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SAANICH PENINSULA WATER COMMISSION
Notice of Meeting on **Thursday, June 21, 2018 at 8:30 am**
Saanich Peninsula Treatment Plant Meeting Room, 9055 Mainwaring Road, North Saanich, BC

M. Williams (Chair)	P. Wainwright (Vice-Chair)	R. Barnhart	M. Doehnel
Z. King	M. Lougher-Goodey	C. Stock	M. Thompson
M. Underwood	M. Weisenberger	R. Windsor	

AGENDA

Distribution:
Staff/Town Halls, etc.

R. Lapham	T. Robbins	B. Barnett, Central Saanich
L. Hutcheson	I. Jesney	P. Robins, Central Saanich
N. Chan	M. McCrank	R. Buchan, North Saanich
A. Orr	D. Robson	E. Toupin, North Saanich
A. To	D. Puskas	R. Humble, Sidney
G. Harris	S. Orr	T. Tanton, Sidney
	Commission file	

To ensure a quorum, advise Sharon at 250.474-9622 if you or your alternate cannot attend.
IWSS-928280410-6133

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MINUTES OF A MEETING OF THE SAANICH PENINSULA WATER COMMISSION
Held March 15, 2018 in the Saanich Peninsula Treatment Plant Meeting Room, 9055 Mainwaring Road, North Saanich, BC

PRESENT **COMMISSIONERS:** M. Williams (Chair), R. Barnhart, M. Doehnel, A. Holman (for Z. King), M. Lougher-Goodey, M. Thompson, P. Wainwright (Vice-Chair), R. Windsor, M. Weisenberger

STAFF: T. Robbins, General Manager, Integrated Water Services; M. McCrank, Senior Manager, Infrastructure Operations; I. Jesney, Senior Manager, Infrastructure Engineering; G. Harris, R. Lapham (9:20 am); S. Orr (recorder)

ABSENT: C. Stock, Z. King, M. Underwood

The meeting was called to order at 8:30 am.

1. APPROVAL OF AGENDA

There was one addition to the agenda:

- Item 7 - Presentation – Planning For Post Disaster Water Supply Across Greater Victoria

MOVED by Commissioner Wainwright, **SECONDED** by Commissioner Lougher-Goodey,

That the Saanich Peninsula Water Commission approve the agenda as amended.

CARRIED

2. ADOPTION OF MINUTES

MOVED by Commissioner Lougher-Goodey, **SECONDED** by Commissioner Barnhart,

That the Saanich Peninsula Water Commission adopt the minutes of the January 18, 2018.

CARRIED

3. CHAIR'S REMARKS

The Chair had no remarks.

4. PRESENTATIONS/DELEGATIONS

There were no presentations/delegations.

5. SAANICH PENINSULA WATER DEVELOPMENT COST CHARGE OVERVIEW

I. Jesney spoke to the report and provided a summary of the DCC programs and issues that affect the update of the Commission's DCC programs.

MOVED by Commissioner Lougher-Goodey, **SECONDED** by Commissioner Wainwright, That the Saanich Peninsula Water Commission receive the report for information.

CARRIED

6. SAANICH PENINSULA WATER DEVELOPMENT COST CHARGE UPDATE

I. Jesney spoke to the report and followed up on the direction from the Commission from the meeting held January 18, 2018 that staff provide additional information on maintaining the Development Cost Charge's (DCC). He stated the value of current development projects are less than the balance of the reserve fund and that there is no requirement to set the DCC rate above zero.

MOVED by Commissioner Windsor, **SECONDED** by Commissioner Weisenberger,
That the Saanich Peninsula Water Commission direct staff to proceed with finalizing the 2018 Saanich Peninsula Water Development Cost Charges Update and draft amendments to DCC Bylaw No. 3208 (including amendments by subsequent amending bylaws to 2017) for the Commission's consideration. The rates for this update to be set to zero.

CARRIED

Commissioner Doehnel OPPOSED

7. PRESENTATION – PLANNING FOR POST DISASTER WATER SUPPLY ACROSS GREATER VICTORIA

T. Robbins gave a presentation on the post disaster water supply initiative and provided an overview of the regional water systems, stating that staff is focused on establishing a resilient network by planning to install hardened hydrants at proposed locations around the supply network to serve as water supply points for post disaster distribution centres. He presented a conceptual design of a post disaster water supply distribution centre, provincial earthquake hazard mapping, and a resiliency grid map, identifying pipes on the peninsula which may be vulnerable during an earthquake. He stated he presented the plan to the Local Government Emergency Planning Advisory Committee in January 2018 and received positive feedback. He stated the next steps will include presenting at the Water Quality Symposium in April, meeting with regional municipal engineering staff, finalizing protocols and resources, identifying hardened hydrant priorities and undertaking further seismic assessment of critical transmission facilities.

MOVED by Commissioner Windsor, **SECONDED** by Commissioner Lougher-Goodey,

That the Saanich Peninsula Water Commission would like Planning and Protective Services Commission consider earthquake hazard mapping for the Saanich Peninsula.

CARRIED

MOVED by Commissioner Windsor, **SECONDED** by Commissioner Lougher-Goodey,

That the Saanich Peninsula Water Commission receive the report for information.

CARRIED

The Commission acknowledged staff for their work on the initiative.

8. WATER WATCH

MOVED by Commissioner Lougher-Goodey, SECONDED by Commissioner Windsor,

That the Saanich Peninsula Water Commission receive the report for information.

CARRIED

9. NEW BUSINESS

There was no new business.

10. ADJOURNMENT

MOVED by Commissioner Lougher-Goodey, **SECONDED** by Commissioner Windsor,

That the Saanich Peninsula Water Commission meeting be adjourned at 9:43 am.

CARRIED

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CHAIR

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Agenda Item 5
REPORT #SPWC 2018-04

REPORT TO SAANICH PENINSULA WATER COMMISSION
MEETING OF THURSDAY, JUNE 21, 2018

SUBJECT **SAANICH PENINSULA WATER DEVELOPMENT COST CHARGES UPDATE**

ISSUE

This report is to present the final Saanich Peninsula Water Development Cost Charge (DCC) program update with the background report and associated draft bylaw.

BACKGROUND

The Capital Regional District (CRD) established a combined water and wastewater Development Cost Charges Program and Bylaw (Bylaw No. 3208 and Amendment Bylaw No. 3340) with the intent of funding growth and capacity related improvements to the CRD Saanich Peninsula water and wastewater systems.

The rates for the Saanich Peninsula water and wastewater DCC programs were last reviewed and updated in 2007. In 2016, the Saanich Peninsula Water Commission (SPWC) approved a capital project to review the DCC program and in February 2017 Kerr Wood Leidal Associates (KWL) were retained to undertake the review.

The last update was provided to the SPWC at its March 15, 2018 meeting and staff were directed at that time to finalize the 2018 Saanich Peninsula Water DCC update and draft amendments to DCC Bylaw No. 3208 (including amendments by subsequent amending bylaws to 2017) for the Commission's consideration.

Staff have now received the final KWL report (Attachment 1) as well as the amended draft bylaw (Attachment 2). It is recommended to include four new projects in the 2018-2037 water DCC program as follows:

- Hamsterly Pumpstation Backup Power Generator (2020)
- Water Strategic Plan Update (2022)
- DCC Program Update (2023)
- Hamsterly Pumpstation Capacity Upgrade (2025)

The SPW Service DCC reserve fund balance is currently approximately $1.55 million. After the proposed identified projects are completed, the DCC reserve fund balance is expected to be approximately $775,000.

As a result of this positive balance it is recommended that the water DCC rates for all land use designations be set to zero as shown in Table A.

Table A

Land Use Designation and Unit	Existing DCC Rate	Proposed DCC Rate
Single Family Residential Per dwelling unit	$1,555.00	$0
Small lot Single Family Residential Per dwelling unit	$1,100.00	$0
Townhouse Residential Per dwelling unit	$1,100.00	$0
Apartment Residential Per dwelling unit	$957.00	$0
Commercial Per sq.m. gross floor area	$7.04	$0
Industrial Per sq.m. gross floor area	$3.81	$0
Institutional Per sq.m. gross floor area	$4.35	$0

Although there has been municipal stakeholder engagement as the DCC program update has been developed, the CRD is proposing to hold one final stakeholder information session to present the program updates, following presentation of this report to the Commission and prior to advancing the Commission's recommendation to the CRD Board.

ALTERNATIVES

Alternative 1

That the Saanich Peninsula Water Commission receive the attached report "Saanich Peninsula Water and Wastewater Services Development Cost Charge Update Background Report" as prepared by Kerr Wood Leidal and direct staff to hold one final stakeholder information session prior to advancing Bylaw No. 4251, "Saanich Peninsula Water and Wastewater Development Cost Charges Bylaw No. 1, 2004, Amendment Bylaw No. 2, 2018", to the CRD Board; and

That the Saanich Peninsula Water Commission recommend to the CRD Board:

1. That Bylaw No. 4251, "Saanich Peninsula Water and Wastewater Development Cost Charges Bylaw No. 1, 2004, Amendment Bylaw No. 2, 2018", be introduced and given first and second reading, and,

2. That Bylaw No. 4251, "Saanich Peninsula Water and Wastewater Development Cost Charges Bylaw No. 1, 2004, Amendment Bylaw No. 2, 2018", be given third reading.

Alternative 2

That the Saanich Peninsula Water Commission request additional information.

IMPLICATIONS

Alternative 1 – In order to finalize the Water Development Cost Charge update and associated bylaw, the proposed bylaw amendment must be approved by the SPWC and be forwarded to the CRD Board. After third reading of the bylaw, it will then be sent to the Inspector of Municipalities for approval. After the Inspector of Municipalities approves the bylaw, it will be returned to the CRD Board for final adoption. Acceptance of the report and new bylaw will provide an adjustment in the DCC rate that will benefit growth in the region.

Alternative 2 – Requesting additional information will further delay approval of the program and may give rise to challenging of the Water DCC rates by the development community.

CONCLUSION

A detailed review of the Water DCC program including growth projections, has resulted in DCC reserves exceeding the cost of identified projects required to facilitate growth. As a result, the Water DCC rates are being recommended to go to zero for all land use designations.

RECOMMENDATION

That the Saanich Peninsula Water Commission receive the attached report "Saanich Peninsula Water and Wastewater Services Development Cost Charge Update Background Report" as prepared by Kerr Wood Leidal and direct staff to hold one final stakeholder information session prior to advancing Bylaw No. 4251, A Bylaw to Amend Bylaw 3208, "Saanich Peninsula Water and Wastewater Development Cost Charges Bylaw No. 1, 2004", to the CRD Board; and

That the Saanich Peninsula Water Commission recommend to the CRD Board:

1. That Bylaw No. 4251, "Saanich Peninsula Water and Wastewater Development Cost Charges Bylaw No. 1, 2004, Amendment Bylaw No. 2, 2018", be introduced and given first and second reading, and,

2. That Bylaw No. 4251, "Saanich Peninsula Water and Wastewater Development Cost Charges Bylaw No. 1, 2004, Amendment Bylaw No. 2, 2018", be given third reading.

Submitted by:	Ian Jesney, P. Eng., Senior Manager, Infrastructure Engineering
Concurrence:	Ted Robbins, BSc, CTech, General Manager, Integrated Water Services
Concurrence:	Nelson Chan, CPA, CMA, Chief Financial Officer, Finance & Technology
Concurrence:	Kristen Morley, JD, General Manager, Corporate Services
Concurrence:	Robert Lapham, MCIP, RPP, Chief Administrative Officer

IJ/TR:so

Attachments:

1. Saanich Peninsula Water and Wastewater Services Development Cost Charge Update Background Report by Kerr Wood Leidal, June 2018

2. Bylaw No. 4251, "Saanich Peninsula Water and Wastewater Development Cost Charges Bylaw No. 1, 2004, Amendment Bylaw No. 2, 2018"

Attachment 2

CAPITAL REGIONAL DISTRICT
BYLAW NO. 4251

****

A BYLAW TO AMEND BYLAW 3208
"SAANICH PENINSULA WATER AND WASTEWATER DEVELOPMENT COST CHARGES BYLAW NO. 1, 2004"

****

The Board of the Capital Regional District in open meeting assembled enacts as follows:

1. Bylaw No. 3208, "Saanich Peninsula Water and Wastewater Development Cost Charges Bylaw No. 1, 2004", is hereby amended as follows:

   (a) By deleting Schedule "B" in its entirety and replacing it with Schedule "B" attached hereto and forming a part of this Bylaw.

2. This Bylaw may be cited as "Saanich Peninsula Water and Wastewater Development Cost Charges Bylaw No. 1, 2004, Amendment Bylaw No. 2, 2018".

READ A FIRST TIME THIS	day of	2018
READ A SECOND TIME THIS	day of	2018
READ A THIRD TIME THIS	day of	2018
APPROVED BY THE INSPECTOR OF MUNICIPALITIES THIS	day of	2018
ADOPTED THIS	day of	2018

____________________________ ____________________________
CHAIR CORPORATE OFFICER

SCHEDULE "B"

SAANICH PENINSULA WATER AND WASTEWATER

DEVELOPMENT COST CHARGES

1. **AMOUNT OF WATER DEVELOPMENT COST CHARGES**

Water development cost charges will be based upon the following:

Land Use Designation	DCC Rate	When Payable
1. Single Family Residential	$0.00 per dwelling unit	Subdivision approval
2. Small Lot Single Family	$0.00 per dwelling unit	Subdivision approval
3. Townhouse Residential	$0.00 per dwelling unit	Building permit approval
4. Apartment Residential	$0.00 per dwelling unit	Building permit approval
5. Commercial	$0.00 per m^2 gross floor area	Building permit approval
6. Industrial	$0.00 per m^2 gross floor area	Building permit approval
7. Institutional	$0.00 per m^2 gross floor area	Building permit approval

2. **AMOUNT OF WASTEWATER DEVELOPMENT COST CHARGES**

Wastewater development cost charges will be based upon the following:

Land Use Designation	DCC Rate	When Payable
1. Single Family Residential	$1,790.00 per dwelling unit	Subdivision approval
2. Small Lot Single Family	$1,429.00 per dwelling unit	Subdivision approval
3. Townhouse Residential	$1,413.00 per dwelling unit	Building permit approval
4. Apartment Residential	$933.00 per dwelling unit	Building permit approval
5. Commercial	$4.00 per m^2 gross floor area	Building permit approval
6. Industrial	$3.89 per m^2 gross floor area	Building permit approval
7. Institutional	$5.30 per m^2 gross floor area	Building permit approval

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Agenda Item #6
REPORT #SPWC 2018-05

REPORT TO THE SAANICH PENINSULA WATER COMMISSION
MEETING OF THURSDAY, JUNE 21, 2018

SUBJECT **WATER AUDIT FOR THE SAANICH PENINSULA WATER SERVICE**

ISSUE

A water audit was conducted of the Saanich Peninsula Water (SPW) service and the findings and recommendations are presented in this report.

BACKGROUND

The Saanich Peninsula Water (SPW) service provides drinking water obtained from the Regional Water Supply (RWS) service and provides water directly to the three peninsula municipalities including the Town of Sidney, District of North Saanich and the District of Central Saanich. First Nations communities in the area are serviced by the municipal distribution systems of the three municipalities.

In 2016, the Capital Regional District (CRD) retained Kerr Wood Leidal Associates Ltd. (KWL) to conduct a water audit of the SPW system for the operating year of 2015. The results are documented in the attached report titled “Greater Victoria Water Supply System Audit – Saanich Peninsula Water System, July 2017”.

Water audits are undertaken by water utilities to assess the efficiency of the system’s ability to deliver drinking water, establish the system water balance, determine the sources of non-revenue water and identify where improvements can be made to reduce the cost of providing a treated water service. This is the first comprehensive audit completed for the SPW system.

The audit consisted of three main objectives:

1. Meter Inventory and Assessment – Compilation of various data sources into a meter inventory database and reporting on the completeness of the dataset and recommended actions,
2. Water Balance – Using inflow meter and meter consumption data from the 2015 calendar year, quantify water entering and exiting the water system (i.e. customer consumption and volumes of losses), and,
3. Asset Management – provide recommendations for meter replacements, meter replacement priorities, maintenance and testing programs, funding requirements, and next steps.

Secondary benefits of water audits include updating of drawings, reviewing existing water meter installations, confirming results of current hydraulic analysis, identifying potential public health issues, and identifying data gaps. The results of the water audit will be useful as a benchmark to measure future system efficiency.

The water audit process was completed using the industry best management practices manual, the American Water Works Association’s (AWWA) *Water Audits and Loss Control Programs Manual 36*, whereby the real and apparent water losses and consumption volumes throughout the system are quantified.

Water consumption (revenue and non-revenue water) and water losses (non-revenue water) include:

- Billed Authorized Consumption: billed bulk metered consumption, billed distribution metered consumption, billed unmetered consumption;
- Unbilled Authorized Consumption: unbilled metered consumption, unbilled unmetered consumption;
- Real Losses: leakage on transmission and distribution mains, leakage and overflows at storage tanks (balancing reservoirs), leakage on service connections up to point of customer metering; and
- Apparent Losses: unauthorized consumption, customer metering inaccuracies, systematic data handling errors.

It should be noted that water audits have also been conducted for two other water supply services managed by Integrated Water Services, the Juan de Fuca Water Distribution (JDFWD) service and the Regional Water Supply (SPW) service. The results of those water audits have been reported directly to those service Commissions.

KWL's key findings (with CRD supplementary information) of the SPW service water audit are summarized as follows (based on the study period of 2015):

1. The SPW meter inventory database consists of 31 bulk water meters. KWL has assessed the inventory and has highlighted data gaps (or meter attributes) that require additional input for completeness.
2. The majority of billing meters in the SPW system are mechanical turbine meters. The SPW system has thirteen mechanical meters and three electro-magnetic (mag) meters used for billing. The balance are used for non-billing purposes to monitor the system's operating performance.
3. Sufficient record drawing information was available to assess the piping configuration of 17 of the 31 meters. The review of those records found that 6 meters met the preferred piping configuration and 11 meter installations did not. The meters with less than the preferred piping configuration have an average distance/diameter ratio of 7 upstream and 6 downstream. No meter configurations are deemed to require additional straight pipe lengths. All meters have a minimum of 5 upstream and 3 downstream distances. Meters with less than the preferred piping configuration can be replaced with mag meters having short straight pipe length requirements.
4. The SPW system customers are metered off the RWS system and not the SPW system. None of the points of connection from the SPW system mains to municipal mains are billed metered sites. As a result, all of the real losses and reservoir cleaning in the SPW are billed to the municipalities.
5. The totalizer on the Dooley #2 west meter failed on July 26, 2015 and was replaced on September 24th. The error associated with the estimation is approximated as +/-5%, or a volume error of +/- 35 ML. Although this meter does not directly measure the flow from the RWS system into the SPW system, it is used for the purpose of billing for supply of water from the RWS system to the SPW system, attributing the cost of real losses in the RWS Main #4 to the SPW. Real losses in this section of Main #4 are however estimated to be negligible.

