooke River treatment plants prior to distribution across the region.

During the past summer, routine water quality monitoring indicated unusually high concentrations of total coliform bacteria entering both the Japan Gulch and Sooke River Road treatment plants. The event peaked in late July and subsided by mid-October. Similar events have been observed in previous years but not to the extent observed in 2017. CRD staff responded to this event immediately and had to operate the disinfection facilities at maximum output capacity to prevent a bacteria breakthrough into the supply system. The safety of the drinking water for Greater Victoria was never compromised throughout the duration of this event and staff kept in regular communication with Island Health officials throughout the event.

In October 2017, the CRD conducted an investigation into this event, retaining the services of Dr. Rick Nordin, a former provincial government limnologist with extensive knowledge of the Sooke Lake Reservoir and water supply area. The investigation involved data analysis from samples collected before and during this event, as well as a review of historical data. The objectives of the investigation were: (a) to determine the factors and reasons that led to this event; (b) to understand the mechanism of such occurrence; and (c) to learn how to prevent a similar water quality risk in the future. The detailed investigation report is provided in Attachment 1, which includes recommendations to review our water quality monitoring program and consider a request for a hydrodynamic modelling study in the 2019 budget.

RECOMMENDATION

That the Regional Water Supply Commission receive this report for information.

Submitted by:	Glenn Harris, Ph.D., R.P.Bio., Senior Manager, Environmental Protection
Concurrence:	Glenn Harris, Acting General Manager, Parks & Environmental Services
Concurrence:	Ted Robbins, B.Sc., C.Tech., General Manager, Integrated Water Services
Concurrence:	Robert Lapham, MCIP, RPP, Chief Administrative Officer

CM:cam

Attachment: Attachment 1 – Investigation Report on High Total Coliform Event in 2017

Memo

The logo for the Capital Regional District (CRD) is located in the top right corner of the memo header. It consists of the letters 'CRD' in a bold, sans-serif font, set against a dark, curved background that resembles a stylized wave or a landscape feature.

TO: File

FROM: Christoph Moch, Manager Water Quality Operations

DATE: December 13, 2017

FILE: 5260-20
Significant Incidents

SUBJECT: INVESTIGATION REPORT ON HIGH TOTAL COLIFORM EVENT IN 2017

SUMMARY

The Total Coliform (TC) bacteria event during the summer of 2017 exhibited the highest ever recorded TC bacteria concentration in the raw water coming from Sooke Lake Reservoir. It was also the first time that TC bacteria seriously threatened to break through the disinfection stages at both the Japan Gulch and the Sooke River Road Treatment Plants.

In October 2017, Capital Regional District (CRD) Water Quality staff, in collaboration with Dr. Rick Nordin (see Appendix A), investigated this unusual TC bacteria event. The investigation involved a water quality data analysis of several parameters from samples collected before and during this event, as well as a review of historical data. The objectives of the investigation were: (i) to determine the factors and reasons that led to this event; (ii) to understand the mechanism of such occurrence; and (iii) how to prevent a similar water quality risk in the future.

The regular raw water quality monitoring program identified unusually high TC concentrations on July 21, 2017. The TC concentrations in raw water entering both Japan Gulch and Sooke River Road treatment plants peaked at over 24,200 CFU/100mL on July 28, 2017 and then slowly decreased. To prevent a TC bacteria breakthrough into the supply and distribution system, the ultraviolet (UV) and chlorination disinfection stages at both treatment plants had to be operated at their maximum output capacity during the peak of the event. TC concentrations in the Sooke Lake Reservoir south basin and in the raw water entering both plants returned to pre-event levels (<100 CFU/100mL) by mid-October, coinciding with the natural lake turn-over.

A review of historical TC bacteria data dating back to 1990 determined that there is a pattern of TC events during the summer months in the south basin of Sooke Lake Reservoir. However, TC concentrations of over 15,000 CFU/100mL are unprecedented. The data analysis found no obvious correlations with any of the wide-range of chemical and biological parameters monitored during the event duration or pre-event routine monitoring for potential effects from the Water Temperature Management Project. The water quality deterioration during this event was limited to an increase in TC concentrations only.

The investigation concluded that the timing of wind-induced internal seiches (a standing wave produced in the interior of a lake at the thermocline level), at a particular thermal stratification constellation, was key to creating this event. Wind-induced internal seiches occur frequently during each summer period. However, they only have the potential to affect water quality when the thermocline is situated near the bottom structures in the Sooke Lake Reservoir south and mid basins, which are shallower. Under those conditions, they are able to introduce sufficient energy

to mobilize very flocculent and light-weight organic sediments associated with high TC concentrations. The Water Temperature Management Procedure, with its usage of the higher elevation intake gates between May and mid-July 2017, likely allowed a higher sedimentation rate of organic material during that timeframe. Due to the recognized water quality risks associated with this project it is recommended in future to continue drawing from bottom level intake gates (first level) throughout the spring and summer period unless emergency situations require otherwise.

This event revealed a gap in our understanding of some of the physical processes occurring regularly in Sooke Lake. The development of a hydrodynamic model for Sooke Lake Reservoir would enable us to better predict similar events and consider the impact of wind forces, internal currents and inflow and mixing effects on water quality.

The investigation has also identified several challenges of the present intake tower location, including its location in the shallow portion of the reservoir with complex bottom morphology. Further investigations are recommended.

The investigation also revealed a lack in our understanding of sedimentation rates and sediment accumulations in critical parts of the reservoir. This could be addressed by implementing a sediment monitoring program which should look at sedimentation rates and the biological composition.

Even though TC bacteria serve as general indicator of potential fecal contamination, the event did not pose a significant health threat as the recorded TC bacteria likely consisted predominantly of generic “decomposer” bacteria. No evidence of an external or internal fecal contamination was found during the investigation.

BACKGROUND

After a promising pilot of the Water Temperature Management Project in the spring of 2016, the staff initiated this project again in 2017. The Guidelines for Canadian Drinking Water recommend a drinking water temperature of less than 15°C for aesthetic and operational reasons. The Regional Drinking Water System regularly exceeds this parameter from July-October. Water temperatures in outlying areas of the distribution systems can exceed 20°C, which is not only unpleasant for the affected customers but also has consequences for the water system operations. High water temperatures facilitate and accelerate undesired biological processes including nitrification and bacterial regrowth which in turn lead to rapidly decreasing chlorine residuals. As a result, affected distribution reservoirs and distribution mains may need to be cleaned/flushed more often throughout the summer months.

The south basin of the reservoir, where the intake tower is located, thermally stratifies each spring which isolates a finite volume of cool water on the bottom of the relatively shallow basin. Historically, the CRD has always withdrawn water from the bottom (first level) gates at the intake tower in the south basin, at least since raising Sooke Lake Dam in 2004. This consistent withdrawal strategy typically depleted the finite cool water volume isolated at the bottom of the basin by July which led to the aforementioned high water temperature affects in the system. This depletion of the cool hypolimnetic water has the effect that the thermal stratification of the south basin typically disappears by mid-July and the entire water column consists of a uniform temperature. This makes the south basin subject to complete mixing if sufficient energy is introduced.

