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# French Creek 2014 Master Plan Update

Final – Revision 2  
December 8, 2014  
KWL Project No. 747.009

Prepared for:  
EPCOR Water Services





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**EPCOR Water Services**  
French Creek 2014 Water System Master Plan Update  
Final Report – Revision 2  
December 2014

## Appendices

Appendix A: Water Model Log

Appendix B: Recommended Project Justification Sheets

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## Section 1

# Introduction



## 1. Introduction

### 1.1 Scope of Report

The goal of the 2014 Water System Master Plan Update is to create a plan suitable to address the water distribution system capital planning needs for EPCOR French Creek's (EFC) upcoming 3-year rate filing (2015 to 2018). The scope of this project includes:

- Existing water system model update;
- Proposed system model update;
- Service and bulk meter data review;
- Water conservation review;
- Develop future growth model scenario including future water demands;
- Hydraulic performance analysis; and
- Capital plan update.

A review of water quality and infrastructure renewal requirements for the utility was not completed as part of the update. However, previously identified projects for water quality and infrastructure renewal are included in the capital plan.

### 1.2 Acknowledgements

The project team and contributors to this project are listed below. This project could not have been completed without timely contributions and assistance of all those listed.

#### EPCOR Water Services

Gary Martens	Senior Manager, BC Water & Wastewater Services
Betty Icharia	Senior Manager, Southern Alberta Water & Wastewater Services
Dan Skidmore	Operations Manager
Karen Bacon	Administrative Assistant
Brian Thorburn	Operator
Susan Ancel	Director of Water Distribution and Transmission
Vincent Corkery	Director of Municipal Operations
Stephen Craik	Director of Quality Assurance and Environment
Christian Madsen	Senior Manager Municipal Projects
Kevin Schultz	Senior Advisor

### 1.3 Reports Referenced

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2. American Water Works Association / International Water Association, *AWWA M36 Manual, Water Audits and Loss Control Programs*, Third Edition.
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16. EPCOR Water Services Correspondence, emails from Brian Thorburn on October 8, 10 and 15, 2014.
17. EPCOR Water Services Correspondence, email from Gary Martens on October 6, 2014.
18. EPCOR Water Services Correspondence, email from Romela Bocancea, August 8, 2014.
19. EPCOR Water Services Discussion, meeting on July 14, 2014.
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## 1.4 Abbreviations Used

The following abbreviations have been used throughout the report.

ADD	Average Day Demand
AC	Asbestos Cement
BDD	Base Day Demand (Typical Indoor Winter Water Usage)
ca	Capita (Person)
CARL	Current Annual Real Losses
CI	Cast Iron Water Main
COM	Commercial
DI	Ductile Iron Water Main
EPCOR	EPCOR Water Services
EFC	EPCOR French Creek
GD	Geodetic Datum
ha	Hectare
HGL	Hydraulic Grade Line
HP	Horsepower
ICI	Industrial, Commercial and Institutional
ILI	Infrastructure Leakage Index
IND	Industrial
INST	Institutional
KWL	Kerr Wood Leidal Associates Ltd.
MDD	Maximum Day Demand
MF	Multifamily
ML	Megalitre ( $10^6$ L)
MLD	Megalitre per Day
PE	Population Equivalent
PHD	Peak Hour Demand
PRV	Pressure Reducing Valve
PRS	Pressure Reducing Station
RES	Residential
SCADA	Supervisory Control and Data Acquisition
SD	Seasonal Demand (Irrigation Demand on Max Day; $BD + SD = MDD$ )
SF	Single Family
TDH	Total Dynamic Head
TWL	Top Water Level
UARL	Unavoidable Annual Real Losses
VFD	Variable Frequency Drive
VIHA	Vancouver Island Health Authority
WTP	Water Treatment Plant





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## Section 2

# Water Model Update



## 2. Water Model Update

### 2.1 Water Model History

The existing water model for French Creek was developed by Koers & Associates Engineering Ltd. in 2002. This model was updated by KWL and Stantec Consulting Ltd. in 2008 and 2011, respectively. The WaterCAD version 8 model (Current\_french\_v6.wtg) was provided by Stantec at the beginning of this project.

The 2011 WaterCAD model was updated and used in the analysis for this report. The name of the current water model is FC-2014-v18.wtg.

### 2.2 Existing Water System Description

The French Creek water system is owned and operated by EPCOR Water Services (EPCOR). Figure 2-1 shows the existing water system.

The major supply facilities in the existing EFC System include:

- 16 groundwater wells;
- Drew Road Water Treatment Plant (WTP);
- Drew Road Reservoirs;
- Drew Road Pump Station;
- Church Road Reservoirs; and
- Church Road Pump Station.

There are three pressure zones in the EFC water system; the Main Pressure Zone, Church Road Booster Zone, and Mercer Point Zone.

#### **79 m Main Pressure Zone**

The majority of the system is located in the Main Pressure Zone. All of the groundwater wells and reservoirs supply the Main Pressure Zone. The other two zones are supplied from the Main Pressure Zone.

Four wells pump directly to the Drew Road Complex (WTP and reservoirs). The WTP is capable of treating 28 L/s at full capacity. The WTP treats the water from the wells for iron and manganese in addition to chlorinating the water, and discharges to the three reservoirs at the site. The reservoirs (40 m TWL; 1300 m<sup>3</sup> total capacity) are located adjacent to the WTP. The Drew Road Pump Station pumps water from the reservoirs to the Main Pressure Zone. The pump station discharge is set to maintain 420 kPa (60.9 psi, 79.9 m HGL) [19].

Eleven wells pump directly to the Church Road Reservoirs (79 m TWL, 2,654 m<sup>3</sup> total capacity). The water is chlorinated and flows from the Church Road Reservoirs by gravity to the distribution system via a 300 mm diameter main.

The French Creek Estates Well (Well R8-2) is located on Lee Road. The water from the well is chlorinated and pumped directly to the distribution system.

The 250 mm diameter main which runs under French Creek from Drew Road to Miller Road is modelled as open to reflect the intended operation of the system [19]. It is understood that a valve on this main is often closed to balance usage between the Church Road and Drew Road reservoirs.



### **168 m Church Road Booster Zone**

The Church Road Booster Zone is located south of the Church Road Reservoirs. The Church Road Booster Zone is supplied by the Church Road Pump Station. There are approximately five lots currently serviced in the Church Booster Zone. The pump station discharge is set to maintain 850 kPa (123 psi, 168.2 m HGL) [19].

### **61 m Mercer Point Zone**

The Mercer Point Zone is a private development serviced by the Main Pressure Zone via a pressure reducing valve station. This zone is located in the north west side of the system. There are approximately 20 lots in this development. The valve station includes a single 150 mm diameter PRV set to 550 kPa (80 psi, 61.3 m HGL)<sup>1</sup>.

## **2.3 2014 Water Model Updates**

The following changes were made to the model for this study:

- Updated volume of Church Road Reservoirs to 2,654 m<sup>3</sup>, based on a total storage volume of 3,954 m<sup>3</sup> [8], and Drew Road Reservoir volume of 1,300 m<sup>3</sup> [5];
- Changed pipe with “Ductile Iron” material type to material type “Unknown” with C Factor of 110 [19]<sup>2</sup>;
- Updated diameters to reflect actual inside diameters, based on pipe material;
- Updated demands as described in Section 4;
- Updated well capacities as described in Section 8.1; and
- Drawings of new subdivisions construed since 2011 were provided by EFC. A summary of the new water mains added to the model is included in Table 2-1.

<sup>1</sup> As per model setting in model delivered to KWL.

<sup>2</sup> EPCOR French Creek staff indicated that there was no ductile iron pipe in the system. Existing pipe is likely asbestos cement; ductile iron was likely default setting in model construction.

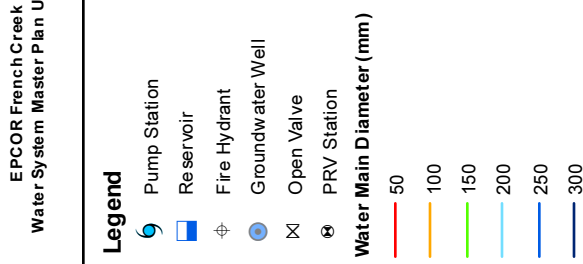
**Table 2-1: New Water Mains**

Project Name	Drawing Reference	Project Completion Date
Subdivision of 516 Wembley Road	L-722-02-02-07	2011
Subdivision of 564 Wembley Road	L-845-01-07-05	2012
38 Lot Subdivision Lowry Road	120-03-12 sheet 12 to 18	2013
Subdivision of 702 & 714 Wembley Road and 916 Island Highway West	L-722-03-04-05	2012
20 Lot Subdivision Prospect Pointe Drive	120-02-1	2013
4 Lot Subdivision Wright Road	190-02-1	2011
2 Lot Subdivision Woodland Drive	218-01-1	2011
3 Lot Subdivision Johnstone Road	206-01-1	2011
French Creek Landing	0224-01-01	2012

For a detailed description of all model updates please refer to the Model Log included in Appendix A.

## 2.4 Model Validation

Model validation and calibration (field measurement of pressures and flows) is not included in the scope of this report.



Our Engineers' fees are based on the 2015-2016 Revenue Requirement and Rates Application. Any use of the information contained herein is at the user's risk. The user acknowledges that the information is for informational purposes only and is not to be used for any other purpose.

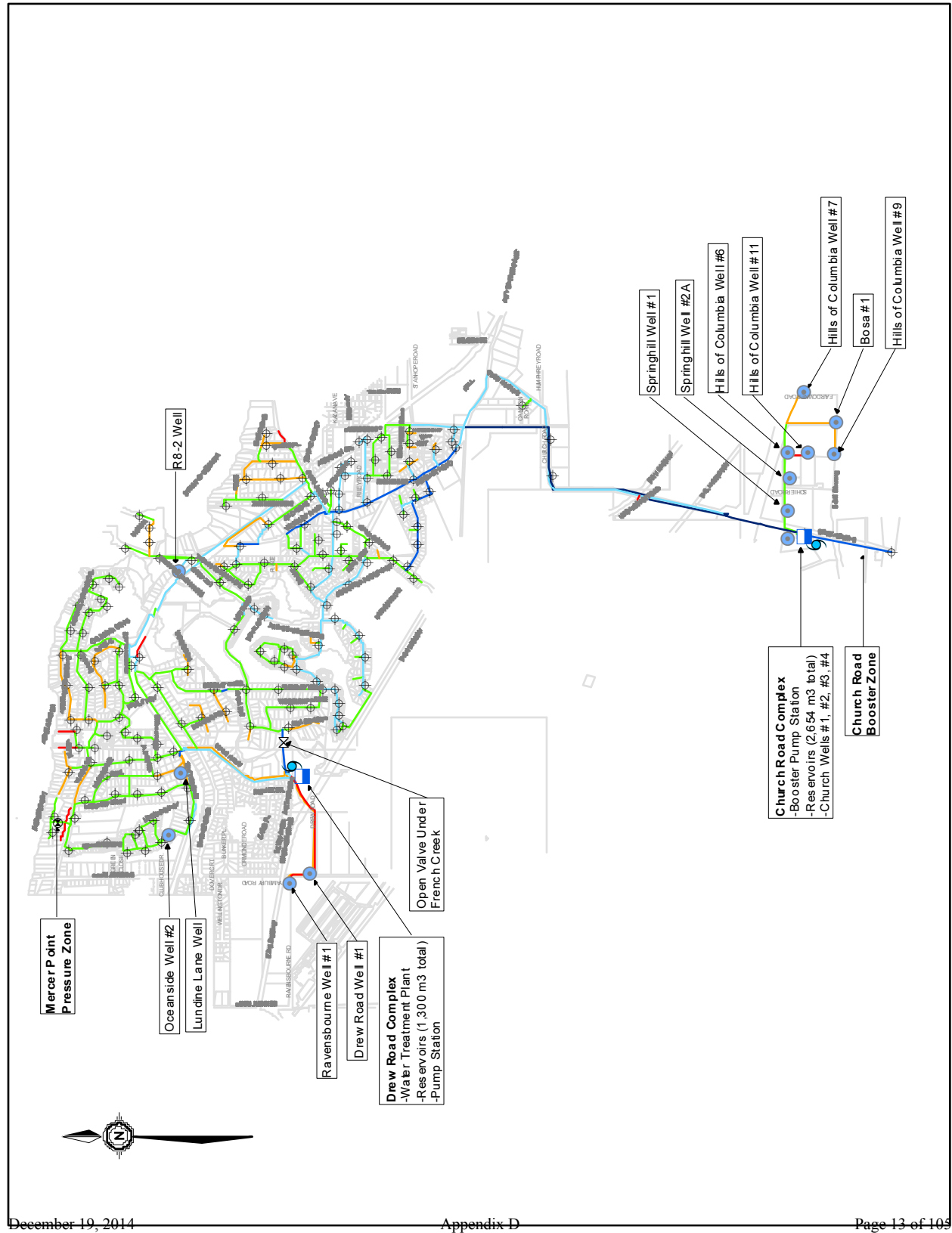
Not to Scale

Project No.  
747.009

Date  
October 2014

## Existing Water System

Figure 2-1





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## Section 3

# Previously Recommended Projects



### 3. Previously Recommended Projects

Various studies have been completed for the French Creek water system. Past reports available for review include:

- Kerr Wood Leidal Associates Ltd., *EPCOR French Creek, Water System Assessment*, April 2008;
- EPCOR Water (West) Inc., *French Creek Resource Plan*, September 2009;
- Stantec Consulting Ltd., *EPCOR French Creek, French Creek Growth Assessment Study*, October 2011; and
- BC Groundwater Consulting Services Ltd., *Summary of Well Testing Results in Support of Source Water Approvals (VIHA): New South Region Wells, DRAFT*, June 20, 2014.

The scope of each report and projects identified are summarized in the sections below.

#### 3.1 EPCOR French Creek Water System Assessment, April 2008.

A report titled *EPCOR French Creek Water System Assessment* was prepared by Kerr Wood Leidal Associates in April, 2008. The scope of the report included:

- An update of the water model originally developed by Koers & Associates Engineering Ltd. in 2002;
- Modelling and results figures for various operational strategies in which isolation valves on pipes on the Old Island Highway and under French Creek are open/closed;
- Review of options for lowering pressures in the Columbia Beach area;
- Review pipe head losses and provide options for increasing pressure and fire flows in deficient areas;
- Review reservoir fire storage requirements and available storage; and
- Review hydrant spacing.

Projects identified in this report include:

2008-1. New pressure zone fed by PRV stations to reduce the pressure in the Columbia Beach area.

2008-2. New pressure zone in the Church Road, Ackerman Road, Wembley Road and Esslinger Road area fed by a new reservoir (with a higher HGL) or a booster pump station to increase available pressure;

2008-3. Upsize or loop mains in the Lowrys Road area to increase available fire flow (*complete*);

2008-4. Upsize the 100 mm diameter water main on Windward Way to increase available fire flow to the Windward Way, Seaward Way, Oceanside Dr, Leeward Way, and Lundine Lane area;

2008-5. Upsize the 100 mm diameter water main on Glenhale Crescent to increase the available fire flow on Cavin Road and Ocean Place;

2008-6. Upsize the 100 mm diameter water main on Admiral Tyron Boulevard to increase the available fire flow in this area;

2008-7. Loop water main between Pintail Drive and Black Brank Drive to increase available fire flow;

2008-8. Install a backup power supply at Drew Road Pump Station or install additional capacity at Church Road Reservoirs to provide required storage capacity in the event of a power failure (*complete*); and



2008-9. Approximately 30 additional hydrants are required to meet Parksville Water Distribution Design Criteria.

### 3.2 French Creek Resource Plan, September 2009

A report titled *French Creek Resource Plan* was prepared by EPCOR Water (West) in September, 2009. The report was requested by the British Columbia Comptroller of Water Rights Office. The intent of the report was to review the capabilities of the existing water utility system, and the scope included:

- Customer demand;
- Raw water supply;
- Treatment plant capacity;
- Treated water storage; and
- Transmission system capacity.

Projects identified in this report include:

- 2009-1. Water loss study to decrease unaccounted for water (*complete*);
- 2009-2. Additional water supply capacity to accommodate growth;
- 2009-3. Water conservation program to reduce peak hour demands (*complete*);
- 2009-4. Review of the current rate schedule with the British Columbia Comptroller of Water Rights (*complete*);
- 2009-5. Abandon and decommission the Lomedunn and Imperial wells and replace with additional wells;
- 2009-6. Additional 650 m<sup>3</sup> of storage capacity (location subject to detailed study) (*complete*);
- 2009-7. New pressure zone to reduce the pressure in the Columbia Beach area;
- 2009-8. New pressure zone in the Church Road, Ackerman Road, Wembley Road and Esslinger Road area fed by a new reservoir (with a higher HGL) or a booster pump station to increase available pressure;
- 2009-9. Upsize / loop water mains in in several areas of French Creek to improve available fire flow;
- 2009-10. Flush and continuously operate the 250 mm diameter water main crossing of French Creek adjacent to the Drew Road site; and
- 2009-11. Install master meters and SCADA monitoring at both reservoir locations to assist in evaluating the capacity of the water system (*complete*).

### 3.3 French Creek Growth Assessment Study, October 2011

A report titled *French Creek Growth Assessment* was prepared by Stantec Consulting Ltd. in October, 2011. The scope of the report included:

- Review of OCP projections;
- Required system upgrades for planned developments;
- Required system upgrades for current development; and
- Recommended water conservation projects;





Projects identified in this report include:

- 2011-1. Main Pressure Zone division including a new pump station, 3 PRV stations, and 2 isolation valves;
- 2011-2. Water main upgrade on Drew Road including 1,560 m of 300 mm diameter main and 18 hydrants, to provide 223 L/s fire flow to a future development at 585 Columbia Drive (RS5 zoning);
- 2011-3. Water main upgrade from 585 Columbia Drive to Lee Road including 1,260 m of 300 mm diameter main and 14 hydrants to provide 223 L/s fire flow to a future development at VIP60349 (RS5 zoning);
- 2011-4. Water main upgrade from 585 Columbia Drive to 1129 Island Highway West including 410 m of 300 mm diameter main and 5 hydrants to provide 300 L/s fire flow to a future development at 1129 Island Highway West (CM6 zoning);
- 2011-5. Water main upgrade from Ackerman Road to 1129 Island Highway West including 2,100 m of 300 mm diameter main and 23 hydrants to provide 300 L/s fire flow to a future development at 1129 Island Highway West (CM6 zoning);
- 2011-6. Water main upgrade from Ackerman Road to 890 Wembley Road including 1,630 m of 300 mm diameter main and 18 hydrants to provide 300 L/s fire flow to a future development at 890 Wembley Road (CM2 zoning);
- 2011-7. Water main upgrade from Ackerman Road to 899 Island Highway West including 750 m of 300 mm diameter main and 8 hydrants to provide 300 L/s fire flow to a future development at 899 Island Highway West (CM2 zoning);
- 2011-8. Water main upgrade from Wembley Road down Riley Road to 879 Island Highway West including 425 m of 250 mm diameter main and 4 hydrants to provide 187 L/s fire flow to a future development at 879 Island Highway West (CM4 zoning);
- 2011-9. Lundine Lane supply main upgrade including 607 m of 150 mm diameter water main between the Oceanside Well #2 chlorination station and Drew Road to accommodate additional supply well capacity (*partially complete*);
- 2011-10. Drew Road WTP capacity upgrade and installation of associated pumping redundancies to accommodate increased supply capacity (*complete*);
- 2011-11. Drew Road Pump Station upgrades including correction of existing hydraulic restrictions and remediation of pumping operations to include VFD operation;
- 2011-12. Drew Road WTP expansion increase to provide future demands;
- 2011-13. Twin Church Road 300 mm diameter trunk main to provide supply redundancy;
- 2011-14. Evaluate potential for bulk water supply from the Arrowsmith Dam to provide future demands;
- 2011-15. Growth assessment study to assess future demands (*complete*);
- 2011-16. Upgrade all 100 mm diameter main leading to a hydrant to reduce velocities below 3.5 m/s during fire flow scenarios;
- 2011-17. Water main upgrade on Drew Road including 1,560 m of 300 mm diameter main and 18 hydrants to provide 150 L/s fire flow to existing commercial developments at 1395 Island Highway West and 1580 Sunrise Drive.



- 2011-18. Install an additional 47 hydrants to meet MMCD hydrant spacing design guidelines.
- 2011-19. Dalmatian Drive residential service upgrade to replace failing service lines to reduce leakage;
- 2011-20. Leak detection program to reduce system leakage;
- 2011-21. AWWA water conservation report (*complete*); and
- 2011-22. Church Road upgrades including the installation of a control valve, magnetic flow meter to monitor well production, maintenance shed, and an exterior coating on Church Road Reservoir #3 and #4 and all 3 Drew Road reservoirs to reduce leakage.

### 3.4 Summary of Well Testing Results in Support of Source Water Approvals (VIHA): New South Region Wells, DRAFT, June 2014

A report titled *Summary of Well Testing Results in Support of Source Water Approvals (VIHA): New South Region Wells, DRAFT*, was prepared by BC Groundwater Consulting Services Ltd. in June, 2014. The report was written for the purpose of Source Water Approval of three new wells.