6. The RWS Hamsterley metering chamber appears to under-register flow. The Bear Hill Reservoir inlet meter, a billing meter for Central Saanich downstream of Hamsterley, registered 3.8% more volume, 105 ML, in 2015.
7. An audit of Main #4 from the Dooley meter to McTavish Reservoir was completed. Adjusting for the error associated with the Dooley meter failure estimated, the volume of real and apparent water loss in Main #4 is 44 ML +/- 35ML. The high end of this estimate represents only 2% of the water supplied through Main #4 which indicates low real losses and apparent metering error in the SPW system billing meters.
8. A review of Central Saanich, North Saanich and Sidney customer billing data from 2015 was completed to assist in quantifying real losses in the SPW as well as the likelihood of apparent losses through SPW billing meters. The accuracy of the North Saanich and Sidney retail water use data is uncertain and is likely to contain significant data-handling errors.
9. A meter sizing and configuration review was conducted to quantify the portion of the total 44ML +/- 35 ML water loss attributed to meter under-registration. The review found the following:
   i) The most likely source of under-registration is the Lowe Pump Station meter, a Rockwell W-5500 make/model installation in 1984. The meter does not have an ideal configuration, is at the end of its expected service life and measures 60% of the volume supplied to North Saanich. Meter under-registration at this site is estimated at 14 ML to 28 ML.
   ii) The Lochside station registered more volume through the large 150mm diameter meter than the small 50 mm diameter meter in 2015 due to an earlier malfunction of the 50 mm meter. Meter under-registration at this site is estimated at 6 ML to 12 ML. The station would have increased metering accuracy and provide flow data for PRV operation and control if it was reconfigured with meters on each PRV leg.
   iii) The 250 mm meter at Martindale station registers more volume through the 250mm meter than the smaller 50mm meter and is operating at the low end of its accuracy limits. Meter under-registration at this site is estimated at 10 to 20 ML.
   iv) The Tsawout metering station registers flow through the large 250mm meter 12 months of the year, as the 50 mm low-range meter is undersized for typical flow rates through the station. Meter under-registration at this site is estimated at 5 ML to 10 ML.
10. Real water losses in the SPW system are expected to be low based on review of the municipal retail meter data. Real losses in Central Saanich are estimated at 29 ML, and losses in the supply to Sidney are expected to be negligible. No assessment of the losses in the mains in the North Saanich system could be completed.
11. The CRD is following best management practices for maintenance and testing of meters, but does not have a formal water loss management plan.
12. Current real loss volumes do not justify a budget for acoustic leak detection or other methods of loss reduction apart from ongoing flow monitoring.
13. A meter renewal prioritization was conducted, based initially on asset age (30-year assumed useful life) and adjusted using the following criteria:
   i) The CRD’s current priorities to address known deficiencies
   ii) Functional deficiencies identified in the study for high criticality meters
   iii) Alignment of the timing of chamber renewals with critical watermain replacements
   iv) Adjustments to renewal timing based on criticality rating to level program costs over the next 30 years (where meters are used for billing purpose, and those with the highest annual flows, are rated highest in criticality).

The following is a summary of KWL's recommendations:

1. Fill data gaps identified in the meter inventory such as meter diameter, date of installation and model.
2. Review record drawings and red-line information to indicate upgrades that have occurred, and as they occur in the future.
3. For all future bulk billing meter chamber installations, provide:
   i) A bypass and suitable valves to achieve WorkSafe BC isolation requirement (e.g. double block and bleed) isolation in the direct vicinity of the chamber, with CRD-owned and maintained valves
   ii) The ability to complete in-situ meter calibration.
4. Standardize meter lay length and type through the recommended renewals program for meters sized 100 – 300mm in diameter to allow for meters to be replaced with spares as part of the calibration program or otherwise.
5. Replace the Lowe Pump Station meter with a magnetic meter at an estimated cost of $22,000.
6. Reconfigure the Lochside PRV station with a 50 mm mag meter on the 50mm PRV leg and a 150 mm mag meter on the 150 mm PRV leg. Existing valves could be re-used and pipework would be replaced, removing the metering pipework and lengthening the two PRV legs between existing shutoff valve locations. The estimated cost is $24,000.
7. Replace the Martindale mechanical meters with a single magnetic meter at an estimated cost of $22,000.
8. Replace the Tsawout 50 mm mechanical meter with a 75mm Omni or equivalent meter at an estimated cost of $3,000.
9. The current locations of bulk billing metering stations are at the connection of the RWS to the SPW and not at the point of connection with the customer. It is recommended that these stations stay in their current locations at this time.
10. It is recommended that meeting locations be moved to the point of customer connection over time, as part of the scope of future main replacements and additions to provide redundancy, and that this issue be considered within the scope of the SPW service asset management plan.
11. Establish an annual budget for the bulk metering program of $86,000/year (2017 dollars) including the following; capital costs for asset replacement, $20,000 per year for meter renewals based on a 30 year replacement frequency, $40,000 per year for SCADA renewal based on a 15 year replacement frequency and operational cost of $26,000 per year for annual meter inspection and testing.
12. Adequate inflation must be added annually to the above budgets which are presented in 2017 dollars.
13. It is recommended that long-term trends in meter test results be monitored to optimize renewal schedules and costs, while billing customers accurately and effectively managing losses.
14. The following program of operational monitoring of both the meter inventory and supply system is recommended:
   i) Implement SCADA alarms for flow anomalies at all meter locations in a similar fashion to that which the RWS system is implementing.

ii) Complete a detailed top down water audit every 5 years as well as internally produce expedient audits on a yearly basis. The expedited audit is intended to update the yearly system input volume, billed authorized consumption and other easily obtained components of the audit without detailed assessment of the data inputs. The detailed audit should have a budget of $50,000 and $8,000 should be budgeted for yearly expedited audits. These budget numbers are for the combined effort of auditing all three water systems including RWS, SPW and JDFWD.

iii) At a future date, when justified by increased water loss in the RWS, SPW of JDFWD systems as identified by the yearly water audits, establish a water loss management plan, at an estimated one time capital budget of $50,000, to complement automated loss monitoring using SCADA. Water loss management should be a joint program between the RWS, SPW and JDFWD services.

CRD staff are considering and prioritizing these recommendations in current operational practices and decisions, and as well as future capital programs.

CONCLUSION

A water audit was successfully completed for the SPW service utilizing best management practices (AWWA M36). The results of the audit show that the water system is conveying water to municipal customers with a high-level of efficiency (i.e. low volume of losses). The significant metering and unauthorized consumption issues identified in the report have been or are being addressed, but the report does provide several recommendations to consider in the future.

RECOMMENDATION

That the Saanich Peninsula Water Commission receive the staff report for information.

Submitted by:	Scott Mason, B.Sc., P.Eng., Manager, Water Supply Engineering & Planning
Concurrence:	Ian Jesney, P.Eng., Senior Manager, Infrastructure Engineering
Concurrence:	Matthew McCrank, P.Eng., Senior Manager, Infrastructure Operations
Concurrence:	Ted Robbins, BSc, CTech, General Manager, Integrated Water Services

SM/TR:mm/so

Attachment:
1. KWL report titled “Greater Victoria Water Supply System Audit – Saanich Peninsula Water System”, dated July 2017

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KERR WOOD LEIDAL
consulting engineers

Vancouver Island
201 - 3045 Douglas Street
Victoria, BC V8T 4N2
T 250 595 4223
F 250 595 4224

Attachment 1

Capital Regional District

Greater Victoria Water Supply System Audit –Saanich Peninsula Water System

Final Report
July 2017
KWL Project No. 0719.050

Prepared for:

CRD

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KERR WOOD LEIDAL
consulting engineers

Executive Summary

Executive Summary

Kerr Wood Leidal Associated Limited (KWL) was retained by the Capital Regional District (CRD) to provide a desktop analysis of the efficiency of each of the three water supply systems that make up the Greater Victoria Water Supply System and identify prioritized actions needed to improve service. This report provides the findings and recommendations for the Saanich Peninsula Water Supply (SPW). The scope of work included the following three tasks:

1. **Meter Inventory and Assessment** – Compilation of various data sources into a meter inventory database and reporting on the completion of the dataset and recommended actions.
2. **Water Balance** – An American Water Works Association (AWWA) M36 water audit for the 2015 calendar year quantifying customer consumption and volumes of real and apparent losses.
3. **Asset Management** – Recommendations on meter replacements, meter replacement prioritization, meter testing program, program funding, and recommendations on further tasks.

Findings

A meter inventory database was created by amalgamating available data from the CRD's existing meter database, Supervisory and Data Acquisition (SCADA) system and available meter record drawings. The SPW meter inventory database consists of 31 bulk water meters and includes: meter size, acquisition date, meter type/model, and meter installation details (upstream and downstream offset distances of meter to valves/bends, meter valve isolation). KWL has highlighted data gaps that require additional input for completeness within Appendix A.

A review of record drawings found that no meter configurations will require additional straight pipe lengths for future meter replacements, avoiding the need for chamber replacements that have an expected remaining life similar to that of the pipe. KWL found 2 instances where record drawings show the original meter whereas the CRD's database identifies a replacement occurred.

The following summarizes the findings of the water balance:

- SPW customers are billed using meters at the points of supply into the SPW system from the RWS system. None of the points of connection from the SPW mains to municipal mains are metered. As a result, all of the real losses and water used for reservoir cleaning in the SPW are billed to the municipalities.
- The metering arrangement does not allow direct assessment of real water loss in the SPW.
- The totalizer on the Dooley #2 West meter failed on July 26th, 2015 and was replaced on September 24th, 2015. The error associated with the estimation is approximated as ±5%, or ±35 ML. Although this meter does not directly measure the flow from the RWS into the SPW, it is used for the purpose of billing for supply of water from the RWS to the SPW, attributing the cost of real losses in RWS Main #4 to the SPW. Real losses in this section of Main #4 are however estimated to be negligible.
- The RWS Hamsterly meters appear to under-register flow. The Bear Hill Reservoir inlet meter, a billing meter for Central Saanich downstream of Hamsterly and with no other source of supply, registered 3.8% (105 ML) more volume than the Hamsterly meter in 2015.
- An audit of Main #4 from the Dooley meter to McTavish Reservoir estimated that the volume of real and apparent water loss in Main #4 was 44 ±35ML in 2015.

- A review of the District of Central Saanich (Central Saanich), District of North Saanich (North Saanich), and Town of Sidney (Sidney) customer billing data from 2015 was completed to assist in quantifying real losses in the SPW as well as the maximum potential apparent losses through SPW billing meters. The accuracy of the North Saanich and Sidney retail water use data is uncertain, and appears to contain significant data-handling errors. As a result, no conclusions could be reached regarding real losses in those portions of the SPW.
- A meter sizing and configuration review was completed to quantify the portion of the total 44 ±35ML water loss attributed to meter under-registration. The review found the following:
  - The most likely source of under-registration is the Lowe Pump Station meter, a mechanical Rockwell W-5500 meter installed in 1984. The meter does not have an ideal configuration, is at the end of its expected service life, and measures 60% of the volume supplied to North Saanich. Meter under-registration at this site is estimated at 14 to 28 ML.
  - The Lochside station registered more volume through the large 150mm diameter meter than the small 50mm diameter meter in 2015 due to an earlier malfunction of the 50mm meter. Meter under-registration at this site is estimated at 6 – 12 ML. The station would have increased metering accuracy and provide flow data for PRV operation and control if it was reconfigured with meters on each PRV leg.
  - The 250mm meter at Martindale station registers more volume through the 250mm meter than the smaller 50mm meter and is operating at the low end of its accuracy limits. Meter under-registration at this site is estimated at 10 to 20 ML.
  - The Tsawout metering station registers flow through the large 250mm meter 12 months of the year, as the 50mm low-range meter is undersized for typical flow rates through the station. Meter under-registration at this site is estimated at 5 to 10 ML.
- Real water losses in the SPW are expected to be low based on review of the municipal retail meter data. Real losses in Central Saanich are estimated at 29 ML, and losses in the supply to Sidney are expected to be negligible. No assessment of the losses in the mains in North Saanich system could be completed.
- The CRD is following best management practices for maintenance and testing of meters, but does not have a formal water loss management plan. The current level of real losses does not justify a budget for acoustic leak detection or other methods of loss reduction apart from implementation of a flow monitoring system as is being implemented in the Regional Water Supply system.
- A meter renewal prioritization was conducted, based initially on asset age (30-year replacement frequency) and adjusted using the following criteria:
  - the CRD's current priorities to address known deficiencies;
  - functional deficiencies identified in this study for high criticality meters;
  - alignment of the timing of meter chamber renewals with critical watermain replacements; and
  - adjustments to renewal timing based on criticality ratings to level program costs over the next 30 years (where meters are used for billing purpose, and those with the highest annual flows, are rated highest in criticality).

Recommendations

KWL has the following recommendations based on the findings above:

- Fill data gaps identified in the meter inventory (Appendix A);
- Review record drawings and red-line to indicate upgrades that have occurred, and as they occur in the future;
- For all future bulk billing meter chamber installations, provide:
  - A bypass and suitable valves to achieve Worksafe isolation requirements (e.g. double block and bleed) isolation in the direct vicinity of the chamber, with CRD-owned and maintained valves; and
  - The ability to complete in-situ meter calibration.
- Standardize meter lay length and type through the recommended renewals program for meters sized 100 – 300mm in diameter to allow for meters to be replaced with spares as part of the calibration program or otherwise.
- Replace the Lowe Pump Station mechanical meter with a magnetic flow meter.
- Reconfigure the Lochside PRV station with a 50mm mag meter on the 50mm PRV leg and a 150mm mag meter on the 150mm PRV leg. Existing valves could be re-used and pipework would be replaced, removing the metering pipework and lengthening the two PRV legs between existing valve locations.
- Replace the Martindale mechanical meters with a single magnetic meter.
- Replace the Tsawout 50mm mechanical meter with a 75mm Omni or equivalent meter.
- The CRD has identified the need to develop over-arching strategic asset management plans for each of its water systems, to establish priorities for renewal of the trunk mains and other major assets in the systems. The current locations of bulk billing metering stations are at the connection of the RWS to the SPW and not at the point of connection to the customer. It is recommended that metering locations be moved to the point of customer connection over time, as part of the scope of future main replacements and additions to provide redundancy, and that this issue be considered within the scope of the SPW strategic asset management plan.
- Establish an annual budget for the bulk metering program of $86,000/year (2017 dollars), including the following:
  - Capital Costs for asset replacement:
    - $20,000 per year for meter renewals based on a 30 year replacement frequency;
    - $40,000 per year for SCADA renewals based on a 15 year replacement frequency; and
  - Operational Costs:
    - $26,000 per year for annual inspection and testing.
- The proposed operation budget includes validation and calibration exercises. Recognizing that removal of larger meters is a difficult and costly exercise, the CRD could choose to complete

more frequent validations, and replace larger meters more frequently, or install test ports prior to future main renewal for high or moderate-high criticality meters with large billing volumes.

- Adjust the annual budget for the bulk metering program annually to account for inflation.
- It is recommended that long-term trends in meter test results be monitored to optimize renewal schedules and costs, while billing customers accurately and effectively managing losses.
- The following program of operational monitoring of both the meter inventory and supply system is recommended:
  - Implement SCADA alarms for flow anomalies at all meter locations in a similar fashion to that which the Regional Water Supply system is implementing;
  - Complete a detailed top down water audit every 5 years as well as internally produced expedient audits on a yearly basis. The expedient audit is meant to update the yearly system input volume, billed authorized consumption and other easily obtained components of the audit without detailed assessment of the data inputs. The detailed audit should have a budget of $50,000 and $8,000 should be budgeted for yearly expedient audits. These budget numbers are for the combined effort of auditing all three water systems including RWS, SPW, and JDFWD.
  - At a future date, when justified by increased water loss in the RWS, SPW or JDFWD systems as identified by the yearly water audits, establish a water loss management plan, at an estimated one time capital budget of $50,000, to complement automated loss monitoring using SCADA. Water loss management should be a joint program between the Regional, Saanich Peninsula and Juan de Fuca water services.

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Section 1

Introduction

1. Introduction

1.1 Context

Kerr Wood Leidal Associates Limited (KWL) was retained by the Capital Regional District (CRD) to provide a desktop analysis of the efficiency of each of the three water supply systems that make up the Greater Victoria Water Supply System and identify prioritized actions needed to improve service. It is the CRD's goal to deliver high quality drinking water to customers and manage water infrastructure in a sustainable manner.

The three systems are administered and funded independently and are described as:

1. **Regional Water Supply (RWS)** – Consists of the trunk water supply mains, reservoirs and appurtenances (including 45 bulk billing meters, 7 source meters, 4 in-line meters and 2 production meters) that deliver drinking water from the Japan Gulch Water Treatment Plant (JGWTP) to the CRD's JDFWD and SPW systems, and to distribution systems owned and operated by the City of Victoria (including Esquimalt), District of Oak Bay and District of Saanich;
2. **Juan de Fuca Water Distribution (JDFWD)** – Consists of the distribution mains, reservoirs and appurtenances that deliver drinking water from the RWS to approximately 21,000 metered individual retail connections (in the municipalities of Langford, Colwood, View Royal, Metchosin, Highlands, Sooke and a portion of the CRD Juan de Fuca Electoral Area; and
3. **Saanich Peninsula Water (SPW)** – Consists of the distribution mains, reservoirs and appurtenances (including 31 bulk meters) that deliver drinking water from the RWS to distribution systems owned and operated by the District of Central Saanich (Central Saanich), the District of North Saanich (North Saanich) and the Town of Sidney (Sidney).

Collectively, the three water systems consist of treatment facilities, transmission and distribution water mains, bulk and customer water meters, pressure control stations, reservoirs, tanks, pump stations, and various other water infrastructure assets. Each of the three water services measures water at a variety of locations for process, treatment, consumption, or billing purposes.

This report is focussed solely for the SPW system. Separate reports were also prepared for RWS and JDFWD systems.

1.2 Project Scope

The project scope is to conduct a water audit and provide meter asset management recommendations for each of the three CRD water services (RWS, JDFWD and SPW) utilizing the American Water Works Association (AWWA M36) - Water Audits and Loss Control Programs manual methodology, and best practices from the National Research Council's Guide to Sustainable Municipal Infrastructure. The work is divided into the following three key tasks consisting of:

1. Meter Inventory and Assessment:

- Develop a bulk meter database that includes type, model, age, size, flow range, use, service area, level of importance based on flow rate and redundancy.

- Complete an installation assessment of bulk water meters and compile utility data: Assess type, function, and installation of CRD's bulk water meters and provide list of recommendations for improvements related to:
  - meter inspection, maintenance, testing and calibration requirements;
  - meter validity and installation;
  - bulk meter checks and balances;
  - use industry standards/guidelines and best practices for recommending future selection; and
  - sizing and replacement of bulk meters, including minimum SCADA requirements.

2. **Water Balance**
   - Assess and quantify all current authorized revenue water consumption within the system.
   - Interview staff and review the current methodology of collecting and validating consumption data and provide conclusions and recommendations.
   - Assess and quantify non-revenue water in the system including apparent losses, real losses, and unbilled authorized consumption; and
   - Quantify the estimated cost of the losses to the CRD.
3. **Asset Management**
   - Identify meter replacement priorities and existing deficiencies;
   - Develop a prioritized meter replacement plan based on asset criticality, age and condition;
   - Develop cost estimates based on the characteristics of replacement and regulatory considerations;
   - Recommend lifecycle operational and maintenance costs;
   - Recommended total annualized lifecycle cost for the metering program; and
   - Recommend further tasks for auditing and water loss management.

The scope of work does not include a field program to detect leakage in the water systems.

1.3 Report Structure

This report provides the results of the water audit for the SPW system.

The body of the report is structured into the three main sections described above in the project scope and also includes this introductory section and a final section summarizing conclusions and recommendations.

1.4 Water Commission Boundaries

Figure 1-1 shows the boundaries between the CRD's three water systems as well as SPW bulk billing meter locations and key in-line metering locations used for the water audit.