The much deeper north basin, however, stays stratified all summer and well into the fall season until the natural turn-over occurs as surface water temperatures decrease. Typically by mid-July, the thermocline in the stratified north basin falls below the crest of the old, submerged 1915 Sooke Lake Dam and other lake bottom structures at the entrance to the south basin so that the cool hypolimnetic water of the north basin stays hydraulically disconnected from the south basin during the late summer and early fall season.

DISCUSSION

Water Temperature Management Procedure

The Water Temperature Management Procedure is an attempt to reserve the cool hypolimnetic water in the stratified south basin during the spring and early summer months when the lake's higher water column still featured water temperatures below 15°C (Appendix B). This is accomplished by changing the withdrawal depth to the highest intake gates (fourth level) right after stratification occurred and then using increasingly deeper water as the surface water warmed. This strategy extends the period of thermal stratification in the south basin and delays the onset of the temperature exceedance until later in the summer. It is understood, however that the total summer consumption exceeds the total volume of cool hypolimnetic water available in the south basin and therefore a temperature exceedance could never be completely avoided with the current intake infrastructure in the basin.

Upon confirmation of stratification of the south basin, the water intake depth was changed on May 8, 2017 from the deepest gates (first level) to the highest gates (fourth level). At that time, Sooke Lake Reservoir was at 99.5% of Full Service Level and therefore the top of the first level intake gates sat 1.4 m below surface level (Appendix B).

On May 29, the water intake was changed to the next deepest intake gate level (third level gates, elevation 178.2 m at the top of the gates, about 7 meters below the surface at full storage capacity). The surface water temperatures at this time were approaching 15°C.

On June 20, the intake gates at the next deepest depth began to be used (second level gates, at elevation 172.96 m, about 13 m below the reservoir surface at the time (186.05 m)).

On July 13, the intake of water was switched to the deepest (first level) gates, elevation 170.68 m, about 14.7 meters below the reservoir surface recorded as 185.37 m on July 13. Staff estimated that at this time the cool hypolimnetic volume left below the thermocline was approximately equivalent of 3-4 weeks of summer consumption. In comparison to 2016, and likely most previous years, the thermocline was about 3 m higher in elevation and still spanning the entire reservoir from the north to the south basin by the end of July (1 m was due to higher overall water levels in the reservoir as compared to 2016 water levels).

Throughout the Water Temperature Management Procedure, staff monitored a wide range of parameters: water temperatures, water chemistry, turbidity, algal numbers and chlorophyll concentrations, zooplankton numbers, water clarity, total coliform and *Escherichia coli* (*E. coli*) numbers in the raw water, temperature profiles and taste and odour evaluations. Measurements were not only taken in the south basin near the intake but also in other parts of Sooke Lake Reservoir.

Total Coliform Event Course

Bacterial concentrations were of particular concern during this period. Both total coliforms and *E. coli* were measured. Five days after the final gate switch it was noted that the concentrations of TC bacteria in the raw water at the Japan Gulch Treatment Plant began to increase. Typically in the May-June sampling and up to July 13, TC concentrations are less than 20 CFU/100mL – often less than 10 CFU/100mL. In the four day period July 18-21, TC concentrations in the raw water entering the Japan Gulch Treatment Plant went from 18 to 94 to 200 to 1,046. This trend of increasingly higher counts triggered increased monitoring and attention. On July 24, TC concentrations were 2,420, by July 26 they were 4,610 and on July 27 two samples provided results of 13,000 and 17,300. At that time, staff decided to switch to the shallower third level gates. TC concentrations in the raw water at Japan Gulch peaked at over 24,200 in the morning of July 28 before the gate switch showed effect.

Subsequently the TC concentrations dropped in the afternoon of July 28 to 9,800. The TC results in the following days were as follows: on July 29, TC = 15,500; on July 30, TC = 9,200; on July 31, TC = 5,170 and 1,670 (morning and afternoon); and on August 1, TC = 1,560 and 1,935 (morning and afternoon). Over the next two months the TC concentrations remained elevated – less than 1,000 but more than 100. *E. coli* concentrations, a much better indicator of fecal contamination, remained very low in this entire period.

Staff also monitored TC concentrations at various lake depths near the intake tower. On July 17, four days after the switch to the bottom (first) level gates, TC concentrations in a sample taken right at the lake bottom were only 56 CFU/100mL and consistent with TC concentrations taken from a sample in 1 m depth at the same location (59 CFU/100mL). On July 24, lake samples from the same location and depths contained already much higher TC concentrations (1m depth: 1,553 CFU/100mL; bottom: >2,420 (could be much higher)).

Surprisingly, no other monitored water quality parameter appeared to be affected or showed any anomalies throughout this event (e.g. turbidity, metals, phosphorus, nitrogen, total organic carbon, algae, solids, zooplankton, water clarity, taste and odour, *E. coli*).

This sudden increase of TC concentrations in the raw water to such high concentrations had the potential to break through the disinfection stages at both the Japan Gulch and Sooke River Road treatment plants. Staff maximized the output capacity of the UV and the chlorination treatment components at both plants, which likely prevented a TC bacteria break-through into the supply and distribution systems.

Historical High TC Episodes

The review of historical data indicated a well-established pattern for higher TC concentrations between late summer and fall (see Appendix C). During a number of pre-inundation summers (1990, 1999, 2000 and 2001) the recorded TC concentrations reached values of well above 10,000 CFU/100mL. During the years post-inundation the pattern continued, however TC concentrations did not exceed 5,000 CFU/100mL until the summer of 2017.

During some years, the summer TC concentration increase had already started in early summer (1995, 2003, 2006 and 2010), whereas in most years the increase started in late July or early August. 2009 saw a separate shorter TC concentration increase between early May and early

June. It is noteworthy that 2009 was a year when the reservoir did not reach full service level in the spring and water levels in the lake were unusually low throughout the spring and summer.

Most of these TC episodes typically ended by mid-October to early November, a timeframe that is consistently associated with the uniform cooling of the entire water column of the south basin and the beginning of the natural turn-over in the north basin. During some years, the TC episode lasted until late November or even early December (1990, 1992, 1998 and 2015). Even in years that are not featured in Appendix C (which lists only periods where TC concentrations exceeded 1,000 CFU/100mL), there have been elevated TC concentrations during the late summer to fall period.

The onset of this typical summer TC pattern occurs approximately around mid-July and seems to coincide with the typical disappearance of the thermal stratification in the south basin due to the cool hypolimnetic water depletion as a result of the continuous bottom gate water extraction. The moment the thermal stratification disappears, the entire water column of the south basin is subject to complete mixing.