The report indicates that three new well were successfully constructed in the south region of French Creek and can be put into operation pending Source Water Approval from VIHA. The characteristics of the new wells according to the report are as follows:

- 2014-1. Springhill Road No. 2A Replacement Well (RW<sub>S1</sub>). Testing results indicate the well can operate a peak rate of 7.4 L/s;
- 2014-2. Springhill Road Additional Capacity Well (AC<sub>S1</sub>). Testing results indicate the well can operate at a peak rate of 7.9 L/s; and
- 2014-3. Church Road South Test Well (TW<sub>S1</sub>). The well was constructed to determine if a deeper regional aquifer is located north of the existing well fields. Testing results indicate the well can operate at a peak rate of 1.6 L/s



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## Section 4

# Existing Demands



## 4. Existing Demands

### 4.1 Source Flow Data

Water demands have been calculated using monthly well flow reports and service meter data provided by EFC. Table 4-1 summarizes the monthly source flow volumes for 2012 and 2013.

**Table 4-1: Monthly Source Flow Totals**

Month	Total Volume Pumped (ML)	
	2012	2013
January	35.7	33.3
February	31.0	31.2
March	34.7	30.4
April	30.8	42.3
May	58.8	52.1
June	63.2	48.4
July	85.2	97.9
August	93.1	81.5
September	69.1	49.6
October	44.1	33.7
November	26.8	28.3
December	37.6	35.9
<b>Total in Year</b>	<b>609.9</b>	<b>564.8</b>
ADD (MLD)	1.7	1.5
ADD (L/s)	19.3	17.9
BDD (MLD)	1.1	1.1
BDD (L/s)	12.9	12.2
MDD (MLD)	3.6	4.0
MDD (L/s)	41.8	45.9
<b>Data Source:</b> EPCOR French Creek Water Inc., 2012 and 2013 Flow Records.		

The base day demand (BDD) is the average demand over the winter months (January, February and March), which corresponds to the metered billing period.



The 2012 and 2013 maximum day demands (MDD) occurred on August 5, 2012 and July 26, 2013, respectively. Historic MDDs are summarized in the table below.

**Table 4-2: Summary of Historic Maximum Day Demands**

Year	MDD		Date
	MLD	L/s	
2009	3.8	44.4	July 2
2010	3.7	42.3	August 12
2011	3.4	39.0	August 4
2012	3.6	41.8	August 5
2013	4.0	45.9	July 26
<b>Data Source:</b> Email dated July 14, 2014 from Brian Thorburn, EFC.			

As indicated in Table 4-2 2013 had the highest MDD on record (45.9 L/s).

## 4.2 Metered Water Usage

All of EFC's services are metered (1,746 meters as of June 2013). The Utility's metered water usage was provided by EFC from January 1, 2012 to December 31, 2013. The data received for July 1, 2013 to December 31, 2013 was erroneous and EFC staff were unable to correct the data: therefore this data was omitted from the summary table below.

**Table 4-3: Summary of Meter Water Usage**

Billing Period	Single Family		Multi-Family		Commercial		Vacant	Total	
	# of Meters	Usage (ML)	# of Meters	Usage (ML)	# of Meters	Usage (ML)	# of Meters	# of Meters	Usage (ML)
<b>2012</b>									
Jan 1 to Mar 31	1,645	57.0	14	5.3	37	13.0	0	1,696	75.4
Apr 1 to Jun 30	1,665	102.8	14	15.0	47	12.0	0	1,726	129.8
Jul 1 to Sep 30	1,661	167.2	14	29.9	47	18.2	0	1,722	215.4
Oct 1 to Dec 31	1,652	73.7	13	6.9	40	9.2	102	1,807	89.8
<b>2012 Total</b>		<b>400.7</b>		<b>57.1</b>		<b>52.5</b>			<b>510.4</b>
<b>2013</b>									
Jan 1 to Mar 31	1,665	56.1	13	5.7	40	8.2	0	1,718	70.0
Apr 1 to Jun 30	1,684	104.2	13	13.6	49	12.5	0	1,746	130.3
<b>Data Source:</b> EPCOR French Creek Water Inc., 2012 and 2013 Service Meter Flow Records.									



### 4.3 Unit Water Demands

Unit water demands are used to estimate the future water usage, and also to compare current usage to other jurisdictions. This section summarizes the estimated unit water demands for the EFC system.

#### Population Estimate

The EPCOR French Creek service population is estimated based on the number of single-family meters (1,684 meters as of June 2013) and the estimated number of multi-family residential customers (324 MFR customers). The estimated population is 4,418, assuming a 2.2 capita/dwelling.

In 2006, the estimated population was 4,024, which corresponds to a 1.3% growth rate.

#### Residential Base Day Demand

Residential indoor usage is referred to as the residential base demand, and is estimated based on the winter water use. The residential base day demand for EFC was calculated from the estimated population and the metered usage from January 1 to March 31. Table 4-4 summarizes the base day demand unit rates for single family and multi-family residential.

**Table 4-4: Estimated 2013 Population and Residential Unit Rates**

Customer Class	Number of Units <sup>3</sup>	Estimated Population <sup>4</sup>	Meter Usage (ML) <sup>5</sup>	Unit Rate (L/ca/day)
Single Family <sup>1</sup>	1,684	3,705	56.1	170.1
Multi-Family <sup>2</sup>	324	713	5.7	89.3
Total		4,418	61.8	157.0
Notes: 1) Assume includes Oceanside Strata Lots and all Single Family Residential Lots 2) Assume includes all strata lots, including Mercer Point, and the trailer park. 3) Based on # of Single family meters as of June 30, 2013, 2009 French Creek Resource Plan, and RDN Map ( <a href="http://www.rdn.bc.ca/cms.asp?wpID=419">http://www.rdn.bc.ca/cms.asp?wpID=419</a> ) property layer. 4) Population estimate is based on 2.2 capita per dwelling unit. 5) January 1 to March 31, 2013 metered usage				

The single-family base day demand unit rates are lower than most design criteria figures, however it is not considered un-realistic due to:

- Recent changes to the BC Building code;
- Success of water conservation incentives;
- French Creek's transient population; and
- Universal metering of the French Creek system.

The base demands are in line with benchmarks [15] for single family homes retrofitted with water efficient fixtures and appliances of 155.4 L/ca/d – 162 L/ca/d (1.8 - 2.4 cap/dwelling).

The multi-family residential base demand is much lower than expected. The low multi-family BDD could be attributed to a large transient population or a lower population density than assumed (i.e. 2.2 ca/dwelling), resulting in a smaller winter population than used in the above forecast.



For the purposes of this study it was assumed that single family and multi-family residential have a design base demand of 160 L/ca/day.

## ICI Base Demand

The 2013 ICI base demand was 8.2 ML (0.1 MLD), which is approximately 12% of the total usage for the same period. Based on the 160 L/ca/day (residential based demand) the ICI population equivalent (PE) is 587.

The estimated ICI lot area is 27.5 ha, therefore the ICI base demand unit rate is 21 PE/ha/day (3,360 L/ha/day)

## Seasonal Demand

Seasonal demand (SD) is the difference between the maximum day demand (MDD) and the base day demand (BDD), and is normally attributed to irrigation. To calculate the SD unit rate the total SD usage was divided by the estimated irrigation area. Table 4-5 summarizes the estimated irrigation area for the different customer classes.

**Table 4-5: Estimated Irrigation Area**

	SFR	MFR	ICI	Total
Lot areas (ha) <sup>1</sup>	183.0	96.7	27.5	307.2
% irrigated	45%	45%	10%	
Irrigated Area	82.3	43.5	2.7	128.5
Notes:				
1) SFR lot area was capped at 0.3 ha/lot				

The existing MFR consists of single-family homes or duplexes located on strata lots. The strata lots range in size:

- small strata lots - lots sizes of 136 to 315 m<sup>2</sup> with common irrigated area; and
- large strata lots - lot sizes of 850 to 2200 m<sup>2</sup>.

Based on the existing lot coverage for SFR and MFR, it was assumed that both customer classes irrigate approximately 45% of the total lot area. SFR lots were capped at 0.3 ha.

Based on the 2013 MDD of 45.9 L/s and the estimated irrigation area; the current irrigation rate was calculated to be 22,700 L/ha/day.



## Non-Revenue Water

Non-revenue water is the volume of water lost between the bulk water meters and the service meters. A summary of the bulk and service meter usage for 2012 is summarized in the table below.

**Table 4-6: Non-Revenue Water**

Flow Data	Annual Usage (ML/Year)	% NRW
Total Annual Usage (Source Meters)	609.9	
Total Annual Usage (Service Meters)	510.4	
Annual NRW	99.5	
% NRW of Total Demand		16.3%
% NRW of BD		25.8%
<b>Data Source:</b> EPCOR French Creek Water Inc., 2012 Bulk Meter and Service Meter Flow Records.		

For this study a NRW of 25.8% of BD was assumed for the system.

## 4.4 Existing Demand Summary

The existing demands for the system are summarized in Table 4-7. The existing demands were assigned on a lot-by-lot basis, based on current and OCP zoning.



Table 4-7: Existing Demand Summary

Base Demand	Base Demand Rate (L/ca/day)	IC	SF-RES	MF-RES	Total RES	Non-Revenue Water (NRW)	Total	Notes
Number of Meters		49	1,684	13	1,697		1,746	As of June 2013 read date.
Number of Residential Units			1,684	324	2,008			Estimated based on the number of meters, customer class, Regional District Maps and aerial imaging of the area.
Percentage of Total Meters		3%	96%	1%				
Base Demand (L/s)		1.1	6.9	1.3	8.2	3.2	12.5	Average of source flow records for January, February, March 2013. NRW calculated by comparing meter data to source flow data.
Percentage of Total Metered Usage		12%	74%	14%	88%			Percentages based on meter consumption information.
Base Demand Rate (L/ca/day)		160.0						
Population/Population Equivalents		587	3,705	713	4,418		5,005	Based on the number of units at 2.2 cap/dwelling (Based on 2011 census Data for Electoral Area G).
Estimated Irrigation Area (ha)		2.7	82.3	43.5	125.8		128.5	
Seasonal Demand (L/s)		0.7	21.7	11.4	33.1		33.8	Additional seasonal demand on maximum demand day (Based on 2013 MDD).
Percentage of Seasonal Demand		2%	64%	34%	98%			
Maximum Day Demand (L/s)		1.8	28.5	12.7	41.2	3.2	46.3	Base demand plus seasonal demand.



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## Section 5

# Water Conservation Study



## 5. Water Conservation Study

### 5.1 Water Use

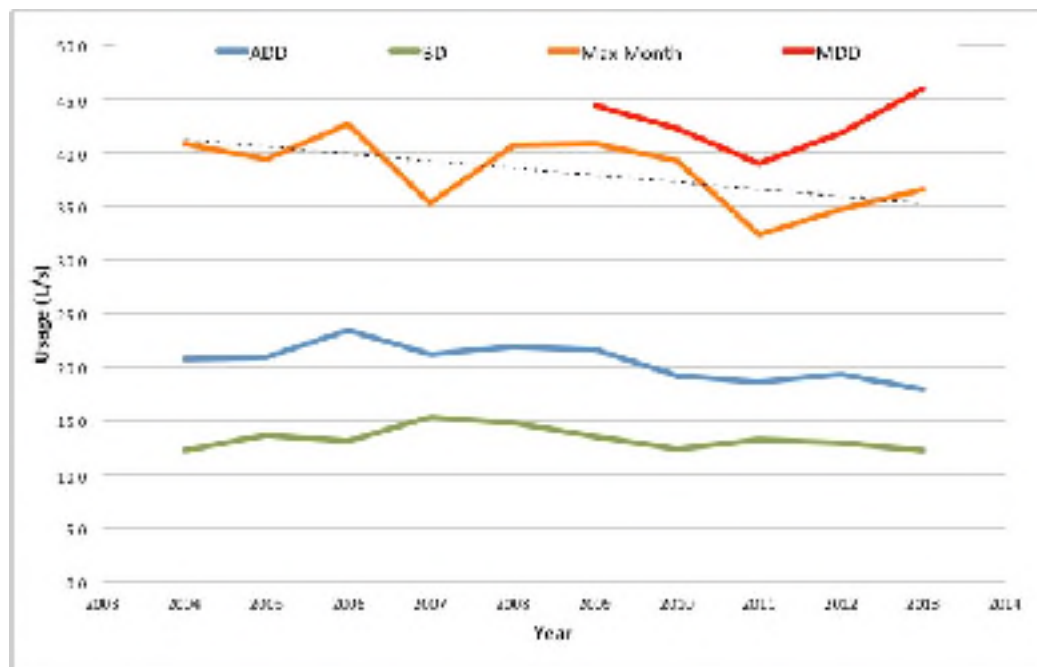
#### Historical Water Use

EFC's historical water use is summarized in the table and figure below.

**Table 5-1: Historical Water Usage (Bulk Meters)**

Year	ADD (L/s)	BD (L/s)	Max. Month (L/s)	MDD (L/s)
2004	20.7	12.3	40.8	
2005	20.9	13.7	39.4	
2006	23.5	13.1	42.6	
2007	21.3	15.4	35.3	
2008	21.9	14.8	40.7	
2009	21.6	13.5	40.8	44.4
2010	19.2	12.4	39.2	42.3
2011	18.6	13.2	32.4	39.0
2012	19.3	12.9	34.8	41.8
2013	17.9	12.2	36.6	45.9

**Data Source:** Bulk Meter usage provided by EPCOR French Creek for 2009 to 2013 data, and 2009 French Creek's Resource Plan from 2004 to 2008 data



**Figure 5-1: Historical Water Usage (Bulk Meters)**



As shown in Figure 5-1 the ADD and BDD have remained fairly constant over the last 10 years, even with an average population growth rate of 1.3% per year (2006 to 2013). The max month demand is also trended downward during the same period.

### Other Jurisdictions

Water usage for EFC and other jurisdictions are summarized in Table 5-2 below.

**Table 5-2: Comparison of Annual Water Usage**

Jurisdiction	Average Annual Water Consumption (L/ca/d)	
	Total All Uses	Residential Use Only
<b>EPCOR French Creek<sup>1</sup></b>	<b>322</b>	<b>289</b>
NanOOSE Bay Peninsula <sup>2</sup>	n/a	267
Englishman River <sup>3</sup>	n/a	390
RDN French Creek <sup>4</sup>	n/a	263
Metro Vancouver <sup>5</sup>	471	n/a
British Columbia <sup>6</sup>	606	353
Canada <sup>6</sup>	510	274
Canada – Utilities with Municipal Population between 2000 - 5000 <sup>6</sup>	712	385
<b>Data Source:</b> 1) Calculated from 2012 EFC meter data. 2) Regional District of Nanaimo, Water Service Area Annual Report 2012 – NanOOSE Bay Peninsula Water System, June 2013 3) Regional District of Nanaimo, Water Service Area Annual Report 2012 – Englishman River Community Water System, June 2013 4) Regional District of Nanaimo, Water Service Area Annual Report 2012 – French Creek Water System, June 2013 5) Metro Vancouver Water Consumption Statistics Report, 2011 6) Environment Canada, 2011 Municipal Water Use Report, 2009 Statistics.		

The EFC water use is in line with the other local water service areas, and generally lower than provincial and national water use rates.

## 5.2 Non-Revenue Water (NRW)

The American Water Works Association (AWWA) and the International Water Association (IWA) has formulated an approach to conducting water audits and calculating non-revenue water (NRW) [1]. Non-revenue water is the difference between the system input volume (total source flow), and the total revenue water (metered water), and is comprised of unbilled authorized consumption, and water losses (Real & Apparent).

The historical NRW for EFC are summarized in the table below. As indicated the total NRW has ranged from 12% to 19% of total annual water consumed.

**Table 5-3: Historical Non-Revenue Water**

Year	Bulk Meter ADD (L/s)	Metered ADD (L/s)	% NRW
2004	20.7	18.3	12%
2005	20.9	17.4	17%
2006	23.5	19.0	19%
2007	21.3	17.4	18%
2008	21.9	17.6	19%
2009	21.6	19.0	12%
2010	19.2	17.1	11%
2011	18.6	15.8	15%
2012	19.3	16.1	16%
2013	17.9		
<b>Data Source:</b> Bulk Meter usage and metered usage provided by EPCOR French Creek for 2009 to 2013 data, and 2009 French Creek's Resource Plan for 2004 to 2008 data <b>Note:</b> 1) % NRW is based on total annual water use.			

Environment Canada's 2011 Municipal Water Use Report indicates that the average NRW in 2009 across Canada was 13.3% of total annual water use.

## Leakage Assessment

Comparing the 2012 source flow data with the 2012 meter records, the NRW was calculated to be 99.5 ML (16.3% of total annual usage). To estimate the water loss percentage (Real & Apparent), allowances were made for unbilled authorized consumption (i.e. EFC's hydrant flushing program and meter under-reading). Table 5-4 shows the water loss calculation.

**Table 5-4: Estimated Water Loss Percentage (Real and Apparent)**

	Yearly Volume (ML)	Comments
NRW - Total	99.5	Estimate based on the 2012 source flow data compared to 2012 meter records.
Unidirectional Flushing Program	2.1	Estimated historical average consumption for the annual flushing program. Source EPCOR French Creek (2,100 m <sup>3</sup> /year).
Allowance for Meter Under-Reading	5.1	1.0% of annual service meter volume - Based on expected under registry of 0.1% per year of age of the meter. Meters are replaced at a rate of 100 meters/year therefore assume average age of meter is approximately 10 years.
<b>Water Loss (Real &amp; Apparent)</b>	<b>92.3</b>	<b>Includes leakage and service meter bypass. Current Annual Real Losses (CARL)</b>
Total Annual Usage (Source Meters)	609.9	
Water Loss % (Real & Apparent)	15.1%	



As indicated in the table above the percentage of water loss from the EFC system is estimated to be approximately 15.1% of the total annual usage.

The AWWA M36 indicates that there are a number of flaws in using the water loss percentage as a sole performance indicator. The flaws identified in the manual include:

- Practices to define the volume of water loss vary widely; therefore the calculation of this percentage has been widely inconsistent;
- The percentage indicator is highly sensitive to the level of customer consumption. For example, if consumption increases or decreases noticeably, the percentage can change with no actual change in water loss; and
- The percentage indicator does not segregate apparent and real losses,

Due to the above noted issues, the infrastructure leakage index for the EFC system was calculated to determine if the level of water loss from the system is within acceptable limits.

### Infrastructure Leakage Index

The Infrastructure leakage index (ILI) is a performance indicator used to benchmark water utilities. A water utilities ILI is the ratio of Current Annual Real Losses (CARL) to Unavoidable Annual Real Losses (UARL).

According to the section above, the CARL for EPCOR French Creek is 92.3 ML (2.9 L/s).

The UARL represents the theoretical low limit of leakage that can be achieved if all of the current best management practices are undertaken. The UARL calculation is based on leakage data gathered from well-maintained and well managed system. Equations for calculating expected UARL for individual system were developed and tested by the International Water Association's Water Loss Task Force in 2000 [9]. The equation is expressed as:

$$UARL \left( \frac{L}{day} \right) = (18 \times L_m + 0.8 \times N_c + 25 \times L_c) \times P$$

Where:

$L_m$  = water main length (km) = 46.9 km (Source: Water Model)

$N_c$  = Number of service connections = 1,746 (as of June 2013 read date)

$L_c$  = Total length of service connections (km) = 8.7 km (assumed average service connection length estimated at 5 m per connection)

$P$  = Average system pressure (m water column) = 54.3 m (estimated using average of all water model junctions at total system demand of 32 L/s).

The calculated UARL for the French Creek water system is 48.7 ML or 1.5 L/s. The Infrastructure leakage index (ILI) for the French Creek system based on 2012 data is **1.9**.

A worldwide comparison of water audit ILI results [9] showed that utilities had a median ILI of 2.94 and an average ILI of 4.38. ILI rates for well-managed systems (with established best management practices for lowering water losses) are typically around 2. Costs for lowering ILI rates below 2 increase exponentially.



### 5.3 Water Conservation Summary

The key findings from the previous sections regarding water use in EFC are:

- Single family indoor usage was found to be 170.1 L/ca/day, which is only slightly higher than benchmarks for single family homes retrofitted with water efficient fixtures and appliances (155.4 L/ca/day -162 L/ca/day);
- The residential average day demand was found to be inline with other local jurisdictions, and lower than the average use in BC and other utilities of similar size.
- Non-revenue water within the system was found to be 16.3% of the total usage, and
- The infrastructure leakage index (ILI) was calculated to be 1.8.

Based on the above findings, it can be assumed that the majority of the single-family homes have already been retrofitted with water efficient fixtures and appliances and residents are observing the current sprinkling restrictions. Based on these assumptions, water conservation strategies targeting indoor and irrigation usage may produce limited results, and therefore are not recommended at this time.

