Greater Vernon Water (GVW)

Technical Memorandum No. 4

Domestic Water System Analysis

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Revision Log

Revision #	Revised By	Date	Issue / Revision Description
1	NW	October 4, 2012	Original Draft
2	NW	December 5, 2012	Addresses RDNO Comments, see revisions table.
3	NW	December 7, 2012	Leakage as % of average demand.
4	NW	January 22,2013	Address RDNO comments regarding fire hydrant spacing and completed KLPS VFD project.
5	NW	February 6, 2013	Naming consistency corrections.
6	NW	February 8, 2012	Table 2-2 typo corrected.
7	NW	February 26, 2013	As per RDNO comments corrections to existing physical system (below PRV 39 Swan Lake, BX Road, and Lower Coldstream areas.

Signatures

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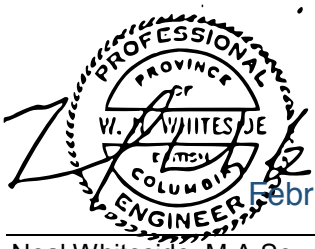

February 27, 2013

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1 Introduction

1.1 Purpose

Development of a long-term water supply plan for the Greater Vernon Water (GVW) requires an understanding of the existing domestic water system and its deficiencies relative to current and projected demands. This technical memorandum identifies the deficiencies of the existing system and the required domestic system conveyance capital tasks (i.e. excluding supply and treatment) to meet current and future demands.

For system modeling and analysis, a baseline is required to complete an analysis. The baseline used for this technical memorandum is "Limited System Separation and Two Filtration Plants" (Option 1 of TM9 - System Separation Options). Changes to the base set of capital tasks will be identified for other system separation options in TM9.

The purpose of this technical memorandum is to:

- Document / summarize the existing domestic conveyance system,
- Identify design criteria for evaluation of the domestic system,
- Analyze the water system and identify key transmission, storage and pumping deficiencies (on the basis of supply Option 1), and
- Identify required upgrades.

1.2 Report Objectives

This technical memorandum analyzes the existing domestic water system and provides recommendations for upgrades. The memorandum addresses the following items from the Terms of Reference:

- Task 2 – Inventory of Existing System.
- Task 11 – Domestic Water System Development.
- Task 14 – Development of System Hydraulic Models.
- Task 28 – Storage Requirements for Distribution.
- Task 30 – Infrastructure Requirements for Storage.

1.3 Coordination with Other Technical Memoranda

This technical memorandum builds on previous work contained in other technical memoranda as follows:

- Demand Forecast - as developed in Technical Memorandum #1. Generally yr-2052 demands were used to evaluate the system.
- Water Treatment and Sources - as developed in Technical Memoranda #2, 3, and 7. It is assumed that the main supply points to the domestic system are Duteau Water Treatment Plant and Mission Hill Water Treatment Plant. Existing Ranch Wells and Goose Lake Reservoir are to be used for irrigation only.
- Independent Agricultural System - as developed in Technical Memorandum # 5 and presented as Option 1 in Technical Memorandum #9. For the initial analysis, it was assumed that only the current Lavington and Swan Lake separation programs were completed (including the Von-Keyserlingk, King Edward, Binns and West Swan Lake separation programs). It is understood that the design work for Binns/Highway #6 is completed and the remaining design is underway. Springfield is scheduled to be undertaken in 2013. Both

will be completed in 2013. The West Swan Lake Separation program design is complete and construction is approximately 65% complete (as of Dec. 2012).

It is noted that the evaluation of deficiencies and upgrades required cannot be done in complete isolation from the consideration of the overall system separation strategy between agricultural and domestic uses. Where deficiencies exist that could be rectified / materially impacted through system separation, the domestic deficiencies are identified in this technical memorandum and the evaluation of upgrading requirements is considered in Technical Memorandum #9 (System Separation Options).

1.4 Scope

The scope of the analysis is as appropriate for a master water plan. As such, the focus of the memorandum is on identification of transmission system issues. Identification and correction of all local distribution system level deficiencies (e.g. in general less than 300 mm dia. piping) has not been completed.

1.5 Definitions

Domestic Service Main (PW) - For the purposes of this memorandum, a domestic service main is defined as a main that is only connected to services requiring potable water. It would include areas with residential, industrial, commercial and institutional land uses. A domestic main may be supplied by a CW main.

Agricultural Service Main (RW) – An RW is any main that is only connected to services that do not require potable water, i.e. agricultural irrigation services. A RW main may be supplied by a CW main.

Combined Service Main (CW) - A main that has both potable water and non-potable (agricultural irrigation) services connected.

Tank - A closed treated water tank for daily balancing, fire and emergency storage. This term is used to differentiate this class of facilities from the RDNO's much larger open raw water reservoirs used for seasonal storage.

2 Design Criteria

2.1 General

Water system design criteria have been taken from the GVWU Waterworks Regulation Bylaw No. 2063 (GVS, 2005) except where noted otherwise. This memorandum considers sizing criteria (i.e. relating to conveyance capability) only. Consideration of water quality, condition, and operational adequacy (e.g. pipe condition, access, chlorine residuals) is not included in the scope.

2.2 Water Demands

Based on GVW operational records and a water conservation planning approach, the following unit rates in Table 2-1 were used to develop the water demand forecasts used in the analysis. For details on the derivation of the unit rates see Technical Memorandum #1 of the Master Water Plan (MWP).

Table 2-1: Domestic Unit Rates

Description	Value	Unit	Source
Base residential water use (winter)	250	L/ca/day	Existing average value is 271 L/ca/day from 2009 Model Update. 250 L/ca/day accounts for water conservation efforts.
Dwelling Unit Density			
Single-Family	2.62	ca/DU	Values based on increase in dwelling units and population forecasted in Regional Growth Strategy
Multi-Family	2.12	ca/DU	
Base ICI water use	100	L/emp/day	Existing observed value derived from 2009 Model Update report.
Unaccounted for Water	13.6 %	% of ADD	Existing estimate (KWL, 2009) distributed as of current MDD (no variation - winter to summer).
Seasonal water demand rate			
Residential	17,300	L/ha/day	Observed values from metered residences (2007).
Residential Density			
(average lot area/DU)			
Single-family detached	600	sq.m./DU	Observed value from recent developments.
Single-family attached	300	sq.m./DU	Assigned value in consultation with RDNO planning.
Multi-family medium density	150	sq.m./DU	Assigned value in consultation with RDNO planning.
Multi-family high density	100	sq.m./DU	Assigned value in consultation with RDNO planning.
Seasonal ICI water use	185	L/emp/day	from existing average (2009 model report)

The unit rates combined with growth forecasts and agricultural usage results in overall system demands as shown in Table 2-2:

Table 2-2: Demand Forecast

	Annual Demand (ML)				Max. Day Demand Consumption (MLD)		
Year	**Domestic**	**Agricultural (actual)**	**Agricultural (allotment)**	**Total[1]**	**Domestic**	**Agricultural**	**Total**
2011	9,670	12,600	17,400	27,100	59.4	213	272[2]
2016	9,880		17,400	27,300	60.1	213	273
2021	10,470		17,400	27,900	63.1	213	276
2026	11,060		17,400	28,500	66.0	213	279
2031	11,550		17,400	29,000	68.1	213	281
2041	12,450		17,400	29,900	73.4	213	286
2052	13,360		17,400	30,800	78.5	213	292

2.3 Pressures

Table 2-3 shows the design pressures for distribution mains required. The design criteria do not apply to transmission mains (mains without service connections). The Standard suggests a maximum design pressure of 1550 kPa for transmission mains, however in practice design pressures for transmission mains are typically specific to the service (i.e. lower pressure at high points near sources and potentially higher at low points).

[1] *Total Annual consumption is agricultural allotment (2564 ha @ 550 mm/yr) + domestic.*
[2] *Observed Maximum Demand of 192 MLD for 2011 (wet summer).*

Table 2-3: Pressure Criteria. (Source: GVS, 2005)

Condition	kPa	Psi
Min. Pressure (Fire)	140	20
Min. Normal Pressure (Peak Hour)	300	44
Max. Static Pressure	900	130

2.4 Fire Protection

The minimum fire demands required by GVS Standards (2005) are shown in Table 2-4 for reference.

Table 2-4: Fire Demand Criteria. (Source: GVS, 2005)

Land Use	Required Fire Flow	Design Duration (hr)	Required Fire Volume
Single Family Residential	60 L/s (5.2 MLD)	1.5	0.32 ML
Low-Medium Density Residential	90 L/s (7.8 MLD)	2.0	0.65 ML
Light Industrial / Commercial	90 L/s (7.8 MLD)	2.0	0.65 ML
High Density Residential	150 L/s (13.0 MLD)	2.0	1.08 ML
Industrial	200 L/s (17.3 MLD)	2.5	1.80 ML

In areas with separated domestic and agricultural mains, hydrant fire protection may be provided by either main.

The building fire sprinkler demands are based on NFPA standards and are to be provided by the domestic service. The required sprinkler demands for buildings governed by NFPA13D (single family homes) is 1.6 L/s (2 sprinkler heads) for a duration of 10 min. (1 m^3 volume). For other sprinkler systems governed by NFPA 13 or 13R, flows are system specific. However an allowance of 60 L/s for 90 min. (324 m^3 volume) allows for most ordinary hazard buildings.

2.5 Minimum Pipe Size

The Standard requires a minimum pipe size of 150 mm dia. (100 mm in cul-de-sacs with no fire hydrants) for water mains in new developments where mains provide fire protection.

For costing of projects the MWP follows this standard.

Smaller domestic mains (subject to hydraulic limitations) could be considered for servicing of isolated domestic services where an existing larger agricultural main is already providing adequate fire protection and domestic services connected are limited and only single-family homes (i.e. governed by NFPA13D).

2.6 Fire Hydrant Spacing

Examination of existing fire hydrant spacing is not part of the MWP. Hydrants requirements for each jurisdiction (City of Vernon, Coldstream and RDNO) are to be established by that jurisdiction.

2.7 Tank Storage

The Waterworks System Bylaw 2063 requires tank volumes based on the need to provide daily balancing storage fire storage (B), and emergency storage (C). Fire storage and emergency storage may be obtained from higher zones. The following formula is reproduced from the (Waterworks System Bylaw 2063) for calculation of required tank volume (V):

V = A + B + C = (6 hours x service area MDD) + (FUS[3] Volume based on fire demand) + (25% x (A+B))

While not specifically allowed by the Standard, common practice (including in the RDNO system) also allows for provision of storage via pumping where it is not practical to provide a gravity supply (typically for smaller isolated zones above the existing tank).

2.8 Pump Station Rated Capacity

The Waterworks System Bylaw 2063 requires the rated capacity of a pump station to be considered with the largest pump out of service. Where the system serviced has a balancing tank available, the station capacity must be sufficient for maximum day demands (MDD). If the station is providing instantaneous demands (no tank) then the station shall be sized for the greater of fire demands plus MDD or peak hour demand (PHD).

3 Existing System

3.1 Supply Systems

The main supply systems are described / defined below.

- *Mission Hill Treated system (MHT)* - The treated water system that is serviced from the Mission Hill Water Treatment Plant (current capacity of 40 megalitres per day or MLD, upgradeable to 58 MLD). This includes virtually all of the serviced areas of the City of Vernon plus portions of Coldstream adjacent to Vernon.