At the same time, the remaining thermocline in the mid- and north basins typically resides for a relatively short period of time at an elevation near the higher and prominent crests of lake-bottom structures in the mid-basin and at the entrance to the south basin. This results in a narrow band of cool hypolimnetic water compressed below the remaining thermocline in small channels and pockets between numerous lake bottom structures, including the old, submerged 1915 dam [crest elevation: 176.00m above sea level (ASL)]. These pockets harbor varying levels of fine organic sediments from natural organic decomposition.

Lake Sediment Analysis

In 1998, a Sooke Lake Dam Silt Assessment study by Novatec Consultants investigated, using divers, the sediment levels near the old, submerged 1915 dam. The results indicated significant amounts of very light sediments directly upstream of this structure that, once disturbed, remain suspended for a long time. This is an indication of a natural accumulation of very light organic sediments around any prominent lake bottom structures.

Freshwater lakes and reservoirs have a steady sedimentation of organic material from the surface to the bottom. The organic material consists of dying or dead plankton material, organic material brought in by inflow streams and organic material deposited directly on the reservoirs surface. The organic material, as it sinks, is decomposed and mineralized by a variety of bacteria and fungi. The accumulation rates of organic material in the sediments varies over the year and with the level of biological production.

Peak numbers of phytoplankton occurred in late March and early April in 2017. The processed organic material deposited is substantial, (several mm per year), is rich in nutrients and minerals, and forms the typical black organic sediment layer found on the bottom of all lakes. Generally, a layer of very fine suspended organic material exists above these deposited sediments, called the Benthic Boundary Layer or the nepheloid layer. This layer can be several meters thick and has concentrations of organic particulate material and associated bacteria several times higher than the water above it. Many of these highly concentrated decomposer bacteria are included in the TC enumeration. These are species that decompose organic matter in the environment, including leaf litter, algal cells, zooplankton, and are found in a wide array of aquatic environments.

A disturbance of this TC-rich Benthic Boundary Layer initiated by the seiche, is the likely cause of the annual TC pattern including the 2017 TC event, and is further explained below. The observation that no other water quality parameters typically associated with deeper lake bottom sediments were affected during this event (metals, nutrients, turbidity) seems to confirm that only the higher residing Benthic Boundary Layer was disturbed and not the heavier, deeper mineral sediments.

Internal Seiches and Wind Data

The study also reviewed weather records (wind data) during the critical time period in 2017. There were several periods when winds could have introduced sufficient energy to induce an internal seiche. An internal seiche has the capacity to generate deep water currents which in turn could agitate the Benthic Boundary Layer or even re-suspend bottom sediments. In order to document and monitor seiches, specialized equipment and instrumentation would be required for measurement and tracking of deep water currents. Such data could then be used for developing a hydrodynamic model of Sooke Lake Reservoir which would be a useful tool to identify and demonstrate the potential effects of regularly occurring seiches in this reservoir.

The occurrence of an internal seiche in a thermally stratified reservoir requires wind energy and transfer of that energy by friction to generate surface currents and subsequently deep water currents. An internal seiche causes the thermocline to tilt by having the epilimnion deepen at the downwind end of the reservoir. When the wind decreases the epilimnion corrects the imbalance and creates strong internal currents. Sooke Lake Reservoir is likely susceptible to seiche creation as it lies on a north-south axis in a valley with predominant wind direction from the south during summer months. A diagram of an internal seiche is shown in Appendix D. A wind rose for the weather station at the intake tower for July and August 2017 with the dominant wind direction is provided in Appendix E.

Wind events (maximum wind greater than 30 km/h for more than 3 hours at the dam) were recorded on July 7, 12, 15, 20, 27, 30, August 2, 12, 24 and 28, 2017. These examples can be used as an indication of a potential frequency of seiches and that they are likely a feature of Sooke Lake Reservoir physics and a factor in deep water current generation and disturbance of the Benthic Boundary Layer. In reviewing the lake temperature profiles between July 5 and August 14, 2017, the study found potential evidence for internal seiche effects during this timeframe. The depth of the thermocline in the south basin fluctuated during this period between -8.5 m and -10.5 m (below surface).

During the critical time period that defines the onset and the peak of the 2017 TC event between July 24 and August 8, 2017, the thermocline depth changed as follows: July 24: -10.5m; July 26: -9.0m and August 8: -8.5m. It seems very plausible that such sudden shifts of a strong boundary layer as the thermocline in this advanced stage of stratification in near proximity to peaks and crests of the south and mid-basin bottom structures can generate enough sloshing action to cause major disturbances of the Benthic Boundary Layer and upper sediments.

Sooke Lake Reservoir typically stratifies between mid-April to mid-May. Therefore it is likely that seiches regularly occur in Sooke Lake Reservoir between May and the breakdown of the stratification in the fall of each year (October/November). It appears however that these internal seiches only impact the Benthic Boundary Layer at an advanced stage of the stratification later on in the summer as the annual TC episodes including the 2017 TC event typically start at the end of the summer. The much earlier onset of the annual TC episode in 2009 was likely due to

the exceptionally low summer water levels in the lake which may have accelerated the stratification progress that year.

Seiche Vulnerable Zone

The revisited water quality data suggests that internal seiches in Sooke Lake Reservoir have no measurable impact on water quality as long as the thermocline rests well above the lake bottom in the shallow south basin. As a typical summer progresses, the depletion of the hypolimnion in the south basin, as well as the natural surface water warming, forces the thermocline gradually deeper in the water column. As the thermocline approaches the lake bottom in the shallow south basin with its prominent bottom structures and the old submerged 1915 dam, any occurring seiches begin to have a disturbing effect on the bottom near Benthic Boundary Layer. The thermocline is now in the "Seiche Vulnerable Zone". This is when the typical annual TC pattern starts with increasing TC concentrations.

As more hypolimnetic water gets extracted, the thermocline drops quickly below the lake bottom peaks, crests in the south basin and gets disconnected between both lake basins. Just before this happens, an occurring seiche would have the highest potential of stirring up lake-bottom sediments and materials as any tilting of the near bottom situated thermocline would exert the most energy into this very thin layer of remaining hypolimnetic water. This energy would certainly have the potential to flush out much of the light organic sediments accumulated in the deeper pockets between the lake bottom structures. The variability of the TC episodes each year is a result of whether a seiche actually occurs during these few days of greatest vulnerability and obviously of the strength of an occurring seiche at that time.

Once the thermocline has been disconnected, the stratification in the south basin typically breaks down within a few days. The remaining thermocline is then confined to the much deeper north basin and any subsequently occurring seiches would not have any direct impact on the south basin anymore. The thermocline is now out of the "Seiche Vulnerable Zone". Based on the limited data available, it is believed that this "Seiche Vulnerable Zone" for the thermocline starts at approximately 175m ASL and ends at about 170m ASL as the thermocline becomes disconnected. After the disconnection of the thermocline, only very strong seiches may be able to tilt the north basin's thermocline so severely that it may jump the south basin bottom structures and cause strong deep water currents with hypolimnetic water ingress and associated sediment movements. Staff found indications of such phenomena in the reviewed data but the data available is insufficient to provide real evidence for this.