Non-revenue water expressed as a percentage of total use (16%) was found to be slightly above the national average (13%). However this is primarily due to total use being low rather than NRW being high. The ILI of 1.9 indicates system leakage is acceptable and not economically viable to reduce much further.. Due to costs associated with reducing the ILI rate, it is not recommended that EFC start any new projects to reduce water loss, but it is recommended that EFC complete the projects previously identified. The projects previously identified by EFC are:

- Dalmatian Drive Residential Service Upgrades – EFC identified 50 service connections along Dalmatian Drive that are corroded and pitted. These water services are a known cause of water loss; therefore replacement of these service connections should be completed.
- Leak Detection Program – In 2006 EFC conducted a leak detection assessment on approximately 60% of the system. It is recommended that this project be completed, so that EFC has a good understanding of its existing system losses, and to determine if additional savings can be achieved.
- Church Road Reservoir Upgrades – The existing reservoirs are cracked allowing water to infiltrate into the reservoirs and leak from the reservoirs. Lining of these reservoirs should be completed to mitigate potential health concerns, and also to reduce water loss from the reservoir.
- Geotechnical Study for Drew Road Reservoirs – Leakage from Drew Road Reservoir has been identified; this project would investigate the extent of the leakage, to determine if further remediation is warranted.

In addition to the above projects, EFC should continue to support the water conservation measures and programs adopted by the Regional District of Nanaimo and the BC building code.



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## Section 6

# Future Demands





## 6. Future Demands

### 6.1 Overall Growth Forecast

In 2009 EPCOR Water (West) Inc. completed a French Creek Resource Plan, which indicated population and lot projections to 2031. The Resource Plan was based on an estimated 2006 population of 4,024.

The Resource Plan estimated future populations based on a low growth projection (1%), OCP growth projection (2.7%), and a high growth projection (4%). The estimated population projections are indicated in the table below.

**Table 6-1: Population Projections**

Year	Population Projections		
	Low Growth (1%)	OCP Growth (2.7%)	High Growth (4%)
2006	4,024		
2031	5,161	7,833	10,727
<b>Data Source:</b> 2009 French Creek's Resource Plan			

By combining EFC meter records with the Electoral Area G OCP, the projected lot count for 2031 was estimated, and is summarized in the table below.

**Table 6-2: Projected Lot Count**

Location	Neighbourhood Residential	Multi-Family Residential	Total Residential	ICI	Total
2006 Existing	1,549	280	1,829	45	1,875
Future Area 'G' OCP Lots	835		835	28	863
Wembley Neighbourhood		356	356		
French Creek Harbour		963	963		
<b>Total Future</b>	<b>835</b>	<b>1,319</b>	<b>2,154</b>	<b>28</b>	<b>2,181</b>
<b>Total Serviced Lots</b>	<b>2,384</b>	<b>1,599</b>	<b>3,983</b>	<b>74</b>	<b>4,027</b>
<b>Data Source:</b> 2009 French Creek's Resource Plan					

Based on the OCP zoning, some of the "Future Area 'G' OCP lots" were allocated to Multi-family residential, the assumed future residential lot allocation and population is summarized in Table 6.3.



**Table 6-3: Future Residential Lot Count and Populations**

Location	Neighbourhood Residential	Multi-Family Residential	Total Residential	Estimated Population <sup>1</sup>
2006 Existing	1,549	280	1,829	4,024
Future Area 'G' OCP Lots	470	365	835	1,837
Wembley Neighbourhood		356	356	783
French Creek Harbour		963	963	2,119
<b>Total Future</b>	<b>470</b>	<b>1,684</b>	<b>2,154</b>	<b>4,739</b>
<b>Total Serviced Lots</b>	<b>2,019</b>	<b>1,964</b>	<b>3,983</b>	<b>8,763</b>
Note: 1) Based on 2.2 capita/dwelling				

## 6.2 Industrial, Commercial and Institutional (ICI) Growth

Currently commercial usage accounts for 12% of overall system base demands. It has been assumed that the ICI usage will continue to form the same percentage of the total system demands.

## 6.3 Future Water Demands

Future water demands were calculated based on the following assumptions:

- Residential Base Demand = 160 L/ca/day;
- Irrigation Rate = 22,700 L/ha/day;
- Population per dwelling = 2.2 Cap/dwelling;
- ICI usage remains 12% of total usage;
- NRW remains at 25.8% of Base Day Demand;
- Irrigated Lot Areas:
  - SFR – lot area is capped at 0.3 ha, and 45% of lot is irrigated,
  - MFR – 45% of the lot is irrigated, and
  - ICI – 10% of the lot is irrigated.

The projected water demands for the EFC water service area are summarized in the table below.

**Table 6-4: Projected Water Demands**

Demand Scenario	Demands (L/s)					
	SFR	MFR	Total Residential	ICI	NRW	Total
Existing (2013)						
Base Demand	6.9	1.3	8.2	1.1	3.2	12.5
Seasonal Demand	21.7	11.4	33.1	0.7		33.8
MDD	28.5	12.7	41.3	1.8	3.2	<b>46.3</b>
Future (2031)						
Base Demand	9.3	6.9	16.2	2.2	6.4	24.8
Seasonal Demand	24.3	11.4	35.7	0.8		36.5
MDD	33.6	18.3	51.9	3.0	6.4	<b>61.3</b>

The forecast shows MDD water demands not increasing at the same rate as population growth. This is entirely related to the forecasted densification within the service area which leads to only a marginal increase in irrigated area and hence seasonal demands.

Future demands were allocated on a lot-by-lot basis, based on the existing and OCP zoning.



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## Section 7

# Design Criteria



## 7. Design Criteria

Criteria from the Master Municipal Construction Document (MMCD) Design Guideline Manual were used to evaluate the system, and are summarized in the sections below.

### 7.1 System Pressure

The required system water pressures are summarized in the table below.

**Table 7-1: Required System Pressure**

Description	Required Pressure kPa (psi)
Minimum Pressure at Peak Hour Demand	300 kPa (44)
Maximum Allowable System Pressure	850 kPa (123)
Minimum Pressure Coinciding with Fire Flow and MDD	150 kPa (22)

### 7.2 Required Fire Flow

MMCD minimum fire flow values based on land use type are provided in the table below.

**Table 7-2: Required Fire Flow**

Land Use Type	Required Fire Flow (L/s)	Required Duration (hr)	Storage Volume (ML)
Single Family Residential	60	1.4	0.3
Apartments, Townhouses	90	1.9	0.6
Commercial	150	2	1.1
Institutional	150	2	1.1
Industrial	225	2.9	2.3

A maximum design fire flow for the system of 150 L/s (commercial / institutional) was used for evaluation of the storage capacity in the system. It is noted that previous studies have suggested higher fire flow requirements for existing developments; up to 220 L/s based on existing commercial land uses [7] and 302 L/s based on proposed commercial developments [8]. However, as the current user base does not include large commercial or industrial land uses, planning for this standard is cost prohibitive. If commercial or industrial developments with large fire flow requirements apply for service, significant additional storage and transmission upgrades may be required. These should be evaluated on a case-by-case basis (if such development materializes).

Establishing an appropriate fire flow requirement and fire storage volume is critical to planning for the system with significant capital cost impacts for associated additional projects relating to reservoir storage and transmission.

RDN has jurisdiction for identifying the required fire protection levels for EFC. Discussions with RDN indicated that for planning and design purposes, the MMCD minimum fire flow values are appropriate for both existing and future developments [20].



### 7.3 Fire Hydrant Spacing

The design guidelines for fire hydrant spacing in residential areas indicates that hydrants shall be:

- Not more than 150 m apart; and
- No more than 90 m from a building.

Additional hydrants may be needed where required fire flows are higher than 90 L/s.

### 7.4 Cost Basis

Class D opinions of probable cost have been developed for each recommended project. The cost opinions have been assembled with little or no site information and are based on the 2014 construction year. No allowance has been provided in these figures for escalation in subsequent years. The cost opinions in this report are indicative and have been prepared for long-term budgeting purposes only (i.e. 3-year plan). Unit prices are based on recent costs for similar tasks; however, no detailed quantity take-offs or equipment selection has been completed. Land acquisition costs (if applicable) are not included.

Costs for water main construction reflect typical scope for a distribution main with road restoration.

Costs for water main construction tasks were developed using the unit rates provided in the following table.

**Table 7-3: Water Main Unit Costs**

Item	Unit Cost <sup>1</sup>
150 mm Diameter Water Main	\$450/m
200 mm Diameter Water Main	\$530m
250 mm Diameter Water Main	\$590m
300 mm Diameter Water Main	\$710/m
400 mm Diameter Water Main	\$850/m
Hydrant	\$5,800/each
Tie-in	\$4,600/each
Note: 1) Unit costs do not include engineering, overhead / administration, contingency or taxes.	

The following allowances were added to the above unit rates to arrive at the total opinion of probable cost for each water main installation project:

- 20% engineering and construction management services;
- 10% overhead / administration; and
- 30% contingencies.

An estimate of \$650 per meter (including overhead and labour costs) was used to develop the annual cost for the meter replacement program.

Costs for the projects listed below were provided by EPCOR French Creek. The scope of these projects were not reviewed by KWL.

- Drew Road Pump Station Upgrades (Project ID 3). Quote from Park City Engineering Ltd. provided by EPCOR French Creek Staff [16].



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- Lundine Lane Raw Water Supply Upgrades (Project ID 13). Quote from Park City Engineering Ltd. provided by EPCOR French Creek staff [16].
- Well Completion Projects (Project ID 18, 19 and 20). Costs from Romela Bocancea [18].
- Well Rehabilitation (Project ID 21). Cost provided by EPCOR French Creek staff [16].
- Leak Detection Program (Project ID 24). Cost provided by EPCOR French Creek staff [16].
- Groundwater Exploration (Project ID 28). Cost provided by EPCOR French Creek staff [17].
- Decommission Abandoned Groundwater Wells (Project ID 29 and 30). Costs provided by EPCOR French Creek staff [17].
- Church Road Complex Upgrades (Project ID 31). Quote from Park City Engineering Ltd. provided by EPCOR French Creek staff [16].
- Church Road Reservoir Upgrades (Project ID 32). Quote from Park City Engineering Ltd. provided by EPCOR French Creek staff [16].
- Church Road Well Supply Main Upgrades (Project ID 33). Quote from Park City Engineering Ltd. provided by EPCOR French Creek staff [16].
- Geotechnical Study for Drew Road Reservoirs (Project ID 34). Cost provided by EPCOR French Creek staff [16].



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## Section 8

# System Evaluation





## 8. System Evaluation

### 8.1 Supply

The EFC water system is currently supplied by 16 groundwater wells. With the exception Well R8-2, all of the wells pump to either the Drew Road Reservoirs (via. the WTP) or the Church Road Reservoirs. Well R8-2 pumps directly to the distribution system.

French Creek has historically used a surface water intake to augment supply in the summer but this source is no longer in use and is physically disconnected from the water system.

The supply capacity of the groundwater wells are summarized in the table below.

**Table 8-1: Supply Capacity of Groundwater Wells**

Reservoir / Distribution System	Well Name	Well Capacity <sup>1</sup>	
		L/s	MLD
Church Road Reservoirs	Church Road Well #1	1.5	0.13
	Church Road Well #2	2.0	0.17
	Church Road Well #3	3.5	0.30
	Church Road Well #4	1.5	0.13
	Springhill Road #1	2.0	0.17
	Springhill Road #2A	1.5	0.13
	Hills of Columbia #6	1.4	0.12
	Hills of Columbia #7	2.1	0.18
	Hills of Columbia #9	1.5	0.13
	Hills of Columbia #11	2.0	0.17
	Bosa #1	3.5	0.30
Drew Road Reservoirs	Drew Road Well #1	4.0	0.35
	Ravensbourne Well #1	5.0	0.43
	Lundine Lane Well	1.0	0.09
	Oceanside Well #2	10.0	0.86
Distribution System	Well R8-2	3.0	0.26
<b>Total Capacity (all wells)</b>		<b>45.5</b>	<b>3.93</b>
<b>Supply Capacity (largest well out of service)</b>		<b>35.5</b>	<b>3.07</b>
Note: 1) Well capacity from Table 3 - Pumping Rate Recommendations (peak recommended pumping rate), last updated January 2010.			

The supply capacity for a water system must exceed the maximum daily demand to avoid water shortages during peak summer demands. In rating the supply capacity, it is normal practice to exclude the largest well to provide a level of safety to deal with maintenance emergencies that may occur during peak demands.



The existing system rated supply capacity from the groundwater wells with the largest well out of service is 35.5 L/s (3.07 MLD). The existing max day demand (46.3 L/s) and 2031 future max day demand (61.3 L/s) exceed the current rated supply capacity by 10.8 L/s and 25.8 L/s respectively.

Well completion projects to address this deficiency are described in Section 9.

## 8.2 Storage

Required storage capacity, existing available storage and deficiencies are summarized in the following table. Required storage capacity has been calculated according to MMCD design criteria as a guideline, the MMCD's formula is as follows:

$$\text{Required Storage} = A + B + C$$

Where:  $A = \text{Fire Storage (from Section 7.2)}$

$B = \text{Balancing Storage (25\% of Maximum Day Demand)}$

$C = \text{Emergency Storage (25\% of (A + B))}$

The following table shows the storage requirements for forecasted (future) demands.

**Table 8-2: Storage Assessment**

<u>Required Storage Capacity:</u>		
Balancing Storage:	61.3 L/s x 25%	= 1.32 ML
Fire Storage:	150 L/s for 2 hours	= 1.08 ML
Emergency Storage:	25% of above storage	= 0.60 ML
<b>Total Required:</b>		<b>= 3.00 ML</b>
<u>Available Storage Capacity:</u>		
	Church Road Reservoirs	= 2.65 ML
	Drew Road Reservoirs	= 1.30 ML
<b>Total Available:</b>		<b>= 3.95 ML</b>
<b>Deficiency:</b>		<b>0 ML</b>

Based on the design criteria described above, no additional storage capacity is required.

An assessment of the condition of the existing reservoirs is outside of the scope of this report. A previous study [8] recommended exterior coatings or liners on Church Road and Drew Road Reservoirs to reduce leakage. In addition, EPCOR French Creek staff have indicated that a geotechnical study is required to evaluate leakage for the Drew Road Reservoirs [16]. These projects (Project ID 32 and 34) are included in the recommended projects on Table 9-2.

## 8.3 System Pressure Results

Figure 8-1 and Figure 8-2 show peak hour pressure with existing and future maximum day demands, respectively.

Note that the supply capacity from the wells scheduled for summer 2015 completion (RW<sub>S1</sub>, AC<sub>S1</sub>, and TW<sub>S1</sub>) have been included in the 2031 future system model. In addition, the 250 mm diameter pipe that runs under French Creek is modelled as open for all scenarios.



Modelling indicates that there are existing peak hour pressure deficiencies (pressure is less than 44 psi) at the following locations:

- Ackerman Road, between Humphrey Road and Wembley Road;
- Wembley Road, between Esslinger Road and Church Road;
- Osprey Way, Prospect Pointe Drive and Crystal Court;
- Church Road, between Humphrey Road and Wembley Road; and
- Esslinger Road, between Wembley Road and Ackerman Road.

In the future demand scenario, the pressure deficiencies occur in the same area as well as spreading further along Lowrys Road and Wembley Road.

As noted in previous studies [7], the low pressures are due to the high elevation of the area (45 m to 51 m) compared to the pressure available from the supply system. The maximum static pressure available at this location is 79 m. Even with substantial pipe upgrades, the pressures in this area would be marginal, i.e. the problem is not undersized mains due to friction head losses but rather insufficient static head.

Two options described in Section 9.2 were developed to address the pressure deficiencies noted above.

EFC has expressed concerns in the past that the pressures in the Columbia Beach area are excessive. Figure 8-3 shows the maximum pressure in the system (i.e. during base demand flows). Maximum pressures in the system meet the design criteria (less than 123 psi). According to the water model results the pressures in the Columbia Beach area range between 100 psi and 111 psi.

## 8.4 Available Fire Flow Results

Figure 8-4 and Figure 8-5 show the available fire flow with existing and future maximum day demands, respectively. Lots are colour coded to indicate the fire flow required based on the design criteria for each land use as shown in Table 7-2.

Note that the supply capacity from the wells scheduled for summer 2015 completion ( $RW_{S1}$ ,  $AC_{S1}$ , and  $TW_{S1}$ ) have been included in the 2031 future system model. In addition, the 250 mm diameter pipe that runs under French Creek is modelled as open for all scenarios.

Modelling indicates that there are fire flow deficiencies in all areas zoned multifamily (90 L/s required) and institutional / commercial (150 L/s required). In addition, there are fire flow deficiencies in many of the single family areas (60 L/s required) including:

- Windward Way, Seaward Way, Oceanside Dr, Leeward Way, Pintail Drive, Mallard Drive and Lundine Lane;
- Admiral Tyron Boulevard, west of Columbia Drive;
- Admiral Tyron Boulevard, east of Viking Way;
- Breakwater Road, Glenhale Crescent, Ocean Place, Cavin Road;
- Mason Trail;
- Marine Circle;
- South end of Lowrys Road; and
- Manse Road.

Fire flow deficiencies are largely due to the low static pressure condition, and the location of the Church Road supply relative to the majority of the water users. The Drew Road Facility does not have sufficient capacity to provide fire flows of 150 L/s.



## 8.5 Fire Hydrant Spacing

Fire protection requirements are typically specified by the local fire authority. However, hydrant locations have been reviewed using various design criteria in previous reports. Based on 150 m maximum required spacing, the 2011 Stantec report [8] indicated that 47 additional hydrants were required. Since then, additional hydrants have been installed as new developments or redevelopment occurred. There are still areas that do not meet the design criteria for hydrant spacing.

To improve fire protection in the existing system, an annual hydrant installation program is recommended. This program should be coordinated and funded through the local fire authority. Hydrants should also be installed as water main upgrades, new development, and redevelopment occur.

## 8.6 Meter Replacement

There are 1,746 water meters in the EFC water system according to the 2013 meter records. An annual meter replacement program is currently in progress. EFC staff have indicated that approximately 100 meters per year are replaced, and there are 400 to 500 meters remaining that require replacement.

Meters continue to function as they age, but wear over time will cause them to under record resulting in loss of revenue. The optimum replacement age is dependant on local factors such as water chemistry, soil conditions, and usage. According to the AWWA M6 "Water Meters - Selection, Installation, Testing, and Maintenance" manual, a water supplier should develop a meter replacement program based on testing of a representative sample of residential meters that establishes an accuracy versus age relationship. EFC has not established a replacement relationship to-date; therefore until one is established it would be prudent to follow the industry standard, which is to replace meters on a 20-year cycle. It is recommended that EFC continue with the meter replacement program.