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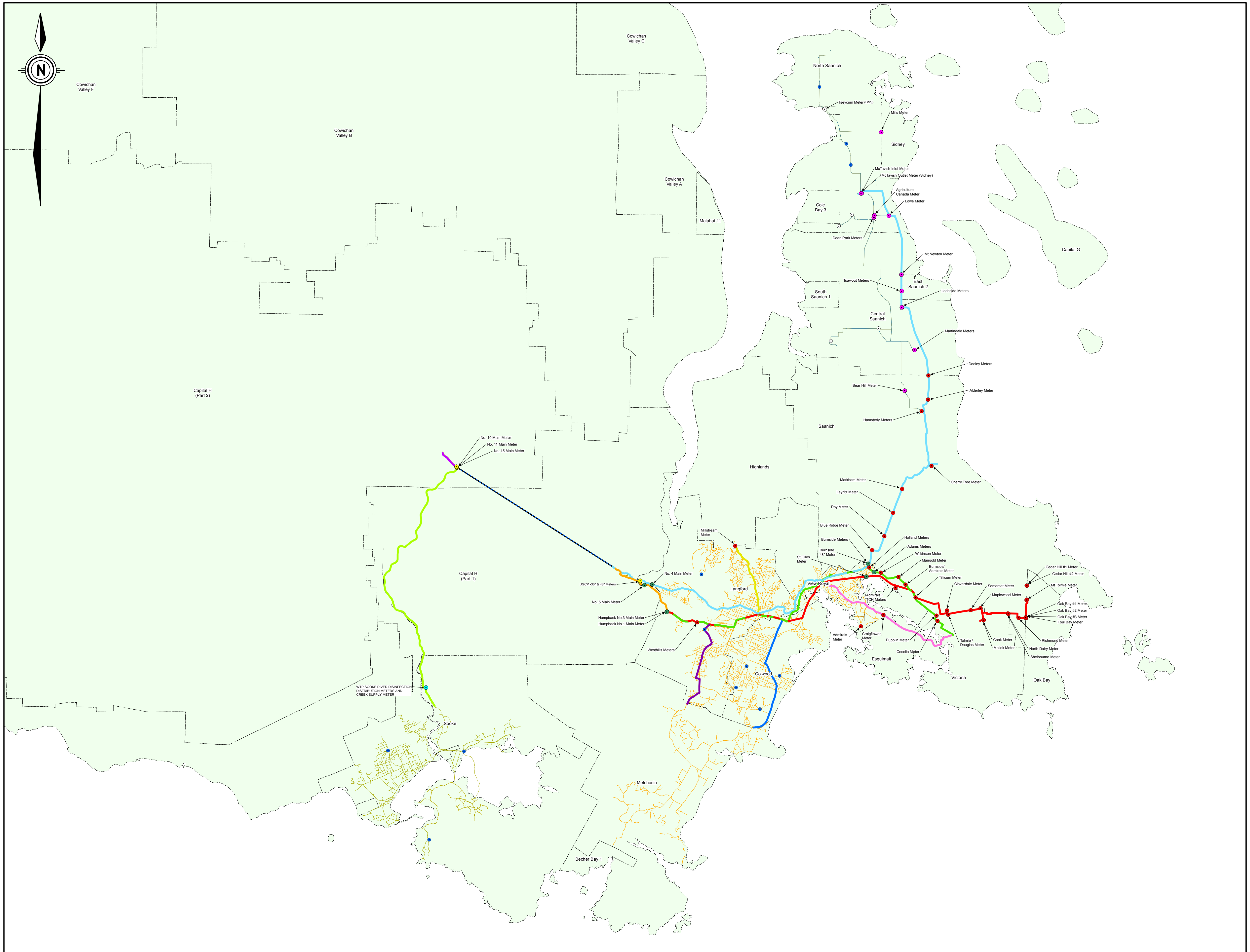

Greater Victoria

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Project No.	Date
719-050	March 2017

Water Commission Boundaries and Assets

Figure 1-1

Path: O:\0700-0799\719-050\430- GIS\MXD-Rp\719050_DistributionMains.mxd Date Saved: 08/03/2017 1:27:41 PM
Author: PCollins

1.5 Data Sources, Assumptions and Limitations

Data Sources

The following data sources were provided by the CRD:

1. Database of Water infrastructure assets labeled “2016_July27_CRDWaterInfrastructure_KWL” (Access Database File)
2. CRD Metering schematic labelled “3994 Metering Schematic” (PDF)
3. A 2012 preliminary assessment of bulk meters within the RWS labelled “Bulk Meter Review Draft Report 2012” (PDF)
4. Municipal Retail consumption statistics for the communities serviced with bulk water by the CRD labelled “CRD Water Consumption Retail Water Use Statistics by Municipality 2015” (Excel)
5. RWS and SPW transmission main drawing labelled “DrinkingWaterSupplySystem_24x26” (PDF)
6. 2004 strategic plans for water management labelled “Review Strategic Plan for Water Mgmt Nov 2004” (PDF) and “Update Strategic Plan for Water Mgmt- Transmission System Dec 2004” (PDF)
7. 2015 Hourly and Daily SCADA data for RWS and SPW meters labelled “RWS SCADA -Daily and Hourly” (Excel) and “SPW SCADA -Daily and Hourly Flows” (Excel);
8. Strategic Plan for Water Management: Supply Management and Demand Management (Volume 1 of 4) –Mar 9, 1999 labelled “Strategic Plan for Water Mgmt Vol 1 of 4 TOC-Transmission System Mar 1999” (PDF)
9. Strategic Plan for Water Management: Transmission System (Volume 2 of 4) –Aug 19, 1999 labelled “Strategic Plan for Water Mgmt Vol 2 of 4 -Transmission System Aug 1999”
10. The 2016 wholesale meter database labelled “Wholesale Meter Database 2016” (Excel)
11. 2015 SPW Bulk Meter Readings labelled “WaterConsumption(SPWS)2015-01” (12 Excel spreadsheets representing each month of data)
12. RWS supply schematics labelled “3280-A Supply Schematic” (PDF) and “3280-B Saan Pen” (PDF);
13. Main #4 and #5 magnetic (mag) meter 6 point calibration results conducted at time of installation labelled “#4&5 mags” (PDF);
14. Fourty two (42) bulk metering station record drawings (Various PDFs) and a database reference file labelled “Meter Mechanical Dwgs TOC” (Excel)

Assumptions and Limitations

The following is a general list of assumptions and limitations related to the work of this report:

- A number of components of non-revenue water cannot be assessed for the SPW system due to the lack of metering at the points of connection from the SPW to the municipal distribution systems. Real losses and apparent losses in the form of unauthorized connections are both billed to the municipalities, since wholesale billing is based on meters located at the points of supply into the SPW system from the RWS system (Main #4).
- Apparent losses in the form of customer metering inaccuracies and systematic data handling errors are quantified through an audit of Main #4.

- The meter billing data was reviewed and checked for errors where possible. It is assumed that the billing databases are free of errors and omissions that could not have been identified through our review process;
- It is assumed that billing data represents actual meter reads and has not been altered to represent the volume billed to the customer if billing credits were made to any accounts;
- Review of municipal retail billing statistics was completed. No attempt could be made to assess whether the datasets used for the statistics accurately represented the 2015 calendar year. It is noted that the customer billing data provided by the municipalities to the CRD could have the following errors which can occur in any large water distribution system:
  - Incorrect units of measure or unit conversion errors;
  - Miscalculated or missed meter multipliers;
  - Meter reading errors;
  - Volumetric billing deductions made through customer billing;
  - The timing of meter reads may not represent the 2015 calendar year; and
  - The possibility of duplicated or missing records within the database.

  The accuracy of the municipal retail water use data is therefore qualified as uncertain.
- To estimate the quantity of current annual real losses (CARL) in Central Saanich, North Saanich and Sidney for 2015, KWL makes the following assumptions with regards to other forms of water use:
  - Retail customer metering error estimated as a 1.5% under-registration; and
  - Un-metered municipal use as 1.25% of the total volume supplied, as per the recommended AWWA default value for authorized un-metered use.
- It is noted that the totalizer on the Dooley #2 West meter failed on July 26th, 2015 and was replaced on September 24th, 2015 and therefore billing to the SPW system through this meter was estimated based on July 2015 average daily flows for the five days in July and the 5 year historical average for August and September. KWL assumes the error in this estimate to be no more than ±5%, and the associated volumetric error to be no more than ± 35 ML.
- Data in the 2016 wholesale meter database is correct and as-built drawings provided represent the current meters installed unless otherwise shown to have been changed through KWLs cross referencing to the 2016 wholesale meter database.
- Bulk monthly meter read data represents actual register reads or estimates complete with supporting data. Where estimates were performed we assume the comments in the excel database are complete and accurate.
- Levels of uncertainty are estimated from engineering judgement based on the quality of the data used and its limitations as well as meter manufacturer literature. Compounding levels of uncertainty are derived from the Gaussian equation for normally-distributed errors which states that if:

  $$Q = a + b + c + d,$$

  the expected uncertainty in Q, δQ is:

$$\delta Q = \sqrt{\delta a^2 + \delta b^2 + \delta c^2 + \delta d^2}$$

- Mag meter performance was assessed assuming Endress and Hauser (E&H) ProMag 53W performance, regardless of the manufacturer, as a simplifying assumption. E&H mag meters represent 61% of the population, 23 of the total 38, and 11 of the 12 mag meters installed since 2010 are E&H ProMag 53W.
- A review of SCADA flow data was completed to estimate low flow error. Velocity rates below the manufacturer's error curve limits are given an assumed accuracy of ±30% as manufacturers do not provide accuracy information below the stated low flow limits.
- Water service connections are assumed to be 10 metres in length.
- A ±1% measurement error is assumed for all bulk billing meters not found through the audit to have greater measurement error.
- The proportion of losses associated with RWS and JDFWD are calculated by assuming the two systems have an equivalent infrastructure leakage index (ILI) for mains and accounting for Haliburton losses. This assumption divides the total real losses by the unavoidable annual real losses (UARL for each system.
- A unit cost of $20-30 per ML is estimated for chlorination and UV disinfection at the JGWTP.
- We assume that the general approach for meter replacements is to minimize changes to the existing pipework and avoid the need for chamber replacement for the purpose of improving the hydraulic configuration of meters.
- The following is a list of cost assumptions associated with Scenario 1 installations:
  a. It is assumed that meters included in Scenario 1 can be safely and efficiently isolated for replacement (i.e. valves and ports are readily available for isolation in compliance with Part 9 of the WorkSafeBC OHS Guidelines, and without interrupting water service to any customers).
  b. all stations will at a minimum require two short sections of piping to be replaced on either side of the meter with the inclusion of a flange adaptor;
  c. Allow engineer time ($600) for meter selection, and design retrofit of piping within the station;
  d. Three operator crew ($100/hr/operator) for one day allowed for meter sizes 50 – 200mm; and
  e. Four person crew ($100/hr/operator) and heavy equipment time ($250/hour) for one day allowed for meters sized 250 – 1200mm.
- The following is a list of cost assumptions associated with Scenario 2 installations:
  a. Materials costs, excluding the meter, are assumed to be 50% more than in Scenario 1;
  b. Allow engineer time ($1200) for meter selection, and design retrofit of piping within the station;
  c. Three operator crew ($100/hr/operator) for one day allowed for meter sizes 50 – 200mm; and
  d. Four person crew ($100/hr/operator) and heavy equipment time ($250/hour) for one day allowed for meters sized 250 – 600mm. Note there are no Scenario 2 meters larger than 600mm.
- The following is a list of cost assumptions associated with Scenario 3 installations:

a. additional cost of excavating and installing additional gate valves outside the metering chamber as well as double time on labour rates to account for night work.
b. Materials costs as per Scenario 2 plus one gate valve;
c. Allow engineer time ($2400) for meter selection, and design retrofit of piping and isolation at the station;
d. Four operator night crew ($200/hr/operator) for one day allowed for meters sized 100 – 400mm; and two days allowed for meters sized 450 – 750mm; and
e. Heavy equipment time ($500/hour) for one day allowed for meters sized 100 – 400mm; and two days allowed for meters sized 450 – 750mm.

- The unit costs provided in this report are Class C opinions of probable cost, are not guaranteed or warranted and are based on recent supplier quotations and assumed average levels of construction and engineering effort for each constructability scenario as described in Section 4.2 and therefore do not consider site specific requirements. An additional 30% allowance for construction contingency and 10% allowance for CRD project management are in addition to the costs provided in this section.

1.6 Units of Measure

The units of measure used in the water audit are metric. Water volume is given in megalitres (ML). One ML is equal to one million litres, and 1,000 cubic metres. Operating pressures are given in metres head (mH), and length of water mains is expressed in kilometers (km).

1.7 Definitions and Abbreviations

The following standard water loss management terms and abbreviations used in this Report and the AWWA M36 Water Audits and Loss Control Programs Manual.

Active Leakage Control — A proactive utility policy and program to control unreported leaks in a water distribution system, including regular sounding, monitoring minimum night flows in district metered areas (DMAs), and continuous monitoring of leak noise levels.

ADD — Acronym for Average Day Demand.

Apparent Losses — Error in the measurement or estimation of customer water use due to customer meter inaccuracy, systematic data handling errors and unauthorized consumption.

Asset Management — An integrated approach to managing the selection, construction, maintenance, renewal and replacement of utility infrastructure in a manner that provides sustainable service at expected levels, at a minimum life cycle cost.

Authorized Consumption — The volume of water taken by customers, the supplier and others with the supplier's explicit or implicit approval.

AWWA — Acronym for American Water Works Association.

Background Leakage (BL) — Leakage that is not detectable by acoustic detection methods.

Bottom-Up Approach	Detailed investigation of individual components of water loss, including minimum night flow measurement and step testing in district metered areas, to accurately quantify loss volume and cost impact.
Current Annual Real Losses (CARL) and Current Real Losses (CRL)	Current Annual Real Losses is the total volume of losses occurring through reported, un-reported and background leakage as calculated by a top-down water audit. Current Real Losses is a terminology used for the purpose of bottom-up analysis (night flow testing) and represents the loss volume on the day of a test.
District Metered Area (DMA)	A hydraulically discrete part of a water distribution system that is supplied from one or more metered point.
Infrastructure Leakage Index (ILI)	The ratio of current annual real losses to the calculated unavoidable annual real losses: ILI = CARL / UARL.
Leakage	Water escaping from the pressurized distribution system through defects, ruptures or failures.
Leak Detection Programs (Acoustic Leak Sounding)	Seeking, discerning and pinpointing leak noise generated from pressurized water distribution systems, typically using specialized acoustic instruments.
Minimum Night Flow	The minimum recorded flow into a system or district metered area (DMA) during the period of lowest demand, typically between 2:00 AM and 4:00 AM.
Non-Revenue Water	Water that does not provide revenue consisting of un-billed authorized and unauthorized consumption, real losses and apparent losses.
Real Losses	The physical volume of water lost from the pressurized distribution system up to the point of customer consumption due to leakage and operator error.
Top-Down Approach	Compiling an annual water balance from available water supply and customer meter readings, and other available records of water uses and losses in the system.
Unauthorized Consumption	Any water taken from the system without the approval of the supplier, unauthorized use of hydrants, illegal connections, customer meter bypasses or tampering.
Unavoidable Annual Real Losses (UARL)	UARL is the minimum volume of annual real losses that can be expected for a well-managed system calculated for top-down water auditing purposes. UARL includes run-time loss volumes due to reported and unreported leakage as well as unavoidable background leakage.

Water Audit	A thorough examination of water utility data to estimate the volumes of water moved from the source to customers. The primary objective of a water audit is to separate volumes reaching customers from volumes lost in the system. Audits may use a top-down and/or bottom-up approach.
Water Balance	The summary of water audit data used to account for all water entering the system.

1.7.1 The AWWA Water Audit

The AWWA water audit methodology published in the M36 Water Audits and Loss Control Programs manual quantifies customer consumption and volumes of real and apparent losses. This method reveals the destinations of water supplied throughout the distribution system and quantifies volumes of consumption and losses. The complete audit process occurs at three levels, each adding increasing refinement:

- Top-down approach: the initial desktop process of gathering information from existing records, procedures, data, and other information systems (included within scope of services);
- Component analysis: a technique that models leakage volumes based on the nature of leak occurrences and durations. Component analysis analyzes district metered flows before, during and after a leak detection find a fix program is completed. It is an important water loss management tool utilized by water loss management teams somewhere 3-5 years out from plan inception (not in scope);
- Bottom-up approach: validating the top-down results with actual field measurements. A bottom up validation of water losses was completed for the JDFWD – Sooke system (not in scope).

1.7.2 Top-down Approach (Water Balance)

The top-down approach is the recommended starting point for water authorities that have 100% metered customers. A blank copy of the water balance summary sheet for the Top-down audit is shown in Figure 1-2. The balance sheet shows each of the different components and how they related to revenue and non-revenue water and authorized consumption and water loss. The goal of the audit is to reduce sources of non-revenue water (highlighted in blue).

A number of components of non-revenue water cannot be assessed for the SPW system due to the lack of metering at the points of connection from the SPW to the municipal distribution systems. Real losses and apparent losses in the form of unauthorized connections are both billed to the municipalities, since wholesale billing is based on meters located at the points of supply into the SPW system from the RWS system (Main #4). These components of the audit are shown with grey text on Figure 2-1. Billed unmetered consumption and billed water exported, components of revenue water, are also shown in grey text as they are zero for the SPW system.

Apparent losses in the form of customer metering inaccuracies and systematic data handling errors can be quantified through an audit of Main #4.

<table>
<tr><td rowspan="11">System Input Volume</td><td rowspan="5">Authorized Consumption</td><td rowspan="3">Billed Authorized Consumption</td><td>Billed Water Exported</td><td rowspan="3">Revenue Water</td></tr>
<tr><td>Billed Metered Consumption</td></tr>
<tr><td>Billed Unmetered Consumption</td></tr>
<tr><td rowspan="2">Unbilled Authorized Consumption</td><td>Unbilled Metered Consumption</td><td rowspan="8">Non-revenue Water</td></tr>
<tr><td>Unbilled Unmetered Consumption</td></tr>
<tr><td rowspan="6">Water Losses</td><td rowspan="3">Apparent Losses</td><td>Unauthorized Consumption</td></tr>
<tr><td>Customer Metering Inaccuracies</td></tr>
<tr><td>Systematic Data Handling Errors</td></tr>
<tr><td rowspan="3">Real Losses</td><td>Leakage on Transmission and Distribution Mains</td></tr>
<tr><td>Leakage and Overflows at Utility's Storage Tanks</td></tr>
<tr><td>Leakage on Service Connections up to point of Customer metering</td></tr>
</table>

Figure 1-2: AWWA M36 Water Balance

1.7.3 Bottom-up Approach (not in scope)

The bottom-up approach relies on field measurements and data to determine real losses, including district metering and minimum night flow analysis, typically expressed as instantaneous flow rates (e.g. litres per second) rather than annual total flows. The bottom-up approach does not include reported and unreported leaks in the calculation of un-avoidable losses.

The volume of legitimate water use that must be estimated using a bottom-up approach is quite small – only the small fraction that occurs during the period of minimum overnight flow between 2AM and 4AM – and leakage represents a larger percentage of total supply flow during this period. Therefore the error in bottom-up leakage estimates is inherently smaller than in the top-down approach.

The main disadvantage of the bottom-up approach is the requirement to conduct field work, and the reliance on a specific system of infrastructure for DMA isolation and accurate measurement of low flow rates into each DMA. For successful implementation, a bottom-up approach should include a sufficient number of district metering points to reduce both field work and computational effort. In order to accurately identify leakage, it is also imperative that meters are sized to accurately measure the expected minimum night flows.