Once the thermocline is confined to the north basin and the stratification in the south basin has dissipated, this latter part of the lake is subject to complete mixing. The previously stirred up mineral and heavier organic sediments settle out quickly again but the materials from the disturbed Benthic Boundary Layer seem to remain suspended for the rest of the summer season. Benthic components found high up in the water column all summer long and all across the south basin in 2017 provided some evidence of this. The energy introduced by wind and internal currents into an unstratified south basin appears to be sufficient to prevent settling of this very light material with high TC concentrations. As this material gets dispersed in the entire water column, it is diluted and, as a result, the monitored TC concentrations in the raw water entering Japan Gulch Treatment Plant decrease but remain elevated until the fall.

Factors in the 2017 TC Event

In 2017, this process played out a bit differently due to the influence of the Water Temperature Management Procedure. A first factor in the changed behavior of Sooke Lake Reservoir that year may have been a higher accumulation of organic sediments, particularly in the south basin near the intake tower. The use of higher elevation intake gates from early May to mid-July may have allowed more decomposing organic material to accumulate on the lake bottom which would have likely been drawn gradually into the intake when using the deepest intake gates as in years prior. The Benthic Boundary Layer, with its high TC concentrations, may have built up more than in previous years, particularly upstream of the many lake-bottom structures including the old submerged 1915 dam.

The most significant factor in the 2017 TC event was likely how the stratification and the depth of the thermocline were influenced by the Water Temperature Management Procedure. The use of the higher elevation gates in the spring and early summer created a very strong and stable stratification throughout the summer. The thermocline was situated higher in the water column compared to previous years and as it moved slowly deeper, it remained in this critical depth, the "Seiche Vulnerable Zone", for much longer than in any previous year. The effect of any seiche(s) was compounded by the stagnancy of the thermocline. The thermocline remained connected across the entire lake all summer long and seiche-induced deep water currents could build up to greater strength and longer durations.

The decision to switch back to the upper intake gates, as high TC concentrations started entering the Japan Gulch Treatment Plant, helped retain the thermocline in this vulnerable zone. In contrast, a continued extraction from the deep intake gates would have expedited the lowering of the thermocline until the thermocline disconnection was achieved which in turn would have ended the direct impact of seiches on the south basin.

CONCLUSIONS

During the summer of 2017, Sooke Lake Reservoir experienced wind induced internal seiches at a time when the thermocline was situated in the most vulnerable zone of depth. The energy introduced by internal seiches at the end of July mobilized light-weight organic sediments with high concentrations of decomposer bacteria that typically include TC bacteria. This caused an unprecedented TC event in the south basin of Sooke Lake Reservoir where the water intake is located. As a result, high TC concentrations in the raw water threatened to break through the disinfection stages at both treatment plants. Staff prevented a bacteria breakthrough by increasing the UV and chlorination dosage at both plants to the maximum output capacity. Due to the nature of the bacteria involved in this event, the risk to the public health was low even if a breakthrough had occurred. The investigations found no evidence of any external or fecal contamination of the raw water.

The timing and the strength of the seiche(s) were likely the most important factors that led to this unprecedented event. The Water Temperature Management Procedure during the spring and early summer likely played a contributing role in this event by allowing a larger build-up of the TC-rich Benthic Boundary Layer and by critically altering the situation and the progress of the thermocline during the summer.

RECOMMENDATIONS

The investigations into this event identified a need to review the water quality monitoring program in the Reservoir. The event also highlighted CRD's limited understanding of physical processes taking place in Sooke Lake Reservoir.

Water Temperature Management

The 2016 and 2017 Water Temperature Management Procedure with its utilization of various levels of water intake throughout the spring and summer months was an attempt to address high drinking water temperature concerns in the system. It was successful in its objective to reserve about 3-4 weeks' worth of cool hypolimnetic water for later in the summer and defer the temperature exceedance by that amount of time. However, it likely allowed more organic sediment to accumulate and it critically influenced the thermocline to remain longer in the "Seiche Vulnerable Zone", all factors that increase the risk of a very strong TC event as experienced in 2017. Staff will discontinue this project in future years and continuing to withdraw water from the bottom intake gates throughout the summer. This is expected to diminish any extreme elevated TC events but result in elevated temperatures for a longer period of the year. While there is no obvious short-term solution to address the elevated temperatures in the late summer and early fall, staff will investigate options to address these warm water conditions.

Water Quality Monitoring Program

The event indicated that other lines of monitoring may be useful to better predict or anticipate elevated TC events in the future. Staff will review the Sooke Lake Reservoir monitoring program and evaluate whether other lines of evidence, including a study to identify species of total coliform bacteria common to Sooke Lake Reservoir sediments and the Benthic Boundary Layer. This would allow the CRD to rule out or consider a contamination event much faster than is currently possible. Staff will also examine the inclusion of lake sediment monitoring in the water quality monitoring program. This may offer valuable insight in sediment accumulation and transport processes in the lake and their potential impact on water quality.

Hydrodynamic Lake Model

A hydrodynamic model, developed through a hydrodynamic study, for the entire Sooke Lake Reservoir would be a very useful tool for predicting currents and their potential impacts. This would not only aid in predicting potential water quality concerns but also help in understanding inflow and mixing effects from tributaries and a potential future Leech River diversion into Sooke Lake Reservoir. Staff will recommend that this study be included in the 2019 budget for consideration.