**EPCOR French Creek  
Water System Master Plan Update**

**Legend**

- Pump Station
- Reservoir
- Fire Hydrant
- Groundwater Well
- Open Valve
- PRV Station

**Peak Hour Pressure (psi)**

- < 35
- 35.1 - 40.0
- 40.1 - 44.0
- 44.1 - 50.0
- 50.1 - 90.0
- 90.1 - 123.0
- > 123

**Water Main Diameter (mm)**

- 50
- 100
- 150
- 200
- 250
- 300



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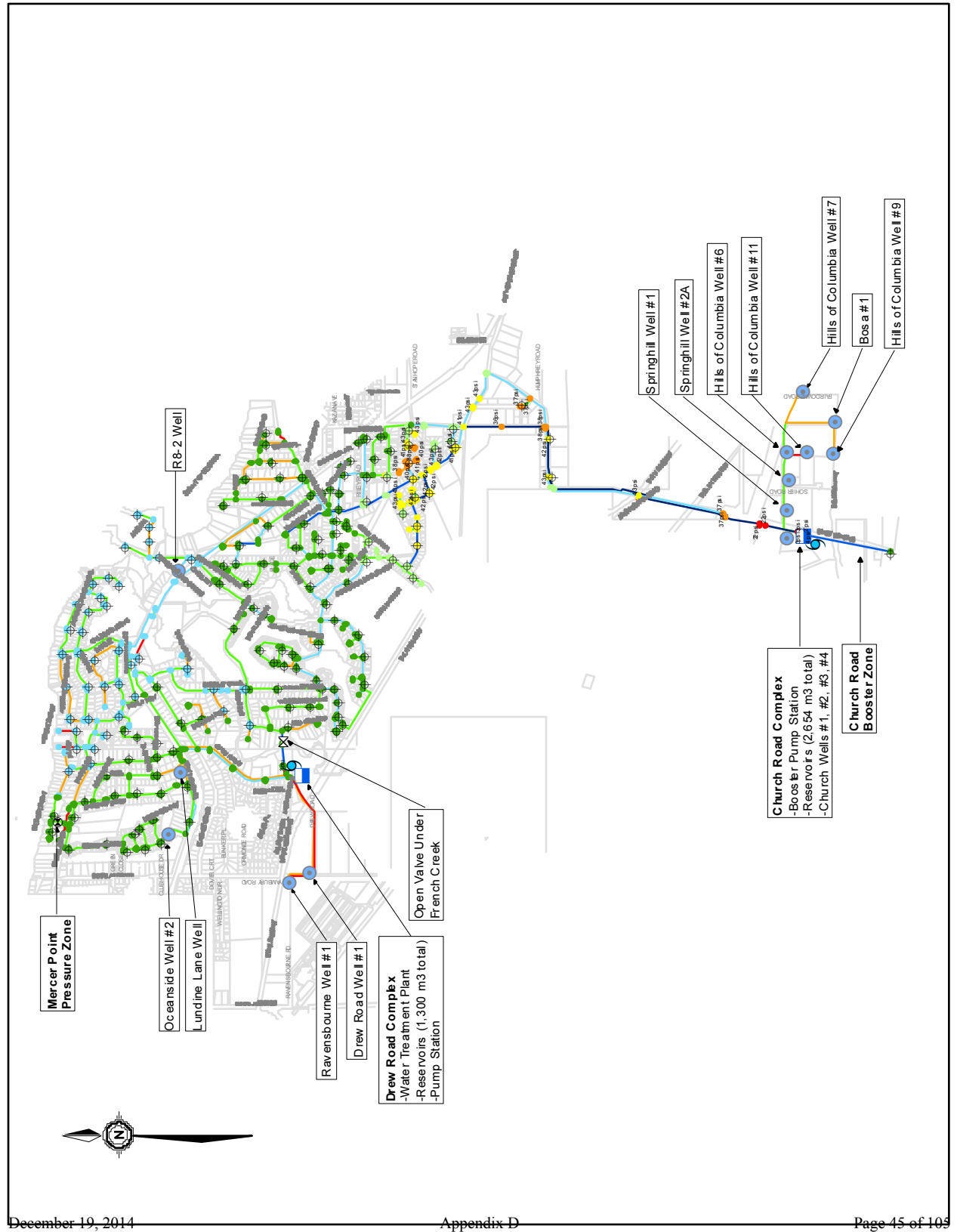
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Project No.  
747.009

Date  
October 2014

**Peak Hour Pressure  
2013 Max Day Demands**

**Figure 8-1**



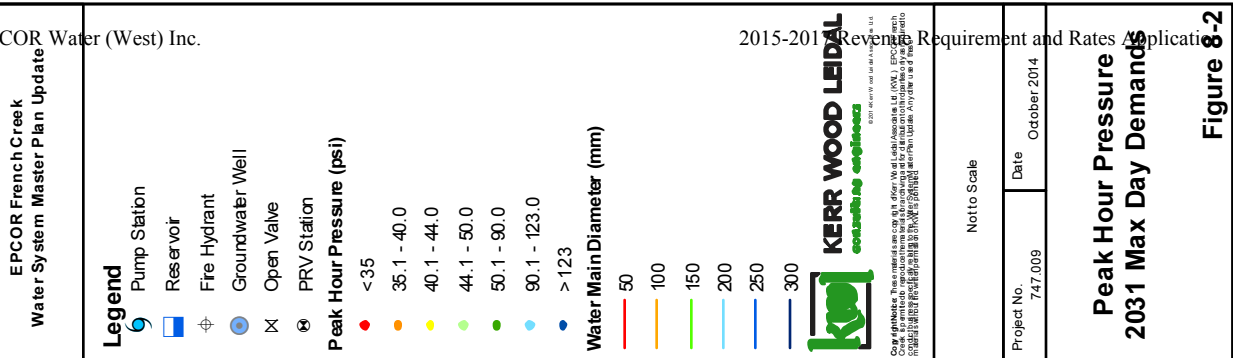
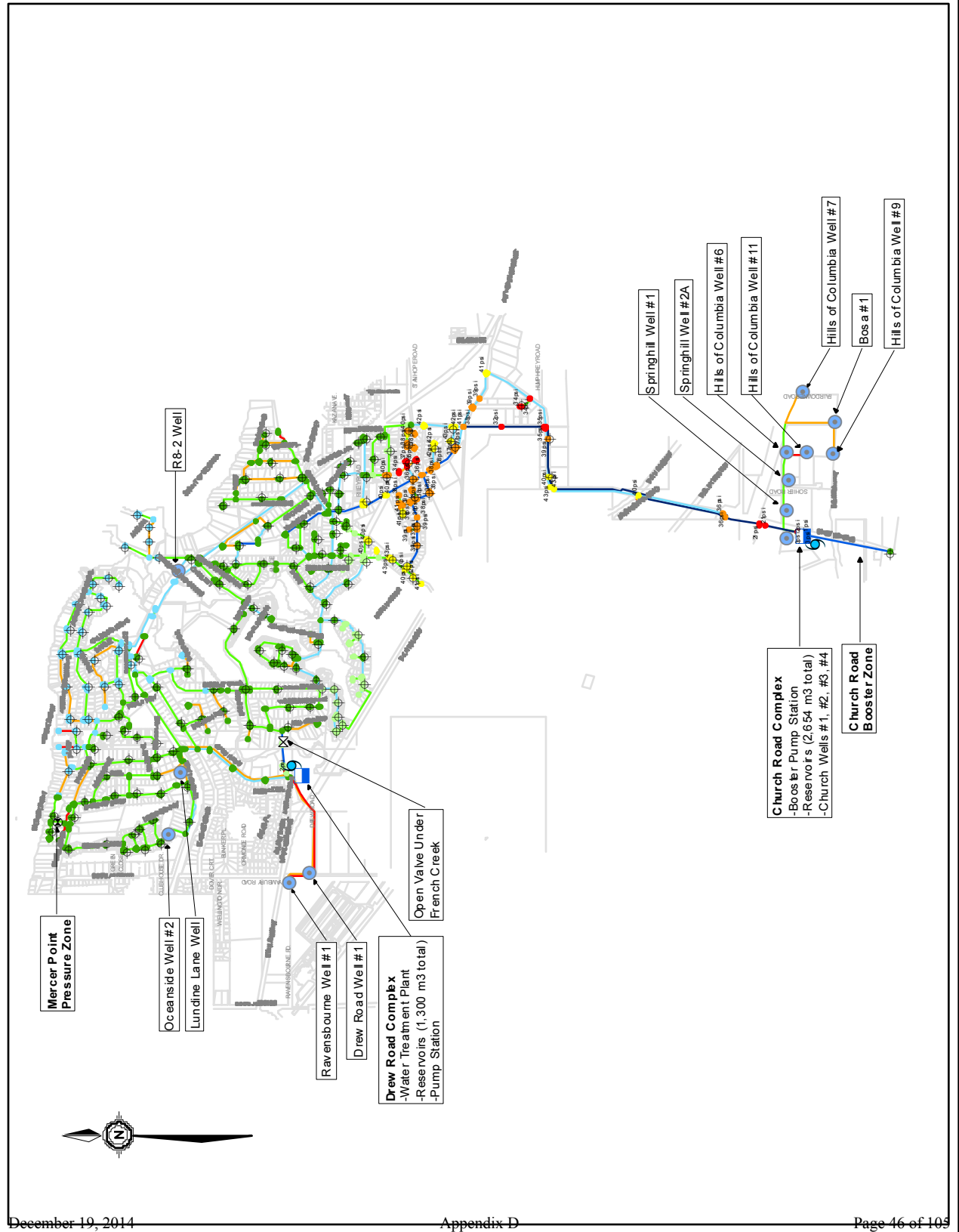


Figure 8-2



**EPCOR French Creek  
Water System Master Plan Update**

**Legend**

- Pump Station
- Reservoir
- Fire Hydrant
- Groundwater Well
- Open Valve
- PRV Station

**Peak Hour Pressure (psi)**

- <35
- 35.1 - 40.0
- 40.1 - 44.0
- 44.1 - 50.0
- 50.1 - 90.0
- 90.1 - 123.0
- >123

**Water Main Diameter (mm)**

- 50
- 100
- 150
- 200
- 250
- 300



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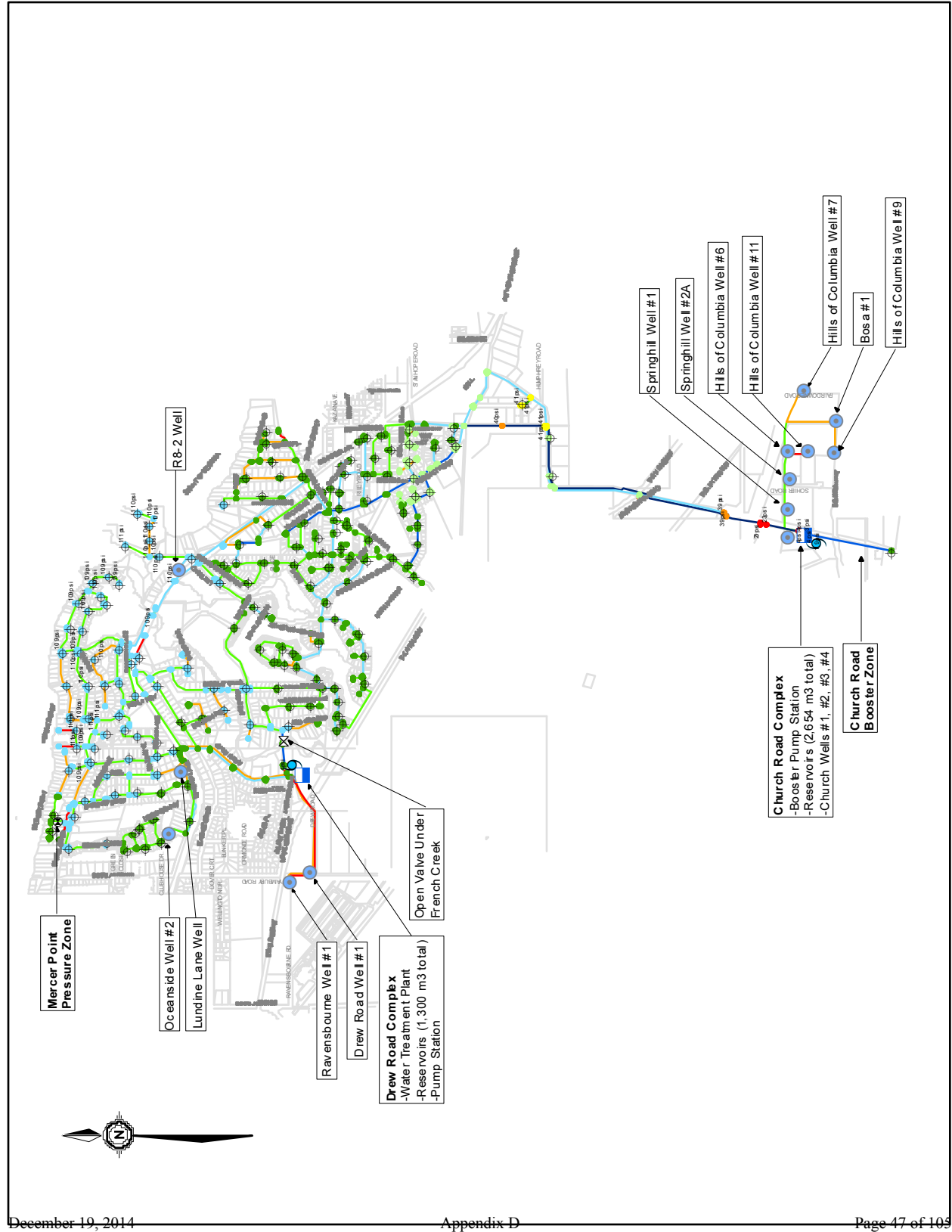
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Date  
October 2014

**Maximum Pressure  
2013 Base Day Demands**

**Figure 8-3**





- |   |              |
|---|--------------|
|  | Pump Station |
|  | Reservoir    |
|  | Fire Hydrant |
|  | Groundwater  |
|  | P RV Station |
|  | Open Valve   |

**Available Fire Flow (L/s)**

- < 50  
● 51 - 60  
● 61 - 90  
● 91 - 150  
● 151 - 225  
● > 225

Water Main Diameter (mm)

- 50

3.00  
Fire Flow Required (L/s)

- 0 L/s 90 L/s  
60 L/s 150 L/s



**KERR WOOD LEIDAL**  
consulting engineers

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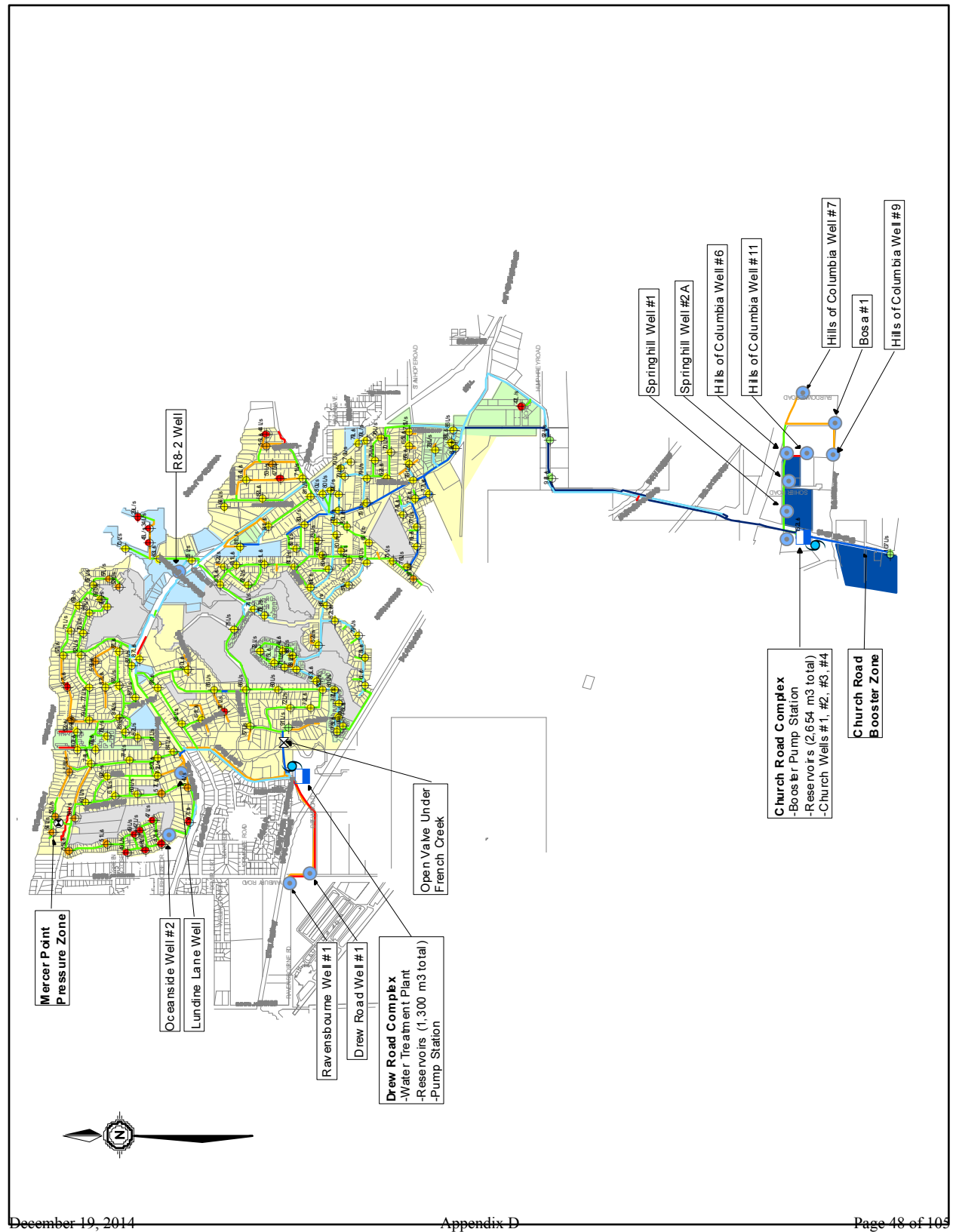
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Project No.

Date \_\_\_\_\_

**Available Fire Flow**  
**2013 Max Day Demand**

Figure 8-4





**EPCOR French Creek  
Water System Master Plan Update**

**Legend**

- Pump Station
- Reservoir
- Fire Hydrant
- Groundwater Well
- PRV Station
- Open Valve

**Available Fire Flow (L/s)**

- < 50
- 51 - 60
- 61 - 90
- 91 - 150
- 151 - 225
- > 225

**Water Main Diameter (mm)**

- 50
- 100
- 150
- 200
- 250
- 300

**Fire Flow Required (L/s)**

- 0 L/s
- 60 L/s
- 90 L/s
- 150 L/s
- 225 L/s



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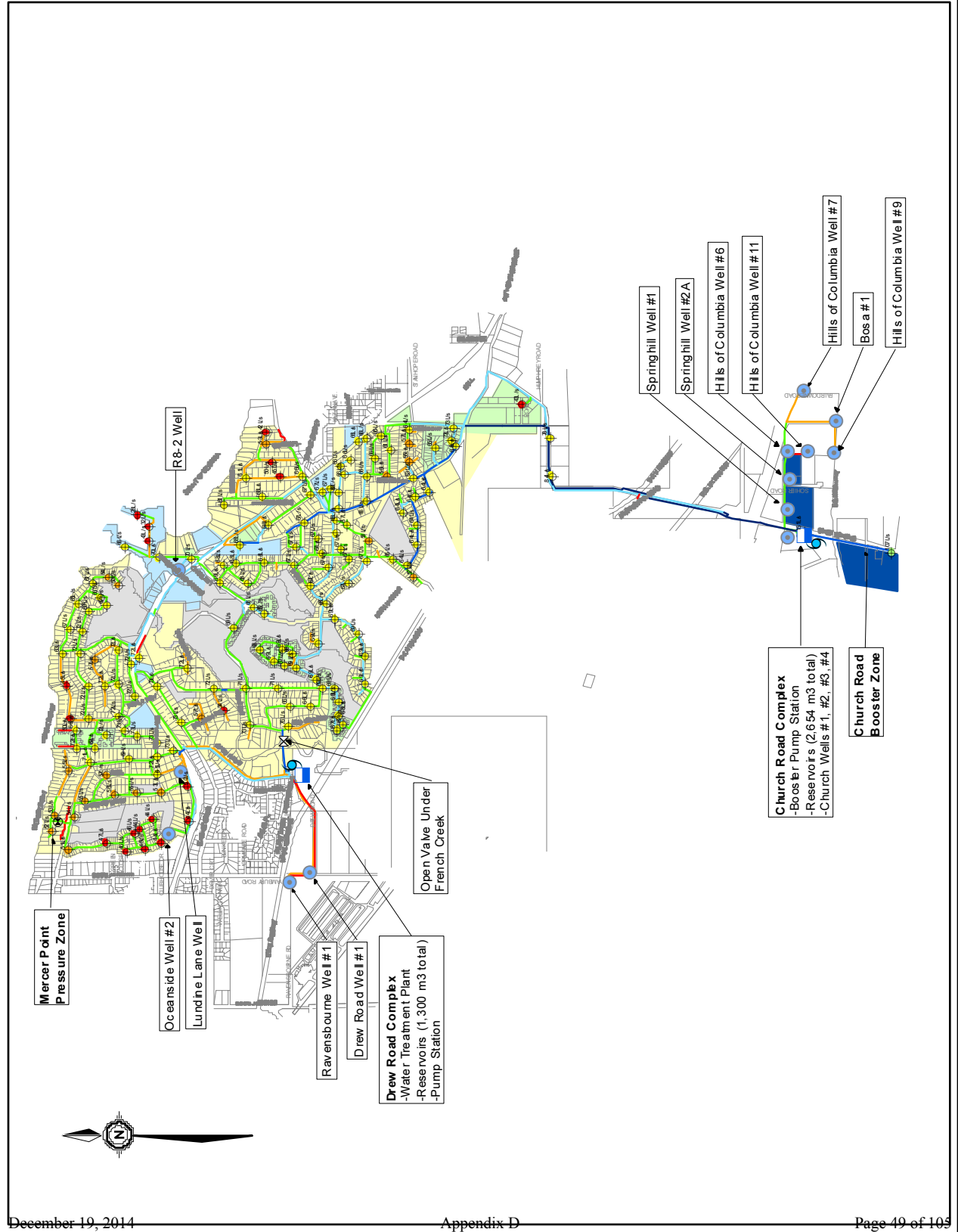
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Project No.  
747.009

Date  
October 2014

**Available Fire Flow  
2031 Max Day Demands**

**Figure 8-5**





**KERR WOOD LEIDAL**  
CONSULTING ENGINEERS

## Section 9

# Recommended Projects



## 9. Recommended Projects

Recommended projects have been prioritized as follows:

- **Annual Programs:** Projects that are recommended to be carried out on an annual basis.
- **Recommended Projects (2015 – 2018):** These projects are recommended to be included in the 2015 to 2018 plan.
- **Projects Deferred (Beyond 2018):** These projects are recommended to address system deficiencies. However they are lower priority and are recommended to be deferred beyond 2018.

Work scheduled for 2014 completion is not included in the recommendations. In addition, recommended projects do not include ongoing operations and maintenance programs such as:

- Reservoir maintenance and cleaning;
- Water main flushing; and
- Water main repairs required due to leaks or emergencies.

### 9.1 Addressing Supply Deficiencies

A draft report by BC Groundwater Consulting Services Ltd. [3] indicates three new wells have been installed, tested, and will be under review by VIHA as part of the Source Water Approval process.

The characteristics of the new wells according to the report are as follows:

- Springhill Road No. 2A Replacement Well (RW<sub>S1</sub>). Testing results indicate the well can operate at a peak rate of 7.4 L/s;
- Springhill Road Additional Capacity Well (AC<sub>S1</sub>). Testing results indicate the well can operate at a peak rate of 7.9 L/s; and
- Church Road South Test Well (TW<sub>S1</sub>). The well was constructed to determine if a deeper regional aquifer is located north of the existing well fields. Testing results indicate the well can operate at a peak rate of 1.6 L/s;

The three wells noted above are scheduled to be completed by summer 2015<sup>3</sup>. Under the assumption that these wells are connected to the system, the available supply capacity increases from 35.5 L/s to 52.4 L/s and the rated supply capacity of the system is sufficient for existing demands. An additional 8.9 L/s of supply capacity is required for the 2031 future demand scenario.