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Section 2

Meter Inventory and Assessment

2. Meter Inventory and Assessment

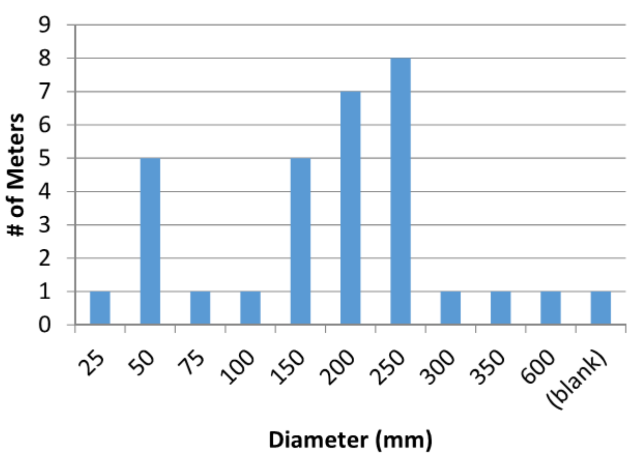
A meter inventory database was created by amalgamating available data from the CRD's existing meter database, Supervisory and Data Acquisition (SCADA) system and available meter record drawings.

The database includes the following information: meter size, acquisition date, meter type/model, and meter installation details (upstream and downstream offset distances of meter to valves/bends, meter isolation capability). The meter installation details are addressed in the subsection 2.2 titled: Meter Installation Assessment.

2.1 Database Assessment

The SPW system meter inventory database consists of 31 bulk water meters. KWL has assessed the inventory and has highlighted data gaps that require additional input for completeness within Appendix A. Meter installation details (record drawings) were available for 17 of the 31 meters; however, the drawings have not been updated or marked up with notes as meters have been replaced. In the RWS system, KWL found 10 instances where record drawings show the original meter whereas the CRD's database identifies that a replacement has occurred. For the SPW system, the record drawing for the Martindale pump station meters did not show the smaller 50mm diameter meter and the Mills Road metering station did not show that a mag meter has replaced the original mechanical meter. We recommend that the CRD review the accuracy of record drawings and red-line markup upgrades as they occur in the future.

Figure 2-1 below provides the type and size of meters within the inventory.



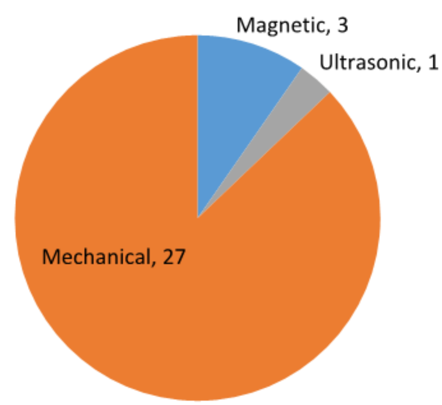


Figure 2-1: Meter Size and Type Statistics

2.2 Meter Installation Assessment

Flow meter manufacturers and AWWA guidelines specify that flow meters are to be installed with a minimum straight pipe run upstream and downstream of the meter, in order to prevent turbulence from fittings affecting the flow regime and velocity profile, which introduces error into the meter readings.

Record drawings were reviewed to assess upstream and downstream distances from the meter to the nearest fitting (valves, bends, etc.), evaluate whether or not the meter can be isolated with current valve configurations shown on record drawings and within GIS, and if the meter is below grade or above grade. This information was added into the meter database to assist with asset management of the meters.

Meters require an undisturbed laminar velocity profile to provide the most reliable readings. Upstream and downstream distances from meters to fittings were estimated from available record drawings to:

- identify meters that may have reading errors; and
- identify any additional design and construction effort required for future meter renewal.

Allowable distances from fittings vary between types and manufacturers; however, a general rule of thumb for magnetic (mag) meters is the upstream fitting should be a minimum distance of 10 pipe diameters from the meter and downstream fitting should be a minimum 5 pipe diameters. Turbo meters upstream distances can be reduced to 5 pipe diameters if a strainer is installed.

Metering sites with less than optimal straight pipe lengths can consider replacement mag meters with shorter straight pipe length requirements or the use of flow straighteners. Mag meters with a zero lay length requirement are available but have a reduced internal diameter for the purpose of shaping the flow profile which would need to be considered, along with hydraulic capacity, if this technology is considered to replace an existing bulk meter. Engineered flow straighteners work on a similar approach of shaping the flow and are designed and tested with meters calibrated for the anticipated flow/velocity profile.

Record drawings were reviewed to confirm whether meter isolation can be achieved in near proximity to the meter chamber. This data is included in the database for the purpose of maintenance planning. Record drawings indicate that all meters can be isolated with single valves on either side of the meter.

The CRD's GIS data was used to confirm valve locations on the trunk mains for in-line valves however, KWL was not able to assess the level of shut down required for single isolation or double block and bleed isolation where downstream valves are owned by others. Double block and bleed isolation is a commonly utilized approach to safely work in a water distribution system chamber and is one of three approved approaches as per WorkSafe BC Section 9.18.3. See Section 4.3 for further discussion on verifying safe work to WorkSafe BC regulations.

It is recommended that all future bulk billing meter chamber installations include a bypass and enough valves to achieve double block and bleed isolation in the direct vicinity of the chamber, with CRD owned and maintained valves.

Sufficient record drawing information was available to assess the piping configuration of 17 of the 31 meters. Meter locations, below ground chamber or within an above ground structure, could be identified for 19 meters, using drawings and digital imagery. Table 2-1 provides a summary of this data. The meter database spreadsheet in Appendix A can be referred to for details of straight pipe lengths and valve isolation for each meter.

Table 2-1: SPW Meter Installation Summary

Meets Preferred Piping Configuration	Does Not Meet Preferred Piping Configuration	Metering Locations
6	11	Above Ground: 10 Below Ground: 9

The review found 6 meters met the preferred piping configuration and 11 meter installations did not. The meters with less than the preferred piping configuration have an average distance/diameter ratio of 7 upstream and 6 downstream.

No meter configurations are deemed to require additional straight pipe lengths. All meters have a minimum of 5 upstream and 3 downstream distances. Meters with less than the preferred piping configuration can be replaced with mag meters having shorter straight pipe length requirements.

2.3 Meter Sizing Review

A meter sizing review assesses the reliability of each meter based on low flow performance. The CRD owns and operates several different types of meters, all with their own associated performance specifications.

KWL completed a review and compared meter accuracy to the 2015 hourly flow data from the SCADA system where available.

In a compound meter configuration the small meter is sized to register average day flows. The large meter is sized to allow fire flow through the station and will typically register flow during periods of higher seasonal demand. Monthly and yearly average meter readings were assessed for compound and single turbo type metering stations to:

- determine how many months of the year flow is registered through each meter; and
- compare average flow, over the months where flow is registered, to the low flow limits of the meter.

A lookup table was used to associate a measurement error with each SCADA data point and calculate a total volumetric error. Velocity rates below the error curve limits are given an assumed accuracy of ±30% as manufacturers do not provide accuracy information below the stated low flow limits. The derived velocity rates for each meter (hourly flow divided by pipe area) was used to adjust negative flows to be equivalent to zero flow. The adjusted velocities were subsequently used to estimate the meter accuracy and the total volume of flow.

The results of the meter sizing review are provided below. Mag, mechanical, and ultrasonic meters are discussed separately.

2.3.1 Mechanical Style Billing Meters

The majority of billing meters in the SPW system are mechanical turbine meters. The SPW system has 13 mechanical turbine meters used for billing.

The Dean Park meters did not register flow in 2015 as the feeds are isolated and out of service.

The Lochside station registers more volume through the large 150mm diameter meter than the small 50mm diameter meter in 2015 due to an earlier malfunction of the 50mm meter. The compound meter configuration at this station is upstream of a dual pressure reducing valve (PRV) station. Through the warranty process the manufacturer stated that the 50mm meter failed due to flow beyond its maximum capacity which is approximately 13 L/s for this meter. A 19mm meter was installed with a throttled valve to force flow over the larger meter.

Meter under-registration is expected at this station. The stations had a 2015 billing volume of 107 ML. Meter under-registration is expected to be in the range of 5% to 10% which would result in a non-revenue loss of 6 to 12 ML/year. This translates into a $4,000-$8,000 billing loss per year at the 2015 retail rate of $625.4/ML.

The station is poorly designed for both billing (metering) and pressure control. Typical stations have a meter on each PRV leg that allows operations to monitor PRV function, detect failures and more easily and accurately adjust pressure set-points. This station has the compound meter upstream which is separate and independent of the PRVs and thus independent valve operation cannot be monitored. The 50mm meter failed due to the configuration of the mechanical piping which adds additional head loss to the 150mm meter under normal flow conditions (flow passing over the smaller PRV) forcing excess flow over the smaller meter prior to flow passing through the large meter.

Two design solutions exist for this station:

1. Replace the 50mm W-16 DR Turbo meter with a 50mm E&H Promag W 51 (or equivalent). The mag meter has 4 times the turn down ratio, with a minimum flow half that of the turbo meter and a high flow limit twice that of the turbo meter. This is not a preferred design as the meters would still function in parallel resulting in under-registration as flows transition to the larger meter. Given the current configuration, it is also uncertain as to when this transition would occur.
2. Reconfigure the station to add a 50mm mag meter on the 50mm PRV leg and a 150mm mag meter on the 150mm PRV leg. The reconfiguration can be completed within the stations existing isolation valves which simplifies the works. The reconfiguration would allow independent monitoring of PRV function and would increase the accuracy of metering.

We recommend the Lochside PRV station be reconfigured as per design solution number 2.

The Martindale station also registers more volume through the 250mm meter than the smaller 50mm meter. This is attributed to the nature of the high seasonal demands through the pump station as well as the size discrepancy between the two meters. The configuration of metering in relation to the pump station is unknown as the record drawings do not indicate the location of the 50mm meter. Low flow metering error could be occurring through the 250mm meter as the ratio of average flow through the meter to minimum low flow through the meter was 1.3 over the eleven months when flow was registered.

We recommend Martindale station mechanical meters be replaced with a single mag meter to increase metering accuracy and reduce the number of meters to maintain.

The Tsawout metering station registers flow through the large 250mm meter 12 months of the year. Some low flow metering error is expected at this station given the size discrepancy between the small and large meters 50mm and 250mm. The smaller 50mm meter registers an average flow of 2 L/s. A 75mm meter should be considered for replacement of the 50mm meter. The newer Sensus Omni T2 meters have better low flow accuracy than their predecessors; a 75mm Omni will have better low flow accuracy than the existing 50mm meter and will allow less flow to pass through the larger meter.

2.3.2 Magnetic Flow Style Billing Meter

The mag meters at Mills Road, McTavish Inlet, and McTavish outlet were found to be sized appropriately.

It is noted that flows through the Mills Road fluctuate and drop to zero when the McTavish Reservoir is full and or pressures increase in Sidney at low demand. Metering error will increase with flows dropping to zero, however the E & H Promag 53 mag meter, installed at Mills, has a good turn down ratio and is appropriately sized.

No action is recommended.

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Section 3

Water Balance

3. Water Balance

3.1 Overview

This section of the report provides the results of a top-down water audit for the SPW, based on 2015 data. The audit is based on the AWWA M36 standard method. The ultimate purpose of the audit is to determine the sources of non-revenue water and identify where improvements can be made to reduce the cost of providing treated water delivery service. It is the CRD's goal to deliver high quality drinking water to customers and manage water infrastructure in a sustainable manner.

All components of water use in the AWWA M36 water balance cannot be audited in the traditional fashion for the SPW system. Customer meters are located off Main #4 (which is part of the RWS system) where water is supplied into the SPW system mains, and not at the points of customer connections to the SPW system. The SPW system provides transmission main conveyance for the three municipal systems and not as a regional water supply system for the Saanich Peninsula. Real losses associated with the SPW system mains and reservoirs are therefore billed to Central Saanich, North Saanich and Sidney, and cannot be measured as the difference between supply and demand volumes in the SPW. Non-revenue metering error can however be assessed through a water balance of the RWS Main #4.

The Section 3 report structure for the SPW (this section) is different than that provided for the RWS and JDFWD, as the traditional water balance methodology and structure could not be followed.

A complete water balance for the SPW could only be completed with the existing metering locations considered as proxy source meters and new bulk billing meters installed at each custody transfer location.

Refer to Figure 1-1 for a reference to SPW system billing meter locations in relation to the SPW system mains.

A review of each municipality's non-revenue water was completed in order to establish an upper boundary for real losses in the SPW. Customer billing data for Central Saanich, North Saanich, and Sidney were compared with total flows through the CRD bulk meters. Unavoidable levels of loss and other forms of non-revenue water were estimated for each system based on KWLs knowledge of these municipal systems. This review enabled an indirect assessment of both real losses in the SPW (as a component of estimated real losses in the combined CRD and municipal systems supplied through the meters along Main #4), and a basic check for metering error with the bulk meters.

3.1.1 System Boundary

An audit of Main #4 is completed in this section from the Dooley Meter vault (Dooley #1 East and Dooley #2 West meters acting as source meters) to the various bulk billing locations to Central Saanich, North Saanich, and Sidney. Refer to Figure 1-1.

3.1.2 Time Period

The water audit was completed for the 2015 calendar year.

Review of municipal retail billing statistics included 2015 data. No attempt could be made to assess whether the datasets used for the statistics accurately represented the 2015 calendar year.

3.2 Auditing Main #4 Water Loss

Water purchased by the SPW system is measured at Hamsterly (Hamsterly North and Hamsterly South meters) and Dooley (Dooley #1 East and Dooley #2 West meters). The total volume through these two stations in 2015 was 2,660.7 ML for Hamsterly meters and 4,034.7 ML for Dooley meters, and with a combined total of 6,695 ML.

It is noted that the totalizer on the Dooley #2 West meter failed on July 26th, 2015 and was replaced on September 24th, 2015 and therefore billing to the SPW system through this meter was estimated based on July 2015 average daily flows for the five days in July and the 5 year historical average for August and September. KWL assumes the error in this estimate to be no more than ±5%, and the associated volumetric error to be no more than ± 35 ML.

It is also noted that the Hamsterly metering chamber appears to under-register flow. The Bear Hill Reservoir inlet meter, a billing meter for Central Saanich downstream of Hamsterly, registered 3.8% more volume, equivalent to 105 ML, in 2015.

The volume of water loss, real and apparent, in Main #4 downstream of Dooley can be calculated as the difference between the volume measured at Dooley meters (4,034.7 ML) and the sum of the volumes measured through each of the following SPW system billing meters:

- Martindale Pump Station = 190.8 ML;
- Lochside PRV = 107.2 ML;
- Tsawout = 92.7 ML;
- Mt Newton Pump Station = 210.8 ML;
- Lowe Road Pump Station = 1,396.1 ML; and
- McTavish Reservoir Inlet = 1,993.6 ML.
- Total = 3,991.2 ML.

Adjusting for the error associated with the Dooley #2 West meter failure estimate, the volume of water loss in Main #4 is 44 ± 35 ML. The high end of this uncertainty estimate represents 2% of the water supplied through Main #4 (4,034.7 ML) and indicates low real losses and apparent metering errors in the SPW system billing meters.

The estimated volume of losses provided above would be underestimated if the Dooley meter is under-registering flow. An audit of Main #4 from the Burnside 48” meter was completed for verification.

The flow measurements used in the audit of Main #4 from the Burnside 48” meter are provided below. The Burnside 48” meter registered 14,060 ML in 2015. Water supplied past Burnside 48” is summarized as:

- Burnside 4” and 1 ½ ” meters = 14.6 ML;
- Blue Ridge = 102.5 ML;
- Roy Rd = 5.2 ML
- Layritz = 1,246 ML;
- Markham = 2,055 ML;
- Beaver Lake = 0.09 ML;

- Cherry Tree = 3,094 ML;
- Alderley = 286 ML;
- Haliburton Reservoir Losses and Cleaning = 165.3 ML;
- Bear Hill Reservoir Inlet = 2766.2 ML;
- Martindale Pump Station = 190.8 ML;
- Lochside PRV = 107.2 ML;
- Tsawout = 92.7 ML;
- Mt Newton Pump Station = 210.8 ML;
- Lowe Road Pump Station = 1,396.1 ML; and
- McTavish Reservoir Inlet = 1,993.6 ML.
- Total = 13,726 ML

The above provides a water loss estimate in Main #4 from the Burnside 48” meter:

= 14,060 ML – 13,726 ML = 334 ML

The Burnside meter is a venturi installed in 1991 that has not been recently calibrated. An audit for the RWS system concluded that this meter is over-registering given the overall balance of water loss between the RWS and JDFWD Westshore systems.

Ignoring the result from the Burnside 48” meter water balance, non-revenue water in Main #4 is estimated at 44 ± 35 ML and therefore meter under-registration within the SPW meters is estimated at no greater than 80 ML and most likely less than 44 ML.

3.3 Municipal Retail Data Review

A review of Central Saanich, North Saanich, and Sidney customer billing data from 2015 was completed to assist in estimating real losses in the SPW system as well as the likelihood of apparent losses through SPW system billing meters.

It is noted that the customer billing data provided by the municipalities to the CRD could have the following errors which can occur in any large water distribution system:

- Incorrect units of measure or unit conversion errors;
- Miscalculated or missed meter multipliers;
- Meter reading errors;
- Volumetric billing deductions made through customer billing;
- The timing of meter reads may not represent the 2015 calendar year; and
- The possibility of duplicated or missing records within the database.

The accuracy of the municipal retail water use data is therefore qualified as uncertain.

District of Central Saanich

The total measured quantity of water supplied to Central Saanich in 2015 was 3,367 ML. In 2015 Central Saanich sold 2,898 ML. Non-revenue water is therefore approximated as 469 ML in 2015.

In 2010, KWL completed work for Central Saanich that estimated non-revenue water for the years of 2009 and 2010 as 570 ML and 381 ML respectively. This work also estimated unavoidable annual real losses (UARL) as 149 ML/year.

To estimate the quantity of current annual real losses (CARL) in Central Saanich for 2015, KWL makes the following assumptions with regards to other forms of water use:

- Retail customer metering error estimated as a 1.5% under-registration calculated to be 43 ML; and
- Un-metered municipal use as 1.25% of the total volume supplied, as per the recommended AWWA default value for authorized un-metered use calculated to be 42 ML.

Therefore:

CARL (District of Central Saanich) = 3,367 ML (source flow) – 2,898 ML (billed metered use) – 42 ML (un-billed un-metered use) – 43 ML (customer metering inaccuracies) = 384 ML.

The 2015 infrastructure leakage index (ILI, the ratio of CARL to UARL) is therefore calculated as:

ILI = 384 ML (CARL) / 149 ML (UARL) = 2.6.

An ILI of 2.6 represents a well-managed system.

Real losses in the portion of the SPW that supplies Central Saanich are expected to represent only a small fraction of the total losses estimated above. Assuming the same infrastructure leakage index between Central Saanich and SPW system, real losses in this portion of the SPW system are estimated at 29 ML.

District of North Saanich

The total measured quantity of water supplied to North Saanich in 2015 was 2,146 ML. In 2015 North Saanich sold 2,145 ML of water. This indicates that either North Saanich billing data supplied to the CRD has errors or the SPW billing meters for North Saanich are under-registering.

KWL completed a water system master plan for North Saanich in 2015/2016, for which the UARL (including the CRD SPW mains) was estimated to be 157 ML.

To estimate the quantity of discrepancy between the SPW system billing meters and North Saanich retail billing data, KWL makes the following assumptions with regards to other forms of water use in North Saanich:

- Retail customer metering error estimated as a 1.5% under-registration calculated to be 32 ML;
- Un-metered municipal use as 1.25% of the total volume supplied, as per the recommended AWWA default value for authorized un-metered use calculated to be 27 ML; and
- A conservatively low estimate of North Saanich’s Infrastructure Leakage Index = 1.5, corresponding to a CARL = 1.5 x 157 ML (UARL) = 236 ML

Therefore:

> Metering Discrepancy (North Saanich) = 2,146 ML (source flow) – 2,145 ML (billed metered use) – 27 ML (un-billed un-metered use) – 32 ML (customer metering inaccuracies) – 236 ML (CARL) = - 294 ML.