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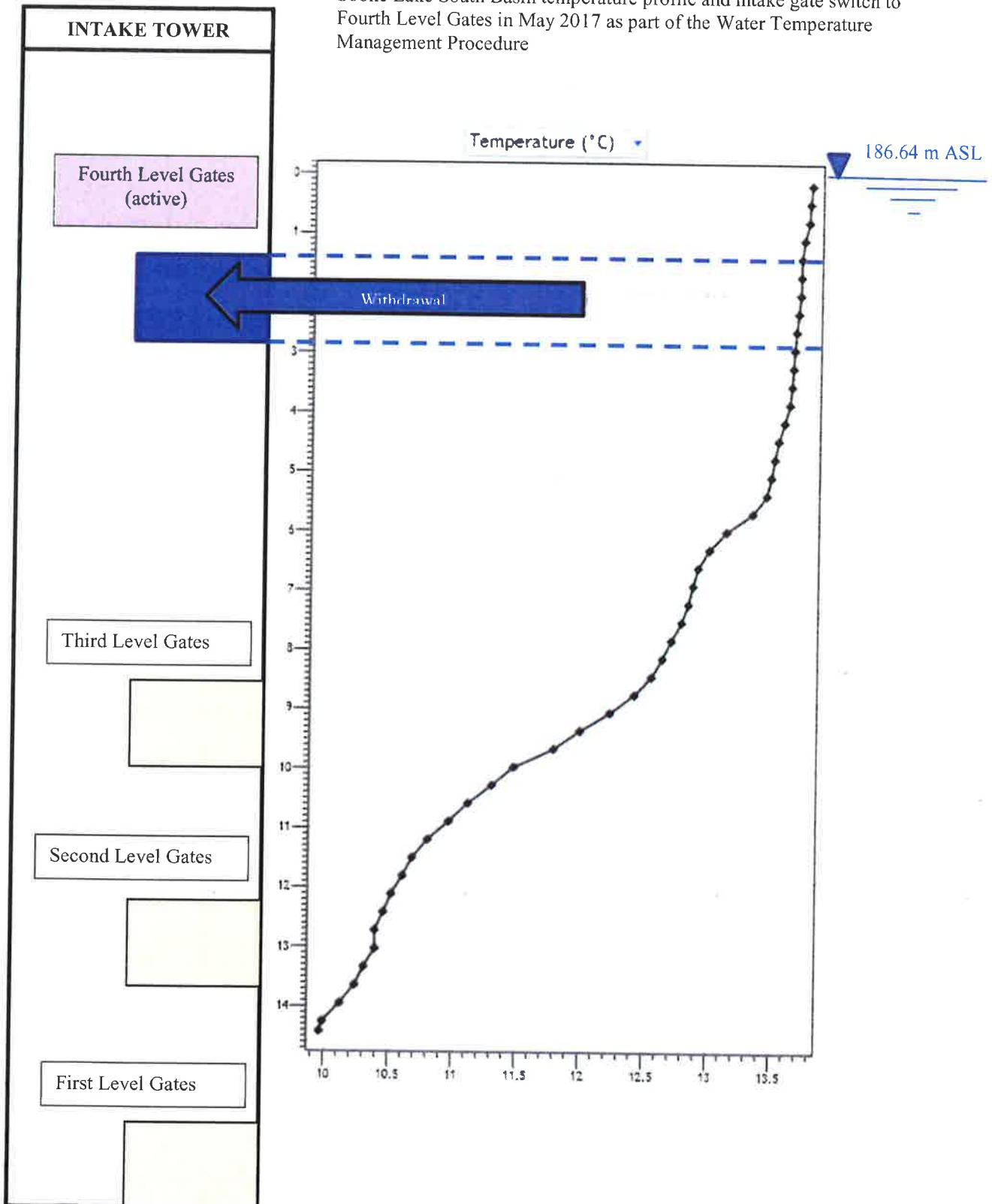
**Memo to File 5260-20 Significant Incidents – December 13, 2017
Investigation Report on High Total Coliform Event in 2017**

Dr. Rick Nordin - Biography

Rick Nordin has a PhD in freshwater biology from UBC, and worked for the BC Ministry of Environment as a specialist in the area of water quality in a position as Provincial Limnologist for 29 years. He was also an adjunct professor at the University of Victoria teaching and doing research on lakes and drinking water protection for 20 years. Rick is a former board member of the North American Lake Management Society and present board member of the BC Lakes Stewardship Society, and has published many scientific papers and reports in government, university and as a consultant on BC water quality and limnology. He has been involved in many studies on Sooke Lake Reservoir and is frequently retained as an expert adviser to CRD due to his extensive knowledge of the CRD drinking watersheds.

Water Temperature Management Procedure

Sooke Lake South Basin temperature profile and intake gate switch to Fourth Level Gates in May 2017 as part of the Water Temperature Management Procedure



**Memo to File 5260-20 Significant Incidents – December 13, 2017
Investigation Report on High Total Coliform Event in 2017**

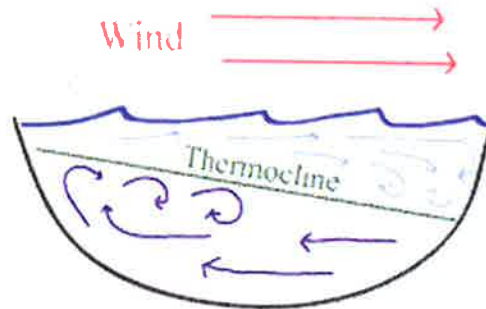
Data history of TC concentrations in raw water entering Japan Gulch Treatment Plant (only TC episodes with peaks > 1,000 CFU/100mL considered):

1990:	27 Juli – 11 Dec	up to 12,600	CFU/100mL
1992:	11 Aug – 21 Sept	up to 1,200	CFU/100mL
1992:	1 Oct – 26 Nov	up to 1,800	CFU/100mL
1993:	24 Sept – 21 Oct	up to 1,000	CFU/100mL
1995:	28 June	2,300	CFU/100mL
1998:	26 Oct – 7 Dec	up to 1,110	CFU/100mL
1999:	11 Aug – 5 Nov	up to 15,000	CFU/100mL
2000:	31 Aug – 23 Oct	up to 11,300	CFU/100mL
2001:	26 July – 28 Sept	up to 13,900	CFU/100mL
2002:	24 July – 16 Aug	up to 3,100	CFU/100mL
2002:	29 Aug – 3 Sept	up to 1,500	CFU/100mL
2003:	28 May – 6 Nov	up to 3,922	CFU/100mL
2004:	22 July – 1 Sept	up to 2,063	CFU/100mL
2005:	8 Aug – 24 Oct	up to 3,578	CFU/100mL
2006:	6 July – 14 Nov	up to 2,240	CFU/100mL
2007:	9 Aug – 16 Oct	up to 1,450	CFU/100mL
2008:	21 July – 15 Oct	up to 1,300	CFU/100mL
2009:	4 May – 5 June	up to 1,300	CFU/100mL
2009:	4 Aug – 30 Oct	up to 1,414	CFU/100mL
2010:	22 June – 9 Sept	up to 4,838	CFU/100mL
2015:	13 July – 23 Nov	up to 2,419	CFU/100mL
2017:	21 July – 24 Oct	up to >24,200	CFU/100mL

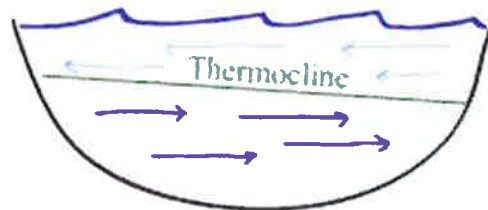
Memo to File 5260-20 Significant Incidents – December 13, 2017
Investigation Report on High Total Coliform Event in 2017