- *Duteau Treated system (DT)* - The treated water system that is serviced from the Duteau Water Treatment Plant (current rated capacity of 151 ML/d). It currently also includes supply from Ranch Well #1. This system includes the majority of the serviced areas of Coldstream, RDNO Electoral Areas “B”, “C”, and “D” and Spallumcheen (Stepping Stones subdivision). Several interconnects exist between the DT and MHT systems including the recent McMechan Interconnect near the McMechan Reservoir.

- *Duteau Raw water system (DR)* - The system that is serviced from the un-treated raw water from the Duteau Creek Watershed source. This system currently services agricultural uses in the vicinity of the Duteau Water Treatment Plant (WTP) including the Von Keyserlingk Pump Station.

- *King Edward Raw system (KER)* - The system that is serviced from King Edward Lake. It currently also includes supply from Ranch Well #2 (82’ deep) and may be supplied by Ranch Well #1 (175’ deep).

- Goose Lake Raw system (GLR) - The system that is supplied from the Goose Lake Reservoir (as created by the current West Swan Lake separation program). Currently the Goose Lake Reservoir is supplied from the DT system. Once the Swan Lake separation program is complete, the Goose Lake Reservoir will still be supplied from the DT system but separated by backflow prevention devices. The Goose Lake Reservoir

[3] *Fire Underwriter’s Survey, Water Supply for Public Fire Protection, 1999.*

receives negligible supply from rainfall / local runoff. When complete, this system will service agricultural uses in West Swan Lake and Bella Vista.

3.2 Domestic Sub-Systems

In order to structure the analysis of the domestic systems (DT and MHT), they were further divided into sub-systems as shown in Table 3-1 and Figure 3-1. Figure 3-2 provides a schematic of the inter-relationship between the sub-systems.

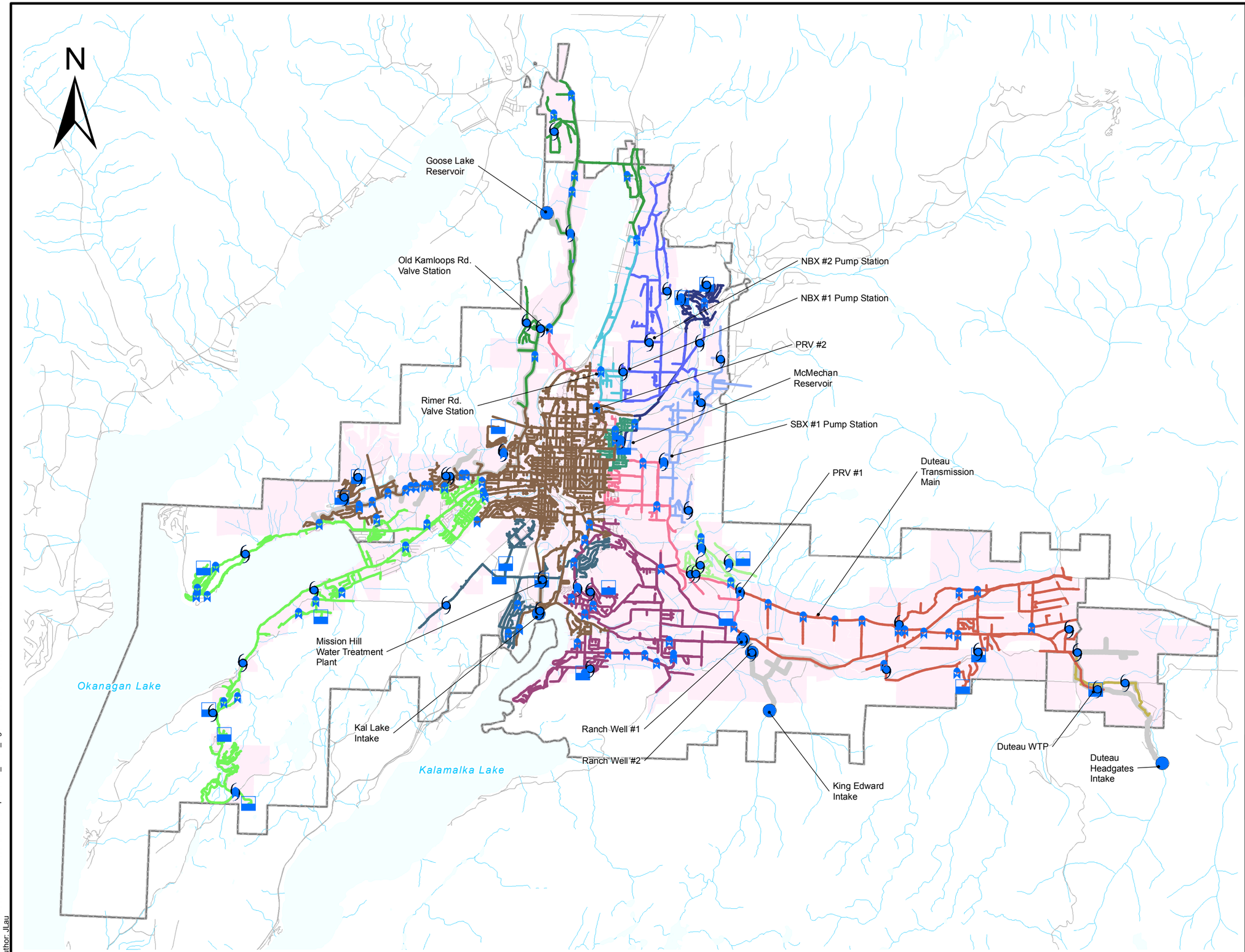
It is noteworthy that the domestic sub-systems are distinct from the service areas shown in Technical Memorandum #1 on demands and refer to the water system infrastructure (i.e. specific water mains, reservoirs, pump and valve stations) rather than service areas.

Where demands are shown in the analysis they are forecast yr-2051 demands as per the current system separation (including West Swan Lake separation). Table 3-1 outlines the DT and MHT domestic sub-systems.

Table 3-1: Domestic Sub-Systems

System	Sub-System	Currently[4] Separated?
Duteau Treated (DT)	Lavington Area "D" Treated Water Pumped	Yes
	Coldstream East	Partially
	Coldstream Valley Estates	No
	PRV 1	No
	Coldstream West	Partially
	South BX	No
	North BX	No
	East Swan Lake	No
	West Swan Lake	Yes, except Stepping Stones
Mission Hill (MHT)	Central Vernon	Yes
	Upper Mission Hill	Yes
	East Vernon	Yes
	Silver Star Foothills	Yes
	SW Vernon	Yes

[4] *Or planned & designed separations including West Swan Lake.*



Greater Vernon Water
2012 Master Water Plan

Legend

- Serviced Area

Subsystem

- Central Vernon
- Coldstream East
- Coldstream West
- East Swan Lake
- East Vernon
- Lavington Area "D" Treated Water Pumped
- North BX
- PRV 1
- Coldstream Valley Estates
- SW Vernon
- Silver Star
- South BX
- Upper Mission Hill
- West Swan Lake
- Raw Water

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Definition Plan for Domestic Subsystems

Figure 3-1

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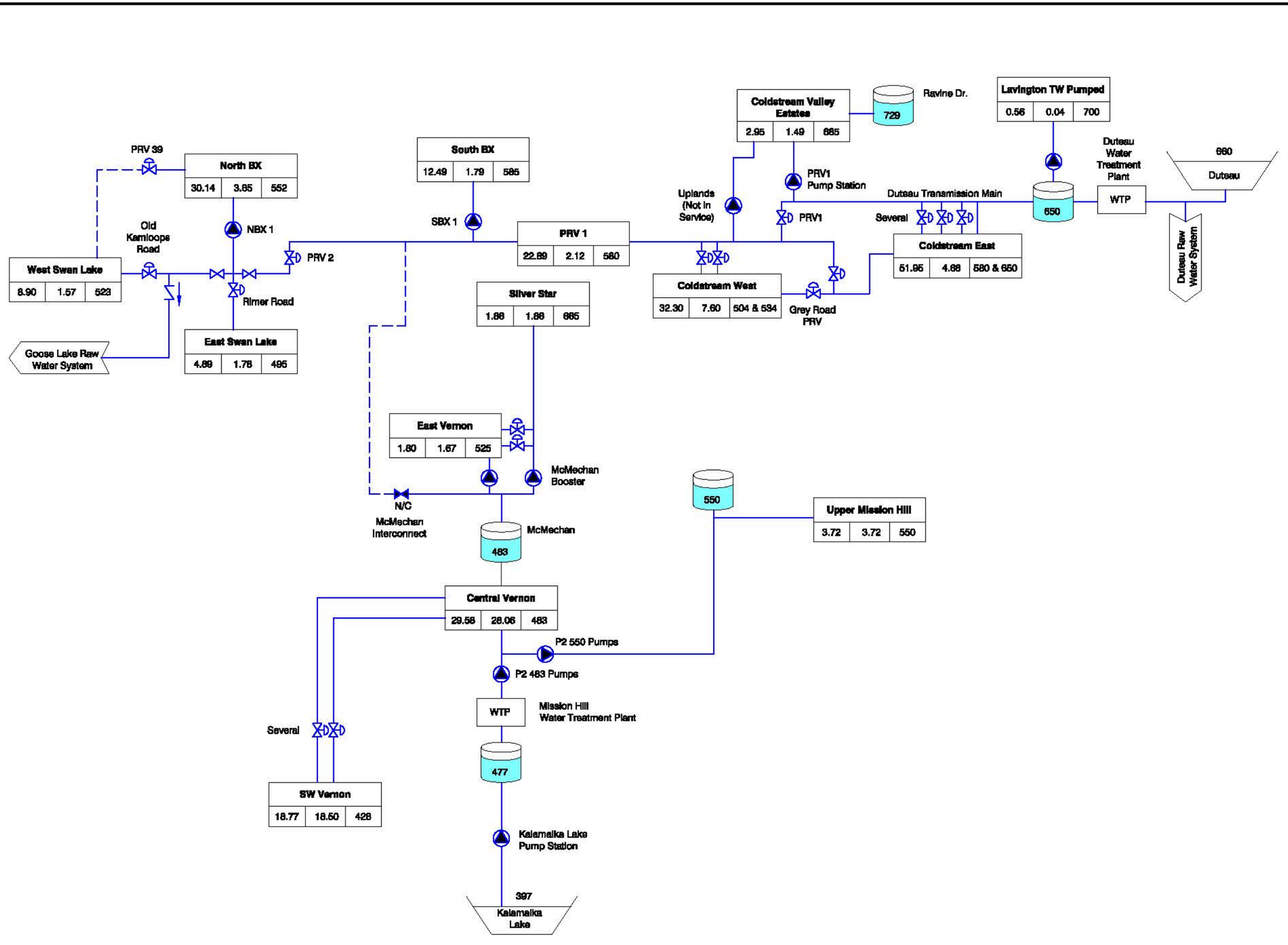
Greater Vernon Water
2012 Master Water Plan



Legend

- N/C — Normally Closed Valve
- PRV
- Pump
- Normal HGL — Source
- Normal HGL — Tank
- Upper Mission Hill — Sub System
  - Main Pressure Zone HGL
  - Domestic (Year 2052) Demand in MLD
  - Total (Year 2052 MDD) Demand in MLD with 100 % Agricultural Allocation (Including Areas without Agricultural Rate)

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Domestic System Schematic Option 1

Figure 3-2

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4 Analysis

4.1 Hydraulic Model Summary

RDNO's existing hydraulic model was modified for use in evaluation of the system.