The results of the Main #4 water balance indicate that the 294 ML discrepancy is due to errors in the retail data provided by North Saanich. Real losses in the SPW system within North Saanich can therefore not be estimated with any real certainty.

Town of Sidney

The total measured quantity of water supplied to Sidney in 2015 was 1,225 ML. In 2015 Sidney sold 1,383 ML of water. This indicates that either the Sidney billing data supplied to the CRD has errors or the SPW billing meters for Sidney are under-registering.

KWL completed a water system master plan for Sidney in 2015 and therefore has previously calculated the systems UARL, to be 129 ML.

To estimate the quantity of discrepancy between the SPW billing meters and Town of Sidney retail billing data, KWL makes the following assumptions with regards to other forms of water use in Sidney:

- Retail customer metering error estimated as a 1.5% under-registration calculated to be 21 ML;
- Un-metered municipal use as 1.25% of the total volume supplied, as per the recommended AWWA default value for authorized un-metered use calculated to be 15 ML; and
- A conservatively low estimate of Sidney's Infrastructure Leakage Index = 1.5 corresponding to a CARL = 1.5 x 129 ML (UARL) = 194 ML

Therefore:

> Metering Discrepancy (Sidney) = 1,225 ML (source flow) – 1,383 ML (billed metered use) – 15 ML (un-billed un-metered use) – 21 ML (customer metering inaccuracies) – 194 ML (CARL) = - 388 ML.

The results of the Main #4 water balance only indicate a 0 ML to 80 ML water loss between the Dooley meters and bulk billing meters. The combined discrepancy between SPW system bulk billing meters and Sidney and North Saanich retail meters is 682 ML.

For this 682 ML discrepancy to be a result of bulk billing under-registration, not noticed by the Main #4 water balance, it would need to be explained as a 600 ML under-registration at Dooley, a 350 ML under-registration at the Burnside 48" meter and a 1,000 ML under-registration at the Main #4 and Main #5 meters. KWL believes the explanation of the discrepancy to therefore be a substantive quantity of error in the retail data provided by North Saanich and Sidney.

The volume of real losses in the SPW system within North Saanich can not be accurately assessed.

3.4 Potential Sources of Non-Revenue Water

Non-revenue water, real and apparent losses in Main #4 is estimated at 44 ± 35 ML.

This section discusses potential sources of metering error within the SPW bulk billing meters.

District of North Saanich and Town of Sidney

The primary meters supplying these two municipalities are discussed below:

McTavish Reservoir Metering Chamber – This station was constructed in 2013 and includes a 300mm meter measuring flow into the reservoir and a 250mm meter measuring flow out of the reservoir and supplied to Sidney. The supply to North Saanich is calculated as the difference in these two mag meters. Flow through this metering chamber accounts for 80% of the supply to Sidney and 40% of the supply to North Saanich. This station has adequate straight pipe lengths, and properly sized meters.

Lowe Pump Station Meter – The meter in this station consists of a Rockwell W-5500 turbine meter installed in 1984. The meter is located immediately downstream of a gate valve and back to back 90 degree elbows, not representing an ideal metering configuration. The meter is properly sized for the flows, which represent approximately 60% of the total supply to North Saanich however we recommend its replacement due to its age and system criticality. A 1% to 2% meter under-registration at this site would equate to a 14 to 28 ML apparent loss.

Mills Road PRV Station Meter – The meter in this station is an E & H Promag 53 mag meter installed as a replacement of the original 1980 turbine meter. The date of this replacement is not within the meter database. The meter is adequately sized for average day demands through the station and the meters turn down ratio should accurately handle the fluctuation of flow that occurs at this site.

District Central Saanich

The meter sizing review discussed in Section 2.3.1 found the potential for metering error at the following stations servicing Central Saanich:

- the 250mm meter to Tsawout registers flow throughout the year, which could be a source of meter under-registration. Replacement of the smaller 50mm meter with a 75mm meter would reduce the flow through the large meter and the potential for metering error (refer to Section 4). KWL estimates that a 5% to 10% metering under-registration could be occurring at this station which equates to a 5 to 10 ML apparent loss.
- The 250mm meter at Martindale station registers more volume through the 250mm meter than the smaller 50mm meter and is operating at the low end of its accuracy limits. We recommend Martindale station mechanical meters be replaced with a single mag meter (refer to Section 4). KWL estimates that a 5% to 10% metering under-registration could be occurring at this station which equates to a 10 to 20ML apparent loss.
- The 150mm meter at the Lochside PRV station registers too much of the total flow and is operating near the low end of its accuracy limits. The Lochside station would be improved by reconfiguring the station with mag meters on each of the two PRV legs (refer to Section 4). KWL estimates that a 5% to 10% metering under-registration could be occurring at this station which equates to a 6 to 12 ML apparent loss.

KWL estimates the likely volume of apparent losses attributed to SPW bulk billing meters to be between 34 and 68 ML in 2015.

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Section 4

Asset Management

4. Asset Management

The scope of the asset management tasks covered in this section is limited to the lifecycle cost analysis and replacement planning of bulk water meters and associated SCADA/radio electronics at meter sites, and does not include pipework, vaults/enclosures, antenna masts or other assets owned by the SPW system except where noted. Meters and SCADA electronics have significantly shorter life expectancies than other tangible assets at meter sites. The renewal timing of other assets at meter sites is likely to be concurrent with watermain replacement.

4.1 Meter Replacement Plan and Prioritization Overview

An initial meter replacement program was developed based on the following parameters:

- meter replacement prioritization list provided by CRD operations which identifies priority 1,2 and 3 replacements. Replacement prioritization in this spreadsheet is based on known failures and ongoing maintenance issues and meter age.
- Meter age;
- Meter type;
- Meter size;
- Provision of SCADA; and
- Historical water demands.

Constructability issues and regulatory considerations were assessed utilizing data collected from record drawings and populated into the meter inventory. Hydraulic constraints were also considered, such as deficiencies in meter inlet and outlet conditions, and the ability to safely and efficiently isolate the meter for calibration, maintenance or replacement.

Construction cost estimates were developed based on the size of meters, provision of SCADA at sites where it is currently not installed, and four constructability scenarios (each representing a set of typical conditions for a group of meters).

Finally, lifecycle costs were assessed and a prioritized replacement program was developed.

It is recommended that the CRD seek to standardize meter lay length and type through the recommended renewals program for meters sized 100 – 300mm in diameter. This will allow a calibration program where meters are swapped out with spare meters and simplify unscheduled replacements.

4.2 Constructability Considerations

KWL reviewed the hydraulic configuration of each metering station using available record drawings and found no meter configurations that will require additional straight pipe lengths for future meter replacements. For the purpose of developing renewal cost estimates, the meters are categorized into four constructability scenarios which are described in this section.

We assume that the general approach for meter replacements is to minimize changes to the existing pipework and avoid the need for chamber replacement for the purpose of improving the hydraulic configuration of meters.

The following reasons are given for deferring metering chamber upgrades to the time of pipe replacement:

- The expected life of concrete metering chambers is typically similar to that of the pipe;
- There is a high cost and challenges associated with installing new chambers on existing pipe alignments; and
- Metering solutions exist with shorter straight pipe length requirements.

Scenario 1: Direct Replacement

The majority of meter replacements can be completed with only minor modifications of existing piping to accommodate changes to meter length, optimize the meter location within an existing straight section of pipe as necessary, and allow for ease of removal with flange adaptors. It is assumed that meters included in Scenario 1 can be safely and efficiently isolated for replacement (i.e. valves and ports are readily available for isolation in compliance with Part 9 of the WorkSafeBC OHS Guidelines, and without interrupting water service to any customers).

Most Scenario 1 meter installations have straight upstream / downstream pipe length of at least 10 / 5 pipe diameters, but meter installations that marginally do not meet this criterion are also included. Meters not meeting the 10 / 5 pipe diameters, but with a combined upstream/downstream straight section of 15 pipe diameters or greater, and with room between existing isolation valves to optimize the meter location to a 10 / 5 geometry are included in Scenario 1.

The following is a list of cost assumptions associated with Scenario 1 installations:

- all stations will at a minimum require two short sections of piping to be replaced on either side of the meter with the inclusion of a flange adaptor;
- Allow engineer time ($600) for meter selection, and design retrofit of piping within the station;
- Three operator crew ($100/hr/operator) for one day allowed for meter sizes 50 – 200mm;
- Four person crew ($100/hr/operator) and heavy equipment time ($250/hour) for one day allowed for meters sized 250 – 1200mm; and
- Allow 40 hrs for SCADA and electrical preparation, installation, commissioning and documentations at ($100/hr).

Scenario 2: Configuration Changes and/or Alternate Metering Technology

Scenario 2 configurations are those where the straight length of pipe upstream and downstream of the meter is less than 15 pipe diameters. For scenario 2 renewals, additional allowances are made for engineering and materials such as flow straighteners. The same isolation assumption applies as in in Scenario 1.

The following is a list of cost assumptions associated with Scenario 2 installations:

- Materials costs, excluding the meter, are assumed to be 50% more than in Scenario 1;
- Allow engineer time ($1200) for meter selection, and design retrofit of piping within the station;
- Three operator crew ($100/hr/operator) for one day allowed for meter sizes 50 – 200mm;

- Four person crew ($100/hr/operator) and heavy equipment time ($250/hour) for one day allowed for meters sized 250 – 600mm. Note there are no Scenario 2 meters larger than 600mm; and
- Allow 40 hrs for SCADA and electrical preparation, installation, commissioning and documentations at ($100/hr).

Scenario 3: Lack of Adjacent Isolation and Service Interruption Concerns

Scenario 3 configurations are those where record drawings do not show isolation valves on each side of the meter or where removal of the meter would cause an interruption of service that should be minimized through design and construction considerations. For costing purposes, this scenario assumes the additional cost of excavating and installing additional gate valves outside the metering chamber as well as double time on labour rates to account for night work.

The following is a list of cost assumptions associated with Scenario 3 installations:

- Materials costs as per Scenario 2 plus one gate valve;
- Allow engineer time ($2400) for meter selection, and design retrofit of piping and isolation at the station;
- Four operator night crew ($200/hr/operator) for one day allowed for meters sized 100 – 400mm; and two days allowed for meters sized 450 – 750mm;
- Heavy equipment time ($500/hour) for one day allowed for meters sized 100 – 400mm; and two days allowed for meters sized 450 – 750mm; and
- Allow 40 hrs for SCADA and electrical preparation, installation, commissioning and documentations at ($100/hr).

Scenario 4: Special Considerations

Scenario 4 captures specific considerations for meters that are not recommended to be replaced with a magnetic meter. These include the Stelly's 600mm diameter ultrasonic meter that is recommended to be replaced with an equivalent ultrasonic meter to avoid a costly installation; the Agricultural Canada meter that is assumed to be a 50mm meter that would be replaced with an equivalent mechanical meter; and the Tsawout 50mm mechanical meter that is recommended to be replaced with a 75mm Omni or equivalent meter.

4.3 Regulatory Considerations

WorkSafe BC provides the guidelines and employer requirements for safe work. Replacement of water meters typically involves confined space entry and isolation to control against the hazard of water under pressure. Section 9.18 (3) (Control of harmful substance in adjacent piping) of the *OHS Regulation* ("*Regulation*") states:

> *(3) Before a worker enters a confined space where adjacent piping contains a substance that is harmful only because of the temperature, pressure or quantity of the substance, the harmful substance must be controlled*
>
> > *(a) by either disconnecting the adjacent piping or isolating it using blanks or blinds that meet the requirements of section 9.20 or using a double block and bleed system that meets the requirements of section 9.21,*

(b) by isolating the adjacent piping in a manner that a professional engineer has certified will make the confined space safe for a worker to carry out the intended work, or

(c) if there is no head pressure in the adjacent piping, by de-energizing and locking out each pressure source for the adjacent piping and depressurizing the adjacent piping.

WorkSafeBC OHS Guideline G9.18(3)(b) recognizes that there are circumstances where it is impracticable to isolate a valve or metering chamber in a water system by disconnecting, blinding, blanking, or using double block and bleed technology, and provides for an alternative manner of isolation under certification by a professional engineer.

Single valve isolation and lockout on either side of the work area may be certified by a professional engineer where conditions are found to be safe for work. Engineering certifications should typically include consideration of the amount of leakage, age, and maintenance history of the piping and valves to be isolated and any other means in place to make the confined space safe for a worker to carry out the intended work. The certification should include a detailed operational process of ensuring adequate isolation and lockout, review of the adequacy of valve and adjacent pipe restraint under the expected range of operating pressures and a review of the potential for transient pressures. Certifications are expected to be site specific and time limited, and the engineer will need to make the determination of the applicable time period as part of the certification process.

An allowance of $1000 for engineering certification of safe work practices is included for all stations. This is an average cost, taking into consideration that some stations may be isolated by double block and bleed without significant disruption to service and therefore will not need engineering certification, while others will require more than average allowance for consideration of valve condition not owned and maintained by the CRD.

4.4 Criticality Review

A criticality rating of: low, moderate, moderate-high, or high, was assigned to each meter to assist in renewals prioritization. The following criteria were used to assign the criticality rating:

- **Billing or non-billing meter:** Billing meters were given a minimum criticality rating of Moderate. Non-billing meters are given a criticality rating based on system function;
- **Customer demand:** Billing meter criticality is increased to:
  - Moderate-high for meters registering 2% or greater of the total billed consumption for 2015 or where the average single meter flow through a duplex meter station is 2% or higher; and
  - High for meters registering 5% or greater of the total billed consumption for 2015;
- **System Function:** Non-billing source meters are assigned a rating of high. In-line meters useful for auditing and a proposed automated loss monitoring and warning system are assigned a rating of medium. Non-billing meters less critical to system auditing are assigned a low rating.

4.5 Construction Cost Estimates

Table 4-1 provides estimated unit costs for the various meter sizes for constructability scenarios 1 through 3.

Costs related to the renewal of SCADA components are covered in Section 4.7 Lifecycle Costs.

The unit costs are a Class C opinion of probable cost, are not guaranteed or warranted and are based on recent supplier quotations and assumed average levels of construction and engineering effort for each constructability scenario as described in Section 4.2 and therefore do not consider site specific requirements. It represents the summation of all identifiable project elemental costs and is used for program planning. An additional 30% allowance for construction contingency and 10% allowance for CRD project management are in addition to the costs provided in this section.

Table 4-1: Cost Estimates by Meter Size for Constructability Scenarios 1 through 3

Meter Size	Meter / Transmitter Cost	Safety Plan	Testing and Commissioning	Constructability Scenario: SCENARIO 1 Additional Materials	SCENARIO 1 Labour	SCENARIO 1 TOTAL Scenario 1	SCENARIO 2 Additional Materials	SCENARIO 2 Labour	SCENARIO 2 TOTAL Scenario 2	SCENARIO 3 Additional Materials	SCENARIO 3 Labour	SCENARIO 3 TOTAL Scenario 3
50	$2,000	$1,000	$600	$1,000	$6,900	**$11,500**	$1,500	$7,500	**$12,600**	NA	NA	**NA**
75	$2,500	$1,000	$600	$1,000	$6,900	**$12,000**	$1,500	$7,500	**$13,100**	NA	NA	**NA**
100	$3,000	$1,000	$600	$1,000	$6,900	**$12,500**	$1,500	$7,500	**$13,600**	$3,000	$16,200	**$23,800**
150	$3,500	$1,000	$600	$1,500	$6,900	**$13,500**	$2,300	$7,500	**$14,900**	$3,800	$16,200	**$25,100**
200	$4,000	$1,000	$600	$1,500	$6,900	**$14,000**	$2,300	$7,500	**$15,400**	$4,300	$16,200	**$26,100**
250	$5,000	$1,000	$600	$2,000	$9,500	**$18,100**	$3,000	$10,100	**$19,700**	$6,500	$16,200	**$29,300**
300	$6,000	$1,000	$600	$2,500	$9,500	**$19,600**	$3,800	$10,100	**$21,500**	$8,800	$16,200	**$32,600**
350	$7,000	$1,000	$600	$3,000	$9,500	**$21,100**	$4,500	$10,100	**$23,200**	$12,300	$16,200	**$37,100**
400	$8,000	$1,000	$600	$3,500	$9,500	**$22,600**	$5,300	$10,100	**$25,000**	$13,800	$16,200	**$39,600**
450	$9,000	$1,000	$600	$4,000	$9,500	**$24,100**	$6,000	$10,100	**$26,700**	NA	NA	**NA**
600	$12,000	$1,000	$600	$5,000	$9,500	**$28,100**	$7,500	$10,100	**$31,200**	NA	NA	**NA**
750	$15,000	$1,000	$600	$7,500	$9,500	**$33,600**	NA	NA	**NA**	NA	NA	**NA**
900	$20,000	$1,000	$600	$7,500	$9,500	**$38,600**	NA	NA	**NA**	NA	NA	**NA**
1200	$25,000	$1,000	$600	$7,500	$9,500	**$43,600**	NA	NA	**NA**	NA	NA	**NA**

Note: Costs in Table 4-1 exclude renewals of SCADA equipment. The cost of SCADA renewals is included in Section 4.7 Lifecycle Costs

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4.6 Project Prioritization and Timing

Table 4-2 provides the recommended renewals prioritization, cost estimates, recommended timing and data used for the prioritization and costing. The prioritization process was as follows:

1. Initially, set the replacement year for all meters at 30 years from the installation date;
2. Adjust replacement year to address functional deficiencies with critical meters within 5 years:
3. Adjust meter renewal dates based on criticality ratings of meters to approximately level the replacement program costs over the next 30 years.

All costs are provided in 2017 Canadian dollars and not adjusted for inflation.

All costs are provided in 2017 Canadian dollars and not adjusted for inflation. The CRD needs to add annual inflation to the budget past 2017.

The total estimated cost for replacements is $600,000. Based on an average 30-year meter life cycle, a budget of $20,000 annually (in 2017 dollars) is estimated to be required for bulk meter replacements.

The CRD has budgeted to develop a strategic asset management plan for the Regional Water Supply system in 2017, which will establish priorities for renewal of the trunk mains and other major assets in the system. The current locations of bulk billing metering stations are at the connection of the RWS to the SPW and not at the point of connection to the customer. It is recommended that metering locations be moved to the point of customer connection as part of the scope of future main replacements and additions to provide redundancy and that this be considered within the scope of the RWS strategic asset management plan.