Anatomy of a Seiche

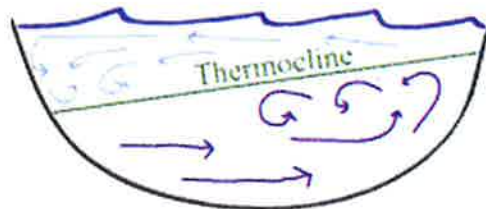
Step 1: Wind Tilts the Thermocline



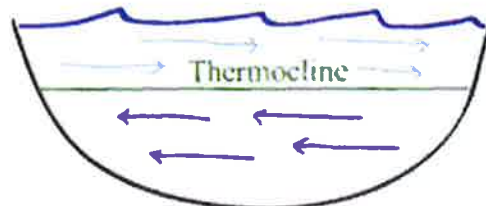
Step 2: The Wind Stops. Water Moves



Step 3: Off Kilter the Other Direction



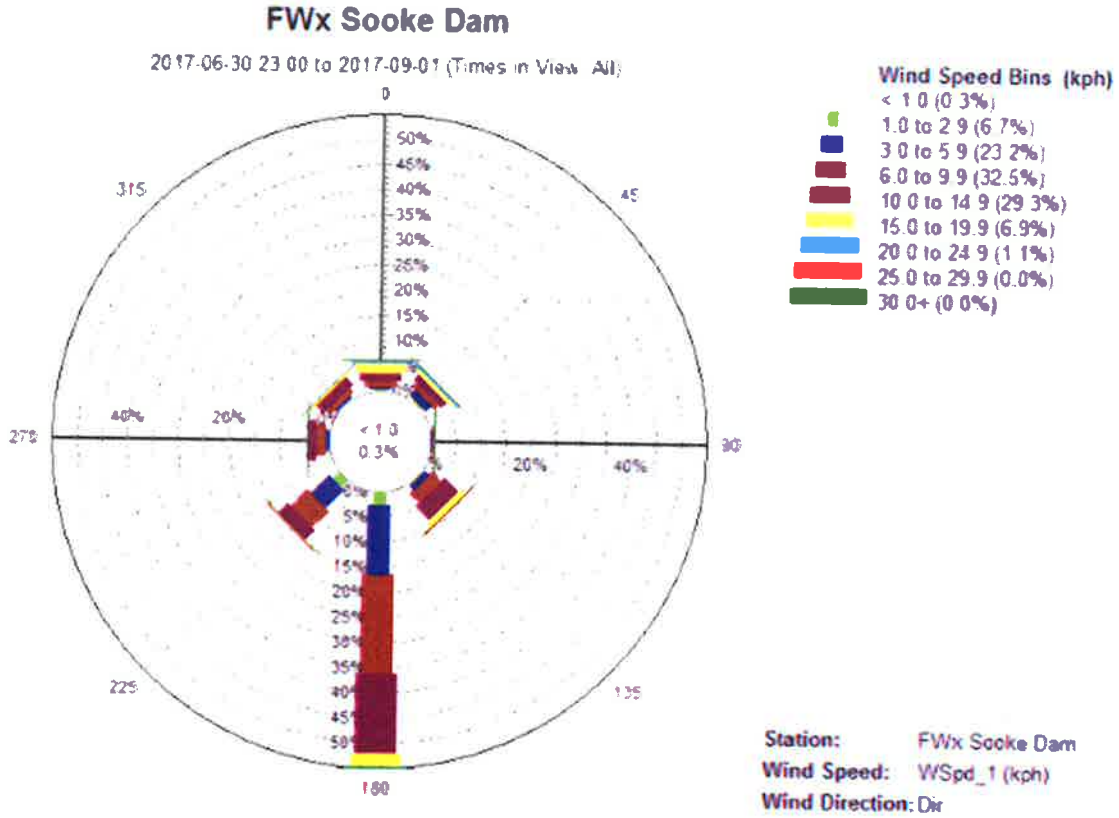
Step 4: Final Stage. it Then Repeats



http://cayugafisher.net/pages/water/wind_driven_water.php

**Memo to File 5260-20 Significant Incidents – December 13, 2017
Investigation Report on High Total Coliform Event in 2017**

Wind Data for July and August 2017, Sooke Lake Dam



CAPITAL REGIONAL DISTRICT - INTEGRATED WATER SERVICES
Water Watch

Issued January 08, 2018

Water Supply System Summary:

1. Useable Volume in Storage:

Reservoir	January 31 5 Year Ave		January 31/17		January 7/18		% Existing Full Storage
	ML	MIG	ML	MIG	ML	MIG	
Sooke	89,882	19,774	92,727	20,400	92,727	20,400	100.0%
Goldstream	8,715	1,917	8,547	1,880	8,204	1,805	83.5%
Total	98,597	21,691	101,274	22,280	100,931	22,205	98.4%

2. Average Daily Demand:

For the month of January	95.0 MLD	20.90 MIGD
For week ending January 07, 2018	94.4 MLD	20.77 MIGD
Max. day January 2018, to date:	100.5 MLD	22.11 MIGD

3. Average 5 Year Daily Demand for January

Average (2013 - 2017)	96.3 MLD ¹	21.19 MIGD ²
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¹MLD = Million Litres Per Day ²MIGD = Million Imperial Gallons Per Day

4. Rainfall January:

Average (1914 - 2017):	270.1 mm
Actual Rainfall to Date	19.5 (7% of monthly average)

5. Rainfall: Sep 1- Jan 7

Average (1914 - 2017):	851.8 mm
2017 / 2018	870.9 (102% of average)

6. Water Conservation Action Required:

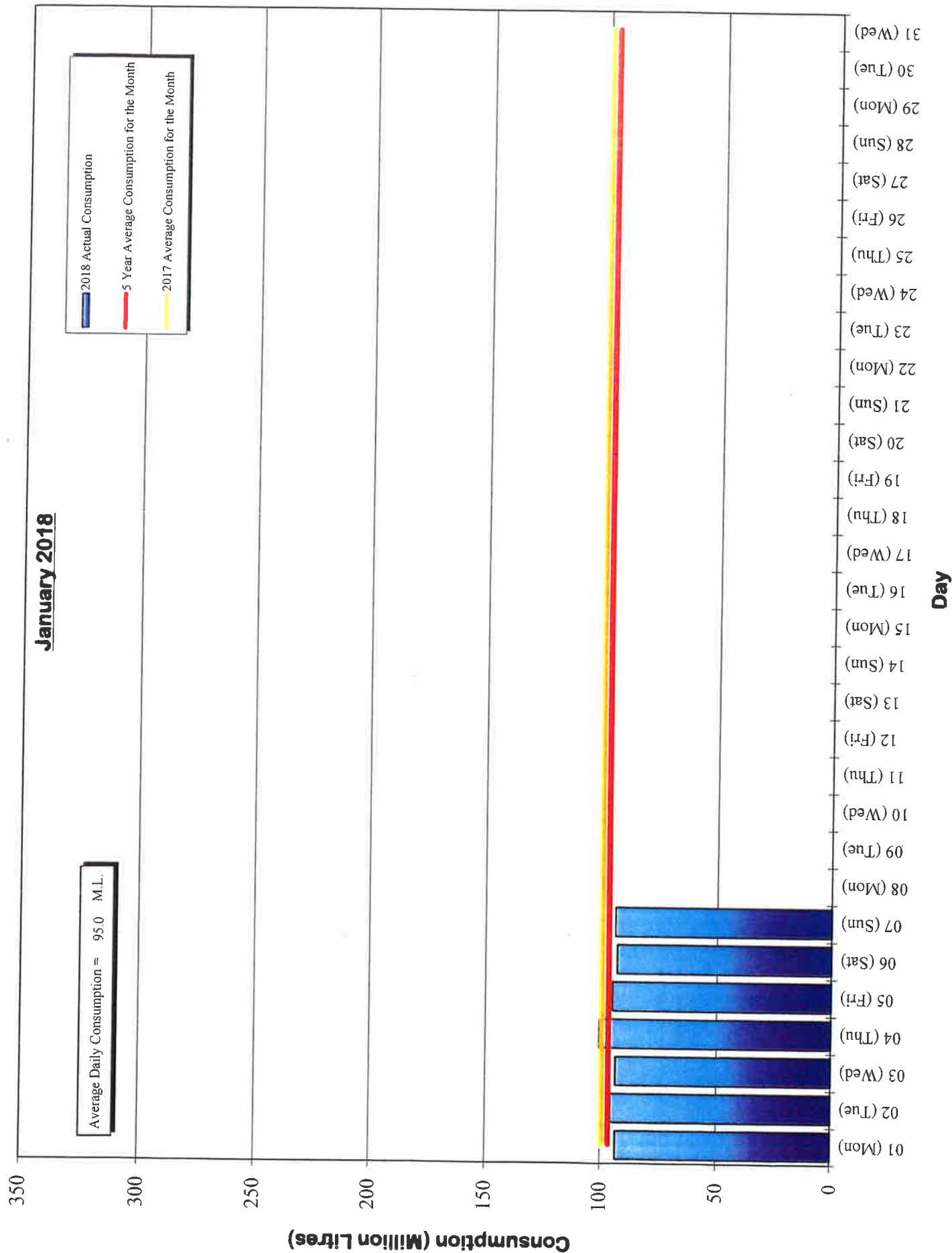
To avoid possible leaks this spring, now is the time to winterize your sprinkler system
 Check our website at www.crd.bc.ca/water for more information.