Model information for reference:

- Software: Bentley WaterCAD v8.11.03.19
- Model Filename: GVW_v3.1.wtg
- Scenarios used: 'MWP Option1' and 'MWP opt 1 PH'

The following is a summary of the key boundary conditions and recent system modifications included in the model:

- Demands: As per TM#1 Draft #3, MDD of 254 MLD, PHD of 342 MLD corresponding to yr-2052 demands.
- Boundary Conditions:
  - Duteau Clearwell Supply HGL = 649.9 m
  - Mission Hill WTP Discharge HGL = 492.3 m
  - Ranch Well #1 and #2, King Edward, and Goose Lake not supplying domestic system
  - Old Kamloops Road Valve Station; no flow at peak demand period (all local irrigation supply from Goose Lake, for separated areas in Bella Vista and West Swan Lake)
  - Other water sources - not in service
- Recent system upgrades Included:
  - Longspoon Dr. Reservoir
  - Ranchlands Watermains & Reservoir (Coldstream Estates sub-system)
  - Sunpeaks Reservoir & Pump Station
  - McMechan Interconnect
  - 29th Street Upgrades
  - Cunliffe Reservoir
  - Middleton Mountain Reservoir
  - Turtle Mountain Watermains & Demands
  - Tavistock (Adventure Bay) Watermains & Demands
  - PRV #73 Station (2013 planned work), Grey Rd. Reservoir decommissioned.
  - Bessette PRV Station (2012 planned work) – done – Park Lane – PRV#3 on standby
  - Removed decommissioned water sources
    - Coldstream Creek
    - Coldstream Kal Intake
    - Antwerp Springs Wells.

Model pressure deficiencies and other noted deficiencies are shown on Figure 4-1 to Figure 4-3.

PRV #2
SBX 2 Pump Station
McMechan Booster
McMechan Reservoir
SBX #1 Pump Station
SBX Sub-system
Valencia Heights Pump Station
Coldstream Valley Ventures #3 Pump Station
Coldstream #2 Valley Ventures Pump Station
Ravine Drive Pump Station
Ravine Dr
PRV #1 Sub-system
Coldstream Estates Sub-system
Middleton Way Pump Station
Husband Rd Pump Station
Middleton Mtn
Buchanan Rd Pump Station
Coldstream #1 Valley Ventures Pump Station
PRV #1 Pump Station
Duteau Transmission Main
Warren Road Pump Station
Bessette PRV #5
Lateral #3 Pump Station
Whisper Ridge Pump Station
Von Keyserlingk Pump Station
PRV 73
Ranch Well #1
Ranch Well #2
Coldstream West Sub-system
Coldstream East Sub-system
Brewer Road Pump Station
Lavington
Lateral #1 Pump Station
Duteau Pump
Duteau WTP
Whisper Ridge Tank
Palfrey Drive Pump Station
Cunliffe Rd
King Edward Intake
Duteau Headgates Intake
N

Greater Vernon Water
2012 Master Water Plan

Legend

- Jurisdiction Boundary
- PRV
- Pump
- Source
- Tank
- 1 Capital Task

Subsystem

- Central Vernon
- Coldstream East
- Coldstream West
- East Swan Lake
- East Vernon
- Lavington Treated Area "D" Water Pumped
- North BX
- PRV 1
- Ranchlands
- SW Vernon
- Silver Star
- South BX
- Upper Mission Hill
- West Swan Lake
- Raw Water

Year 2052 Model Pressure Results
Peak hour

- < 300 kPa (44 psi)
- < 140 kPa (20 psi)

(Excluding Raw Water System)

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System Deficiencies and Proposed Capital Tasks (East Portion of System)

Figure 4-1

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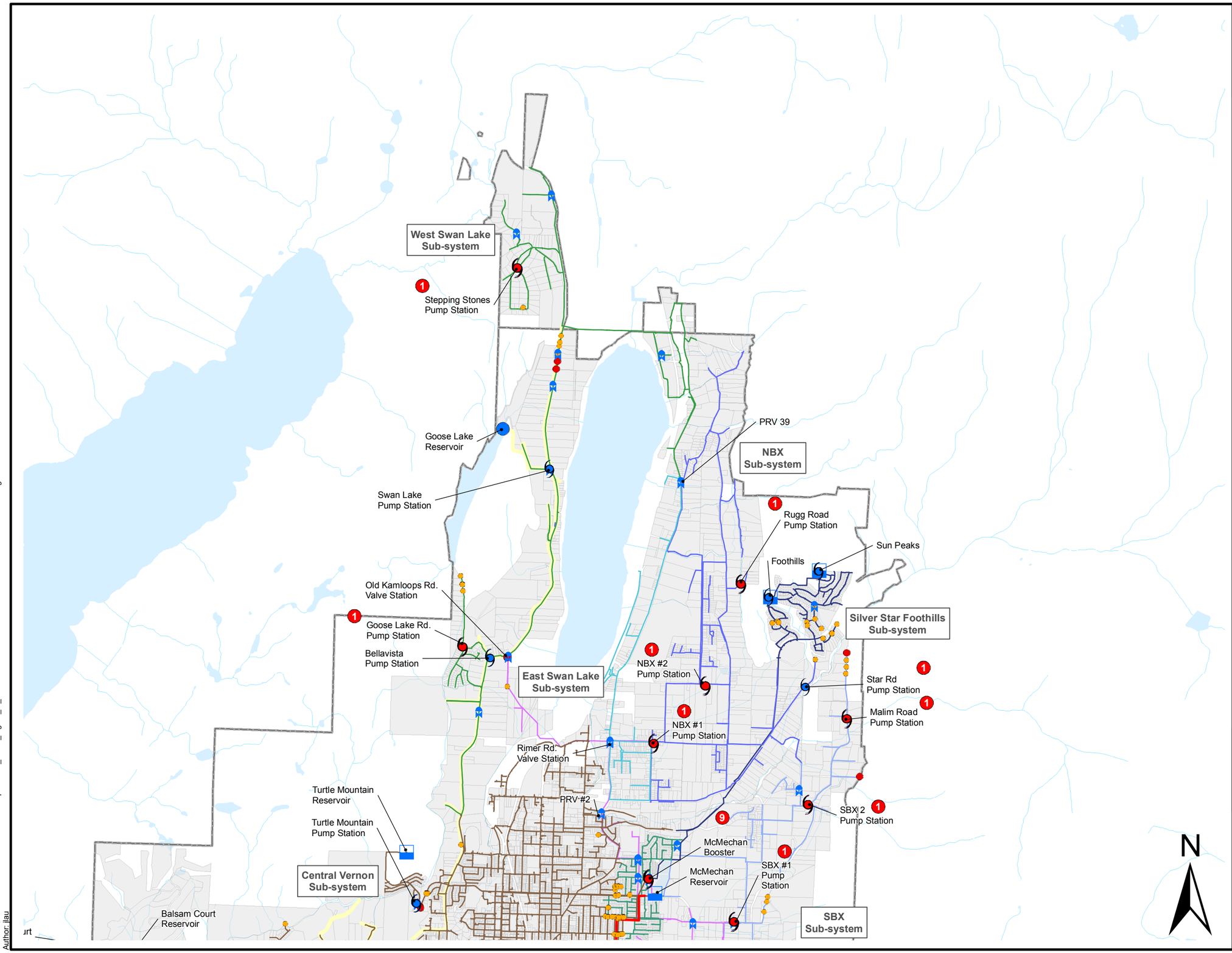

Greater Vernon Water
2012 Master Water Plan

Legend

- Jurisdiction Boundary
- PRV
- Pump
- Source
- Tank
- Capital Task

Subsystem

- Central Vernon
- Coldstream East
- Coldstream West
- East Swan Lake
- East Vernon
- Lavington Treated Area "D" Water Pumped
- North BX
- PRV 1
- Ranchlands
- SW Vernon
- Silver Star
- South BX
- Upper Mission Hill
- West Swan Lake
- Raw Water

Year 2052 Model Pressure Results
Peak hour

- < 300 kPa (44 psi)
- < 140 kPa (20 psi)

(Excluding Raw Water System)

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System Deficiencies and Proposed Capital Tasks (North Portion of System)

Figure 4-2

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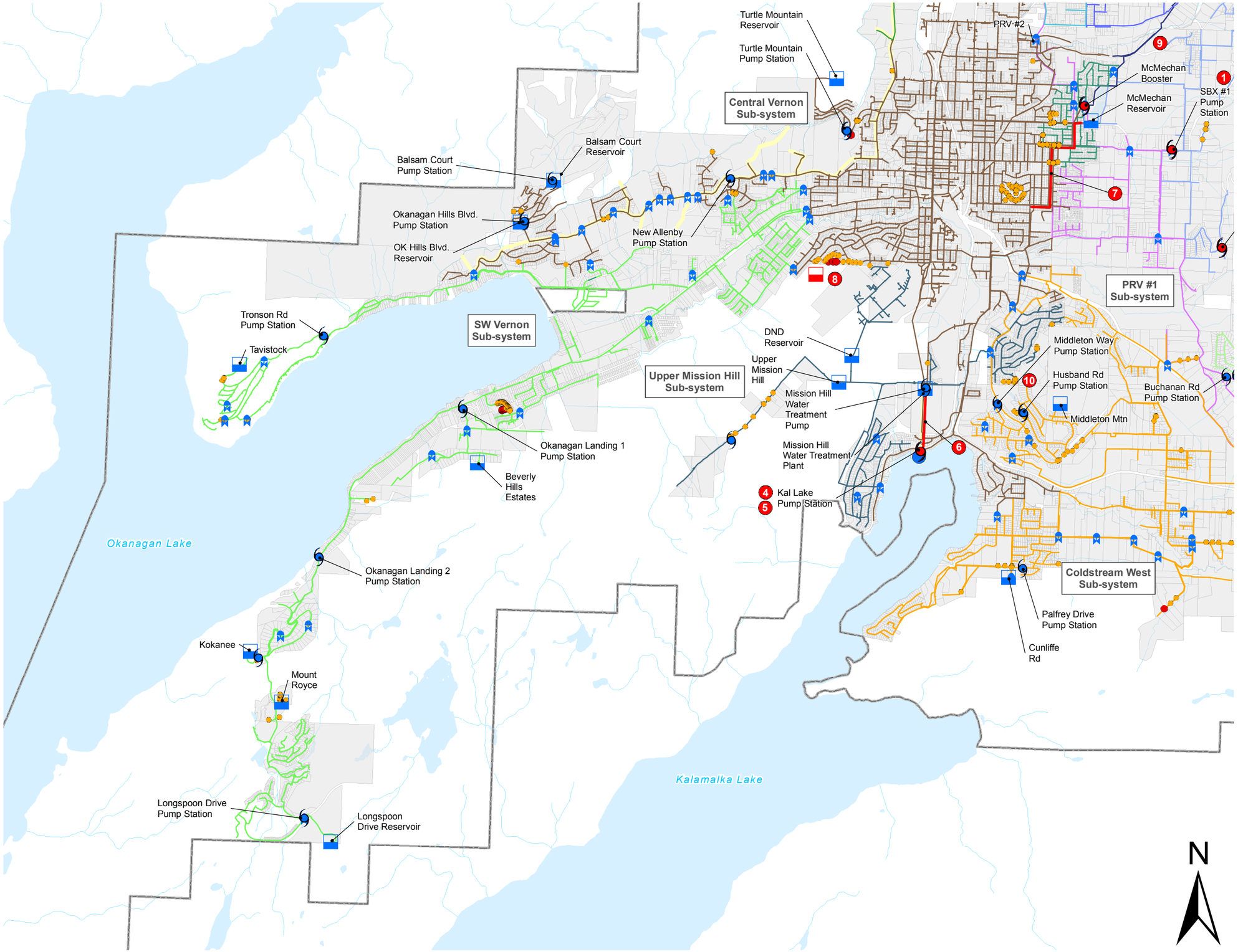