If non revenue water was reduced to 10% of the annual average demand, the existing and 2031 future max day demand would be reduced to 44.8 L/s and 58.3 L/s, respectively. Assuming the three wells noted above are completed and connected to the system, the available supply capacity is sufficient for existing demands and an additional 5.9 L/s of capacity is required for the 2031 future demand scenario.

The condition of the existing groundwater wells is outside of the scope of this report. However, recommended practice includes well rehabilitation and condition assessments every 5 to 10 years. Projects for periodic well assessment and rehabilitation are recommended.

<sup>3</sup> Estimated schedule for well completion is subject to receiving Source Water Approval from VIHA before January 2015.



## 9.2 Addressing Pressure and Fire Flow Deficiencies

As discussed in Section 8.3 and 8.4, there are deficient peak hour pressures in the Wembley Area (includes approximately 250 lots) as well as numerous fire flow deficiencies elsewhere in the Main Pressure Zone which are related to low residual pressures in the Wembley Area. Two options to address these deficiencies are discussed below.

All options include the automatic butterfly valve on the 250 mm diameter main under French Creek to remain open for peak hour and fire flow conditions. It is understood that the butterfly valve on this main is often closed to balance usage between the Church Road and Drew Road reservoirs. A project to balance the storage usage including review and revision of the operating logic of the system and reprogramming existing instrumentation is recommended (Project ID 27) so this valve can be normally open.

### Option 1: Fire Pump at Drew Road and New Wembley Pressure Zone

In Option 1, a new local pumped pressure zone would be created for the Wembley area, supplied by a booster pump station. Option 1 was previously recommended in the 2008 Water System Assessment Study [7], Project ID 2008-2. A fire pump at Drew Road would be installed to provide required fire flows for the Main Pressure Zone.

A conceptual plan for the Option 1 servicing strategy includes:

- A new booster pump station located at Humphrey Road and Church Road, with capacity of 10 L/s at 15 m TDH and a check valve bypass;
- A new Main Pressure Zone supply main from the new booster pump station on Humphrey Road to Wembley Road (at Robertson Boulevard), approximately 1,200 m long;
- Closed valves at Wembley Road at Robertson Boulevard, Neden Way at Riley Road, Lowrys Road and Robertson Boulevard, and Robertson Boulevard at Arrowsmith Way;
- 320 m of 200 mm diameter water main on Robertson Boulevard between Wembley Road and Lowrys Road;
- 140 m of 200 mm diameter water main on Neden Way;
- A check valve chamber at Esslinger Road and Wembley Road; and
- A fire pump located at the Drew Road Complex.

### Option 2: Increase Main Zone Supply HGL

In Option 2 pressure and fire flow deficiencies would be addressed by increasing the supply pressure to the entire Main Pressure Zone. This would require modification of the pumps at Drew Road and installing a booster pump station including a fire pump at the Church Road Complex.

In addition, the higher pressure requires installation of PRV stations to create a pressure reduced zone to protect the lower elevation areas from excessive pressures. In order to overcome losses in the transmission system when supplying fire flow (i.e. 150 L/s) from Church Road, the HGL of the Main Pressure Zone would have to be increased to approximately 110 m. This requires a major expansion of the proposed pressure reduced zone (beyond the Columbia Beach area).



## Discussion

Option 1 is considered more cost effective and is recommended for planning purposes. Note that a reduced pressure zone in the Columbia Beach Area is feasible in conjunction with Option 1 and could be added at a later date if reducing pressures (for asset management reasons) becomes a priority.

Note that additional water main upgrades and water main looping projects are required to address local fire flow deficiencies for both Options 1 and 2.

Review of these options should be completed as a separate scoping study prior to initiation of the specific upgrade projects for Option 1 (Project ID 5). The individual projects associated with Option 1 are included in the recommended projects on Table 9-2 (Project ID 6 and 8).

## 9.3 Review of Existing Recommendations

Projects identified in previous studies are described in Section 3. Table 9-1 summarizes the previously recommended projects and their current status.

**Table 9-1: Review of Existing Recommendations**

Task ID	Project Name	Status				
		Complete	Ongoing	2015-2018 Recommended Project	Deferred Beyond 2018	Not Recommended
2008-1 / 2009-7	New Columbia Beach Area Pressure Zone					X(1)
2008-2 / 2009-8 / 2011-1	New Wembley Road Area Pressure Zone				X	
2008-3 / 2009-9	Lowrys Road Area Fire Flow Upgrades	X				
2008-4 / 2009-9	Windward Way Fire Flow Upgrades				X	
2008-5 / 2009-9	Glenhale Crescent Fire Flow Upgrades				X	
2008-6 / 2009-9	Admiral Tyron Boulevard Fire Flow Upgrades				X	
2008-7	Pintail Drive and Black Brant Drive Looping					X(2)
2008-8	Increase Emergency Storage Capacity	X				
2008-9 / 2011-18	Hydrant Installation Program			X		



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 French Creek 2014 Water System Master Plan Update  
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Task ID	Project Name	Status				
		Complete	Ongoing	2015-2018 Recommended Project	Deferred Beyond 2018	Not Recommended
2009-1	Water Loss Study	X				
2009-3	Water Conservation Program	X				
2009-4	Rate Schedule Review	X				
2009-5	Abandon and Decommission the Lornedunn and Imperial Wells			X		
2009-6	650 m <sup>3</sup> Storage Capacity Upgrade	X				
2009-10	Open the Closed Valve Under French Creek			X(3)		
2009-11	Flow Meters and SCADA Monitoring at Reservoirs	X				
2011-2	Fire Flow Upgrades for 585 Columbia Drive					X(4)
2011-3	Fire Flow Upgrades for VIP60349					X(4)
2011-4 / 2011-5	Fire Flow Upgrades for 1129 Island Highway West					X(4)
2011-6	Fire Flow Upgrades for 890 Wembley Road					X(4)
2011-7	Fire Flow Upgrades for 899 Island Highway West					X(4)
2011-8	Fire Flow Upgrades for 879 Island Highway West					X(4)
2011-9	Lundine Lane Well Supply Main Upgrade	X(5)			X(5)	
2011-10	Drew Road WTP Capacity Upgrade	X				
2011-11	Drew Road Pump Station Upgrade			X		
2011-12	Drew Road WTP Expansion					X(6)
2011-13	Twin Church Road Supply Main at Highway				X	
2011-14	Arrowsmith Bulk Water Supply Evaluation					X(7)
2011-15	Growth Assessment Study	X				
2011-16	100 mm Diameter Water Main Upgrades					X(8)
2011-17	Drew Road Water Main Upgrades For Existing Commercial Developments					X
2011-19	Dalmatian Drive Residential Service Upgrades			X		
2011-20	Leak Detection Program			X		
2011-21	AWWA Water Conservation Report	X				
2011-22	Church Road Reservoir Upgrades			X		



Task ID	Project Name	Status				
		Complete	Ongoing	2015-2018 Recommended Project	Deferred Beyond 2018	Not Recommended
2014-1 / 2009-2	Springhill Road No. 2A Replacement Well Completion			X		
2014-2 / 2009-2	Springhill Road Additional Capacity Well Completion			X		
2014-3 / 2009-2	Church Road South Test Well Completion			X		
<b>Notes:</b> 1. Not currently recommended as maximum pressure are below design criteria however this project may be recommended at a later date if pressure reduction (for asset management purposes) becomes a priority. 2. Not recommended because this project requires looping an EFC main with a main in the private development on Mercer Point Drive. 3. The valve is scheduled to be normally open during peak demand periods however it is understood that it is often closed to balance usage between the Church Road and Drew Road supplies. A project to balance the storage usage including review and revision of the operating logic of the system and reprogramming existing instrumentation is recommended (Project ID 27) so this valve can be normally open. 4. Install as required when development proceeds. 5. 2/3 of the 100 mm diameter water main upgrade is complete. The remaining 1/3 of the upgrade can likely be deferred depending on future well capacity and condition of the existing main. It is recommended that this project be completed in conjunction with other upgrades recommended on Lundine Lane. See Project ID 13 on Table 9-2. 6. It is understood that there is no space at the Drew Road complex for a water treatment plant expansion. 7. EPCOR French Creek has opted to exclude themselves from the bulk water project occurring in the neighbouring communities. 8. Not recommended to upgrade pipes only to satisfy velocity requirements for a fire flow scenario.						

## 9.4 Cost Allocation

Projects identified in this report either address existing deficiencies, future deficiencies (due to growth) or a combination of the two. Projects identified to address growth or future deficiencies are developer funded. For projects that partially address existing deficiencies but also allow for growth, the cost allocation was derived using the following formula:

$$\text{Future Allocation \%} = 1 - \frac{\text{Existing Deficiency (eg. Existing Capacity Deficiency)}}{\text{Deficiency with Future Growth (eg. Future Supply Capacity Deficiency)}}$$

## 9.5 Recommended Projects

The recommended projects are listed in Table 9-2 and shown on Figure 9-1.

Note that field fire flow testing, water model validation and calibration, and a rezoning study (Project ID 5) is recommended prior to completing projects required to address fire flow and pressure deficiencies.



A project to review the existing system instrumentation and operating logic is recommended to allow the automatic butterfly valve on the 250 mm diameter main under French Creek to be normally open (Project ID 27).

The opinion of probable cost as described in Section 7.4 is included for each project in Table 9-2.

Several projects were identified by EPCOR French Creek staff. These projects are identified with a footnote on Table 9-2. Project scope, justification, and costs were provided by EPCOR French Creek staff and were not reviewed by KWL.

Justification sheets for each recommended project is included in Appendix B.

Justification categories are used to indicate the primary reason(s) to complete each project. A brief description of each justification category is provided below.

1. **Safety:** The project will address safety issues for staff members and/or the general public and will reduce the risk of an incident.
2. **Customer Requirements:** The project will address water servicing deficiencies (i.e. fire flow, pressure, inability to service) for existing and new customers or neighbourhoods.
3. **Reliability:** The project will improve reliability by reducing the risk of a service disruption.
4. **Life Cycle Costs:** The project will improve staff and/or operational efficiency providing the opportunity to realize future cost savings.
5. **Regulatory:** The project is required to comply with regulations.
6. **Environmental:** The project will address an existing environmental concern or reduce the risk of an environmental incident.
7. **Financial:** The project will provide financial benefit.
8. **Technical / Product Development:** The project includes new technology that will provide financial benefits and/or improved efficiencies.



Table 9-2: Recommended Projects

ID	Project Type	Previous Project ID	Task Name	Description of Works	Justification <sup>1</sup>	Option of Water for Project <sup>2</sup>
1	Annual Program	2008-9 2011-18	Hydrant Installation Program	Install 6 hydrants per year.	Improve system wide hydrant coverage and fire protection.	\$ 35,000
2	Annual Program	New	Meter Replacement Program	Replace 100 water meters per year.	Reduce meter under reading and non-revenue water, increase staff efficiency.	\$ 65,000
3	2015-2018 Recommended Project	2011-11	Drew Road Pump Station Upgrades <sup>3</sup>	This project consists of various necessary upgrades to the pump station. This project is required to update existing infrastructure, increase capacity, and improve safety and efficiency. This project includes upgrades to the ventilation system, replacing existing pump motors and electrical upgrades, and piping upgrades.	The list of necessary improvements was identified in the 2011 French Creek Growth Assessment Study prepared by Stantec Consulting Ltd. The upgrades to the existing infrastructure are required to improve safety and efficiency. This project will also eliminate existing hydraulic restrictions and increase reliability and protection of the incoming and outgoing water supply.	\$ 215,000
4	2015-2018 Recommended Project	2011-19	Dalmatian Drive Residential Service Upgrades <sup>3</sup>	Replace failing services on Dalmatian Road. From previous studies it is estimated that there are 46 services that require replacement. Allow for replacement of 25% of these services during this 3 year period with an allowance for leak detection to determine the location of the largest leaks.	Reduce leakage and non revenue water.	\$ 48,000
Appendix D	2015-2018 Recommended Project	New	Model Validation and Rezoning Study	Complete water model validation including a field hydrant flow testing program. Using validated water model, review recommended upgrade for Wembley Road Area Pressure Zone Study (Project ID 6) and revise as required.	To verify model results and assist in scoping and prioritizing fire flow and pressure improvement projects.	\$ 35,000
6	Beyond 2018	2008-2 2009-8	New Wembley Road Area Pressure Zone	This project includes a new booster pump station for the Wembley Road Area. Preliminary scope includes: -5 HP Booster pump station to provide domestic flow to the new Wembley Zone with check valve bypass for fire flow -1,210 m of 400 mm diameter supply main to Main Pressure Zone -320 m of 200 mm diameter main on Robertson Boulevard for fire flow in the new Wembley Zone -140 m of 200 mm diameter main on Neden Way for fire flow in the new Wembley Zone -Check valve chamber at Esslinger Road for fire flow in the new Wembley Zone -4 closed valves on existing piping	Increase available fire flow system wide. Improve pressure in the Wembley Road area. Pressures increase from 32-40 psi to 55-70 psi. Approximately 250 lots are affected by this project.	2015-2017 Revenue Requirement and Rates Application \$ 2,651,000
7	Beyond 2018	2011-13	Twin Church Road Supply Main at Highway	Install 510 m of 300 mm diameter water main from Church Road Complex to the north side of Highway 19 using the existing available casing beneath the highway.	Provide supply redundancy for the section of main under the highway. Improves available fire flow to the east side of the Main Pressure Zone.	\$ 594,000
8	Beyond 2018	New	Drew Road Fire Pump	Install a diesel driven fire pump at the Drew Road Complex including an enclosure.	Increase available fire flow system wide. The System Balancing Storage Control project (Project ID 27) is required prior to installing the Drew Road Fire Pump.	\$ 500,000
9	Beyond 2018	New	Island Highway Looping	Install 410 m of 200 mm diameter main to complete loop between Wright Road and Riley Road on Island Highway West including 3 fire hydrants (to be confirmed based on coverage of Parksville hydrants).	Improve available fire flow to existing commercial and institutional developments at the 800 block of Island Highway West. Available fire flow increases from 66 to 150 L/s. 2 commercial/institutional lots are affected by this project. Note the that Wembley Road Area Pressure Zone (Project ID 6) is required to provide 150 L/s of available fire flow at this location.	\$ 390,000

Table 9-2: Recommended Projects

Project ID	Project Type	Previous Project ID	Task Name	Description of Works	Justification <sup>1</sup>	Option of Work for Project <sup>2</sup>
10	Beyond 2018	New	Morningstar Drive Looping	Install 320 m of 200 mm diameter main to complete loop between Morningstar Drive and Robertson Boulevard including 2 fire hydrants.	Improve available fire flow to the multi-family development on Morningstar Drive and Lee Road. Available fire flow increases from 70 L/s to 150 L/s. 1 multi-family development is affected by this project.	(West) Inc. \$ 305,000
11	Beyond 2018	New	Wembley Road Looping	Install 180 m of 250 mm diameter main to complete loop between Tara Crescent and Reid Road on Wembley Road including 2 fire hydrants.	Improve available fire flow to existing commercial and institutional developments at Wembley Road and Island Highway West. Available fire flow increases from 68 to 150 L/s. 2 commercial/institutional lots are affected by this project. Note the flat Wembley Road Area Pressure Zone (Project ID 6) is required to provide 150 L/s of available fire flow at this location.	\$ 203,000
12	Beyond 2018	New	Island Highway and Sunrise Drive Fire Flow Upgrades	Upgrade 170 m of existing 150 mm diameter water main on Island Highway west of Sunrise Drive to 200 mm diameter main including 2 hydrants.	Improve available fire flow at existing commercial developments located at 1580 Sunrise Drive and 1395 Island Highway West. Available fire flow increases from 72 to 150 L/s. 3 commercial/institutional lots are affected by this project.	\$ 177,000
13	Beyond 2018	2008-4 2009-9 2011-9	Lundine Lane Fire Flow Upgrades and Raw Water Supply Upgrades <sup>3</sup>	Project includes upgrades to the transmission system (for fire flow improvements) and the supply system. <u>Transmission System:</u> Upgrade 200 m of existing 100 mm diameter main on Lundine Lane to 200 mm diameter main including 1 fire hydrant. <u>Supply System:</u> Upgrade 130 m of existing 100 mm diameter raw water supply main including a highway crossing.	<u>Transmission System:</u> Improve available fire flow on Windward Way. Available fire flow increases from 45 to 70 L/s. Approximately 150 lots are affected by this project. <u>Supply System:</u> Reduce losses in raw water supply main to allow for higher well yield in the future.	\$ 331,000
14	Beyond 2018	2008-5 2009-9	Breakwater Road Fire Flow Upgrades	Upgrade 140 m of existing 100 mm diameter main on Breakwater Road to 150 mm diameter main including 2 fire hydrants.	Improve available fire flow on Breakwater Road. Available fire flow increases from 45 to 85 L/s. Approximately 10 lots are affected by this project.	\$ 134,000
15	Beyond 2018	2008-5 2009-9	Cavin Road Fire Flow Upgrades	Upgrade 60 m of existing 100 mm diameter main on Cavin Road to 150 mm diameter main including 1 fire hydrant.	Improve available fire flow on Cavin Road. Available fire flow increases from 40 to 60 L/s. Approximately 5 lots are affected by this project.	\$ 60,000
16	Beyond 2018	2008-6 2009-9	Admiral Tyron Boulevard West of Columbia Drive Fire Flow Upgrades	Upgrade 230 m of existing 100 mm diameter main on Admiral Tyron Boulevard west of Columbia Drive to 150 mm diameter main including 2 fire hydrants.	Improve available fire flow on Admiral Tyron Boulevard. Available fire flow increases from 45 to 60 L/s. Approximately 35 lots are affected by this project.	\$ 199,000
17	Beyond 2018	New	Mason Trail Fire Flow Upgrades	Upgrade 150 m of existing 100 mm diameter main on Mason Trail to 150 mm diameter main including 1 fire hydrant.	Improve available fire flow on Mason Trail. Available fire flow increases from 35 to 90 L/s. Approximately 15 lots are affected by this project.	\$ 132,000
18	2015-2018 Recommended Project	2014-1 2009-5	Springhill Road No. 2A Replacement Well (RWs1) Completion <sup>3</sup>	Complete well and tie-in to system.	Provide supply capacity for existing development.	\$ 160,000
19	2015-2018 Recommended Project	2014-2 2009-5	Springhill Road Additional Capacity Well (ACs1) Completion <sup>3</sup>	Complete well and tie-in to system.	Provide supply capacity for existing development.	\$ 248,000
20	2015-2018 Recommended Project	2014-3 2009-5	Church Road South Test Well (TWs1) Completion <sup>3</sup>	Complete well and tie-in to system.	Provide supply capacity for future development.	\$ 313,000

Table 9-2: Recommended Projects

Project ID	Project Type	Previous Project ID	Task Name	Description of Works	Justification <sup>1</sup>	Option of Water for Project <sup>2</sup>
21	2015-2018 Recommended Project	New	Well Rehabilitation <sup>3</sup>	A regular program of rehabilitation including brushing, redeveloping, jetting, etc. to clean settled material around the well casings and to maintain well performance. Allow for rehabilitation of free wells during this three year period.	Maintain existing supply capacity.	(West) Island \$ 75,000
22	Beyond 2018	New	Marina Fire Flow Improvements	Upgrade 280 m of existing 150 mm diameter main on Lee Road from Island Highway West to the Marina to 200 mm diameter main including 2 fire hydrants.	Improve available fire flow to the Marina. Available fire flow increases from 70 L/s to 150 L/s. 3 commercial/institutional lots are affected by this project. Note the flat Wembley Road Area Pressure Zone (Project ID 6) is required to provide 150 L/s of available fire flow at this location.	\$ 278,000
23	Beyond 2018	2008-5 2009-9	Glenhale Crescent Fire Flow Upgrades	Upgrade 70 m of existing 100 mm diameter main on Glenhale Crescent to 150 mm diameter main including 1 fire hydrant.	Improve available fire flow on Glenhale Crescent. Available fire flow increases from 55 to 70 L/s. Approximately 10 lots are affected by this project.	\$ 74,000
24	2015-2018 Recommended Project	2011-20	Leak Detection Program <sup>3</sup>	Complete a leak detection study. Pending results of the study, a water audit may be included.	Reduce leakage and non revenue water.	\$ 30,000
25	Beyond 2018	2008-6 2009-9	Admiral Tyron Boulevard East of Viking Way Fire Flow Upgrades	Upgrade 180 m of existing 150 mm diameter main on Admiral Tyron Boulevard east of Viking Way to 200 mm diameter main including 2 fire hydrants.	Improve available fire flow on Admiral Tyron Boulevard. Available fire flow increases from 50 to 65 L/s. Approximately 5 lots are affected by this project.	\$ 188,000
26	Beyond 2018	New	Manse Road Looping	Install 300 m of 200 mm diameter main to complete loop on Manse Road to Wembley Road including 2 fire hydrants.	Improve available fire flow on Manse Road. Available fire flow increases from 45 to 85 L/s. Approximately 5 lots are affected by this project.	\$ 288,000
27	2015-2018 Recommended Project	New	System Balancing Storage Control	This project will address the unbalance that occurs in the system when the automatic butterfly valve under French Creek is open. An allowance of \$25,000 for this project has been included to provide a review of the existing system controls and revise system operating logic. This allowance assumes that all existing instrumentation can be reprogrammed and no additional equipment is required.	To improve system fire flows, pressure, and redundancy, it is recommended that the butterfly valve under French Creek remain normally open. A study to review the existing system instrumentation and operating logic is required to allow the butterfly valve to remain open while ensuring that sufficient fire storage at the Drew Road Reservoirs is maintained. Completion of this project is required prior to the installation of the Drew Road Fire Pump (Project ID 8).	2015-2018 Revenue \$ 25,000
28	Beyond 2018	New	Groundwater Exploration (Exploratory Boreholes) <sup>3</sup>	Includes electrical resistivity tomography (ERT) to map a portion of the aquifer and drilling boreholes. The cost includes an allowance for two boreholes.	Required to develop new wells and increase source water capacity.	\$ 149,000
29	2015-2018 Recommended Project	2009-5	Decommission Existing Abandoned Groundwater Wells <sup>3</sup>	Close and decommission Oceanside, Imperial, and Lorneville wells in accordance with BC Ground Water Protection Regulations.	Close abandoned wells in accordance with BC Ground Water Protection Regulations.	\$ 85,000
30	Beyond 2018	New	Decommission Future Abandoned Groundwater Wells <sup>3</sup>	Close and decommission Springhill Road #1 and #2 wells in accordance with BC Ground Water Protection Regulations. The cost includes an allowance of \$25,000 per well.	Close abandoned wells in accordance with BC Ground Water Protection Regulations.	\$ 50,000
31	2015-2018 Recommended Project	2011-22	Church Road Complex Upgrades <sup>3</sup>	This project includes booster pump station controls and a magnetic flow meter on the well supply main.	Improve operation of the Church Road booster pump station by reducing the frequency that the fire pump operates and improve energy efficiency. Installation of the magnetic flow meter on the well supply line will provide information required for well capacity analysis.	\$ 67,000