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Table 4-2: Meter Replacement Prioritization Plan

#	Station Name	Wholesale Billing Meter?	% of Total Billed	Diameter	Meter Type	On SCADA	Meter Above/Below Ground	Meter Age (years)	Age-Based Remaining Life	Age-Based Renewal Year	Adjustment for CRD Priority	Adjustment to Address Functional Deficiency	CRITICALITY	Adjustment for Criticality and Cost Levelling	Prioritized Replacement Year	Meter Age at Replacement Year	Constructability Scenario	Cost Est.	30% Contingency, 10% CRD Project Management	TOTAL Est. COST
1	PST LOWE	YES	17%	250	MECH	Yes	NA	33	0	2017			High		2017	33	2	$19,700	$7,880	$27,580
2	MET TSAWOUT	YES	1%	50	MECH	Yes	Below	14	16	2033		2017	Moderate		2017	14	4	$2,000	$800	$2,800
3	PST MARTINDALE	YES	1%	50	MECH	Yes	NA	34	0	2017		2018	Moderate		2018	35	1	$11,500	$4,600	$16,100
4	PST MARTINDALE	YES	2%	250	MECH	Yes	NA	34	0	2017		2018	Moderate		2018	35	2	$19,700	$7,880	$27,580
5	PRS LOCHSIDE	YES	0%	50	MECH	NO	Above	20	10	2027		2019	Moderate		2019	22	2	$11,600	$4,640	$16,240
6	PRS LOCHSIDE	YES	1%	150	MECH	Yes	Above	20	10	2027		2019	Moderate		2019	22	2	$13,900	$5,560	$19,460
7	RES BEAR HILL	YES	35%	250	MECH	NO	Above	21	9	2026		2020	High		2020	24	2	$18,700	$7,480	$26,180
8	MET DEAN PARK	YES	0%	100	MECH	NO	Above	41	0	2017			Moderate	2021	2021	45	1	$11,500	$4,600	$16,100
9	MET DEAN PARK	YES	0%	200	MECH	NO	Above	26	4	2021			Moderate	2022	2022	31	1	$13,000	$5,200	$18,200
10	RES DEAN PARK UPPER	NO		150	MECH	NO		36	0	2017			Low	2023	2023	42	1	$13,500	$5,400	$18,900
11	PST STELLY'S	NO		600	Ultrasonic	Yes	Below	31	0	2017			Low	2024	2024	38	4	$15,000	$6,000	$21,000
12	PST DEAN PARK LOWER	NO		200	MECH	NO	Above	28	2	2019			Low	2025	2025	36	1	$13,000	$5,200	$18,200
13	PST DEAN PARK LOWER	YES	0%	25	MECH	NO	Above	21	9	2026			Moderate		2026	30	1	$1,500	$600	$2,100
14	SPWS DISTRIBUTION	YES	0%		MECH	NO	NA		30	2047			Moderate	2026	2026	9	4	$1,300	$520	$1,820
15	PST DEAN PARK LOWER	NO		200	MECH	NO	Above	24	6	2023			Low	2026	2026	33	1	$13,000	$5,200	$18,200
16	MET TSAWOUT	YES	0%	250	MECH	NO	Below	14	16	2033			Moderate	2027	2027	24	1	$18,100	$7,240	$25,340
17	PST DEAN PARK LOWER	NO		250	MECH	NO	Above	24	6	2023			Low	2028	2028	35	1	$17,100	$6,840	$23,940
18	PRS MEADOWBANK	NO		200	MECH	Yes	Below	21	9	2026			Low	2029	2029	33	2	$15,400	$6,160	$21,560
19	PRS MEADOWBANK	NO		50	MECH	NO	Below	21	9	2026			Low	2030	2030	34	2	$12,600	$5,040	$17,640
20	PST DAWSON	NO		75	MECH	Yes	Above	20	10	2027			Low	2031	2031	34	1	$11,000	$4,400	$15,400
21	SPWS DISTRIBUTION	NO		250	MECH	NO	Below	16	14	2031			Low	2032	2032	31	1	$18,100	$7,240	$25,340
22	RES DEAN PARK UPPER	NO		150	MECH	NO		24	6	2023			Low	2033	2033	40	1	$13,500	$5,400	$18,900
23	RES DEAN PARK UPPER	NO		50	MECH	NO		22	8	2025			Low	2034	2034	39	1	$11,500	$4,600	$16,100
24	PST DEEP COVE	NO		150	MECH	Yes	NA	13	17	2034			Low	2035	2035	31	1	$13,500	$5,400	$18,900
25	RES DEAN PARK UPPER	NO		200	MECH	NO		22	8	2025			Low	2036	2036	41	1	$14,000	$5,600	$19,600
26	SPWS DISTRIBUTION	NO		250	MECH	NO	Below	15	15	2032			Low	2037	2037	35	1	$18,100	$7,240	$25,340
27	PST DEAN PARK MIDDLE	NO		200	MECH	Yes	Above	22	8	2025			Low	2038	2038	43	1	$13,000	$5,200	$18,200
28	MET MCTAVISH	YES	12%	300	Magnetic	Yes	Below	3	27	2044			High	2039	2039	25	1	$19,600	$7,840	$27,440
29	MET MCTAVISH	YES	25%	350	Magnetic	Yes	Below	3	27	2044			High	2040	2040	26	1	$21,100	$8,440	$29,540
30	PRS MT NEWTON	YES	3%	150	MECH	Yes	Above	2	28	2045			Moderate	2041	2041	26	1	$12,500	$5,000	$17,500
31	PRS MILLS	YES	3%	250	Magnetic	Yes	Below		30	2047			Moderate-High	2042	2042	25	2	$19,700	$7,880	$27,580
																	TOTALS	$427,700	$171,080	$598,780

4.7 Operational Costs

The optimal frequencies of maintenance activities, and associated annual costs, are dependent on meter type, age, purpose (billing or other), and annual flow through the meter. It is recommended that an operational maintenance program include both validations and calibrations periodically throughout the lifecycle of a billing meter.

Validation and calibration procedures will be faster and less costly where meter installations include provisions for in-situ calibration, including adequately sized test ports located at least 5 pipe diameters downstream of the meter allowing a calibration meter to be placed in series. Currently no sites have such provisions, making full calibration a costly exercise involving removal of the meter, especially for large diameter meters.

Validation includes the following procedures:

- Installation of a clamp-on ultrasonic flow meter where practical to compare flows;
- Check meters error/fault logs, verify span, force mA out (min, mid, max) and confirm SCADA is recording same; and
- If electronic issues are identified test coil resistances and key voltages following manufacturer recommendations.

Calibration includes the following procedures:

- Remove meter and replace with a temporary meter;
- Send meter away for factory calibration or complete calibration in-house; and
- Reinstall meter or leave replacement meter in place where the meter is a standard stocked size.

Generalized operational meter maintenance activities, estimated costs and recommended frequencies are provided in Table 4-4. Operational tasks include annual inspections, validations, and calibrations, with an increasing level of effort for each of these tasks. One activity will occur each year for each meter. Annual inspections will only occur on years when neither validation nor calibration is scheduled. The total annual cost is calculated by dividing the lifecycle cost per meter by 30 years, the anticipated life cycle.

SCADA renewals are recommended every 15 years at an estimated average cost of equipment replacements and labour of $50,000. With the addition of SCADA at Holland, Burnside @ 1446 West there will be a total of 42 SCADA sites. This equates to an annual SCADA renewal budget of $140,000 per year.

Table 4-3: Operational Activities, Estimated Costs and Frequencies

Meter Type	Activity	Frequency (years)	Cost	Operational Cost	# of Meters	Notes
Moderate to High Criticality	Annual Inspection	1	$200	$2,400	13	2 operators at $100 per hour for 1 hours (only on years when validation or calibration doesn't occur)
	Validation	2	$600	$7,200		2 operators at $100 per hour for 3 hours
	Calibration	5	$6,200	$37,200		2 operators at $100 per hour for 6 hours total + $1,000 factory calibration and 40hrs SCADA operator at $100 per hour for setup.
	Lifecycle Cost Per Meter =			**$46,800**	**Annual Cost =**	**$20,300**
Low Criticality	Inspections	2	$200	$3,000	15	2 operators at $100 per hour for 1 hours (only on years when validation or calibration doesn't occur)
	Validation	5	$600	$2,400		2 operators at $100 per hour for 3 hours
	Calibration	15	$6,200	$6,200		2 operators at $100 per hour for 6 hours total + $1,000 factory calibration and 40hrs SCADA operator at $100 per hour for setup.
	Lifecycle Cost Per Meter =			**$11,600**	**Annual Cost =**	**$5,800**
TOTAL ANNUAL COST ALL METERS =						**$26,100**

The recommended total analyzed lifecycle cost for the metering program is estimated at $86,000 including:

Capital Costs:

- $20,000 per year for meter renewals based on a 30 year replacement frequency;
- $40,000 per year for SCADA renewals based on a 15 year replacement frequency; and
- Operational Costs:
- $26,000 per year for annual inspection and testing with effort based on type and annual flow through the meter.

Monitoring long-term trends in meter test results will enable renewal schedules to be adjusted to potentially extend meter life cycles and minimize the overall cost of renewals, while preserving accuracy of billing to customers and effectively managing losses.

4.8 Operational Best Practice Review

Customer Billing - Water Meters

The CRD is generally following best management practices for maintenance and testing of meters. We note that full calibrations are not taking place for all meters, and that the financial cost of removing meters for factory calibration is prohibitive in many instances.

Recognizing that removal of larger meters is a difficult and costly exercise, the CRD could choose to complete more frequent validations, and replace larger meters more frequently, or install test ports prior to future main renewal for high or moderate-high criticality meters with large billing volumes.

The CRD operates an annual maintenance and validation/calibration program for each of the large meters to ensure accuracies and identify upcoming maintenance items. In addition to the maintenance program, the CRD implement a SCADA system that provides operators with real-time flow data that is used to identify flow anomalies.

No flow alarms have been implemented in the SPW system. The RWS is in the process of implementing alarms to alert operators if a meter is operating outside of its typical regime for a given time of year. The system of alarms currently being implemented in the RWS is recommended for the SPW.

In addition to the SCADA system, the CRD tracks historic consumption trends at each meter.

Transmission - Supply Piping

The CRD does not have a formal water loss management plan for any of the three water systems. A water loss management plan establishes the appropriate level of funding, schedules for water loss prevention measures and procedures, the size and makeup of the team, targets for loss reduction, and the tools required, based on levels of loss calculated in the water audit. The CRD does not have equipment and training in acoustic leak detection or a system of monitoring to identify leakage as it occurs.

The following are recommendations for operational monitoring of both the meter inventory and supply system:

- Implement SCADA alarms for flow anomalies at all metering stations, as in the RWS system;
- Complete a detailed top down water audit every 5 years as well as internally produced expedient audits on a yearly basis. The expedient audit is meant to update the yearly system input volume, billed authorized consumption and other easily obtained components of the audit without detailed assessment of the data inputs.
- Complete a detailed top down water audit every 5 years as well as internally produced expedient audits on a yearly basis. The expedient audit is meant to update the yearly system input volume, billed authorized consumption and other easily obtained components of the audit without detailed assessment of the data inputs.
- At a future date, when justified by increased water loss in the RWS, SPW or JDFWD systems as identified by the yearly water audits, establish a water loss management plan to complement automated loss monitoring using SCADA. Water loss management should be a joint program between the Regional, Saanich Peninsula and Juan de Fuca water services.

4.9 A Roadmap for Water Loss Management

The four general strategies for managing real water losses in water distribution systems are pressure management, active leakage control, asset management and speed and quality of repairs. Figure 4-1 displays how these four management strategies acting to reduce current real losses (water being lost today), the unavoidable real losses (how much water loss cannot be avoided at any cost), and the economic level of real loss or target leakage levels (losses that cannot cost-effectively be avoided). The difference between current real losses and economic level of leakage is the potentially recoverable real loss (red shaded area), the target of a WLMP.

The pillars of loss control are further described as:

- **Active Leakage Control**: Losses are frequently and proactively identified and quantified by monitoring flows and using acoustic leak detection to locate significant leaks. *(The CRD's current level of effort in Active Leakage Control includes the monitoring of flow data)*
- **Speed and Quality of Repairs**: The duration and recurrence of leaks are minimized by promptly repairing new leaks and breaks with good workmanship and appropriate materials. *(The CRD's current level of effort in Speed and Quality of Repairs includes timely response to leakage repairs)*
- **Pressure Management**: Leakage rates vary roughly in direct proportion to system pressure. Systems with higher than optimum pressures can achieve significant and immediate loss reductions through careful and selective reduction that maintains adequate pressures for customer and firefighting needs. Monitoring pressures can also reveal transients (water hammer) that contribute to distribution leaks and breaks. *(The CRD's current level of effort in Pressure Management includes monitoring pressures for abnormalities via SCADA)*
- **Asset Management**: Water distribution infrastructure assets have a finite life span and must be rehabilitated or replaced to maintain acceptable service. As assets approach the end of their useful lives, leak and break frequency and severity increase, causing excessive background leakage and unreliable service. Effort and cost for maintenance, including water loss management, must be balanced against the cost and timing of asset renewal or replacement. Asset management also reduces apparent losses through the timely replacement of meters. *(The CRD's current level of effort for Asset Management includes condition assessment initiatives and asset management initiatives including the scope of this report.)*

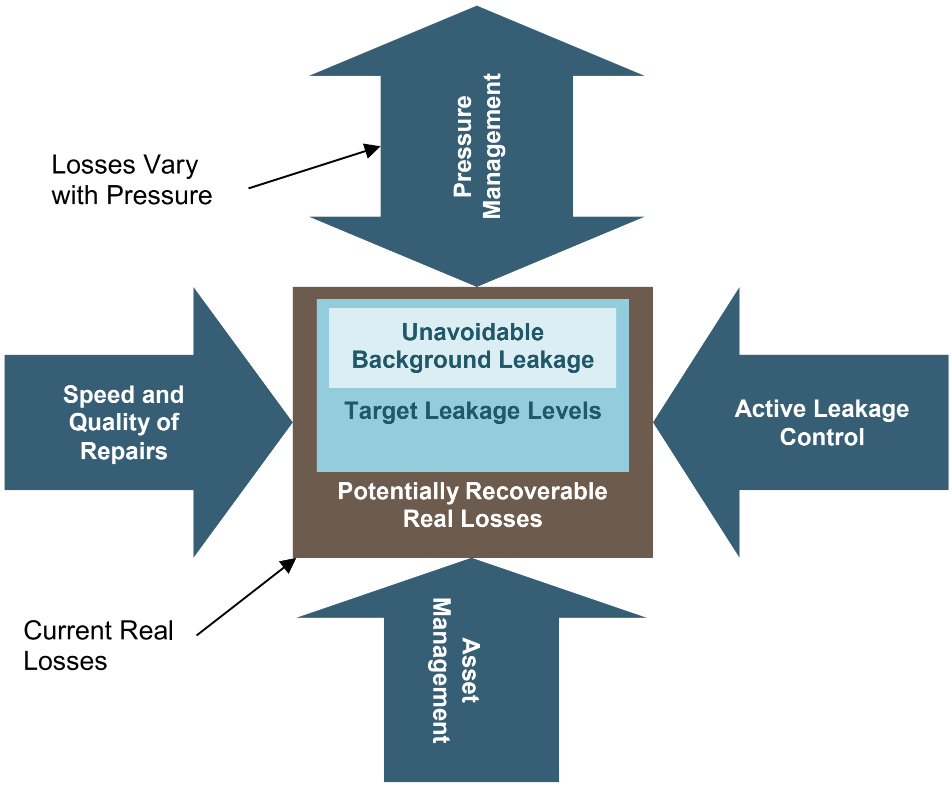

Figure 4-1: The Four Pillar Approach to Managing Water Losses (IWA/AWWA)

To achieve and maintain low leakage volumes, some level of activity may be required in each of the four pillars of loss control. Effective WLM planning requires an appropriate combination of effort on each of the four pillars.

Drawing upon the IWA/AWWA methodology and KWL's experience with other water systems in BC, the methodology for structuring a Water Loss Management Plan is shown in Figure 4-2. The plan involves an iterative process of planning, implementation and review where the water audit is completed to evaluate program performance in the review phase and is completed as the first step to establish targets and budgets.

Capital Regional District
Greater Victoria Water Supply System Audit
Report for: Saanich Peninsula Water System
July 2017

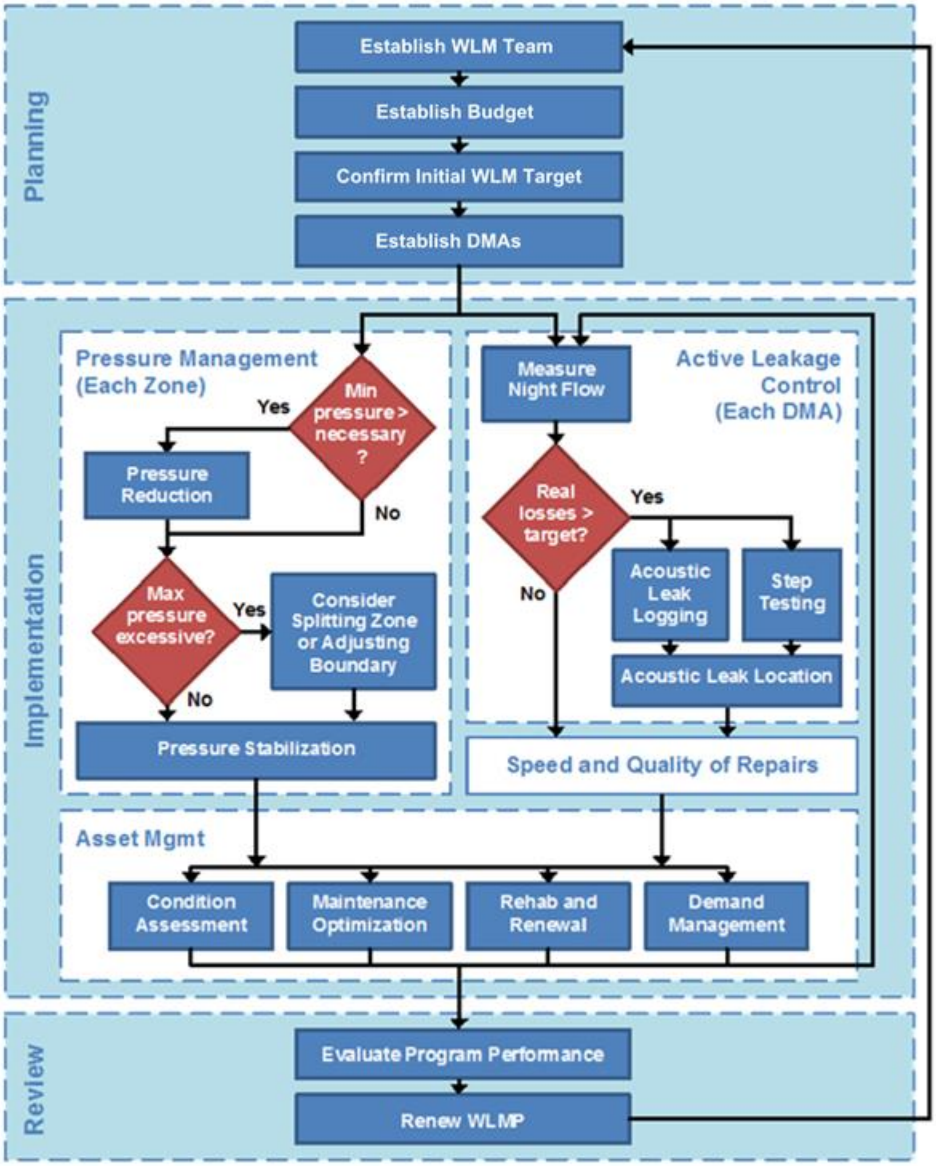

Figure 4-2: Water Loss Management Framework

4.10 Flow Meter Selection

Bulk customer billing meters must be capable of accurately capturing expected minimum flows while not overly restricting the conveyance of high flows for the purpose of fire-flows. Accuracy can vary significantly over a meters stated operating range. The following three criteria must be considered together to gauge the true accuracy of a meter at the design low flow rate:

- The percentage accuracy of reading. Meters offering only % accuracy reported at full scale should not be chosen.
- The plus/minus error in the reading; and
- The meter's low flow cut-off.

Table 3-2 gives a comparison of six 150mm meters, showing accuracy at low flow rates calculated from manufacturers' specifications. Flow rates below a meter's low flow cut-off are indicated as "Not Read". The values in the table are not an indication of the overall quality of the meters, but instead to display how the stated accuracy in terms of percent reading, plus/minus minimum error and low flow cut-off affected metering accuracy.