Greater Vernon Water
2012 Master Water Plan

Legend

- Jurisdiction Boundary
- PRV
- Pump
- Source
- Tank
- 1 Capital Task

Subsystem

- Central Vernon
- Coldstream East
- Coldstream West
- East Swan Lake
- East Vernon
- Lavington Treated Area "D" Water Pumped
- North BX
- PRV 1
- Ranchlands
- SW Vernon
- Silver Star
- South BX
- Upper Mission Hill
- West Swan Lake
- Raw Water

Year 2052 Model Pressure Results
Peak hour

- < 300 kPa (44 psi)
- < 140 kPa (20 psi)

(Excluding Raw Water System)

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System Deficiencies and Proposed Capital Tasks (West Portion of System)

Figure 4-3

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4.2 Lavington Area "D" Treated Water Pumped Sub-System

4.2.1 Overview

As shown on Figure 3-1; the Lavington Area "D" Treated Water Pumped system is the small sub-system supplied from the Duteau WTP from the treated water pumps at the treatment plant. The system was recently created to separate domestic uses from agricultural in the higher elevation areas surrounding the WTP. The system was designed as part of the Lavington system separation program (AECOM, 2009) and services isolated residential uses near the Duteau WTP with an elevation range of 620 - 660 m +/-.

Table 4-1 outlines the analysis of the sub-system.

Table 4-1: Lavington Area "D" Treated Water Pumped Sub-System

Area	Lavington Treated Water Pumped
Supply	Treated Water Pumps in Duteau WTP, rated capacity 0.53 MLD at 50m TDH
Main Pressure Zone (MDD in MLD)	PZ 700 Duteau Treated (0.04 MLD)
Other Pressure Zones Serviced Directly and associated demands (MDD in MLD)	None
Adjacent Systems Serviced Indirectly (MDD in MLD)	Systems gravity supplied from Duteau WTP
Total Demand Direct Supplied (MDD for storage calculation)	0.04 MLD
Balancing storage required	0.01 ML
Service area land use(s) for fire supply	Rural/Residential
Fire flow requirement (volume)	None provided
Total storage required	0.01 ML
Storage provided	11.4 ML at Duteau WTP clearwell WL - 645 m to 650 m
Storage deficiency	None
Design supply requirement	0.10 MLD (PHD for area)
Supply limiting factor	Pump Station sizing, 200 mm supply main
Supply capacity	0.53 MLD
Supply deficiency description (if applicable)	None
Minimum peak hour pressure(s) (excluding non-service mains) and location(s)	360 kPa
Pressure deficiencies	None

4.2.2 Discussion

Irrigation areas are no longer connected to potable water for this sub-system.

No deficiencies are noted.

4.3 Coldstream East Sub-System

4.3.1 Overview

The Coldstream East sub-system covers the eastern portion of Lavington. The sub-system includes both domestic and agricultural connections (i.e. not currently separated). The sub-system is defined as the water infrastructure connected to the Duteau (treated water) transmission main upstream of Grey Road.

The sub-system includes the piping network that was formerly supplied by the Antwerp Springs Wells and the Coldstream Creek intake now supplied by the Duteau transmission main. It also includes some domestic service areas, which have always been serviced off of the Duteau transmission main. This sub-system includes numerous separate connections, each typically with their own PRV station and isolated pressure zone. Table 4-2 outlines the Coldstream East sub-system characteristics.

Table 4-2: Coldstream East Sub-System

Area	Coldstream East
Supply	Duteau WTP clearwell & Duteau transmission main
Main Pressure Zone (MDD in MLD)	PZ650 Duteau Treated (12.85 MLD)
Other Pressure Zones Serviced Directly and associated demands (MDD in MLD)	PZ580 Lavington (3.38 MLD), PZ730 Whisper Ridge (0.34 MLD), PZ566 PRV 7 (0.27 MLD) PZ599 PRV 8 Warren Rd. (0.18 MLD) PZ710 Warren Rd. (2.56 MLD) PZ596 PRV 6 Brewer Rd. (0.21 MLD) PZ618 PRV70 Brewer Rd. West (0.73 MLD) PZ610 PRV208 Brewer Rd. (0.36 MLD) PZ581 PRV12 Buchanan Rd. (4.57 MLD) Others....
Adjacent Systems Serviced Indirectly (MDD in MLD)	Remainder of Duteau System (133 MLD)
Total Demand Direct Supplied (MDD for storage calculation)	51.9 MLD (Total) 4.68 MLD (Domestic uses excluding agricultural)
Balancing storage required	1.17 ML
Service area land use(s) for fire supply	Rural Residential (Interface areas)
Fire flow requirement (volume)	60 L/s (0.32 ML)
Total storage required	1.86 ML
Storage provided	11.4 ML at Duteau WTP Clearwell WL - 645 to 650 m 2.3 ML at Lavington Tank – 580 to 585 m 0.75 ML at Whisper Ridge Tank - 725 to 728 m
Storage deficiency	None
Design supply requirement	51.9 MLD + Duteau System flows
Supply limiting factor	Duteau Transmission Main capacity
Supply capacity	Varies on location
Supply deficiency description (if applicable)	None

Area	Coldstream East
Minimum peak hour pressure(s) (excluding non-service mains) and location(s)	In PZ 650 on Duteau Transmission Main, pressures are low but no services In PZ 580 Lavington: 180 kPa on Learmouth Rd, east of Park Lane 200 kPa end of Noble Canyon Road 240 kPa Springfield Rd and Hwy # 6
Pressure deficiencies	Localized in PZ580 as noted above.

4.3.2 Discussion

The Coldstream East system primarily services agricultural irrigation (85% of flows on MDD). The model results show pressures that are generally adequate except for some higher serviced areas in PZ580 Lavington.

Analysis was completed with the proposed Bessette PRV station in place to service the PZ580 Lavington Zone from the Duteau transmission main (it is understood that this station was completed in 2012).

These deficiencies are primarily due to undersized piping between the Lavington Reservoir and the upper areas. Two projects are proposed to correct deficiencies:

- 500 m of 200 mm dia. water main on School Rd. from north of Jeffers Dr. to Hwy 6. (existing main is 150 mm), and
- 1,200 m of 200 mm dia. water main on Learmouth Dr. from Dawe Dr. to Park Lane (existing main is 150 mm).

Storage is provided primarily by the 10 ML Duteau WTP clear well. Additional storage is provided by the 2.3 ML, 585 m TWL Lavington tank and the 0.75 ML, 728 m TWL Whisper Ridge Tank. Adequate storage is generally provided, however in some areas fire flows would be compromised by the hydraulic distance from the tank(s).

4.4 Coldstream Valley Estates Sub-System

4.4.1 Overview

The Coldstream Valley Estates sub-system has been defined as the pumped system north of the Duteau Transmission main near PRV #1. This sub-system is primarily supplied by the PRV #1 Pump Station (with the pump station suction located on the high pressure side of the PRV #1 Station). The system can also be supplied from below PRV #1 from the Uplands Pump Station (normally not used). Table 4-3 outlines the sub-system characteristics.

Table 4-3: Coldstream Valley Estates Sub-System

Area	Coldstream Valley Estates
Supply	PRV 1 Pump Station (note station is separate from PRV 1 station and is named such as it is just upstream of the PRV 1 station)
Main Pressure Zone (MDD in MLD)	PZ660 PRV1 PS Cypress Dr. (1.25 MLD)
Other Pressure Zones Serviced Directly and associated demands (MDD in MLD)	PZ 730 Coldstream Valley Estates (neg.) – Ravine Drive PZ 700 Coldstream Valley Estates (neg.) – Ranchland Place

Area	Coldstream Valley Estates
	PZ 630 Upland Dr. (0.93 MLD) PZ 606 White Fence (0.68 MLD) – Scenic Drive PRV 62
Adjacent Systems Serviced Indirectly (MDD in MLD)	None
Total Demand Direct Supplied (MDD for storage calculation)	2.95 MLD (1.49 MLD domestic, note agricultural allotments are not active)
Balancing storage required	0.37 ML
Service area land use(s) for fire supply	Residential (Interface)
Fire flow requirement (volume)	60 L/s (0.32 ML)
Total storage required	0.86 ML
Storage provided	0.82 ML at Ravine Dr. Tank, WL - 725 to 728 m
Storage deficiency	0.04 ML (unless Duteau is considered as a supply source).
Design supply requirement	2.86 MLD (including agricultural allotments)
Supply limiting factor	PRV 1 PS Capacity
Supply capacity	Nominally 3.3 MLD each pump at PRV1 PS ; note capacity varies considerably with Duteau main HGL
Supply deficiency description (if applicable)	None
Minimum peak hour pressure(s) (excluding non-service mains) and location(s)	350 kPa on Ravine Dr.
Pressure deficiencies	None

4.4.2 Discussion

Modelling shows that the Coldstream Valley Estates sub-system has acceptable pressures. The system has redundancy of supply provided by the two supply pump stations: PRV 1 PS (normally) and Uplands PS (below PRV#1).

The local storage deficiency noted is minor and can be made up by the excess pumping capacity. A generator set / standby power could be considered for the PRV1 Pump Station. No capital tasks are proposed however due to redundancy provided by the Uplands PS. The adequacy of the Uplands PS should be reviewed further to confirm.

4.5 PRV#1 Sub-System

4.5.1 Overview

The PRV#1 sub-system is defined as the collection of areas that are directly fed off of the Duteau Transmission main below the PRV #1 Station (including some small pressure reduced zones). The PRV # 1 Station has a nominal supply HGL of 583 m. The Coldstream West, South BX, North BX, East Swan Lake, and West Swan Lake sub-systems are all connected downstream from the PRV#1 sub-system, with the PRV #1 sub-system feeding these other sub-systems (generally off of the Duteau Transmission main connections) . The sub-system also supplies the Goose Lake raw water system and PRV #2.

Table 4-4 outlines the sub-system characteristics.