Table 9-2: Recommended Projects

ID	Project Type	Previous Project ID	Task Name	Description of Works	Justification <sup>1</sup>	Option of Water for Project <sup>2</sup>
32	2015-2018 Recommended Project	2011-22	Church Road Reservoir Upgrades <sup>3</sup>	Install flexible liners for Church Road Reservoir #3 and #4.	Existing concrete reservoirs have been cracking over the years such that water pooling on the top of the reservoirs can leak inside. In the past, Xypex grout products have been used every few years to mitigate leaks. Installing the liners will provide a more durable, long term solution.	\$ 110,000
33	Beyond 2018	New	Church Road Well Supply Main Upgrades <sup>3</sup>	Upgrade 120 m of existing Church Road well supply main to 200 mm diameter.	With the increase in flow and production expected from the new wells in the south region, scheduled to come online in the 2015 to 2018 period, a section of the well supply main can be upgraded to reduce losses and increase well capacity.	\$ 42,000
34	2015-2018 Recommended Project	New	Geotechnical Study for Drew Road Reservoirs <sup>3</sup>	Conduct an investigation to determine the extent of the leakage from the reservoirs and provide mitigation options.	Reduce leakage and non revenue water.	\$ 20,000
<b>Total Annual Programs (\$ per year)</b>						\$ 100,000
<b>Total, 2015-2018 Recommended Projects</b>						\$ 1,431,000
<b>Total All Recommended Projects (not including Annual Programs)</b>						\$ 8,174,000

Notes:

1.) The flow and pressure improvements cited are the result of all of the recommended upgrades completed (i.e. Project ID 1 through 34). Results of stand alone projects will not be the same. In many cases, the majority of the fire flow improvement is due to the New Wembley Road Area Pressure Zone project (Project ID 6) and Drew Road Fire Pump (Project ID 8).

2.) Class D opinions of probable cost have been developed for each recommended project. The cost opinions have been assembled with little or no site information and are based on the 2014 construction year. No allowance has been provided in these figures for escalation in subsequent years. The cost opinions in this report are indicative and have been prepared for long-term budgeting purposes only (i.e. 3-year plan). Land acquisition costs (if applicable) are not included. Where indicated (highlighted), costs for projects have been provided by EPCOR French Creek staff.

3.) Project IDs 3, 4, 13, 18, 19, 20, 21, 24, 28, 29, 30, 31, 32, 33, and 34 were identified by EPCOR French Creek staff. Project descriptions, justifications and costs were provided by EPCOR French Creek. The scope of these projects were not reviewed by KW L.

Indicates a project recommended for the Beyond 2018 time period.

\\lbra25.bur.naby.ker.nwood.leida.org\000-00-999\0700-0799\747-009\400-Work\Recommended Upgrades\2014\201\_Recommended Upgrades.xls\Recommended Upgrades Table

2015-2017 Revenue Requirement and Rates Application

**EPCOR French Creek  
Water System Master Plan Update**

**Legend**

- Pump Station
- Reservoir
- Groundwater Well
- Open Valve
- PRV Station
- Fire Hydrant

**Water Main Diameter (mm)**

- 50
- 100
- 150
- 200
- 250
- 300

- (5) Project ID
- (8) Project ID
- Proposed Upgrade (2015 - 2018)
- Proposed Upgrade (Beyond 2018)
- Proposed Well (2015 - 2018)
- Proposed Pump Station
- Proposed Check Valve Chamber
- Proposed Closed Valve
- Proposed Wembley Pressure Zone



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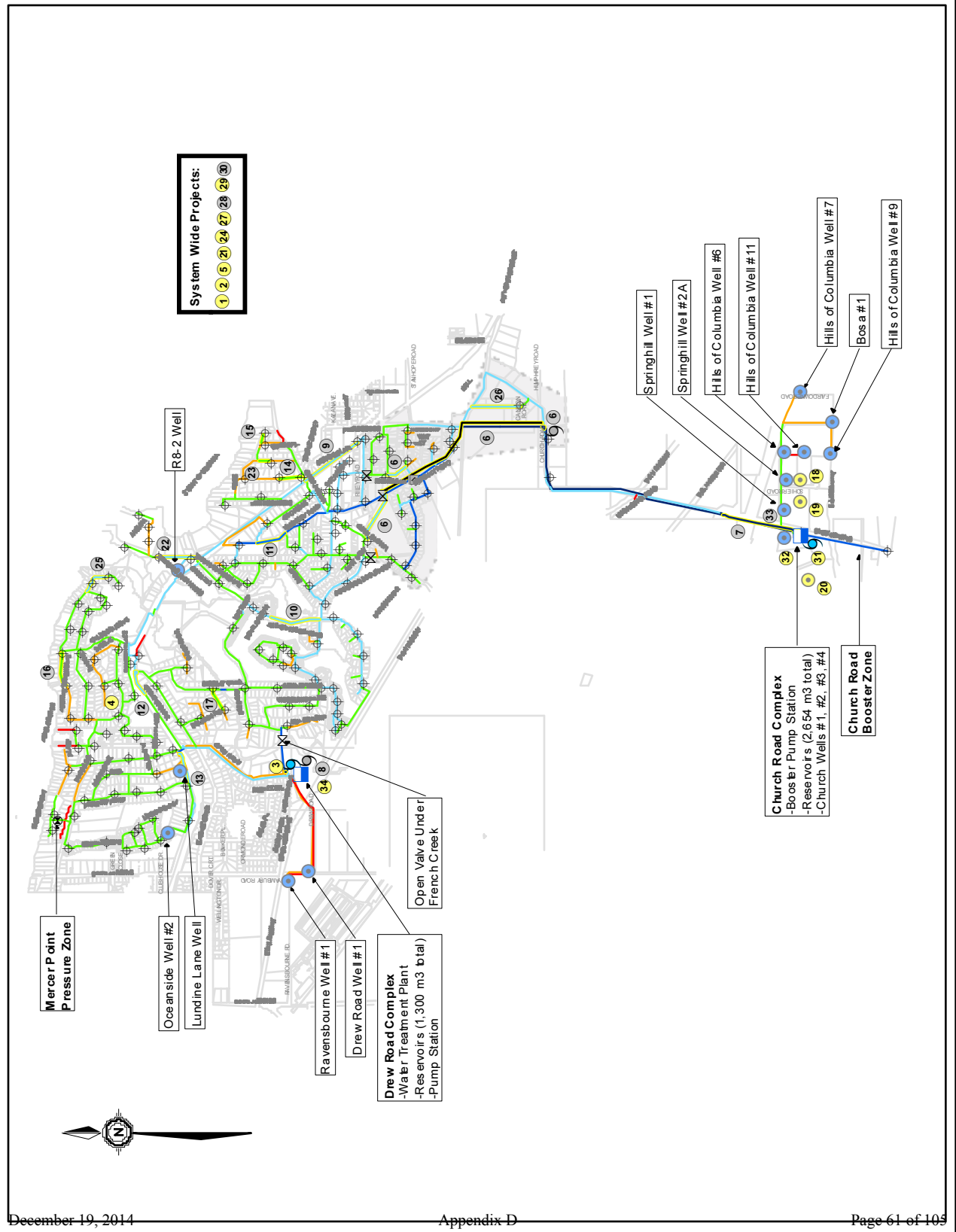
Not to Scale

Project No.  
747.009

Date  
October 2014

**Recommended  
Projects**

**Figure 9-1**





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## Section 10

# Conclusion



## 10. Conclusion

### 10.1 Summary

The master plan update reviewed the EPCOR French Creek water system performance using estimated existing and future (2031) demand scenarios.

Key findings from the master plan update are summarized below.

- A review of source flow and water meter data indicated a per capita base demand of 160 L/ca/day and a per capita maximum day demand of 289 L/ca/day. The existing maximum day demand is estimated to be 46.3 L/s.
- A benchmarking study indicated that the per capita rate estimated for EPCOR French Creek is consistent with local per capita rates (NanOOSE Bay Peninsula, RDN French Creek), and is generally lower than other jurisdictions (British Columbia, smaller Canadian utilities).
- Non-Revenue Water was 3.2 L/s in 2012, approximately 16% of the total annual demand.
- Based on a 2031 residential population of 4,739, the future 2031 max day demand is estimated to be 61.3 L/s.
- The supply capacity of the groundwater wells with the largest well out of service is 35.5 L/s. There are currently three groundwater wells under source water approval, and are scheduled to be online by summer 2015. Combined, it is estimated that the new wells can provide 16.9 L/s of supply capacity, bringing the total system supply capacity to 52.4 L/s. An additional 8.9 L/s of supply capacity is required to meet 2031 max day demand requirements.
- The existing storage reservoirs at Drew Road and Church Road provide adequate fire (150 L/s for two hours), emergency and balancing storage for the existing and future scenarios;
- Modelling indicates that there are approximately 250 lots around the Wembley Road area that experience deficient (less than 44 psi) pressure during peak hour conditions for the 2031 demand scenario.
- High pressure in the Columbia Beach area has been flagged as a concern by EPCOR French Creek staff and in previous studies. Modelling indicates that the maximum pressure during existing base day flows is 100 – 111 psi in this area.
- Modelling indicates that there are fire flow deficiencies in all areas zoned multifamily (90 L/s required) and institutional/ commercial (150 L/s required). There are also a number of fire flow deficiencies in the single family residential areas. Fire flow deficiencies are largely due to the low static pressure condition, and the location of the Church Road supply relative to the majority of the water users. The Drew Road Pump Station does not have sufficient capacity to provide required fire flows to the Main Pressure Zone.



## 10.2 Recommendations

An overall servicing strategy was established to address the pressure deficiencies in the Wembley Road area and improve available fire flow for the system as a whole as discussed in Section 9.2 (Option 1) and described on Table 9-2 (Project ID 6 and 8). Note that a reduced pressure zone in the Columbia Beach Area is feasible in conjunction with Option 1 and could be added at a later date if pressure reduction becomes a priority.

All recommended projects and annual programs are summarized on Table 9-2 and shown on Figure 9-1. A Class D opinion of probable cost is provided for each project, and the totals are summarized below.

- Recommended annual programs: \$100,000;
- Recommended 2015-2018 projects: \$1,431,000; and
- All recommended projects (not including annual programs): \$8,174,000.

Model validation and a rezoning study (Project ID 5) is recommended prior to completing any projects that address fire flow or pressure deficiencies. A project to review the existing system instrumentation and operating logic is recommended to allow the automatic butterfly valve on the 250 mm diameter main under French Creek to be normally open (Project ID 27).





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### 10.3 Report Submission

Prepared by:

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This document is a copy of the sealed and signed hard copy original retained on file. The content of the electronically transmitted document can be confirmed by referring to the filed original.

KERR WOOD LEIDAL ASSOCIATES LTD.  
consulting engineers



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## Statement of Limitations

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## Revision History

Revision #	Date	Status	Revision	Author
0	July 25, 2014	Draft		MDR / RS
1	Sept 23, 2014	Draft - Revision 1	Incorporated comments from EPCOR Water Services, Revised model results, added costs to recommended upgrade table.	MDR / RS
2	Oct 24, 2014	Final	Incorporated comments from EPCOR Water Services, added projects identified by EPCOR French Creek staff.	MDR / RS
3	Nov 28, 2014	Final – Revision 1	Added section for water conservation. Added justification sheets for each recommended project.	MDR / RS
4	Dec 8, 2014	Final – Revision 2	Incorporated comments from EPCOR Water Services.	MDR / RS

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 2015-2017 Revenue Requirement and Rates Application



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## Appendix A

# Water Model Log

**Project:** Water Master Plan Update  
**Description:** Complete model of water utility  
**Client:** EPCOR Water Services French Creek  
**Software/Version:** WaterCAD 8.0

Appendix A  
 KWL No. 747.009

Date	Model	Scenario(s)	User	Changes/Updates
20-Jun-14	FC-2014-v0.wtg	AI	RS	A copy of the model from Stantec called "Current_french_v6.wtg" (last updated in 2011) Saved to KWL network and re-named FC-2014-v0.wtg
04-Jul-14	FC-2014-v1.wtg	AI	RS	Shift pipes to correct geographical location. export nodes for demand build
08-Jul-14	FC-2014-v2.wtg	AI	RS	Fit in correct geographical location is distorted, talked to Dan Skidmore and he instructed us to leave the model where it is, skip this version
				Add background layers from CAD file called "french_creek_cadastre_stantec.dwg"
				Remove obsolete scenarios, create a 2014 Existing Model Scenario
				Add updates to model based on pdf record drawings of subdivisions provided by EPCOR French Creek (Karen Bacon)
				-updated section of 200mm main on Wembley Rd between Crystal Court and Ackerman Rd to 250 mm dia per dwg L-722-02-02-07
				-add 200mm dia main and hydrant on Rd A, and additional hydrant on Wembley Rd per dwg L-722-02-02-07
				-add 200mm dia main and 2 hydrants on Wally's Way per dwg L-845-01-07-05
				-add 150 mm dia main and 3 hydrants on Road 1, Lowry Rd, and Road 2 per dwg set 120-03-12
				-change material type of existing water main on Arrowsmith Way, Yellowbrick Road, and Lowery Rd from Ductile Iron to PVC per dwg set 120-03-12
				-add 200mm dia main and 3 hydrants on Sanika Close and Neden Way per dwg L-722-03-04-05
				-add 200mm dia main, 150mm dia main and 2 hydrants on Prospect Point Dr and Road 1 per dwg 120-02-1
				-add 50mm dia main on Wright Rd east of Ocean Pl per dwg 190-02-1
				-add 1 hydrant at 770 Woodland Dr per dwg 218-01-1
				-add 1 hydrant at north east side of intersection of Johnstone Rd and Old Island Highway per dwg 206-01-1
				-add 200mm dia main and 1 hydrant at Old Island Hwy and Aberdeen Dr per dwg 0224-01-01
				-add 150mm dia main and 1 hydrant on Emerald City Way per Stantec CAD drawing
				-add 150mm dia main, 100mm dia main and 5 hydrants for Lakes Blvd development per Stantec CAD drawing
				-revise alignment of 200mm dia main at the intersection of the Old Island Hwy and Columbia Dr per Stantec CAD drawing
				-add hydrant at the east end of Cavin Rd per Stantec CAD drawing
16-Jul-14	FC-2014-v3.wtg	AI	RS	-add user defined field for hydrant lead
				-updated diameters of pipe on Meadow / White Pine streets
17-Jul-14	FC-2014-v4.wtg	AI	RS	-added base and future demands
				-added fire flow and EPS model scenarios
17-Jul-14	FC-2014-v5.wtg	AI	RS	-change all "Ductile Iron" material type to "Unknown", with C factor of 110
				-change nominal diameters to actual inside diameters of known for pipes with known material types
				-updated diameter of Church Road Reservoir per information in 2011 Stantec Report (total volume at Church Rd is 2654 m3)
20-Jul-14	FC-2014-v6.wtg	AI	RS	Revise demands - Total existing demand = 46.3 L/s, Total Future Demand = 62.1 L/s
20-Jul-14	FC-2014-v7.wtg	AI	RS	Compact database
				Revise well capacities per Table 3-Pumping Rate Recommendations, Updated January 2010
				Add recommended upgrade scenario
05-Aug-14	FC-2014-v8.wtg	AI	RS	Created a Merger Point Pressure Zone and rezoned nodes
08-Aug-14	FC-2014-v9	AI	RS	Revised control valves on pump stations (changed diameter to 999 mm and set minor loss to zero) to simulate pressure sustaining valve on recirculation line
11-Aug-14	FC-2014-v9	AI	RS	Added recommended scenario with PRV stations for lower areas and Sprinchill Road Pump Station
22-Aug-14	FC-2014-v10	Rec Upgrades	RS	New recommended upgrade scenario (increase Main Pressure zone pressure)
28-Aug-14	FC-2014-v11	Rec Upgrades	RS	Added PRVs for reduced pressure zone
08-Sep-14	FC-2014-v12	Rec Upgrades	RS	Modify recommended upgrade scenario, review various options
10-Sep-14	FC-2014-v13	Rec Upgrades	RS	Modify recommended upgrade scenario, review various options
14-Sep-14	FC-2014-v14	Rec Upgrades	RS	Modify recommended upgrade scenario, review various options
15-Sep-14	FC-2014-v15	AI	RS	Revise Drew Road complex pump curves as follows: -1x25 HP: Goulds 25 HP pump Model #: 3756S with size 2.5 X 3 - 7 impeller diameter 7.063 -2x15 HP: Aurora pump model 344 size 2x2.5x7A with 5.75 inch diameter impeller
				Finalize recommended upgrade option
17-Sep-14	FC-2014-v16	Rec Upgrades	RS	Revise demands - Total existing demand = 46.3 L/s, Total Future Demand = 61.3 L/s
17-Sep-14	FC-2014-v17	AI	RS	Revise demands - Total existing demand = 46.3 L/s, Total Future Demand = 61.3 L/s
08-Oct-14	FC-2014-v18	Rec Upgrades	RS	Add recommended upgrade scenario without the new Wembley Area Pressure Zone to see the impact on available fire flow.



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## Appendix B

# Recommended Project Justification Sheets



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## Recommended Project Justification Sheets

Justification sheets have been created for each recommended project. Projects have been prioritized as follows:

- **2015 – 2018 Recommended Project:** These projects are recommended to be completed in the 2015 to 2018 period.
- **Annual Programs:** Programs recommended to be carried out on an annual basis.
- **Beyond 2018 Recommended Project:** These projects are recommended to address system deficiencies. However they are lower priority and are recommended to be deferred beyond 2018.

## Justification Categories

Justification categories are used to indicate the primary reason(s) to complete each project. A brief description of each justification category is provided below.

1. **Safety:** The project will address safety issues for staff members and/or the general public and will reduce the risk of an incident.
2. **Customer Requirements:** The project will address water servicing deficiencies (i.e. fire flow, pressure, inability to service) for existing and new customers or neighbourhoods.
3. **Reliability:** The project will improve reliability by reducing the risk of a service disruption.
4. **Life Cycle Costs:** The project will improve staff and/or operational efficiency providing the opportunity to realize future cost savings.
5. **Regulatory:** The project is required to comply with regulations.
6. **Environmental:** The project will address an existing environmental concern or reduce the risk of an environmental incident.
7. **Financial:** The project will provide financial benefit.
8. **Technical / Product Development:** The project includes new technology that will provide financial benefits and/or improved efficiencies.



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**Project Category:** 2015 – 2018 Recommended Project

**Project Name:** Drew Road Pump Station Upgrades

**Project ID:** 3

**Project Description:**

This project consists of various necessary upgrades to the pump station. This project is required to update existing infrastructure, increase capacity, and improve safety and efficiency. This project includes upgrades to the ventilation system, replacing existing pump motors and electrical upgrades, and piping upgrades.

**Project Justification:**

The list of necessary improvements was identified in the 2011 French Creek Growth Assessment Study prepared by Stantec Consulting Ltd.

The upgrades to the existing infrastructure are required to improve safety and efficiency. This project will also eliminate existing hydraulic restrictions and increase reliability and protection of the incoming and outgoing water supply.

**Engineering/Financial Evaluation:**

Costs are estimated to be \$215,000 based on the 2014 construction year.

The cost to increase the piping capacity (upgrade from 100 mm diameter to 150 mm diameter) is 9% of the total cost; therefore 9% of this project is developer funded.

**Consequences of NOT Undertaking the Project:**

Hydraulic restrictions in the pump station will limit water supply capacity and aging infrastructure will be vulnerable to failure / downtime.