Table 4-4: Meter Accuracy Comparison for 150mm (6") Installations

Meter Make/Model	Accuracy Description	Accuracy at a Specified Flow Rate (±)					
		50 L/s	15 L/s	8 L/s	2 L/s	1 L/s	0.5 L/s
E+H Proline Promag 10D Full Bore Magmeter	0.5% of Reading ± 2mm/s	0.6%	0.7%	0.9%	2.3%	4.0%	7.6%
Fuji PortaFlow-C clamp-on Ultra Sonic Transit-Time Meter	1% of Reading or ± 30.5mm/s	1.1%	3.6%	6.7%	27%	54%	108%
GF Signet Insertion Paddlewheel meter	1% of Full Scale	2.1%	7.1%	13%	53%	Not Read	Not Read
Hydreka - HydrINS 2 Insertion Mag meter	2% of Reading or ± 2mm/s	2.0%	2.0%	2.0%	2.0%	3.5%	7.1%
Seametrics EcoFlo Mag Full Bore Magmeter	1% of Reading ± 4mm/s	1.1%	1.5%	1.9%	4.5%	8.1%	Not Read
Seametrics IP215 Paddlewheel Flow Sensor	1.5% of Full Scale	4.8%	16%	30%	119%	Not Read	Not Read

The percentage accuracy of reading is meaningless at low flow if the plus/minus minimum error is large. Equally, a meter with a higher percentage of reading error value can perform with higher accuracy if the minimum error is low and the meter is sized for the anticipated low flow rates.

Design low flow rates should consider both:

- The historical flows where available; and
- The calculated theoretical minimum night use through review of the number and type of customers supplied.

An AWWA M22 meter sizing calculation should be done for the sizing of all meters.

KERR WOOD LEIDAL
consulting engineers

Section 5

Conclusions and Recommendations

5. Conclusions and Recommendations

5.1 Conclusions

The following summarizes the key points of the water audit for the SPW:

- The SPW meter inventory database consists of 31 bulk water meters. KWL has assessed the inventory and has highlighted data gaps that require additional input for completeness within Appendix A.
- The majority of billing meters in the SPW system are mechanical turbine meters. SPW has thirteen mechanical meters and three mag meters used for billing.
- Sufficient record drawing information was available to assess the piping configuration of 17 of the 31 meters. The review found 6 meters met the preferred piping configuration and 11 meter installations did not. The meters with less than the preferred piping configuration have an average distance/diameter ratio of 7 upstream and 6 downstream. No meter configurations are deemed to require additional straight pipe lengths. All meters have a minimum of 5 upstream and 3 downstream distances. Meters with less than the preferred piping configuration can be replaced with mag meters having shorter straight pipe length requirements.
- SPW system customers are metered off the RWS system and not the SPW system. None of the points of connection from the SPW system mains to municipal mains are billed metered sites. As a result, all of the real losses and reservoir cleaning in the SPW are billed to the municipalities.
- The totalizer on the Dooley #2 West meter failed on July 26th and was replaced on September 24th. The error associated with the estimation is approximated as ±5%, volume error of ±35ML. Although this meter does not directly measure the flow from the RWS system into the SPW system, it is used for the purpose of billing for supply of water from the RWS system to the SPW system, attributing the cost of real losses in the RWS Main #4 to the SPW. Real losses in this section of Main #4 are however estimated to be negligible.
- The RWS Hamsterly metering chamber appears to under-register flow. The Bear Hill Reservoir inlet meter, a billing meter for Central Saanich downstream of Hamsterly, registered 3.8% more volume, 105 ML, in 2015.
- An audit of Main #4 from the Dooley meter to McTavish Reservoir was completed. Adjusting for the error associated with the Dooley meter failure estimate (see bullet 5 above), the volume of real and apparent water loss in Main #4 is 44 ±35ML. The high end of this estimate represents only 2% of the water supplied through Main #4 which indicates low real losses and apparent metering error in the SPW system billing meters.
- A review of Central Saanich, North Saanich, and Sidney customer billing data from 2015 was completed to assist in quantifying real losses in the SPW as well as the likelihood of apparent losses through SPW billing meters. The accuracy of the North Saainch and Sidney retail water use data is uncertain and is likely to contain significant data-handling errors.
- A meter sizing and configuration review was completed to quantify the portion of the total 44 ±35ML water loss attributed to meter under-registration. The review found the following:
    - The most likely source of under-registration is the Lowe Pump Station meter, a Rockwell W-5500 installed in 1984. The meter does not have an ideal configuration, is at the end of its expected

service life, and measures 60% of the volume supplied to North Saanich. Meter under-registration at this site is estimated at 14 to 28 ML.

    - The Lochside station registered more volume through the large 150mm diameter meter than the small 50mm diameter meter in 2015 due to an earlier malfunction of the 50mm meter. Meter under-registration at this site is estimated at 6 – 12 ML. The station would have increased metering accuracy and provide flow data for PRV operation and control if it was reconfigured with meters on each PRV leg.
    - The 250mm meter at Martindale station registers more volume through the 250mm meter than the smaller 50mm meter and is operating at the low end of its accuracy limits. Meter under-registration at this site is estimated at 10 to 20 ML.
    - The Tsawout metering station registers flow through the large 250mm meter 12 months of the year, as the 50mm low-range meter is undersized for typical flow rates through the station. Meter under-registration at this site is estimated at 5 to 10 ML.

- Real water losses in the SPW system are expected to be low based on review of the municipal retail meter data. Real losses in Central Saanich are estimated at 29 ML, and losses in the supply to Sidney are expected to be negligible. No assessment of the losses in the mains in North Saanich system could be completed.
- The CRD is following best management practices for maintenance and testing of meters, but does not have a formal water loss management plan.
- Current real loss volumes do not justify a budget for acoustic leak detection or other methods of loss reduction apart from ongoing flow monitoring.
- A meter renewal prioritization was conducted, based initially on asset age (30-year assumed useful life) and adjusted using the following criteria:
    - the CRD's current priorities to address known deficiencies;
    - functional deficiencies identified in this study for high criticality meters;
    - alignment of the timing of chamber renewals with critical watermain replacements; and
    - adjustments to renewal timing based on criticality ratings to level program costs over the next 30 years (where meters are used for billing purpose, and those with the highest annual flows, are rated highest in criticality).

5.2 Recommendations

The following is KWL's list of recommendations:

- Fill data gaps identified in the meter inventory (Appendix A);
- Review record drawings and red-line to indicate upgrades that have occurred, and as they occur in the future;
- For all future bulk billing meter chamber installations, provide:
  - A bypass and suitable valves to achieve Worksafe isolation requirements (e.g. double block and bleed) isolation in the direct vicinity of the chamber, with CRD-owned and maintained valves; and
  - The ability to complete in-situ meter calibration.
- Standardize meter lay length and type through the recommended renewals program for meters sized 100 – 300mm in diameter to allow for meters to be replaced with spares as part of the calibration program or otherwise.
- Replace the Lowe Pump Station meter with a magnetic meter at an estimated cost of $22,000.
- Reconfigure the Lochside PRV station with a 50mm mag meter on the 50mm PRV leg and a 150mm mag meter on the 150mm PRV leg. Existing valves could be re-used and pipework would be replaced, removing the metering pipework and lengthening the two PRV legs between existing shutoff valve locations. The estimated cost is $24,000.
- Replace the Martindale mechanical meters with a single magnetic meter at an estimated cost of $22,000.
- Replace the Tsawout 50mm mechanical meter with a 75mm Omni or equivalent meter at an estimated cost of $3,000.
- The CRD has identified the need to develop over-arching strategic asset management plans for each of its water systems, to establish priorities for renewal of the trunk mains and other major assets in the systems. The current locations of bulk billing metering stations are at the connection of the RWS to the SPW and not at the point of connection to the customer.
- It is recommended that metering locations be moved to the point of customer connection over time, as part of the scope of future main replacements and additions to provide redundancy, and that this issue be considered within the scope of the SPWS strategic asset management plan.
- Establish an annual budget for the bulk metering program of $86,000/year (2017 dollars), including the following:
  - Capital Costs for asset replacement:
    - $20,000 per year for meter renewals based on a 30 year replacement frequency;
    - $40,000 per year for SCADA renewals based on a 15 year replacement frequency; and
  - Operational Costs:
    - $26,000 per year for annual meter inspection and testing.

- Adequate inflation must be added annually to the above budgets which are present in 2017 dollars.
- It is recommended that long-term trends in meter test results be monitored to optimize renewal schedules and costs, while billing customers accurately and effectively managing losses.
- The following program of operational monitoring of both the meter inventory and supply system is recommended:
  - Implement SCADA alarms for flow anomalies at all meter locations in a similar fashion to that which the Regional Water Supply system is implementing;
  - Complete a detailed top down water audit every 5 years as well as internally produced expedient audits on a yearly basis. The expedient audit is meant to update the yearly system input volume, billed authorized consumption and other easily obtained components of the audit without detailed assessment of the data inputs. The detailed audit should have a budget of $50,000 and $8,000 should be budgeted for yearly expedient audits. These budget numbers are for the combined effort of auditing all three water systems including RWS, SPW, and JDFWD.
  - At a future date, when justified by increased water loss in the RWS, SPW or JDFWD systems as identified by the yearly water audits, establish a water loss management plan, at an estimated one time capital budget of $50,000, to complement automated loss monitoring using SCADA. Water loss management should be a joint program between the Regional, Saanich Peninsula and Juan de Fuca water services.

5.3 Report Submission

Prepared by:

KERR WOOD LEIDAL ASSOCIATES LTD.

ORIGINAL SIGNED AND SEALED

Ryan Lesyshen, M.Sc. P.Eng.
Project Manager

Reviewed by:

ORIGINAL SIGNED

Colwyn Sunderland, AScT
Specialist – Asset and Demand Management

Statement of Limitations

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This document represents KWL's best professional judgement based on the information available at the time of its completion and as appropriate for the project scope of work. Services performed in developing the content of this document have been conducted in a manner consistent with that level and skill ordinarily exercised by members of the engineering profession currently practising under similar conditions. No warranty, express or implied, is made.

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Revision History

Revision #	Date	Status	Revision	Author
Draft Report	10 March, 2017	Draft		RYL
Final Report	13 April, 2017	Final	Revisions to address CRD comments on Draft Submission	RYL
Revised Final Report	20 June, 2017	Final	Revisions to address CRD comments following report presentation.	RYL

OQM | Organizational Quality Management Program

KERR WOOD LEIDAL
consulting engineers

Appendix A

Appendix A: Meter Database (Data Gaps Highlighted)

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#	Station Name	Address	Wholesale Billing Meter?	Description	Meter Diameter (mm)	Acquisition Date	Manufacturer	Model	Meter Type	On SCADA
1	MET DEAN PARK	1890 Dean Park Rd	YES	Meter #1, Flow, 100mm	100	01/01/1976	Sensus	W-1000	Mechanical	NO
2	MET DEAN PARK	1890 Dean Park Rd	YES	Meter #2, Flow, 200mm	200	01/01/1991	Rockwell	W-3500	Mechanical	NO
3	MET MCTAVISH	1717 McTavish Rd	YES	Meter, Mag, 305mm, Sidney Line	300		ABB		Magnetic	Yes
4	MET MCTAVISH	1717 McTavish Rd	YES	Meter, Mag, 355mm, McTavish Fill Line	350		ABB		Magnetic	Yes
5	MET TSAWOUT	7538 Central Saanich Rd	YES	Meter #1, Turbo, 250mm	250	01/01/2003	Sensus	5500DR	Mechanical	NO
6	MET TSAWOUT	7538 Central Saanich Rd	YES	Meter #2, Turbo, 50mm	50	01/01/2003	Sensus	W160	Mechanical	Yes
7	PRS LOCHSIDE	7271 Central Saanich Rd	YES	Meter #1, Flow, 150mm, D/S of basket	150	01/01/1997	Sensus	W-2000 DR	Mechanical	Yes
8	PRS LOCHSIDE	7271 Central Saanich Rd	YES	Meter #2, Flow, 50mm	50		Sensus		Mechanical	NO
9	PRS MEADOWBANK	1942 Meadowbank Rd	NO	Meter #1, Flow, 200mm	200	01/01/1996	Sensus	W-3500 DR	Mechanical	Yes
10	PRS MEADOWBANK	1942 Meadowbank Rd	NO	Meter #2, Flow, 50mm	50		Neptune		Mechanical	NO
11	PRS MILLS	1991 Mills Rd	YES	Meter, Mag, Flow, 250mm	250		E & H	PROMAG 53	Magnetic	Yes
12	PRS MT NEWTON	7798 Central Saanich Rd	YES	Meter, Flow, 150mm	150	01/01/2015	Sensus	Omni T2	Mechanical	Yes
13	PST DAWSON	1185 Benvenuto Rd	NO	Meter, Flow, 75mm	75	01/01/1997	Sensus	W-350 DR	Mechanical	Yes
14	PST DEAN PARK LOWER	1870 Dean Park Rd	YES	Meter, Flow, 25mm	25	01/01/1996	Sensus	SRII	Mechanical	NO
15	PST DEAN PARK LOWER	1870 Dean Park Rd	NO	Meter #3, Flow, 200mm	200	01/01/1989	Rockwell	W-3500	Mechanical	NO
16	PST DEAN PARK LOWER	1870 Dean Park Rd	NO	Meter #1, Flow, 200mm	200	01/01/1993	Sensus	W-3500	Mechanical	NO
17	PST DEAN PARK LOWER	1870 Dean Park Rd	NO	Meter #2, Flow, 254mm	250	01/01/1993	Sensus	W-3500	Mechanical	NO
18	PST DEAN PARK MIDDLE	8752 Carmanah Terr	NO	Meter, Flow, Inlet	200	01/01/1995	Rockwell	W-3500	Mechanical	Yes
19	PST DEEP COVE	10775 West Saanich Rd	NO	Meter, Flow, 150mm	150	01/01/2004	Sensus	W-2000-03L	Mechanical	Yes
20	PST LOWE	8720 Aldous Terrace	YES	Meter, Flow, 250mm, Subfloor	250	01/01/1984	Rockwell	W-5500	Mechanical	Yes
21	PST MARTINDALE	2607 Martindale Rd	YES	Meter #2, Flow, 50mm	50		Sensus		Mechanical	NO
22	PST MARTINDALE	2607 Martindale Rd	YES	Meter #1, Flow, 250mm	250		Rockwell	W-5500T	Mechanical	Yes
23	PST STELLY'S	7271 Central Saanich Rd	NO	Meter, Ultrasonic, Flow, 762mm	600	11/01/1986	Nusonics	8400	Ultrasonic	Yes
24	RES BEAR HILL	5647 Batu Road	YES	Meter,Flow, 200mm, Main Floor	250	01/01/1996	Sensus	W-5500T	Mechanical	NO
25	RES DEAN PARK UPPER	1400 Dean Park Rd	NO	Meter, Flow, 150mm, Recirculating Pump	150	01/01/1981	Rockwell	W-2000T	Mechanical	NO
26	RES DEAN PARK UPPER	1400 Dean Park Rd	NO	Meter, Flow, 50mm, Outlet	50	01/01/1995	Sensus	W-160-S	Mechanical	NO
27	RES DEAN PARK UPPER	1400 Dean Park Rd	NO	Meter, Flow, 200mm, Outlet	200	01/01/1995	Sensus	W-3500 TURBO	Mechanical	NO
28	RES DEAN PARK UPPER	1400 Dean Park Rd	NO	Meter, Flow, 150mm, Inlet	150	01/01/1993	Sensus	W-2000 TURBO	Mechanical	NO
29	AGRICULTURE CANADA	8801 East Saanich Rd	YES	Meter, Flow, Agriculture Canada			Rockwell		Mechanical	NO
30	AIRPORT - WILLINGDON RD	9500 Willingdon Road	NO	Meter,Flow,Turbine,254mm,ArprtWillingdon	250		Rockwell	W-5500	Mechanical	NO
31	AIRPORT - PROPER		NO	Meter, Flow, 254mm, Airport Proper	250		Sensus	W-5500	Mechanical	NO

#	Meter Above/Below Ground	U/S Distance > 10*D (Bends/Fittings)	D/S Distance > 5*D (Bends/Fittings)	Is Spatial Criteria Met?	Spatial Criteria Description (US D/L - DS D/L)	Meter Isolation	Valve Type	CRD Priority	Customer	2015 Billed Volume (ML)	% of Total Billed	% of Total Billed to Customer	# Months Registering Flow (2015)	APPROX. AVE. FLOW (L/S)	METER MIN CONTINOUS FLOW (L/s)	AVE. Flow % of Meter Min Continuous
1	Above					NA	NA		North Saanich	-	0%	0%	0			
2	Above					NA	NA		North Saanich	-	0%	0%	0			
3	Below	TRUE	TRUE	TRUE		Y	Gate		Sidney	972	3%	79%	12	30.80927235		
4	Below	TRUE	TRUE	TRUE		Y	Gate		North Saanich	1,994	6%	93%	12	63.21506966		
5	Below	FALSE	TRUE	FALSE	8 - 8	Y	Gate		Central Saanic	28	0%	1%	12	0.884386292	3.469960802	0.3
6	Below	TRUE	TRUE	TRUE		Y	Ball		Central Saanic	65	0%	2%	12	2.05657072	0.252360786	8.1
7	NA	FALSE	TRUE	FALSE	7 - 7	Y	Gate		Central Saanic	88	0%	3%	12	2.793823545	1.892705892	1.5
8	NA	TRUE	TRUE	TRUE		Y	Ball		Central Saanic	19	0%	1%	10	0.725076262	0.252360786	2.9
9	Below	FALSE	TRUE	FALSE	6 - 5	Y	Butterfly									
10	Below					NA	NA									
11	Below	FALSE	FALSE	FALSE	8 - 4	Y	Gate		Sidney	254	1%	21%	12	8.057111101		
12	Above	FALSE	TRUE	FALSE	9 - 5	Y	Gate		Central Saanic	211	1%	6%	12	6.684267066	0.252360786	26.5
13	Above	TRUE	TRUE	TRUE		Y	Gate									
14	Above					NA	NA		Central Saanic	-	0%	0%	0			
15	Above					NA	NA									
16	Above					NA	NA									
17	Above					NA	NA									
18	Above					NA	NA									
19	NA					NA	NA									
20	NA	FALSE	FALSE	FALSE	5 - 5	Y	Gate		North Saanich	1,396	4%	65%	12	44.27005029	3.469960802	12.8
21	NA	NA	NA			NA	NA		Central Saanic	59	0%	2%	10	2.243683901	0.504721571	4.4
22	NA	FALSE	TRUE	FALSE	5 - 6	Y	Gate		Central Saanic	132	0%	4%	11	4.559292545	3.469960802	1.3
23	NA	TRUE	TRUE	TRUE		NA	NA									
24	Above	FALSE	TRUE	FALSE	8 - 6	Y	Gate		Central Saanic	2,766	8%	82%	12	87.70676707	3.469960802	25.3
25	NA					NA	NA									
26	NA					NA	NA									
27	NA					NA	NA									
28	NA					NA	NA									
29	NA					NA	NA		Ag Canada	18	0%	100%	12	0.568968922		
30	Below	FALSE	TRUE	FALSE	7 - 8 (Fire-Only)	Y	Gate									
31	Below	FALSE	TRUE	FALSE	7 - 6 (Fire-Only)	Y	Gate									

Data Required
Insuficient Data for Assessment
Inconsistent Data Entries
Confirm Data Entry

Agenda Item #7
REPORT#SPWC 2018-06

REPORT TO SAANICH PENINSULA WATER COMMISSION
MEETING OF THURSDAY, JUNE 21, 2018

SUBJECT **PROJECTS AND INITIATIVES UPDATE**

ISSUE

To inform the Saanich Peninsula Water Commission (SPWC) regarding ongoing projects and initiatives.