Table 4-4: PRV#1 Sub-System

Area	PRV#1
Supply	PRV #1 Valve Station via Duteau Transmission Main
Main Pressure Zone (MDD in MLD)	PZ 583 Below PRV1 (13.2 MLD)
Other Pressure Zones serviced directly and associated demands (MDD in MLD)	Buchanan Rd. Pump (1.35 MLD) PZ505 Below PRV 27 (6.15 MLD) PZ525 PRV2 Pleasant Valley Rd. (1.97 MLD)
Adjacent sub-systems serviced indirectly (MDD in MLD)	Coldstream West (32.3), South BX (12.5), North BX (30.1), East Swan Lake (4.89), and West Swan Lake (1.57 MLD)[5]
Total demand direct supplied (MDD for storage calculation)	22.9 MLD (including 2.05 MLD of domestic demand)
Balancing storage required	0.5 ML
Service area land use(s) for fire supply	Rural Residential
Fire flow requirement (volume)	90 L/s (0.65 ML)
Total storage required	1.44 ML
Storage provided	None local, storage from Duteau Clearwell
Storage deficiency	1.44 ML
Design supply requirement	121 MLD (incl. downstream sub-systems, excluding Goose Lake Raw)
Supply limiting factor	Transmission main sizing
Supply capacity	Varies on HGL available at PRV #1 and HGL constraint.
Supply deficiency description (if applicable)	None
Minimum peak hour pressure(s) (excluding non-service mains) and location(s)	320 kPa Shantz Rd. east of 11 St.
Pressure deficiencies	None.

4.5.2 Discussion

This sub-system mostly includes the lowest lying areas along the Duteau transmission main (except where the main passes through developed portion of Vernon). The system MDD is currently greater than 90% irrigation. The service area for this sub-system is a good candidate for separation due to the minimal infrastructure required (no pumping, smaller branch mains), and relatively few direct services.

Other than potential system separation (see I9), no capital tasks are proposed for this sub-system.

4.6 Coldstream West Sub-System

4.6.1 Overview

The current Coldstream West system is made up of two former separate systems:

[5] *Assumes supply of agricultural irrigated separated areas of West Swan Lake and Bella Vista are supplied from Goose Lake on maximum demand day.*

- The westernmost portion of Coldstream that was formerly supplied by the Coldstream Kalamalka Lake intake (no longer in service due to treatment requirements) **excepting** areas of this system that are now connected to the Mission Hill Treated system, and
- The higher northern portion of Coldstream, including areas on Middleton Mountain.

These systems are now joined and supplied by PRV stations from the PRV1 sub-system. Table 4-5 outlines the sub-system. The boundary between the Coldstream West and East sub-systems is Grey Rd.

Table 4-5: Coldstream West Sub-System

Area	**Coldstream West**
Supply	PRV stations off of Duteau Transmission Main located below PRV1.
Main Pressure Zone (MDD in MLD)	PZ545 South Coldstream (14.3 MLD)
Other Pressure Zones Serviced Directly and associated demands (MDD in MLD)	PZ590 Palfrey Rd. Coldstream (0.12 ML) via PS 13 PZ491 PRV 16 Coldstream Creek Rd. (0.08 ML) PZ500 Central Coldstream (2.8 ML) via Grey Rd. PRV PZ530 North Coldstream (0.22 ML) PZ587 Upper Middleton (1.26 ML) PZ534 PRV 24 Mid Middleton (10.23 ML) PZ480 North Coldstream (1.61 ML) PZ526 PRV 67 Lambert Dr. (0.50 ML) PZ487 PRV 61 Husband Rd. (0.36 ML) PZ507 PRV 19 Coldstream Creek Rd. (0.12 ML) PZ491 PRV 20 Coldstream Creek Rd. (0.08 ML) PZ505 PRV 21 Coldstream Creek Rd. (0.35 ML) PZ494 PRV 22 McClounie Rd. (0.31 ML)
Adjacent Systems Serviced Indirectly (MDD in MLD)	None
Total Demand Direct Supplied (MDD for storage calculation)	32.3 MLD (7.6 MLD excluding agricultural)
Balancing storage required	1.90 ML
Service area land use(s) for fire supply	All
Fire flow requirement (volume)	200 L/s (1.80 ML)
Total storage required	4.63 ML
Storage provided	1.80 ML at Middleton Mtn. Tank, WL - 581 to 587 m 1.14 ML at Cunliffe Tank, WL – 495 to 501 m 0.22 ML at Grey Rd. Tank, WL – 500 to 504 m to be decommissioned not incl. in storage calcs.
Storage deficiency	1.68 ML (unless storage from Duteau Clearwell is considered)
Design supply requirement	32.3 MLD + peaking for inadequate storage
Supply limiting factor	Supply split
Supply capacity	N/A
Supply deficiency description (if applicable)	None
Minimum peak hour pressure(s) (excluding non-service mains) and location(s)	150 kPa Cosens Bay Rd. (PZ 500 Coldstream) 250 kPa Northcott Dr. (PZ530 North Coldstream) 180 kPa Palfrey Dr. (PZ500 Coldstream) 210 kPa Middleton Way (PZ534 Mid. Middleton)
Pressure deficiencies	Yes

4.6.2 Discussion

The Coldstream West sub-system services a considerable amount of agricultural irrigation in addition to domestic demands (which only are estimated to amount to 24% of the total MDD). Analysis was completed with the new Grey Rd. PRV station in place (replacing the function of the Grey Rd. reservoir). It is understood that this station will be completed in 2013.

Due to the lack of local storage, the sub-system relies on some peaking of daily demands to be conveyed by upstream transmission mains. The lack of local storage is also a reliability concern.

In general, peak hour pressures are acceptable. In a number of isolated locations (end of Cosens Bay Rd., Northcott Dr., and Palfrey Dr.) modelled pressures are less than 300 kPa. These model deficiencies are generally due to friction losses in undersized local piping (50 mm and 100 mm) servicing a dead-end (<10 properties). No tasks are proposed to address these deficiencies. Pressure deficiencies on Middleton Way are on a section of supply main without services. Accordingly, no upgrades are required.

Portions of the Coldstream West sub-system could be switched over to the Mission Hill system by extending the Upper Mission Hill (550 m) or Central Vernon (480 m) sub-systems. Not examined further in this memo; but part of Technical Memorandum #9 scope.

4.7 South BX Sub-System

4.7.1 Overview

The South BX sub-system is defined as the area supplied by the South BX Pump Station #1. The sub-system consisting of higher areas located downstream of PRV #1 but south of BX Creek. The SBX PS #2 pumps a smaller portion of flows to a higher elevation. Table 4-6 outlines the sub-system.

Table 4-6: South BX Sub-System

Area	South BX
Supply	South BX Pump Station #1
Main Pressure Zone (MDD in MLD)	PZ585 SBX 1 (8.8 MLD)
Other Pressure Zones Serviced Directly and associated demands (MDD in MLD)	PZ629 SBX 2 (2.47 MLD) PZ663 Valencia Heights (0.47 MLD) PZ Malim Rd Pump (0.09 MLD) PZ566 PRV36 Haynes Rd. (0.68 MLD)
Adjacent Systems Serviced Indirectly (MDD in MLD)	None
Total Demand Direct Supplied (MDD for storage calculation)	12.5 MLD (of which only 1.79 MLD is domestic)
Balancing storage required	0.44 ML
Service area land use(s) for fire supply	Rural Residential
Fire flow requirement (volume)	60 L/s (0.32 ML)
Total storage required	0.96 ML
Storage provided	None
Storage deficiency	0.96 ML (unless Duteau Clearwell is considered)
Design supply requirement	12.5 MLD

Area	South BX
Supply limiting factor	SBX 1 Pump Station capacity
Supply capacity	Nominally each of two large pumps is 9.5 MLD. Smaller pump is 4 MLD +/-. Approx. meets design flow with largest pump out of service. Exceeds with both large pumps running.
Supply deficiency description (if applicable)	Capacity adequate for back-up power. Station back-up power.
Minimum peak hour pressure(s) (excluding non-service mains) and location(s)	< 200 kPa on Phillips Rd (100 mm main)
Pressure deficiencies	Phillips Rd. only.

4.7.2 Discussion

The South BX system MDD demands are only 14% domestic.

Most of the demands are in the PZ 585 SBX1 pressure zone which is only marginally below the PRV#1 setpoint, these areas would typically be supplied by gravity in the winter (bypassing SBX 1 pump station, and pumps off).

No local storage is provided so all pump stations must be sized for peak demands and rated for continuous duty. Back-up power requirements for South BX #1 and #2 Pump Stations should be reviewed (i.e. genset). Also, VFD's should be provided to replace pump control valves at SBX#1.

In general pump stations have been constructed to an irrigation system standard and do not generally have redundant pumping capacity (Malim Rd. only has a single pump; SBX1, SBX2 and Valencia Heights pump stations do not have true redundancy with smaller pumps operable at winter HGL's). The stations do not have excess capacity to provide fire flows.

Record information from the Water Infrastructure Facilities Binder indicates that the four pump stations do not have standby power.

4.8 North BX Sub-System

4.8.1 Overview

The North BX sub-system is defined as the area supplied by the North BX #1 pump station and downstream pump stations. The service area includes the areas north of BX Creek that are high enough to require pumping. It also includes some lower areas, which are currently serviced due to convenience via pressure reducing valves from the pumped PZ552 North BX 1. Table 4-7 outlines the sub-system and model results.

Table 4-7: North BX Sub-System

Area	North BX
Supply	North BX #1 Pump Station
Main Pressure Zone (MDD in MLD)	PZ552 North BX 1 (15.9 MLD)
Other Pressure Zones Serviced Directly and associated demands (MDD in MLD)	PZ610 North BX 2 (14.0 MLD) PZ640 Rugg Rd. (0.05 MLD) PZ610 Star Rd. Pump (0.14 MLD)

Area	North BX
	PZ495 East Swan Lake
Adjacent Systems Serviced Indirectly (MDD in MLD)	West Swan Lake Sub-system via PRV 39 (normally closed)
Total Demand Direct Supplied (MDD for storage calculation)	30.1 MLD (3.65 MLD domestic)
Balancing storage required	0.91 ML
Service area land use(s) for fire supply	Rural Residential
Fire flow requirement (volume)	0.32 ML
Total storage required	1.23 ML
Storage provided	None
Storage deficiency	1.23 ML
Design supply requirement	30.1 MLD
Supply limiting factor	NBX #1 pump station capacity
Supply capacity	Two pumps each with nominal capacity of 22.6 MLD
Supply deficiency description (if applicable)	Yes, if only one pump is available. OK with both pumps operational
Minimum peak hour pressure(s) (excluding non-service mains) and location(s)	229 kPa PZ610 Star Rd. pump
Pressure deficiencies	Only minor deficiency at end of water main on Star Rd.

4.8.2 Discussion

As with the South BX system, the pump stations in the North BX system (NBX1, NBX2, Star Rd., and Rugg Rd.) are built to an irrigation system standard without allowance for redundancy, fire flows, or emergency power.

As noted in the table, modelled pressure results at the end of PZ610 are below standard (229 kPa vs. 300 kPa). This is a very localized deficiency, as PZ610 only services six lots (four houses total). It is understood that the highest elevation customer has a private pump to provide adequate pressures which addresses this issue. Local fire protection may not be to standard however. No action is proposed.

4.9 East Swan Lake Sub-System

4.9.1 Overview

The East Swan Lake sub-system includes the area supplied from the Rimer Road Valve Station excluding the pumped areas supplied by the North BX sub-system and the supply to the Old Kamloops Rd. valve station (which supplies the West Swan Lake sub-system). Table 4-8 outlines the sub-system.