**Note:** Project description, justification and cost provided by EPCOR Water Services.

**Justification Category**

1. Safety	x	2. Customer Requirements	x	3. Reliability	x	4. Life Cycle Costs	
5. Regulatory		6. Environmental		7. Financial		8. Tech./Product Dev.	





**Project Category:** 2015 – 2018 Recommended Project

**Project Name:** Dalmatian Drive Residential Service Upgrades

**Project ID:** 4

**Project Description:**

The project consists of replacing the existing corroded and pitted water services (located between 541 and 1606 Dalmatian Drive) with new PE service lines. Some soil consolidation might be required to avoid the current problem of line pitting. EPCOR Water Services expects that some of these services are presently leaking.

This project includes replacement of 25% of the estimated 46 affected services.

**Project Justification:**

EPCOR Water Services identified 50 service connections along the Dalmatian Drive that are disintegrating due to corrosion and service line pitting. Possible reasons behind this pipe pitting are the type of service line and soil condition. EPCOR Water Services indicated that 4 of the services have already been replaced.

This project will contribute to water conservation efforts by reducing water losses.

This project was identified in the 2011 French Creek Growth Assessment Study prepared by Stantec Consulting Ltd.

**Engineering/Financial Evaluation:**

The cost to replace 25% of the affected services is estimated to be \$48,000 based on the 2014 construction year.

**Consequences of NOT Undertaking the Project:**

Service connections will continue to disintegrate resulting in leakage and an increase in non-revenue water.

**Note:** Project description, justification and cost provided by EPCOR Water Services.

**Justification Category**

1. Safety		2. Customer Requirements		3. Reliability	x	4. Life Cycle Costs	
5. Regulatory		6. Environmental		7. Financial	x	8. Tech./Product Dev.	



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**Project Category:** 2015 – 2018 Recommended Project

**Project Name:** Model Validation and Rezoning Study

**Project ID:** 5

**Project Description:**

A computer model of a water system is an effective tool for planning and prioritizing improvements however it is important to establish that the model results reflect the reality of the water system. Validation testing involves taking a series of flow and pressure measurements in the field and comparing values to results predicted in the model under the same flow conditions for each test location.

This project includes a study to complete water model validation including a field hydrant flow testing program. Once the model is validated, review recommended upgrade for Wembley Road Area Pressure Zone Study (Project ID 6) and revise as required.

**Project Justification:**

To verify model results and assist in scoping and prioritizing fire flow and pressure improvement projects.

**Engineering/Financial Evaluation:**

Opinion of probable cost is \$35,000 (2014 dollars).

**Consequences of NOT Undertaking the Project:**

1. Scope of projects to improve fire flow and peak hour pressure may be unsuitable.
2. Additional projects may be required that have not been identified.

**Justification Category**

1. Safety		2. Customer Requirements	x	3. Reliability	x	4. Life Cycle Costs	
5. Regulatory		6. Environmental		7. Financial		8. Tech./Product Dev.	



**Project Category:** 2015 – 2018 Recommended Project

**Project Name:** Springhill Road No. 2A Replacement Well  
 (RWs1) Completion

**Project ID:** 18

**Project Description:**

Complete Springhill Road No. 2A Replacement Well (RWs1) and tie-in to system.

**Project Justification:**

The supply capacity of a water system must exceed the maximum daily demand to avoid water shortages during peak summer demands. The current rated supply capacity of the system is 35.5 L/s. The 2013 max day demand (46.3 L/s) and estimated 2031 future max day demand (61.3 L/s) exceed the current rated supply capacity by 10.8 L/s and 25.8 L/s respectively.

A draft 2014 report by BC Groundwater Consulting Services Ltd. indicates that the Springhill Road No. 2A Replacement Well can operate at a peak rate of 7.4 L/s.

**Engineering/Financial Evaluation:**

A cost of \$160,000 to complete the well based on the 2014 construction year was provided by EPCOR Water Services.

The Springhill well projects (Project ID 18 and 19) scheduled to be completed in the 2015 – 2018 period will together add an estimated 15.3 L/s of additional capacity. Of the 15.3 L/s, 10.8 L/s is required to address existing demands; the remaining (4.5 L/s or 29%) will provide supply capacity for future developments. This project is therefore 29% developer funded.

**Consequences of NOT Undertaking the Project:**

Insufficient supply capacity to meet existing 2013 and future 2031 max day demands.

**Note:** Project description, justification and cost provided by EPCOR Water Services.

**Justification Category**

1. Safety		2. Customer Requirements	x	3. Reliability	x	4. Life Cycle Costs	
5. Regulatory		6. Environmental		7. Financial		8. Tech./Product Dev.	



**Project Category:** 2015 – 2018 Recommended Project

**Project Name:** Springhill Road Additional Capacity Well  
 (ACs1) Completion

**Project ID:** 19

**Project Description:**

Complete Springhill Road Additional Capacity Well (ACs1) and tie-in to system.

**Project Justification:**

The supply capacity of a water system must exceed the maximum daily demand to avoid water shortages during peak summer demands. The current rated supply capacity of the system is 35.5 L/s. The 2013 max day demand (46.3 L/s) and estimated 2031 future max day demand (61.3 L/s) exceed the current rated supply capacity by 10.8 L/s and 25.8 L/s respectively.

A draft 2014 report by BC Groundwater Consulting Services Ltd. indicates that the Springhill Road Additional Capacity Well can operate at a peak rate of 7.9 L/s.

**Engineering/Financial Evaluation:**

A cost of \$248,000 to complete the well based on the 2014 construction year was provided by EPCOR Water Services.

The Springhill well projects (Project ID 18 and 19) scheduled to be completed in the 2015 – 2018 period will together add an estimated 15.3 L/s of additional capacity. Of the 15.3 L/s, 10.8 L/s is required to address existing demands; the remaining (4.5 L/s or 29%) will provide supply capacity for future developments. This project is therefore 29% developer funded.

**Consequences of NOT Undertaking the Project:**

Insufficient supply capacity to meet existing 2013 and future 2031 max day demands.

**Note:** Project description, justification and cost provided by EPCOR Water Services.

**Justification Category**

1. Safety		2. Customer Requirements	x	3. Reliability	x	4. Life Cycle Costs	
5. Regulatory		6. Environmental		7. Financial		8. Tech./Product Dev.	



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**Project Category:** 2015 – 2018 Recommended Project

**Project Name:** Church Road South Test Well (TWs1)  
 Completion

**Project ID:** 20

**Project Description:**

Complete Church Road South Test Well (TWs1) and tie-in to system.

**Project Justification:**

The supply capacity of a water system must exceed the maximum daily demand to avoid water shortages during peak summer demands. The current rated supply capacity of the system is 35.5 L/s. The 2013 max day demand (46.3 L/s) and estimated 2031 future max day demand (61.3 L/s) exceed the current rated supply capacity by 10.8 L/s and 25.8 L/s respectively.

A draft 2014 report by BC Groundwater Consulting Services Ltd. indicates that the well can operate at a peak rate of 1.6 L/s.

**Engineering/Financial Evaluation:**

A cost of \$313,000 to complete the well based on the 2014 construction year was provided by EPCOR Water Services.

This project is required to address future supply capacity requirements. This project is 100% developer funded.

**Consequences of NOT Undertaking the Project:**

Insufficient supply capacity to meet future 2031 max day demands.

**Note:** Project description, justification and cost provided by EPCOR Water Services.

**Justification Category**

1. Safety		2. Customer Requirements	x	3. Reliability		4. Life Cycle Costs	
5. Regulatory		6. Environmental		7. Financial		8. Tech./Product Dev.	

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**Project Category:** 2015 – 2018 Recommended Project

**Project Name:** Existing Wells - Well Rehabilitation

**Project ID:** 21

**Project Description:**

This project includes a rehabilitation program to maintain well performance. This project allows for rehabilitation of three wells during this three year period.

Typical rehabilitation includes removal of the pump, video inspection, motor inspection (meggar), mechanical cleaning of the casing and screen to remove deposits and re-development of the screen to remove fines and precipitates trapped behind the screen.

**Project Justification:**

Recommendations from BC Groundwater Consulting Services Ltd. (hydrogeologist) indicate that wells should be rehabilitated every 5 - 10 years to extend their useful life. Well rehabilitation provides the following:

1. Restores lost capacity;
2. Extends the working life of the well asset;
3. Allows for inspection of down-hole components such as well pump, motor, check valve, and instrumentation, and allows for replacement / rebuild on a structured basis.
4. May provide information on additional work that is required.

**Engineering/Financial Evaluation:**

Costs are estimated to be \$75,000 based on the 2014 construction year.

**Consequences of NOT Undertaking the Project:**

1. Well capacity will degrade; lack of regular redevelopment schedule may result in permanent losses in capacity and the need for drilling new wells to compensate for lost capacity.
2. Down-hole components not maintained on a regular basis increase potential for failure requiring emergency repair and reduces the reliability of the water supply.

**Note:** Project description, justification and cost provided by EPCOR Water Services.

**Justification Category**

1. Safety		2. Customer Requirements	x	3. Reliability	x	4. Life Cycle Costs	
5. Regulatory		6. Environmental		7. Financial		8. Tech./Product Dev.	



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**Project Category:** 2015 – 2018 Recommended Project

**Project Name:** Leak Detection Program

**Project ID:** 24

**Project Description:**

In 2006 a leak detection assessment was conducted but only 60% of the system was completed due to insufficient access to the infrastructure. This project will install the required access points and conduct a complete leak detection assessment. A report will be included that will identify additional possible leak locations for repair.

**Project Justification:**

In 2012, unaccounted-for water was 16% of annual demand for the EPCOR French Creek water system. The remaining areas of the system require a leak detection assessment to supplement water conservation for the community. These upgrades will constitute part of the water conservation initiative for the Utility.

This project was identified in the 2011 French Creek Growth Assessment Study prepared by Stantec Consulting Ltd.

**Engineering/Financial Evaluation:**

Costs are estimated to be \$30,000 (2014 dollars).

**Consequences of NOT Undertaking the Project:**

Continued water loss resulting in reduced revenues and increase in supply capacity requirements.

**Note:** Project description, justification and cost provided by EPCOR Water Services.

**Justification Category**

1. Safety		2. Customer Requirements		3. Reliability	x	4. Life Cycle Costs	
5. Regulatory		6. Environmental	x	7. Financial	x	8. Tech./Product Dev.	

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**Project Category:** 2015 – 2018 Recommended Project

**Project Name:** System Balancing Storage Control

**Project ID:** 27

**Project Description:**

The butterfly valve on the 250 mm diameter water main that runs under French Creek from Drew Road to Miller Road has historically been closed to balance usage between the Church Road and Drew Road reservoirs.

To improve system fire flows, pressure, and redundancy, it is recommended that the butterfly valve remain normally open. This project includes a review of the existing system instrumentation and operating logic and reprogramming existing equipment to allow the butterfly valve to remain open while ensuring that sufficient fire storage at the Drew Road Reservoirs is maintained.

**Project Justification:**

To improve system fire flows, pressure, and redundancy, it is recommended that the butterfly valve under French Creek remain normally open. A study to review the existing system instrumentation and operating logic is required to allow the butterfly valve to remain open while ensuring that sufficient fire storage at the Drew Road Reservoirs is maintained.

Completion of this project is required prior to the installation of the Drew Road Fire Pump (Project ID 8).

**Engineering/Financial Evaluation:**

An allowance of \$25,000 (2014 dollars) for this project has been provided. Note that this allowance assumes that all existing instrumentation can be reprogrammed and no additional equipment is required.

**Consequences of NOT Undertaking the Project:**

Additional upgrades may be required to address system redundancy and pressure and available fire flow deficiencies if this valve remains closed.

**Justification Category**

1. Safety		2. Customer Requirements	x	3. Reliability	x	4. Life Cycle Costs	
5. Regulatory		6. Environmental		7. Financial		8. Tech./Product Dev.	





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**Project Category:** 2015 – 2018 Recommended Project

**Project Name:** Decommission Existing Abandoned  
 Groundwater Wells

**Project ID:** 29

**Project Description:**

This project includes decommissioning the Oceanside, Imperial and Lornedunn wells in accordance with BC Groundwater Regulations.

**Project Justification:**

The Oceanside, Imperial and Lornedunn wells are no longer in use. These wells will be decommissioned in accordance with Section 9 of the Ground Water Protection Regulation that states that wells must be decommissioned if the well has not been used in 10 years.

**Engineering/Financial Evaluation:**

Costs are estimated to be \$85,000 based on the 2014 construction year.

**Consequences of NOT Undertaking the Project:**

1. Non-compliance with BC Groundwater Regulations.
2. Potential to contaminate groundwater aquifer.

**Note:** Project description, justification and cost provided by EPCOR Water Services.

**Justification Category**

1. Safety		2. Customer Requirements		3. Reliability		4. Life Cycle Costs	
5. Regulatory	x	6. Environmental	x	7. Financial		8. Tech./Product Dev.	

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**Project Category:** 2015 – 2018 Recommended Project

**Project Name:** Church Road Complex Upgrades

**Project ID:** 31

**Project Description:**

This project consists of various necessary upgrades to the Church Road Complex site. The upgrades include a magnetic flow meter located on the well supply outlet to measure ground water supply production and additional booster pump station controls.

**Project Justification:**

The need for these upgrades was identified in the French Creek Growth Assessment Study prepared by Stantec Consulting Ltd.

Installation of the magnetic flow meter on the well supply line will provide information required for ongoing well capacity analysis.

Improve operation of the Church Road Booster Pump Station by reducing the frequency that the fire pump operates and improve energy efficiency.

**Engineering/Financial Evaluation:**

Costs are estimated to be \$67,000 based on the 2014 construction year..

**Consequences of NOT Undertaking the Project:**

Without this project, improved system operation, efficiency, and well capacity monitoring will not be achieved.

**Note:** Project description, justification and cost provided by EPCOR Water Services.

**Justification Category**

1. Safety		2. Customer Requirements	x	3. Reliability	x	4. Life Cycle Costs	
5. Regulatory	x	6. Environmental		7. Financial		8. Tech./Product Dev.	



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**Project Category:** 2015 – 2018 Recommended Project

**Project Name:** Church Road Reservoir Upgrades

**Project ID:** 32

**Project Description:**

Install flexible liners for Church Road Reservoir #3 and #4.

**Project Justification:**

The existing concrete reservoirs at Church Road have been cracking over the years such that water pooling on the top of the reservoirs can leak inside. In the past, Xypex grout products have been used every few years to mitigate leaks. Installing the liners will provide a more durable, long term solution.

**Engineering/Financial Evaluation:**

Costs are estimated to be \$110,000 based on the 2014 construction year.

**Consequences of NOT Undertaking the Project:**

1. Potential contamination of stored potable water.
2. Water loss from reservoirs.

**Note:** Project description, justification and cost provided by EPCOR Water Services.

**Justification Category**

1. Safety	x	2. Customer Requirements	x	3. Reliability	x	4. Life Cycle Costs	
5. Regulatory		6. Environmental		7. Financial	x	8. Tech./Product Dev.	

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**Project Category:** 2015 – 2018 Recommended Project

**Project Name:** Geotechnical Study for Drew Road  
 Reservoirs

**Project ID:** 34

**Project Description:**

Conduct a geotechnical investigation to determine the extent of the leakage from the Drew Road reservoirs and provide mitigation options.

**Project Justification:**

Determine the extent of repairs required to maintain the storage capacity of the Drew Road reservoirs and reduce leakage / non-revenue water.

**Engineering/Financial Evaluation:**

The cost is estimated at \$20,000 for this study (2014 dollars).

**Consequences of NOT Undertaking the Project:**

Without this project, the Drew Road reservoirs will continue to leak and the extent of the repairs required will be unknown.

**Note:** Project description, justification and cost provided by EPCOR Water Services.

**Justification Category**

1. Safety		2. Customer Requirements	x	3. Reliability	x	4. Life Cycle Costs	
5. Regulatory		6. Environmental		7. Financial	x	8. Tech./Product Dev.	

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**Project Category:** Annual Programs

**Project Name:** Hydrant Installation Program

**Project ID:** 1

**Project Description:**

Hydrant coverage in certain areas does not meet the guidelines from the Master Municipal Construction Document (MMCD) Design Guideline Manual. Install six hydrants per year to improve hydrant coverage.

**Project Justification:**

The hydrant installation program provides improved fire hydrant coverage. Hydrants should be also be installed as water main upgrades, new development, and redevelopment occur.

**Engineering/Financial Evaluation:**

The cost opinion of probable cost is \$35,000 annually (2014 dollars) based on a cost of \$5,800 per hydrant.

**Consequences of NOT Undertaking the Project:**

Available fire protection may be compromised.

**Justification Category**

1. Safety		2. Customer Requirements	x	3. Reliability		4. Life Cycle Costs	
5. Regulatory		6. Environmental		7. Financial		8. Tech./Product Dev.	

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**Project Category:** Annual Programs

**Project Name:** Meter Replacement Program

**Project ID:** 2

**Project Description:**

There are 1,746 meters in the EPCOR French Creek system according to the 2013 meter records provided by EPCOR French Creek. An annual meter replacement program is currently in progress. EPCOR French Creek staff have indicated that 400 to 500 meters still require replacement. This project includes the replacement of 100 meters per year, which includes upgrading the meter reading technology to a touch pad.

Meters continue to function as they age, but wear over time will cause them to under record resulting in loss of revenue. The meter replacement goal is to replace meters on a 20 year cycle.

**Project Justification:**

1. Reduce meter under reading and non-revenue water.
2. Increase staff efficiency by reducing manual meter reading, recording and transcribing.
3. Accuracy of service meters assists in water auditing.

**Engineering/Financial Evaluation:**

The cost opinion of probable cost is \$65,000 annually (2014 dollars) to replace 100 meters per year.

**Consequences of NOT Undertaking the Project:**

1. Without accurate water meters, water usage cannot be accurately determined and billing is not equitable.
2. Loss of revenue due to under reading meters may occur.
3. Increased operating costs due to manual access, reading, recording and transcribing will occur.
4. Reduced level of service due to infrequent readings, and errors introduced by manual reading, recording and transcribing will affect customer service expectations.

**Justification Category**

1. Safety		2. Customer Requirements		3. Reliability		4. Life Cycle Costs	x
5. Regulatory		6. Environmental		7. Financial	x	8. Tech./Product Dev.	



**Project Category:** Beyond 2018 Recommended Project

**Project Name:** New Wembley Road Area Pressure Zone **Project ID:** 6

**Project Description:**

This project includes a new booster pump station for the Wembley Road Area. Preliminary scope includes:

- 5 HP Booster pump station to provide domestic flow to the new Wembley Zone with check valve bypass for fire flow;
- 1,210 m of 400 mm diameter supply main to Main Pressure Zone;
- 320 m of 200 mm diameter main on Robertson Boulevard for fire flow in the new Wembley Zone;
- 140 m of 200 mm diameter main on Neden Way for fire flow in the new Wembley Zone;
- Check valve chamber at Esslinger Road for fire flow in the new Wembley Zone; and
- 4 closed valves on existing piping

The Model Validation and Rezoning Study (Project ID 5) should be completed prior to this project.

**Project Justification:**

1. Increase available fire flow system wide.
2. Improve pressure in the Wembley Road Area (approximately 250 existing lots). Pressures increases from 32-40 psi to 55-70 psi.

**Engineering/Financial Evaluation:**

The Class D cost opinion of probable cost based on the preliminary scope is \$2,651,000 based on the 2014 construction year.

**Consequences of NOT Undertaking the Project:**

1. Fire flow deficiencies due to low residual pressure in the Wembley Road Area.
2. Pressure deficiencies (less than 44 psi) in the Wembley Road Area.
3. Impacts ability to service new developments particularly with respect to fire sprinklering.

**Justification Category**

1. Safety		2. Customer Requirements	x	3. Reliability		4. Life Cycle Costs	
5. Regulatory		6. Environmental		7. Financial		8. Tech./Product Dev.	



**Project Category:** Beyond 2018 Recommended Project

**Project Name:** Twin Church Road Supply Main at Highway **Project ID:** 7

**Project Description:**

Install 510 m of 300 mm diameter water main from Church Road Complex to the north side of Highway 19 using the existing available casing beneath the highway.

**Project Justification:**

1. Provide redundancy for the section of main under the highway, connecting the supply from Church Road to the distribution system.
2. Improves available fire flow to the east side of the Main Pressure Zone.

**Engineering/Financial Evaluation:**

The Class D cost opinion of probable cost is \$594,000 based on the 2014 construction year.

**Consequences of NOT Undertaking the Project:**

1. No redundancy for the section of main under the highway, connecting the supply from Church Road to the distribution system.
2. Reduced available fire flow in the east side of the Main Pressure Zone.

**Justification Category**

1. Safety		2. Customer Requirements	x	3. Reliability	x	4. Life Cycle Costs	
5. Regulatory		6. Environmental		7. Financial		8. Tech./Product Dev.	





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**Project Category:** Beyond 2018 Recommended Project

**Project Name:** Drew Road Fire Pump

**Project ID:** 8

**Project Description:**

Install a diesel driven fire pump at the Drew Road Complex including an enclosure.

**Project Justification:**

Increase available fire flow throughout the Main Pressure Zone.

The System Balancing Storage Control project (Project ID 27) is required prior to installing the Drew Road Fire Pump.