If you require further information, please contact:

Ted Robbins, B.Sc., C.Tech
 General Manager, CRD - Integrated Water Services
 or

Deborah Walker
 Demand Management Coordinator

Capital Regional District Integrated Water Services
 479 Island Highway
 Victoria, BC V9B 1H7
 (250) 474-9600



Daily Consumptions: - January 2018

Date	Total Consumption		Air Temperature @ Japan Gulch		Weather Conditions	Precipitation @ Sooke Res.: 12:00am to 12:00am			
	(ML)	(MIG)	High (°C)	Low (°C)		Rainfall (mm)	Snowfall (mm)	Total Precip.	
01 (Mon)	93.5		20.6	1.0	-1.0	Sunny / P. Cloudy	0.0	0.0	0.0
02 (Tue)	95.4		21.0	3.0	-1.0	Sunny / P. Cloudy	0.0	0.0	0.0
03 (Wed)	93.6		20.6	2.0	-1.0	Sunny / P. Cloudy	0.0	0.0	0.0
04 (Thu)	100.5	<=Max	22.1	4.0	-1.0	Cloudy	0.0	0.0	0.0
05 (Fri)	94.9		20.9	5.0	3.0	Cloudy / Showers	3.5	0.0	3.5
06 (Sat)	93.1	<=Min	20.5	8.0	3.0	Cloudy / Showers	0.3	0.0	0.3
07 (Sun)	93.9		20.7	6.0	3.0	Rain	15.7	0.0	15.7
08 (Mon)									
09 (Tue)									
10 (Wed)									
11 (Thu)									
12 (Fri)									
13 (Sat)									
14 (Sun)									
15 (Mon)									
16 (Tue)									
17 (Wed)									
18 (Thu)									
19 (Fri)									
20 (Sat)									
21 (Sun)									
22 (Mon)									
23 (Tue)									
24 (Wed)									
25 (Thu)									
26 (Fri)									
27 (Sat)									
28 (Sun)									
29 (Mon)									
30 (Tue)									
31 (Wed)									
TOTAL	664.9 ML		146.27 MIG				19.5	0	19.5
MAX	100.5		22.11	8	3		15.7	0	15.7
AVE	95.0		20.90	4.1	0.7		2.8	0	2.8
MIN	93.1		20.48	1	-1		0.0	0	0.0

ML = Million Litres MIG = Million Imperial Gallons

Average Rainfall for January (1914-2017)	270.1
Actual Rainfall: January	19.5
% of Average	7%
Average Rainfall (1914-2017): Sept 01 - Jan 07	851.8
Actual Rainfall (2017-2018): Sept 01 - Jan 07	870.9
% of Average	102%