Table 4-8: East Swan Lake Sub-System

Area	East Swan Lake
Supply	PRV 38 in Rimer Rd. Valve Station from PRV #1 sub-

Area	East Swan Lake
	system Alternate supply from PRV 39 from North BX Sub-system[6]
Main Pressure Zone (MDD in MLD)	PZ495 PRV 38 Swan Lake (4.89 MLD)
Other Pressure Zones Serviced Directly and associated demands (MDD in MLD)	None
Adjacent Systems Serviced Indirectly (MDD in MLD)	None
Total Demand Direct Supplied (MDD for storage calculation)	4.89 MLD (1.78 MLD)
Balancing storage required	0.45 ML
Service area land use(s) for fire supply	Rural Residential
Fire flow requirement (volume)	0.32 ML
Total storage required	0.96 ML
Storage provided	None
Storage deficiency	Yes, storage derived from Duteau Clearwell
Design supply requirement	7.2 MLD (peak hour demand) 10 MLD for MDD + Fire
Supply limiting factor	PRV 38 (250) and 250 local supply main (& PRV39)
Supply capacity	OK
Supply deficiency description (if applicable)	None
Minimum peak hour pressure(s) (excluding non-service mains) and location(s)	350 kPa
Pressure deficiencies	None

4.9.2 Discussion

As with much of the Duteau System, no local storage is provided for fire, balancing, or emergency use.

No capital plan items are recommended.

4.10 West Swan Lake Domestic Sub-System

4.10.1 Overview

The West Swan Lake domestic system is currently being created as part of the Swan Lake Separation Program. It includes areas on the west side of Swan Lake and the Stepping Stones subdivision in Spallumcheen (areas in Spallumcheen are not being separated in current program). Table 4-9 outlines the sub-system.

Table 4-9: West Swan Lake Domestic Sub-System

Area	West Swan Lake
Supply	Old Kamloops Rd. Valve Station (potable PRV), Secondary supply from PRV 39 (from North BX sub-

[6] *Note PRV #39 station is supplied from the North BX sub-system and has two outlets, one to the West Swan Lake sub-system and one to the East Swan Lake sub-system. Both are normally closed.*

Area	West Swan Lake
	system) Possible future connection to PZ480 Central Vernon at Kin Park (43 Ave.)
Main Pressure Zone (MDD in MLD)	PZ523 Dom Swan Lake West
Other Pressure Zones Serviced Directly and associated demands (MDD in MLD)	PZ547 Goose Lake Rd. (0.53 MLD) PZ575 Stepping Stones Pumped (1.58) PZ461 Golfview Place PZ446 PRV76 Highlands Place PRV76 PZ461 PRV40 Hwy 97 (0.08)
Adjacent Systems Serviced Indirectly (MDD in MLD)	None
Total Demand Direct Supplied (MDD for storage calculation)	8.90 MLD (1.57 MLD domestic), note includes irrigation connections in Spallumcheen and areas close to PRV 39 still not separated.
Balancing storage required	0.39
Service area land use(s) for fire supply	Rural Residential
Fire flow requirement (volume)	0.32
Total storage required	0.89 ML
Storage provided	None local
Storage deficiency	0.89 ML
Design supply requirement	8 MLD peak hour 12 MLD (MDD plus fire)
Supply limiting factor	Supply mains
Supply capacity	OK
Supply deficiency description (if applicable)	None
Minimum peak hour pressure(s) (excluding non-service mains) and location(s)	180 kPa PZ575 Stepping Stones 200 kPa PZ547 Goose Lake Rd.
Pressure deficiencies	Pumped zone pressure deficiencies with largest pump off.

4.10.2 Discussion

No local storage is provided for fire, emergency or balancing storage. Note fire protection can be provided in many cases off of separate irrigation mains.

Stepping Stones and Goose Lake Rd. pump stations are undersized for design criteria. Deficiencies noted are with largest pump off. Supply pressures with both pumps operating would be sufficient. As with most of the Duteau irrigation system these pump stations are not designed to provide fire flows. Redundancy and standby power are also not provided. The Stepping Stones pump station also does not have VFD (for energy efficiency) or a flow meter.

Station upgrading should be completed for both stations to improve reliability and address the above deficiencies.

4.11 Central Vernon Sub-System

4.11.1 Overview

The Central Vernon system is supplied by the Mission Hill WTP via the PZ 483 pumps (excluding the areas re-pumped to PZ550, the Upper Mission Hill System). The main pressure zone is PZ483 Central Vernon with balancing storage provided by the McMechan Reservoir. The system includes the pumped zones supplying Turtle Mountain and the Rise (New Allenby Pump Station). The system includes the majority of the City of Vernon and it also currently extends into Coldstream (portions in PZ483 Central Vernon). Table 4-10 describes the sub-system.

Table 4-10: Central Vernon Sub-System

Area	Central Vernon
Supply	Mission Hill Water Treatment Plant, PZ483 Pumps
Main Pressure Zone (MDD in MLD)	PZ483 Central Vernon (25.4 MLD)
Other Pressure Zones Serviced Directly and associated demands (MDD in L/s)	PZ510 Allenby-OK Hills Reservoir (1.35 MLD) PZ570 The Rise (2.01 MLD) Balsam Court Res. PZ463 Lakeridge Dr. (0.95 MLD) PZ 585 Turtle Mountain Upper (0.81 MLD) PZ630 Balsam Court Pump Station PZ426 Skyview Road PZ 534 Turtle Mountain Lower (0.08 MLD)
Adjacent Sub-system serviced directly	Gravity fed portions of SW Vernon sub-system, i.e. PZ 431 SW Vernon (9.6 MLD) East Vernon direct pumped sub-system (1.80 MLD)
Adjacent Systems Serviced Indirectly (MDD in MLD)	Pumped portions of SW Vernon sub-system (9.2 MLD) Silver Star Foothills Sub-system (1.64 MLD) Upper Mission Hill (3.50 MLD)
Total Demand Direct Supplied (MDD for storage calculation)	29.6 MLD for Central Vernon 9.6 MLD for SW Vernon (PZ 431 only) 1.8 MLD for East Vernon Total 41 MLD note excludes Upper Mission Hill system
Balancing storage required	10.25 ML
Service area land use(s) for fire supply	Up to and including Industrial
Fire flow requirement (volume)	1.8 ML
Total storage required	15.1 ML
Storage provided	13.7 ML at McMechan Reservoir, WL – 476 m to 483.5 m, additional storage is provided for the Rise and OK Hills however it is isolated from the main zone and not available for balancing storage
Storage deficiency	Yes, 1.4 ML
Design supply requirement	55 MLD through PZ 483 Pumps 52 MLD to McMechan Reservoir
Supply limiting factor	Supply main from MHWTP to McMechan Reservoir
Supply capacity	40 MLD +/-

Area	Central Vernon
Supply deficiency description (if applicable)	Yes, mains near the McMechan Reservoir are undersized for night-time refill of McMechan Reservoir. Discharge pressure limited at MHWTP due to pressure constraints at system low points.
Minimum peak hour pressure(s) (excluding non-service mains) and location(s)	170 kPa (high el. Areas near McMechan reservoir) 260 kPa (local high point 28 Crescent (near 18 St.) 120 kPa (local high point 15 Ave and 40 St.) >1,035 kPa (at low areas with static HGL)
Pressure deficiencies	Yes as per above.

4.11.2 Discussion

The Central Vernon system is supplied by the MHWTP and the McMechan Reservoir.

Total projected demand for the current Mission Hill System (which includes the Central Vernon, SW Vernon, Upper Mission Hill, East Vernon, and Silver Star Foothills sub-systems) is 56 MLD. This exceeds the rated capacity of the Kalamalka Lake pump station (KLPS). The following capacity / control upgrades are recommended for the KLPS supply to the MHWTP:

- KLPS capacity upgrade from 46 MLD to 60 MLD.
- KLPS VFD upgrade, it is understood this project is now complete (2012).
- Twinning of Supply main from KLPS to MHWTP (replacement of existing 300 mm dia. mains).[7]

The MHWTP PZ480 pumps supply the sub-system and the discharge from these pumps is limited to a maximum of 493 m HGL (even lower in the winter) to limit maximum pressures in lower areas (el. 365 m) of the zone (to limit night pressures that are in excess of 150 psi).

As previously identified in the Kalamalka Lake Water System Energy Efficiency Study (KWL, 2011), a portion of the connecting supply mains are undersized for conveying design flows (especially night refill of the McMechan Reservoir). The addition of 1600 m of 600 mm dia. water main is required as a minimum to meet future demands.

The addition of more storage for the sub-system either at McMechan Reservoir or another location is required for ultimate demands to meet the design criteria. An alternate site would be a lower balancing reservoir situated to direct feed the PZ 431 SW Vernon Zone (near 15 Crescent / Valleyview Place). A siting study would be required to assess the viability of this option. The timing of additional storage versus supply main improvements is to be evaluated.

4.12 Upper Mission Hill Sub-System

4.12.1 Overview

This system is serviced from the Mission Hill WTP PZ 550 Pumps and the Mission Hill Reservoir. It services the Commonage area, DND, the upper portion of the Kalview subdivision (on the west side of Kalamalka Lake), Country Estates, and portions of Middleton Mountain (City of Vernon side). Table 4-11 outlines the sub-system.

[7] *It is understood that this main is partially complete through the Sage Point development.*

Table 4-11: Upper Mission Hill Sub-System

Area	Upper Mission Hill
Supply	PZ 550 Pumps from the MHWTP
Main Pressure Zone (MDD in MLD)	PZ550 Mid Middleton (0.47 MLD)
Other Pressure Zones Serviced Directly and associated demands (MDD in L/s)	PZ550 C.C. Estates (0.79 MLD) PZ550 Upper West Kal (0.09 MLD) PZ 505 Stoneridge Dr. (0.49 MLD) PZ 526 Mid Middleton (1.05 MLD) PZ 530 DND (0.73 MLD) – including Commonage Cr. PZ590 Upper Commonage Pump (0.10 MLD)
Adjacent Systems Serviced Indirectly (MDD in MLD)	None
Total Demand Direct Supplied (MDD for storage calculation)	3.72 MLD (all domestic)
Balancing storage required	0.93 ML
Service area land use(s) for fire supply	Residential
Fire flow requirement (volume)	0.32 ML
Total storage required	1.57 ML
Storage provided	2.1 ML at Upper Mission Hill Tank, WL – 545 to 550 m 0.66 ML at DND Tank, WL 529 to 533 m
Storage deficiency	None
Design supply requirement	3.72 MLD
Supply limiting factor	PZ 550 pump capacity
Supply capacity	5 MLD each pump of 3, nominally 10 MLD with 2 pumps on.
Supply deficiency description (if applicable)	None
Minimum peak hour pressure(s) (excluding non-service mains) and location(s)	262 kPa at Bulman Place (PZ 550 Mid. Middleton) <200 kPa on Commonage Rd. (suction side of Commonage PS)
Pressure deficiencies	Yes, minor as per above.

4.12.2 Discussion

Generally no major deficiencies noted.

It is understood that pressure deficiency on Commonage Rd. is real. In addition, capacity of the Commonage PS is limited. Some properties use the system to fill cisterns and pump water from these. A study is recommended to review this local area.