**Engineering/Financial Evaluation:**

The Class D cost opinion of probable cost is \$500,000 based on the 2014 construction year.

**Consequences of NOT Undertaking the Project:**

1. Fire flow deficiencies remain throughout the Main Pressure Zone.
2. Impacts ability to service new commercial, industrial, and institutional developments with required fire flow.

**Justification Category**

1. Safety		2. Customer Requirements	x	3. Reliability		4. Life Cycle Costs	
5. Regulatory		6. Environmental		7. Financial		8. Tech./Product Dev.	

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**Project Category:** Beyond 2018 Recommended Project

**Project Name:** Island Highway Looping

**Project ID:** 9

**Project Description:**

Install 410 m of 200 mm diameter main to complete loop between Wright Road and Riley Road on Island Highway West including three fire hydrants (to be confirmed based on coverage of Parksville hydrants).

**Project Justification:**

1. Improve available fire flow to existing commercial and institutional developments at the 800 block of Island Highway West. Existing available fire flow is 79 L/s (150 L/s required). Two existing commercial / institutional lots are affected by this project.
2. Provides looping between Wright Road and Riley Road and improves system redundancy.

Note the that Wembley Road Area Pressure Zone (Project ID 6) and the Drew Road Fire Pump (Project ID 8) are also required to provide 150 L/s of available fire flow at this location.

Note that the Regional District of Nanaimo (RDN) has jurisdiction over the fire protection requirements for EPCOR French Creek. RDN currently requires fire flows to follow the MMCD minimum fire flow values for existing and future developments.

**Engineering/Financial Evaluation:**

The Class D cost opinion of probable cost is \$390,000 based on the 2014 construction year.

**Consequences of NOT Undertaking the Project:**

Calculated available fire flow is 79 L/s (below requirement). Note the that Wembley Road Area Pressure Zone (Project ID 6) and the Drew Road Fire Pump (Project ID 8) are also required to provide 150 L/s of available fire flow at this location.

**Justification Category**

1. Safety		2. Customer Requirements	x	3. Reliability		4. Life Cycle Costs	
5. Regulatory		6. Environmental		7. Financial		8. Tech./Product Dev.	



**Project Category:** Beyond 2018 Recommended Project

**Project Name:** Morningstar Drive Looping

**Project ID:** 10

**Project Description:**

Install 320 m of 200 mm diameter main to complete loop between Morningstar Drive and Robertson Boulevard including two fire hydrants.

**Project Justification:**

1. Improve available fire flow to the multi family development on Morningstar Drive and Lee Road. Existing available fire flow is 70 L/s (90 L/s required). One multi-family development is affected by this project.
2. Provides looping between Morningstar Drive and Robertson Boulevard and improves system redundancy.

Note the that Drew Road Fire Pump (Project ID 8) is also required to provide 90 L/s of available fire flow at this location.

Note that the Regional District of Nanaimo (RDN) has jurisdiction over the fire protection requirements for EPCOR French Creek. RDN currently requires fire flows to follow the MMCD minimum fire flow values for existing and future developments.

**Engineering/Financial Evaluation:**

The Class D cost opinion of probable cost is \$305,000 based on the 2014 construction year.

**Consequences of NOT Undertaking the Project:**

Calculated available fire flow is 70 L/s (below requirement). Note the Drew Road Fire Pump (Project ID 8) is also required to provide 90 L/s of available fire flow at this location.

**Justification Category**

1. Safety		2. Customer Requirements	x	3. Reliability		4. Life Cycle Costs	
5. Regulatory		6. Environmental		7. Financial		8. Tech./Product Dev.	



**Project Category:** Beyond 2018 Recommended Project

**Project Name:** Wembley Road Looping

**Project ID:** 11

**Project Description:**

Install 180 m of 250 mm diameter main to complete loop between Tara Crescent and Reid Road on Wembley Road including two fire hydrants.

**Project Justification:**

1. Improve available fire flow to existing commercial and institutional developments at Wembley Road and Island Highway West. Existing available fire flow is 81 L/s (150 L/s required). Two existing commercial / institutional lots are affected by this project.
2. Provides looping between Tara Crescent and Reid Road and improves system redundancy.

Note the that Wembley Road Area Pressure Zone (Project ID 6) and the Drew Road Fire Pump (Project ID 8) are also required to provide 150 L/s of available fire flow at this location.

Note that the Regional District of Nanaimo (RDN) has jurisdiction over the fire protection requirements for EPCOR French Creek. RDN currently requires fire flows to follow the MMCD minimum fire flow values for existing and future developments.

**Engineering/Financial Evaluation:**

The Class D cost opinion of probable cost is \$203,000 based on the 2014 construction year.

**Consequences of NOT Undertaking the Project:**

Calculated available fire flow is 81 L/s (below requirement). Note the that Wembley Road Area Pressure Zone (Project ID 6) and the Drew Road Fire Pump (Project ID 8) are also required to provide 150 L/s of available fire flow at this location.

**Justification Category**

1. Safety		2. Customer Requirements	x	3. Reliability		4. Life Cycle Costs	
5. Regulatory		6. Environmental		7. Financial		8. Tech./Product Dev.	



**Project Category:** Beyond 2018 Recommended Project

**Project Name:** Island Highway and Sunrise Drive Fire Flow Upgrades **Project ID:** 12

**Project Description:**

Upgrade 170 m of existing 150 mm diameter water main on Island Highway west of Sunrise Drive to 200 mm diameter main including two hydrants.

**Project Justification:**

Improve available fire flow at existing commercial developments located at 1580 Sunrise Drive and 1395 Island Highway West. Existing available fire flow is 72 L/s (150 L/s required). Three existing commercial / institutional lots are affected by this project.

Note that the Drew Road Fire Pump (Project ID 8) is also required to provide 150 L/s of available fire flow at this location.

Note that the Regional District of Nanaimo (RDN) has jurisdiction over the fire protection requirements for EPCOR French Creek. RDN currently requires fire flows to follow the MMCD minimum fire flow values for existing and future developments.

**Engineering/Financial Evaluation:**

The Class D cost opinion of probable cost is \$177,000 based on the 2014 construction year.

**Consequences of NOT Undertaking the Project:**

Calculated available fire flow is 72 L/s (below requirement). Note the Drew Road Fire Pump (Project ID 8) is also required to provide 150 L/s of available fire flow at this location.

**Justification Category**

1. Safety		2. Customer Requirements	x	3. Reliability		4. Life Cycle Costs	
5. Regulatory		6. Environmental		7. Financial		8. Tech./Product Dev.	



**Project Category:** Beyond 2018 Recommended Project

**Project Name:** Lundine Lane Fire Flow Upgrades and Raw Water Supply Upgrades **Project ID:** 13

**Project Description:**

1. Upgrade 200 m of existing 100 mm diameter distribution main on Lundine Lane to 200 mm diameter main including one fire hydrant.
2. Upgrade 130 m of existing 100 mm diameter raw water supply main on Lundine Lane including a highway crossing.

These recommended projects were combined into one project to save on common costs (i.e. paving, excavation, etc.)

**Project Justification:**

1. Improve available fire flow to existing single family residential development on Windward Way. Existing available fire flow is 45 L/s (60 L/s required). Approximately 150 lots are affected by this project.
2. Reduce losses in raw water supply main to allow for higher well yield in the future.

Note that the Regional District of Nanaimo (RDN) has jurisdiction over the fire protection requirements for EPCOR French Creek. RDN currently requires fire flows to follow the MMCD minimum fire flow values for existing and future developments.

**Engineering/Financial Evaluation:**

The Class D cost opinion of probable cost is \$331,000 based on the 2014 construction year.

The portion of this project that provides fire flow improvement addresses an existing deficiency. Upgrading the raw water main is required to address future supply capacity deficiencies. The cost to address the future deficiency is 39% of the total cost; therefore 39% of this project is developer funded.

**Consequences of NOT Undertaking the Project:**

1. Calculated available fire flow is 45 L/s (below requirement).
2. Limited capacity to increase groundwater well yield in the future due to friction losses in existing 100 mm diameter raw water main.

**Note:** Project description, justification and cost provided by EPCOR Water Services.

**Justification Category**

1. Safety		2. Customer Requirements	x	3. Reliability		4. Life Cycle Costs	
5. Regulatory		6. Environmental		7. Financial		8. Tech./Product Dev.	



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**Project Category:** Beyond 2018 Recommended Project

**Project Name:** Breakwater Road Fire Flow Upgrades

**Project ID:** 14

**Project Description:**

Upgrade 140 m of existing 100 mm diameter main on Breakwater Road to 150 mm diameter main including two fire hydrants.

**Project Justification:**

Improve available fire flow to existing single family residential development on Breakwater Road. Existing available fire flow is 47 L/s (60 L/s required). Approximately 10 lots are affected by this project.

Note that the Regional District of Nanaimo (RDN) has jurisdiction over the fire protection requirements for EPCOR French Creek. RDN currently requires fire flows to follow the MMCD minimum fire flow values for existing and future developments.

**Engineering/Financial Evaluation:**

The Class D cost opinion of probable cost is \$134,000 based on the 2014 construction year.

**Consequences of NOT Undertaking the Project:**

Calculated available fire flow is 47 L/s (below requirement).

**Justification Category**

1. Safety		2. Customer Requirements	x	3. Reliability		4. Life Cycle Costs	
5. Regulatory		6. Environmental		7. Financial		8. Tech./Product Dev.	

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**Project Category:** Beyond 2018 Recommended Project

**Project Name:** Cavin Road Fire Flow Upgrades

**Project ID:** 15

**Project Description:**

Upgrade 60 m of existing 100 mm diameter main on Cavin Road to 150 mm diameter main including one fire hydrant.

**Project Justification:**

Improve available fire flow to existing single family residential development on Cavin Road. Existing available fire flow is 44 L/s (60 L/s required). Approximately 5 lots are affected by this project

Note that the Regional District of Nanaimo (RDN) has jurisdiction over the fire protection requirements for EPCOR French Creek. RDN currently requires fire flows to follow the MMCD minimum fire flow values for existing and future developments.

**Engineering/Financial Evaluation:**

The Class D cost opinion of probable cost is \$60,000 based on the 2014 construction year.

**Consequences of NOT Undertaking the Project:**

Calculated available fire flow is 44 L/s (below requirement).

**Justification Category**

1. Safety		2. Customer Requirements	x	3. Reliability		4. Life Cycle Costs	
5. Regulatory		6. Environmental		7. Financial		8. Tech./Product Dev.	





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**Project Category:** Beyond 2018 Recommended Project

**Project Name:** Admiral Tyron Boulevard West of Columbia Drive Fire Flow Upgrades **Project ID:** 16

**Project Description:**

Upgrade 230 m of existing 100 mm diameter main on Admiral Tyron Boulevard west of Columbia Drive to 150 mm diameter main including two fire hydrants.

**Project Justification:**

Improve available fire flow to existing single family residential development on Admiral Tyron Boulevard. Existing available fire flow is 47 L/s (60 L/s required). Approximately 35 lots are affected by this project.

Note that the Regional District of Nanaimo (RDN) has jurisdiction over the fire protection requirements for EPCOR French Creek. RDN currently requires fire flows to follow the MMCD minimum fire flow values for existing and future developments.

**Engineering/Financial Evaluation:**

The Class D cost opinion of probable cost is \$199,000 based on the 2014 construction year.

**Consequences of NOT Undertaking the Project:**

Calculated available fire flow is 47 L/s (below requirement).

**Justification Category**

1. Safety		2. Customer Requirements	x	3. Reliability		4. Life Cycle Costs	
5. Regulatory		6. Environmental		7. Financial		8. Tech./Product Dev.	

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 2017-2018 Revenue Requirement and Rates Application



**Project Category:** Beyond 2018 Recommended Project

**Project Name:** Mason Trail Fire Flow Upgrades

**Project ID:** 17

**Project Description:**

Upgrade 150 m of existing 100 mm diameter main on Mason Trail to 150 mm diameter main including one fire hydrant.

**Project Justification:**

Improve available fire flow to existing single family residential development on Mason Trail. Existing available fire flow is 36 L/s (60 L/s required). Approximately 15 lots are affected by this project.

Note that the Regional District of Nanaimo (RDN) has jurisdiction over the fire protection requirements for EPCOR French Creek. RDN currently requires fire flows to follow the MMCD minimum fire flow values for existing and future developments.

**Engineering/Financial Evaluation:**

The Class D cost opinion of probable cost is \$132,000 based on the 2014 construction year.

**Consequences of NOT Undertaking the Project:**

Calculated available fire flow is 36 L/s (below requirement).

**Justification Category**

1. Safety		2. Customer Requirements	x	3. Reliability		4. Life Cycle Costs	
5. Regulatory		6. Environmental		7. Financial		8. Tech./Product Dev.	



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**Project Category:** Beyond 2018 Recommended Project

**Project Name:** Marina Fire Flow Improvements

**Project ID:** 22

**Project Description:**

Upgrade 280 m of existing 150 mm diameter main on Lee Road from Island Highway West to the Marina to 200 mm diameter main including 2 fire hydrants.

**Project Justification:**

Improve available fire flow to the Marina. Existing available fire flow is 70 L/s (150 L/s required). Three existing commercial / institutional lots are affected by this project.

Note that the Wembley Road Area Pressure Zone (Project ID 6) and the Drew Road Fire Pump (Project ID 8) are also required to provide 150 L/s of available fire flow at this location.

Note that the Regional District of Nanaimo (RDN) has jurisdiction over the fire protection requirements for EPCOR French Creek. RDN currently requires fire flows to follow the MMCD minimum fire flow values for existing and future developments.

**Engineering/Financial Evaluation:**

The Class D cost opinion of probable cost is \$278,000 based on the 2014 construction year.

**Consequences of NOT Undertaking the Project:**

Calculated available fire flow is 70 L/s (below requirement). Note the Wembley Road Area Pressure Zone (Project ID 6) and the Drew Road Fire Pump (Project ID 8) are also required to provide 150 L/s of available fire flow at this location.

**Justification Category**

1. Safety		2. Customer Requirements	x	3. Reliability		4. Life Cycle Costs	
5. Regulatory		6. Environmental		7. Financial		8. Tech./Product Dev.	

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**Project Category:** Beyond 2018 Recommended Project

**Project Name:** Glenhale Crescent Fire Flow Upgrades

**Project ID:** 23

**Project Description:**

Upgrade 70 m of existing 100 mm diameter main on Glenhale Crescent to 150 mm diameter main including one fire hydrant.

**Project Justification:**

Improve available fire flow to existing single family residential development on Glenhale Crescent. Existing available fire flow is 55 L/s (60 L/s required). Approximately 10 lots are affected by this project.

Note that the Regional District of Nanaimo (RDN) has jurisdiction over the fire protection requirements for EPCOR French Creek. RDN currently requires fire flows to follow the MMCD minimum fire flow values for existing and future developments.

**Engineering/Financial Evaluation:**

The Class D cost opinion of probable cost is \$74,000 based on the 2014 construction year.

**Consequences of NOT Undertaking the Project:**

Calculated available fire flow is 55 L/s (below requirement).

**Justification Category**

1. Safety		2. Customer Requirements	x	3. Reliability		4. Life Cycle Costs	
5. Regulatory		6. Environmental		7. Financial		8. Tech./Product Dev.	



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**Project Category:** Beyond 2018 Recommended Project

**Project Name:** Admiral Tyron Boulevard East of Viking Way **Project ID:** 25  
 Fire Flow Upgrades

**Project Description:**

Upgrade 180 m of existing 150 mm diameter main on Admiral Tyron Boulevard east of Viking Way to 200 mm diameter main including two fire hydrants.

**Project Justification:**

Improve available fire flow to existing single family residential development on Admiral Tyron Boulevard. Existing available fire flow is 53 L/s (60 L/s required). Approximately 5 lots are affected by this project.

Note that the Regional District of Nanaimo (RDN) has jurisdiction over the fire protection requirements for EPCOR French Creek. RDN currently requires fire flows to follow the MMCD minimum fire flow values for existing and future developments.

**Engineering/Financial Evaluation:**

The Class D cost opinion of probable cost is \$186,000 based on the 2014 construction year.

**Consequences of NOT Undertaking the Project:**

Calculated available fire flow is 53 L/s (below requirement).

**Justification Category**

1. Safety		2. Customer Requirements	x	3. Reliability		4. Life Cycle Costs	
5. Regulatory		6. Environmental		7. Financial		8. Tech./Product Dev.	

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**Project Category:** Beyond 2018 Recommended Project

**Project Name:** Manse Road Looping

**Project ID:** 26

**Project Description:**

Install 300 m of 200 mm diameter main to complete loop on Manse Road to Wembley Road including two fire hydrants.

**Project Justification:**

Improve available fire flow to existing single family residential development on Manse Road. Existing available fire flow is 47 L/s (60 L/s required). Approximately 5 lots are affected by this project.

Note that the Regional District of Nanaimo (RDN) has jurisdiction over the fire protection requirements for EPCOR French Creek. RDN currently requires fire flows to follow the MMCD minimum fire flow values for existing and future developments.

**Engineering/Financial Evaluation:**

The Class D cost opinion of probable cost is \$288,000 based on the 2014 construction year.

**Consequences of NOT Undertaking the Project:**

Calculated available fire flow is 47 L/s (below requirement).

**Justification Category**

1. Safety		2. Customer Requirements	x	3. Reliability		4. Life Cycle Costs	
5. Regulatory		6. Environmental		7. Financial		8. Tech./Product Dev.	



**Project Category:** Beyond 2018 Recommended Project

**Project Name:** Groundwater Exploration (Exploratory Boreholes)

**Project ID:** 28

**Project Description:**

The scope of this project is to undertake an Electrical Resistivity Tomography (“ERT”) geophysical survey and drill an exploratory borehole at/or around the locations identified by BC Groundwater Consulting Services Ltd.

**Project Justification:**

The Regional District of Nanaimo “Area G” Official Community Plan (GOCP), adopted as Bylaw 1540 in 2008, identified several areas for growth including French Creek Harbour Centre and Wembley Centre. The GOCP (2008) estimated a population for “Area G” of 12,000 by 2026. Additional ground water wells will be required to meet the increase in demand.

In response for the demand for new wells, BC Groundwater Consulting Services Ltd. (“BC Groundwater”) has provided EPCOR Water Services with Well Sustainability Evaluation and Operation Planning Report. They identified that additional wells are required for growth. The EPCOR Water West (EWW) Resource Plan also concluded that additional water supplies are required to meet projected demands. Based on their recent experience with drilling in 2011 BC Groundwater recommends undertaking an ERT survey of the general area to identify two or three potential drilling targets locations. Two of the sites will be selected for advancing a 150 mm (6 inch) diameter exploratory borehole to collect the information required for construction of a future well at the site.

**Engineering/Financial Evaluation:**

Costs are estimated to be \$149,000 based on the 2014 construction year.

This project is required to address future supply capacity requirements. This project is 100% developer funded.

**Consequences of NOT Undertaking the Project:**

New commercial and/or residential developments will not be permitted as supply capacity does not meet future demand requirements. Note wells have already been identified for immediate water capacity needs (Project ID 18 and 19). This study provides for planning beyond the immediate horizon.

**Note:** Project description, justification and cost provided by EPCOR Water Services.

**Justification Category**

1. Safety		2. Customer Requirements	x	3. Reliability		4. Life Cycle Costs	
5. Regulatory		6. Environmental		7. Financial		8. Tech./Product Dev.	



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**Project Category:** Beyond 2018 Recommended Project

**Project Name:** Decommission Future Abandoned  
 Groundwater Wells

**Project ID:** 30

**Project Description:**

This project includes decommissioning the Springhill Road #1 and #2 wells in accordance with BC Groundwater Regulations.

**Project Justification:**

Section 9 of the Ground Water Protection Regulation that states that wells must be decommissioned if the well has not been used in 10 years.

**Engineering/Financial Evaluation:**

Costs are estimated to be \$50,000 based on the 2014 construction year.

**Consequences of NOT Undertaking the Project:**

Non-compliance with BC Groundwater Regulations.

**Note:** Project description, justification and cost provided by EPCOR Water Services.

**Justification Category**

1. Safety		2. Customer Requirements		3. Reliability		4. Life Cycle Costs	
5. Regulatory	x	6. Environmental		7. Financial		8. Tech./Product Dev.	





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**Project Category:** Beyond 2018 Recommended Project

**Project Name:** Church Road Well Supply Main Upgrades **Project ID:** 33

**Project Description:**

Upgrade 120 m of existing Church Road raw water supply main to 200 mm diameter.

**Project Justification:**

With the increase in flow and production expected from the new wells in the south region, scheduled to come online in the 2015 to 2018 period, a section of the well supply main needs to be upgraded to reduce losses and increase well capacity.

**Engineering/Financial Evaluation:**

The cost estimate is \$42,000 based on the 2014 construction year.

This project is required to address future supply capacity requirements. This project is 100% developer funded.

**Consequences of NOT Undertaking the Project:**

Limited capacity to increase groundwater well yield in the future due to friction losses in existing raw water main.

**Note:** Project description, justification and cost provided by EPCOR Water Services.

**Justification Category**

1. Safety		2. Customer Requirements	x	3. Reliability		4. Life Cycle Costs	
5. Regulatory		6. Environmental		7. Financial		8. Tech./Product Dev.	

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