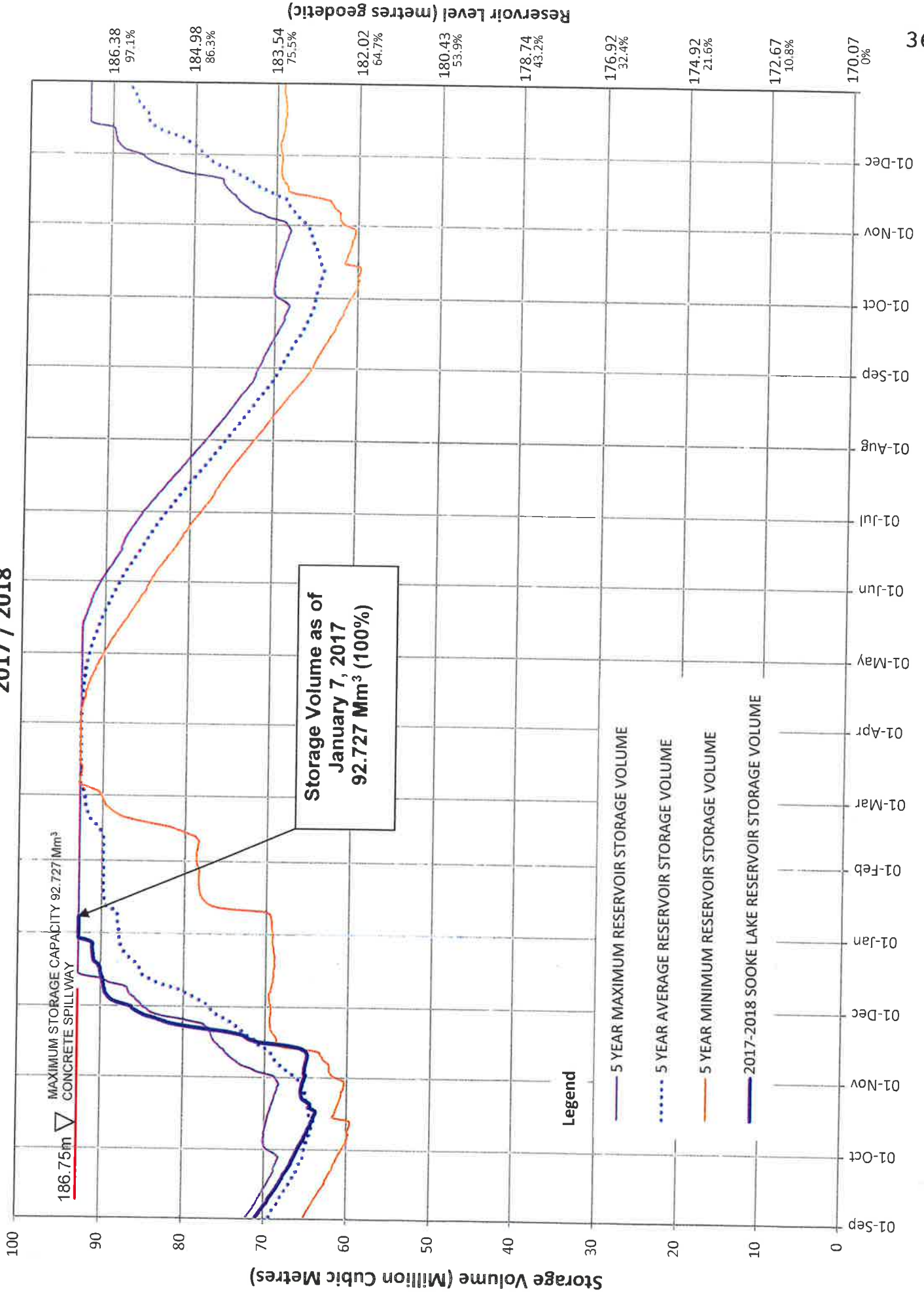
Number days with precip. 0.2 or more
3

Note: 10% of Snow depth applied to rainfall figures for snow to water equivalent.

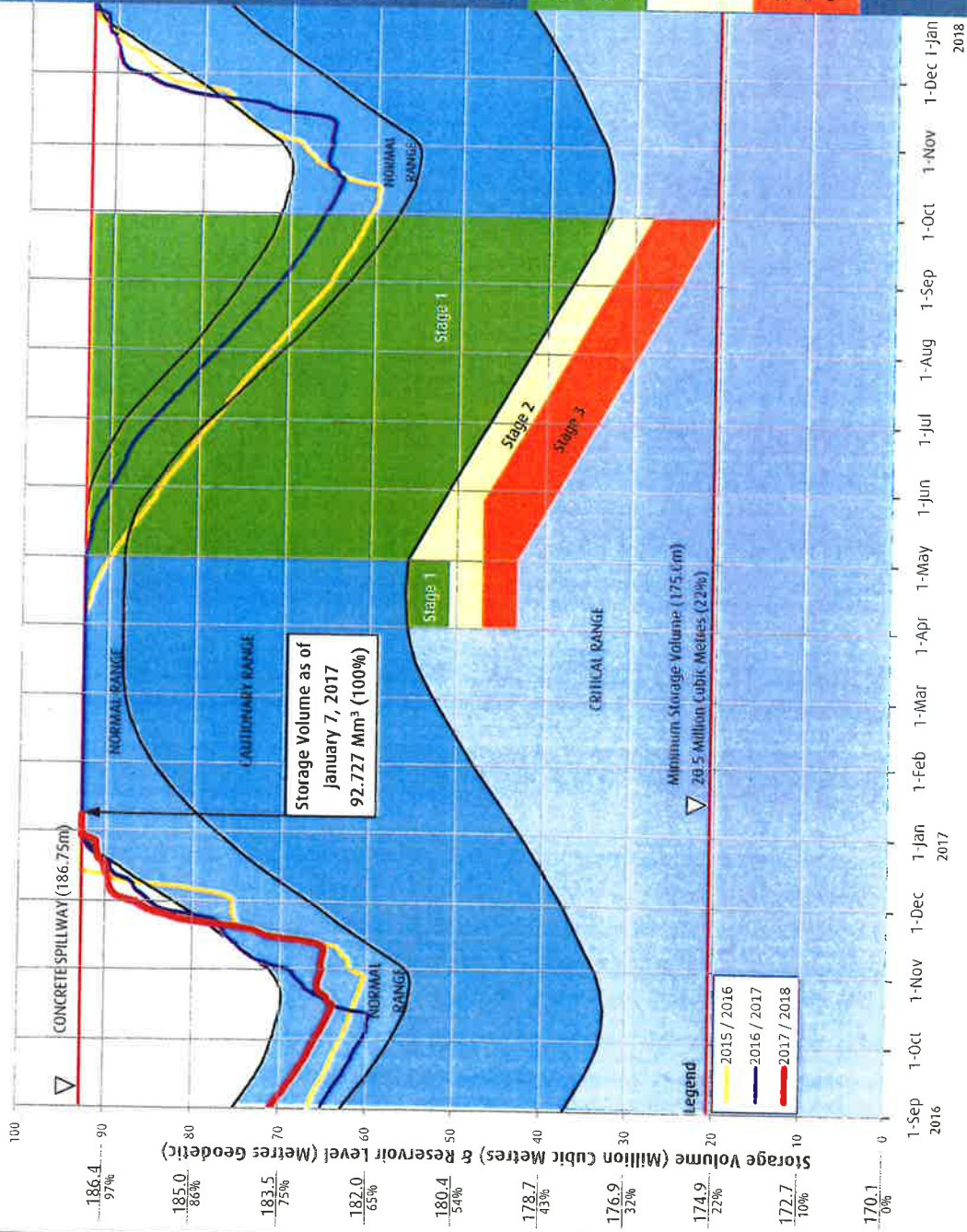
Water spilled at Sooke Reservoir to date = 0.88 Billion Imperial Gallons
 = 4.00 Billion Litres

SOOKE LAKE RESERVOIR STORAGE SUMMARY

2017 / 2018



Sooke Lake Reservoir Storage Level Water Supply Management Plan



FAQs

How are water restriction stages determined?

Several factors are considered when determining water use restriction stages, including:

1. Time of year and typical seasonal water demand trends;
2. Precipitation and temperature conditions and forecasts;
3. Storage levels and storage volumes of water reservoirs (Sooke Lake Reservoir and the Goldstream Reservoirs) and draw down rates;
4. Stream flows and inflows into Sooke Lake Reservoir;
5. Water usage, recent consumption and trends; and customer compliance with restriction;
6. Water supply system performance.

The Regional Water Supply Commission will consider the above factors in making a determination to implement stage 2 or 3 restrictions, under the Water Conservation Bylaw.

At any time of the year and regardless of the water use restriction storage, customers are encouraged to limit discretionary water use in order to maximize the amount of water in the Regional Water Supply System Reservoirs available for nondiscretionary potable water use.

Stage 1 is normally initiated every year from May 1 to September 30 to manage outdoor use during the summer months. During this time, lawn watering is permitted twice a week at different times for even and odd numbered addresses.

Stage 2 is initiated when it is determined that there is an acute water supply shortage. During this time, lawn water is permitted once a week at different times for even and odd numbered addresses.

Stage 3 is initiated when it is determined that there is a severe water supply shortage. During this time, lawn watering is not permitted. Other outdoor water use activities are restricted as well.

For more information, visit www.crd.bc.ca/drinkingwater