Additional pumping capacity exists to extend the sub-system to other areas of Middleton Mountain which are currently supplied by the Duteau system (Coldstream West sub-system).

4.13 East Vernon Sub-System

4.13.1 Overview

The East Vernon sub-system is supplied by the McMechan Booster Pump Station. This station also supplies the Silver Star Foothills sub-system. One pump in the station is dedicated to supply of the PZ525 East Vernon Zone. The pump station also has two pumps to service the higher Silver Star Foothills sub-system (main zone – PZ665 Silver Star Foothills), these pumps can also supply the lower PZ525 East Vernon via PRVs. The NE Vernon zone is a smaller sub-zone that is supplied by PRV stations from the East Vernon Zone. Table 4-12 outlines the sub-system.

Table 4-12: East Vernon Sub-System

Area	East Vernon
Supply	McMechan Booster Pump Station from McMechan Tank
Main Pressure Zone (MDD in MLD)	PZ525 East Vernon (1.36 MLD)
Other Pressure Zones Serviced Directly and associated demands (MDD in L/s)	PZ502 NE Vernon (0.36 MLD)
Adjacent Systems Serviced Indirectly (MDD in MLD)	None
Total Demand Direct Supplied (MDD)	1.80 MLD
Storage	See Central Vernon Summary, supplied from McMechan Tank
Design supply requirement	2.9 MLD PHD
Supply limiting factor	McMechan Booster Pump Station PZ525 Pump
Supply capacity	2.3 MLD from Dedicated pump
Supply deficiency description (if applicable)	Approximately 0.6 MLD must be supplied from PZ665 Silver Star Pumps and/or McMechan Interconnect.
Minimum peak hour pressure(s) (excluding non-service mains) and location(s)	380 kPa
Pressure deficiencies	None

4.13.2 Discussion

The McMechan Booster Pump Station which services the East Vernon sub-system operates continuously to provide required pressures to the zone. An opportunity exists to use the recently constructed Duteau – McMechan interconnect which would allow for gravity supply to this entire sub-system. Alternatively, it is possible to add a second pump for redundancy and variable frequency drives to reduce recirculation (energy consumption) from the pump. Currently redundancy is provided via PRV's connected to the Silver Star system supply main both in the station and at Cavalier Court.

Switching to Duteau supply would reduce overall demand on the Mission Hill system.

4.14 Silver Star Foothills Sub-System

4.14.1 Overview

The Silver Star Foothills system is supplied by the McMechan Booster Pump Station (two of three pumps in the station) which pumps through a 5 km long 400 mm dia. supply main to the Silver Star Foothills subdivision. The system includes four pressure zones. Storage is provided by two reservoirs at 665 m and 765 m elevation. Table 4-13 outlines the system.

Table 4-13: Silver Star Foothills Sub-System

Area	Silver Star
Supply	McMechan Booster Pump Station from McMechan Tank
Main Pressure Zone (MDD in MLD)	PZ 665 Silver Star Foothills (0.78 MLD) – Tank
Other Pressure Zones Serviced Directly and associated demands (MDD in L/s)	PZ 715 Silver Star Foothills (0.37 MLD) via PRVs at Copper Mtn. Ct. & in Foothills PS PZ 765 Upper Silver Star Foothills (0.53 MLD) Sun Peaks Tank PZ 815 Sun Peaks (0.08 MLD) Sun Peaks PS PZ 715 Schon Springs (new zone to be added to model)
Adjacent Systems Serviced Indirectly (MDD in MLD)	Normally none, can supplement East Vernon
Total Demand Direct Supplied (MDD for storage calculation)	1.87 MLD
Balancing storage required	0.47 ML
Service area land use(s) for fire supply	Single-family and Medium Density Residential
Fire flow requirement (volume)	0.65 ML
Total storage required	1.40 ML
Storage provided	0.87 ML Silver Star Foothills Tank, WL- 661 to 667 m 2.29 ML Upper Silver Star Tank – 761 to 766 m Total 3.16 ML
Storage deficiency	None
Design supply requirement	1.87 MLD
Supply limiting factor	Pump Capacity from McMechan
Supply capacity	4.3 MLD (for one pump)
Supply deficiency description (if applicable)	None
Minimum peak hour pressure(s) (excluding non-service mains) and location(s)	210 kPa
Pressure deficiencies	Manning Place north end in PZ 665.

4.14.2 Discussion

No major deficiencies noted.

Low pressures at the north end of Manning Place (currently a cul-de-sac) can be corrected with eventual completion of looping (as part of build-out of the subdivision). The area to the north can be supplied from the PZ715 Zone. A separate capital task is not expected to be required.

4.15 SW Vernon Sub-System

4.15.1 Overview

The SW Vernon system's main pressure zone is PZ431 SW Vernon which is supplied via a series of PRV's from PZ483 Central Vernon. The zone also supplies pumped zones along the Okanagan Lake including Beverly Hills, Kokanee, Predator Ridge and Tavistock areas. Table 4-14 outlines the sub-system.

Table 4-14: SW Vernon Sub-System

Area	SW Vernon
Supply	PZ483 Central Vernon Distribution system
Main Pressure Zone (MDD in MLD)	PZ431 SW Vernon (9.6 MLD)
Other Pressure Zones Serviced Directly	PZ's 425, 483, 535, 585 Adventure Bay PZ445 Longacre Drive PZ468 Longacre Seasons Drive PZ468 Bench ROW Rd SW PZ517 Beverly Hills PZ526 Kokanee PZ 563 Kokanee Rd PZ 744 Predator PZ784 Longspoon
Adjacent Systems Serviced Indirectly (MDD in MLD)	None
Total Demand Direct Supplied (MDD for storage calculation)	18.8 MLD
Balancing storage required	4.7 ML
Service area land use(s) for fire supply	Residential, ICI, Industrial
Fire flow requirement (volume)	1.8 ML
Total storage required	8.1 ML
Storage provided	Several elevated tanks on pumped zones on either side of Okanagan Lake, suitable for local storage for upper zones, but not for PZ431 SW Vernon.
Storage deficiency	Yes, see Central Vernon sub-system.
Design supply requirement	18.8 MLD + peaking for zones without balancing storage (PZ431 SW Vernon). Total = 30 MLD +/- peak hour
Supply limiting factor	PZ480 Distribution piping
Supply capacity	< 30 MLD (as per pressure issues in PZ480 Central Vernon zone)
Supply deficiency description (if applicable)	None
Minimum peak hour pressure(s) (excluding non-service mains) and location(s)	<200 kPa on Seasons Dr. (off of OK Landing Rd., upper area only). Private distribution system.
Pressure deficiencies	Minor as per above.

4.15.2 Discussion

The SW Vernon sub-system internal distribution mains appear capable of supplying the design flows. However, the lack of balancing storage for the zone requires flows to be conveyed across the PZ 480 zone from either McMechan

Reservoir or the MHWTP. The impact is projected to be inadequate pressures in higher areas of PZ480. Provision of local storage may be an option for consideration (rather than additional storage at McMechan Reservoir). A siting study is required, however an initial review shows that the area east of 5000 block of Valleyview Place meets general hydraulic requirements.

5 Discussion and Recommended Upgrades

The following provides an initial overview of upgrades for discussion with current level of system separation. Some additional upgrades may be required while others disappear based on the system separation option selected. Capital task sheets for the recommended upgrades are attached in the Appendix.

5.1 Duteau Treated Water System

The level of service for the combined service portions of the Duteau Treated system was reviewed with RDNO. Due to historic development of the system as an irrigation system, current infrastructure does not meet the design criteria set-out in terms of fire flow availability, fire storage, continuity of service (standby power), and pump station redundancy. A balance was struck that recognizes that:

- Domestic users connected should expect a reasonable level of service,
- The majority of demands are agricultural and hence station reliability / redundancy is not as critical as a domestic only pump station, and
- Fire protection (via hydrants) in many areas has never been provided and is not cost effective given the density of housing versus large amount of agricultural uses.

The following revised standards are proposed for servicing the combined service portions of the Duteau system:

- Similarly, fire storage tanks will not be provided for these areas unless infill development triggers upgrades
- For the pumped Duteau Treated combined sub-systems including South BX, North BX, and West Swan Lake (Stepping Stones area); provision of electrical upgrades to increase energy efficiency, reliability, and maintainability will be provided. Standby power and pumping redundancy upgrades will not be provided.

Electrical upgrades and refurbishment including energy efficiency (variable speed drives)[8], controls, and instrumentation upgrades are proposed at the following stations:

- South BX #1
- South BX #2
- Malim Rd.
- Valencia Heights
- North BX #2
- Rugg Rd.
- Star Rd.
- Stepping Stones, and
- Goose Lake Rd.

Some of the stations have variable speed drives on one pump. Total installed horsepower for ten stations is 1,350 hp. Does not include redundancy or standby power upgrades. Work can be spread over a number of years.

Two watermain projects totalling 1700 m were identified in the Lavington area to address local low pressure results.

[8] *Some of the stations noted have variable speed drives on one pump in the station (NBX#2, SBX #1 and #2). However other pumps are constant speed.*

5.2 Mission Hill System

The following improvements are recommended for the Mission Hill System:

- Upgrades to the Kalamalka Lake Pump Station for redundancy (capacity upgrade) and improved control (VFD project) (See page 15.)
- Twinning of the existing 450 mm DI main joining Kalamalka Lake Pump Station with the Mission Hill Water Treatment Plant (replacing two existing 300 mm AC water mains). GVW is installing a 750 mm DI main to replace the existing 450 mm and the two 300 mm water mains
- Addition of 1,600 m of a new 450 mm dia. supply main between MHWTP and McMechan Reservoir
- Additional PZ431 SW Vernon or PZ480 Central Vernon (McMechan) Storage (min. 1.4 ML is expected to be required)
- Supply of East Vernon sub-system from Duteau system (through existing McMechan interconnect, nominal cost), and
- Integration of Duteau Middleton Mountain pressure zones into the Mission Hill system (no capital task sheet provided nominal cost).

5.3 Related to System Separation Options

Development of system separation costs to remove irrigation demands from the treated domestic system is discussed in Technical Memorandum No. 5 – Independent Agricultural System.

5.4 Cost Basis / Limitations

The following unit prices were used to develop cost opinions for the proposed upgrades. It is noted that these costs have been developed without the benefit of site review and are indicative of expected costs for master planning only. Unit rates have been developed based on similar facilities in B.C. In some cases where costing has been developed in previous studies, the more detailed information from these studies has been used.

- Pump stations (new)
    - Base cost - $ 200,000 plus
    - $ 6,000/hp installed capacity up to 100 hp.
    - $ 3,000/hp installed capacity in excess of 100 hp.
- Pump station electrical upgrades (electrical/controls upgrade only)
    - Base cost - $ 75,000 plus
    - $ 1,000/hp installed capacity.
- Balancing tanks – $500,000 per / ML of storage
- Small structures such as valve stations are valued at $100,000 per site
- Water main costs, as in Table 5-1 (below)
- Contingencies (30%) include unknown items and factors consistent with typical construction projects
- Engineering (15%) generally includes all studies, approvals, design and construction, and
- Cost opinions are in yr-2012 CDN$.