BACKGROUND

As part of delivering the Saanich Peninsula Water Supply 2017/2018 Capital Plan there are a number of projects and initiatives that are underway. Although there are projects identified in the 2018 Capital Plan that have not been started, the following is an update on the projects that have been started:

Seismic Isolation Valves – Study – Project 17-01

- This project was identified in 2017 and included the study and potential installation of seismic valves at 8 reservoirs in the Saanich Peninsula water system.
- Associated Engineering was retained to complete this study. All sites were inspected in May 2018.
- A draft report has been received from Associated and is currently being reviewed by staff. A final report is expected mid-July 2018.
- Next steps: based on recommendations from the report, proceed with the design and installation of seismic valves.

Post Disaster Emergency Water Supply – Project 18-04

- This project was initiated in 2017 to deal address the supply and distribution of water in a post disaster scenario. This program is funded by Regional Water, Saanich Peninsula Water and Juan De Fuca Water services. Program overviews and progress on the initiative been previously presented by staff, both to the SPWC and municipal staff at the CRD Water Symposium in April 2018. Recent technical progress includes:
- Design and installation of seismically resistant hydrants:
    - One new resilient hydrant has been installed at the North Saanich Fire Hall on Wain Road.
    - Design of two more resilient hydrants is complete for the locations Panorama Recreation Center/Forest Park Drive and Elk/Beaver Lake north parking lot locations. Staff and currently completing the construction permitting phase.

- Water Distribution Modules:
    - Detailed specifications for mobile (trailer) and semi-stationary water modules have been prepared.
    - Request for Qualifications of firms to design and build a distribution module have been received and are currently being reviewed. Conceptual costs for the units have also been received.
    - One mobile module, and one semi-stationary module are to be procured.
    - Expected delivery by the end of 2018.
- Earthquake Hazard Mapping
    - CRD staff advised the Deputy Minister of Emergency Management BC (EMBC) at the recent Regional Emergency Management Partnership (REMP) Steering Committee meeting that CRD requires composite relative earthquake hazard mapping for the Saanich Peninsula, Electoral Areas, Sooke and Metchosin, where the mapping currently does not exist. CRD staff will continue to work with provincial staff to advance this initiative.

Air Release Valves Replacement – Phase 5 – Project 16-02

- This project was identified in 2016 to deal with safety issues regarding accessing the air release valves as well as the valves nearing the end of their service life.
- A tender was issued for replacement of 10 air release valves in March 2018. No bids were received. Post tender discussions with contractors were that they were unable to provide resources to conduct the works.
- CRD Operations staff have indicated that they may have resources available in the fall of 2018 to undertake replacements.
- If CRD staff have not replaced the air valves by January 2019, a tender will be reissued.

Elk Lake Main Decommissioning – Project 16-03

- This project was identified in 2016 to deal with the decommissioning of assets.
- Central Saanich's water system has been isolated from the abandoned main at Mt Newton Cross Rd. in 2018.
- A draft report has been prepared highlighting sections of the Elk Lake main that have potential liability if not dealt with appropriately.
- Next steps: Carry out field investigation of highlighted areas, propose work plan for decommissioning and prepare budget to decommission.

RECOMMENDATION

That the Saanich Peninsula Water Commission receive the report for information.

Submitted by:	Dale Puskas, PEng., Manager, Capital Projects
Concurrence:	Ian Jesney, PEng., Senior Manager, Infrastructure Engineering
Concurrence:	Ted Robbins, BSc, CTech, General Manager, Integrated Water Service

IJ:so

Agenda Item #8

CAPITAL REGIONAL DISTRICT - INTEGRATED WATER SERVICES

Water Watch

Issued June 11, 2018

Water Supply System Summary:

1. Useable Volume in Storage:

Reservoir	June 30 5 Year Ave		June 30/17		June 10/18		% Existing Full Storage
	ML	MIG	ML	MIG	ML	MIG	
Sooke	82,860	18,229	85,463	18,802	86,327	18,992	93.1%
Goldstream	8,265	1,818	8,109	1,784	6,320	1,390	64.3%
Total	91,125	20,047	93,572	20,586	92,647	20,382	90.3%

2. Average Daily Demand:

For the month of June	171.0 MLD	37.62 MIGD
For week ending June 10, 2018	170.4 MLD	37.49 MIGD
Max. day June 2018, to date:	198.8 MLD	43.73 MIGD

3. Average 5 Year Daily Demand for June

Average (2013 - 2017)	178.1 MLD [1]	39.19 MIGD [2]

[1] MLD = Million Litres Per Day [2] MIGD = Million Imperial Gallons Per Day

4. Rainfall June:

Average (1914 - 2017):	35.6 mm
Actual Rainfall to Date	4.3 (12% of monthly average)

5. Rainfall: Sep 1- Jun 10

Average (1914 - 2017):	1564.7 mm
2017 / 2018	1589.2 (102% of average)

6. Water Conservation Action Required:

Stage 1 water conservation bylaw is now in effect. Check our website at www.crd.bc.ca/water for more information. It's time to get your irrigation system ready for Spring. Attend a free irrigation workshop to learn system maintenance and waterwise scheduling. Check our website at www.crd.bc.ca/workshops for more information.

If you require further information, please contact:

Ted Robbins, B.Sc., C.Tech
General Manager, CRD - Integrated Water Services
or
Glenn Harris, Ph D., RPBio
Senior Manager - Environmental Protection

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

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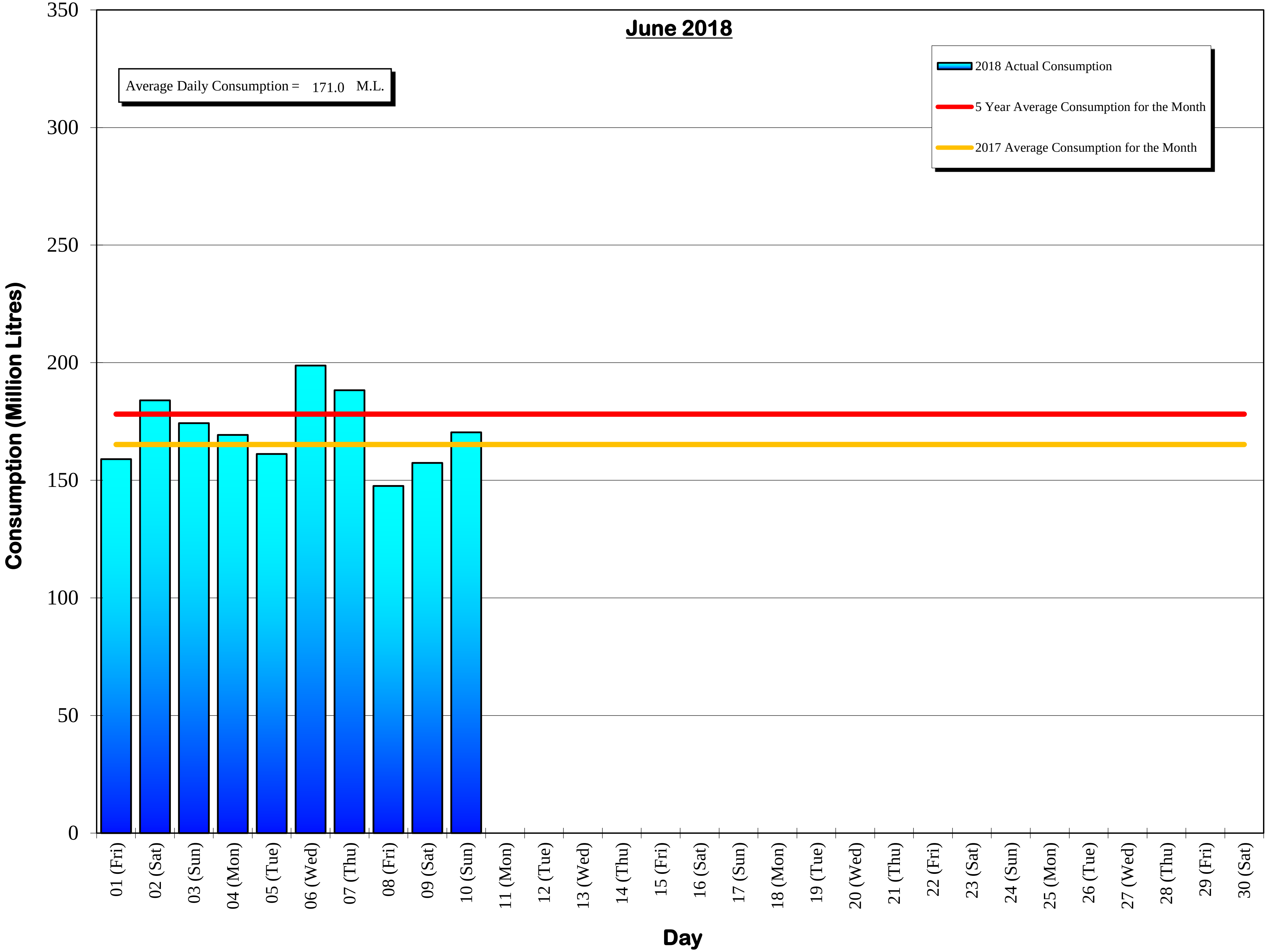

J:\WATERENG\HYDROLGY\AMRIT\MONTHEND.18\H2o watch 2018.xlsxCons. Chart

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Daily Consumptions: - June 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 (Fri)	159.0		35.0	15	7	Cloudy / Showers / P. Sunny	0.3	0.0	0.3
02 (Sat)	184.0		40.5	21	10	Sunny / P. Cloudy	0.0	0.0	0.0
03 (Sun)	174.3		38.3	17	8	Sunny / P. Cloudy	0.0	0.0	0.0
04 (Mon)	169.3		37.3	18	6	Sunny / P. Cloudy	0.0	0.0	0.0
05 (Tue)	161.2		35.5	17	8	Cloudy / P. Sunny	0.0	0.0	0.0
06 (Wed)	198.8	<=Max	43.7	19	9	Cloudy / P. Sunny	0.0	0.0	0.0
07 (Thu)	188.3		41.4	19	11	Cloudy / Showers / P. Sunny	1.0	0.0	1.0
08 (Fri)	147.6	<=Min	32.5	16	9	Cloudy / Showers / P. Sunny	2.5	0.0	2.5
09 (Sat)	157.4		34.6	17	7	Sunny / P. Cloudy	0.0	0.0	0.0
10 (Sun)	170.4		37.5	15	7	Cloudy / Showers / P. Sunny	0.5	0.0	0.5
11 (Mon)									
12 (Tue)									
13 (Wed)									
14 (Thu)									
15 (Fri)									
16 (Sat)									
17 (Sun)									
18 (Mon)									
19 (Tue)									
20 (Wed)									
21 (Thu)									
22 (Fri)									
23 (Sat)									
24 (Sun)									
25 (Mon)									
26 (Tue)									
27 (Wed)									
28 (Thu)									
29 (Fri)									
30 (Sat)									
TOTAL	1710.3 ML		376.25 MIG				4.3	0	4.3
MAX	198.8		43.73	21	11		2.5	0	2.5
AVE	171.0		37.62	17.4	8.2		0.4	0	0.4
MIN	147.6		32.47	15	6		0.0	0	0.0

ML = Million Litres MIG = Million Imperial Gallons

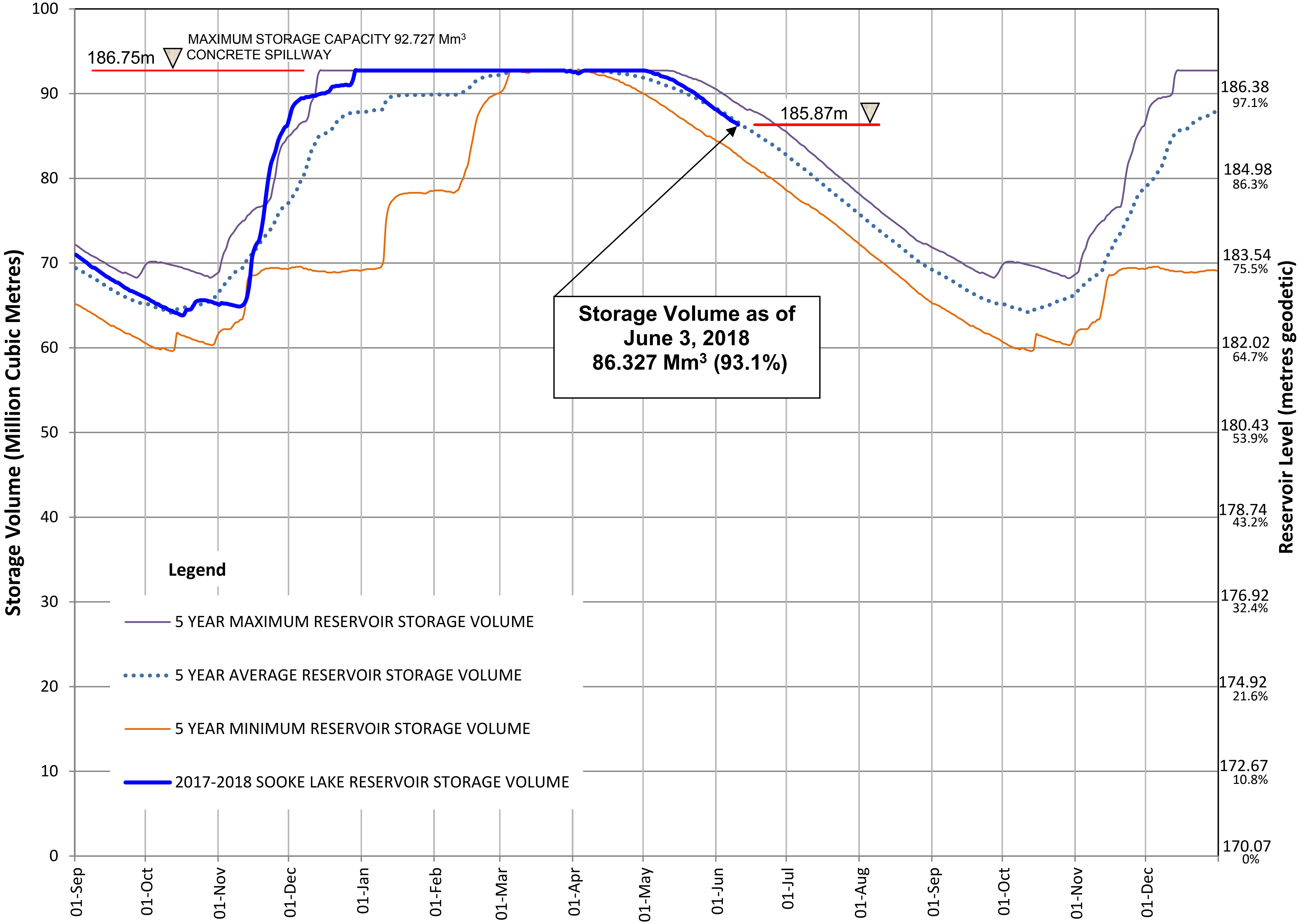
Average Rainfall for June (1914-2017)	35.6
Actual Rainfall: June	4.3
% of Average	12%
Average Rainfall (1914-2017): Sept 01 - Jun 10	1564.7
Actual Rainfall (2017-2018): Sept 01 - Jun 10	1589.2
% of Average	102%

Number days with precip. 0.2 or more
4

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

Water spilled at Sooke Reservoir to date = 9.26 Billion Imperial Gallons
= 42.10 Billion Litres

SOOKE LAKE RESERVOIR STORAGE SUMMARY
2017 / 2018



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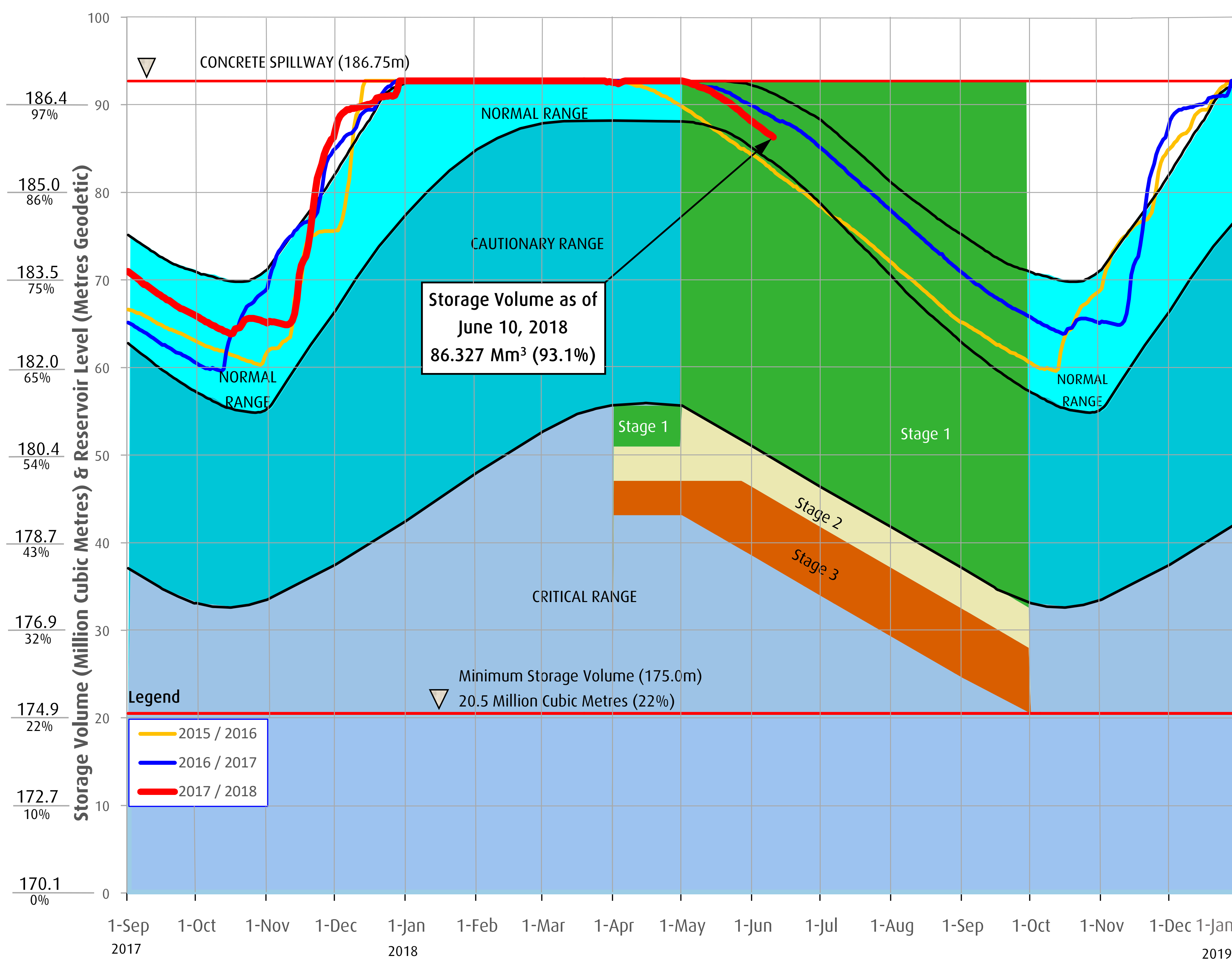
Sooke Lake Reservoir Storage Level

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 Commision 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

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