Table 5-1: Unit Costs for Pipeline Installation

Diameter	Pipe Supply & Install (1)	add Hydrants or Standpipes[2]	Pavement Restoration	Total (in ROW)	Total (in Road)
100	$120	$35	$75	$155	$230
150	$140	$35	$75	$175	$250
200	$190	$35	$75	$225	$300
250	$240	$35	$75	$275	$350
300	$290	$35	$75	$325	$400
350	$340	$35	$90	$375	$465
400	$390	$35	$90	$425	$515
450	$440	$35	$90	$475	$565
500	$490	$35	$90	$525	$615
600	$590	$50	$100	$640	$740
750	$740	$50	$100	$790	$890
900	$890	$50	$100	$940	$1,040
1200	$1,190	$50	$110	$1,240	$1,350

Notes:
(1) PVC or DI Pipe including valves
(2) Assumes one hydrant or standpipe per 300m.
(3) Costs do not include engineering and contingencies

5.5 Summary of Cost Opinions for Domestic Upgrades

The following table summarizes the recommended projects and cost opinions developed in this memorandum. Additional information on each project is provided in the appendix. Project locations are shown on Figure 4-1 through Figure 4-3.

Table 5-2: Domestic System Project Summary

Project	Description	Capital Cost Opinion (incl. eng. & cont.)
1 – Electrical and Controls Upgrades on Combined Service Pump Stations	Electrical upgrades incl. drives, instrumentation and controls for ten pump stations.	$2,400,000
2 – School Road Watermain	500 m of 200 mm dia. watermain on School Road in Lavington Zone from north of Jeffers Dr. to Highway 6	$ 220,000
3 – Learmouth Watermain	1,200 m of 200 mm dia. watermain on Learmouth Dr. from Dawe Dr. to Park Lane	$ 520,000
4- KLPS Pump Station VFD Upgrade	Upgrades to the Kalamalka Lake Pump Station to add VFD's to remaining pumps and improve controls.	COMPLETE
5- KLPS Capacity / Redundancy Upgrade	Upgrades to the Kalamalka Lake Pump Station to provide a rated capacity of 60 MLD (with redundant pump).	$ 2,500,000
6 – KLPS to MHWTP Supply Main	New 750 mm dia. by 850 m long main joining Kalamalka Lake Pump Station with the Mission Hill Water Treatment Plant (replacing the two existing 300 mm AC water mains)	$ 970,000
7 – McMechan Reservoir Supply Main	1,610 m of 600 mm dia. new supply main between MHWTP and McMechan Reservoir	$ 1,700,000

Project	Description	Capital Cost Opinion (incl. eng. & cont.)
8 – PZ431 Balancing Reservoir	1.4 ML reservoir servicing PZ431 SW Vernon and allowance for connecting piping. Alternate project would be additional storage at McMechan Reservoir.	$ 1,500,000
9 – East Vernon Gravity Supply	Supply of East Vernon sub-system from Duteau system	negligible
10 – Combine Middleton Mountain Zones	Integration of Duteau Middleton Mountain pressure zones into the Mission Hill WTP system. Combining the zones will allow for use of the Middleton Mountain Reservoir as balancing / fire storage for a larger area.	negligible
11 – PRV1 PS Standby Power Assessment	Review need for standby power for the PRV#1 Pump Station. A secondary means of supply is from the Uplands Pump Station. The proposed assessment would determine if the Uplands Pump Station provides adequate redundancy for the service area. See discussion on page 16.	$ 110,000
12 – Commonage Rd. Servicing Study	Local pressures in the Commonage area are sub-standard. The servicing study would evaluate options to correct pressure deficiencies. See discussion on page 26.	$ 125,000
Separation Programs	Not included see TM#5 and TM#9	N/A
Total	**Domestic Transmission System Base Upgrades**	**$ 10,045,000**

Note for the last four projects (East Vernon Gravity Supply, Combine Middleton Mountain Zones, PRV#1 PS Standby Power Assessment, and Commonage Rd. servicing study), the scope is expected to be limited. A capital cost opinion for each should be developed following initial work for each.

6 References

AECOM, RDNO Lavington Area System Separation Conceptual Engineering Report, July 2009. (AECOM 2009).

Greater Vernon Water, ***Master Plan Addendum***, March 2004 (GVW 2004).

Greater Vernon Water Utility, ***Master Water Plan Update 2012, Request for Proposals #2011-18 Eng***, August 2011 (GVWU, 2011).

Greater Vernon Services, ***Water System Standards,*** May 2005.

Kerr Wood Leidal Associates Ltd., ***RDNO 2007/2008 Water Model Updates***, updated March 2009 (KWL, 2009).

North Okanagan Water Authority, ***Master Water Plan***, Final Report, April 2002 (NOWA, 2002).

RDNO / KWL, ***Water Infrastructure Facilities Binder***, March 2012.

KWL, ***Kalamalka Lake Water Supply System Energy Efficiency Study***, February 2011 (KWL File 0773.065).

Appendix - Capital Task Sheets for Domestic Transmission Upgrades

RDNO

Class 'D' Cost Opinion

Engineering 15%
Contingency 30%

Item	Description	Unit	Estimated Quantity	Unit Rate	Construction Estimate $	Project Cost Estimate $	Comment
1	**Electrical and Controls Upgrades on Combined Service Pump Stations**						
1.01	Cost per pump station for electrical upgrades	Stations	9	100,000	900,000	1,305,000	SBX#1, SBX#2, Malim, Valencia Hts.
1.02	Cost per horse power of installed capacity	hp	750	1,000	750,000	1,087,500	NBX#2, Rugg Rd., Silver Star Rd.
	ROUNDED SUBTOTAL FOR TASK				**1,700,000**	**2,400,000**	Stepping Stones, Goose Lk. Rd.
2	**School Road Watermain**						
2.01	500 m of 200 mm dia. watermain installation	m	500	300	150,000	217,500	
	ROUNDED SUBTOTAL FOR TASK				**150,000**	**220,000**	
3	**Learmouth Drive Watermain**						
3.01	1,200 m of 200 mm dia. watermain installation	m	1,200	300	360,000	522,000	
	ROUNDED SUBTOTAL FOR TASK				**360,000**	**520,000**	
4	**Kalamalka Pump Station VFD Upgrade**						Complete.
5	**Kalamalka Pump Station Capacity Redundancy Upgrade**						
5.01	Pump station upgrade base cost	each	1	200,000	200,000	290,000	
5.02	Upgrade cost per hp (less than 100 hp)	hp	100	6,000	600,000	870,000	
5.03	Upgrade cost per hp (in excess of 100 hp)	hp	300	3,000	900,000	1,305,000	
	ROUNDED SUBTOTAL FOR TASK				**900,000**	**2,500,000**	
6	**Mission Hill WTP Supply Main from Kal Lake PS Twinning**						
6.01	850 m of 750 mm dia. watermain twinning	m	850	790	671,500	973,675	Revised dia.
	ROUNDED SUBTOTAL FOR TASK				**671,500**	**970,000**	
7	**McMechan Reservoir Dedicated Supply Main**						
7.01	1,610 m of 600 mm dia. watermain	m	1,610	740	1,191,400	1,727,530	
	ROUNDED SUBTOTAL FOR TASK				**1,191,400**	**1,700,000**	
8	**PZ431 SW Vernon Reservoir**						
8.01	Balancing tank cost per ML of storage	ML	1.4	500,000	700,000	1,015,000	
8.02	900 m of 300 mm dia. watermain	m	900	400	360,000	522,000	Connecting watermain to system.
	ROUNDED SUBTOTAL FOR TASK				**1,060,000**	**1,500,000**	
					Total all projects	**9,810,000**	

Note: Cost Opinions have been prepared with little or no site information and as such indicates the approximate magnitude of the cost of the capital tasks, for project planning purposes only. Unit rates were derived from unit costs for similar projects.

O:\0800-0899\811-015\700-CostOpinions\[TM4-Costs.xlsx]Projects

Greater Vernon Water
2012 Master Water Plan

Proposed Capital Projects

Proposed Capital Project Name: **1- Electrical and Controls Upgrades on Combined Service Pump Stations** (Duteau Treated System)

Category:	Distribution
Estimated Capital Cost:	$2,400,000
Driver	Capacity/Growth
% Domestic	100%
% Agricultural	
Timeframe (Years):	2021

Description of Project: Electrical upgrades at irrigation pump stations including variable speed drives, instrumentation and controls. Includes following pumping stations: South BX #1 , South BX #2, Malim Rd., Valencia Heights, North BX #2, Rugg Rd., Silver Star Rd., Stepping Stones, and Goose Lake Rd. Total installed horsepower for ten stations is 750 HP. Does not include redundancy, or standby power upgrades. Work can be spread over a number of years.

Factors that Impact Project Timing :

Justification: Existing irrigation pump stations generally are not built to municipal standard and include deficiencies relating to redundancy, standby power and electrical instrumentation and controls (SCADA) - relative to a municipal standard. This task would address insturmentation and controls for stations including provision of variable speed pumping to reduce operating costs (in off-peak periods). The tasks would not include adding pumps for redundancy or standby power (as most of demand is agricultural and can withstand short duration outages reduction in service level).

Constraints:

Supporting Technical Memo: **TM #4 - Capital Project 1**

Greater Vernon Water
2012 Master Water Plan

Proposed Capital Projects

Proposed Capital Project Name: **2- School Road Watermain**

Category:	Distribution
Estimated Capital Cost:	$220,000
Driver	Capacity/Growth
% Domestic	100%
% Agricultural	
Timeframe (Years):	2021

Description of Project: Replaces existing 100 / 150 mm dia. undersized School Road water main from north of Jeffers Rd. to Highway 6. 500 m of 200 mm dia. Water main. Connects to exisitng 200 mm dia. Mains

Factors that Impact Project Timing :

Justification: Model results show inadequate pressures in PZ 580 at eastern extents of system. The project reduces friction losses from the PZ 580 source (Bissette PRV and Lavington Reservoir).

Constraints:

Supporting Technical Memo: **TM #4 - Capital Project 2**

Greater Vernon Water
2012 Master Water Plan

Proposed Capital Projects

Proposed Capital Project Name: **3- Learmouth Drive Watermain**

Category:	Distribution
Estimated Capital Cost:	$520,000
Driver	Capacity/Growth
% Domestic	100%
% Agricultural	
Timeframe (Years):	2021

Description of Project: Replaces existing 150 mm dia. undersized Learmouth Rd. PZ 580 water main from Dawe Dr. to Park Lane. 1200 m of 200 mm dia. Water main.

Factors that Impact Project Timing :

Justification: Model results show inadequate pressures in PZ 580 at eastern extents of system. The project reduces friction losses from the PZ 580 source (Bissette PRV and Lavington Reservoir).

Constraints:

Supporting Technical Memo: **TM #4 - Capital Project 3**

Greater Vernon Water
2012 Master Water Plan

Proposed Capital Projects

Proposed Capital Project Name: **4- Kalamalka Pump Station VFD Upgrade**

Category:	Distribution
Estimated Capital Cost:	COMPLETE (2012)
Driver	Capacity/Growth
% Domestic	100%
% Agricultural	
Timeframe (Years):	COMPLETE (2012)

Description of Project: Addition of a second VFD drive on a 400 HP pump at the KLPS.

Factors that Impact Project Timing :

Justification: Currently only one of the two larger (400 HP) pumps at the KLPS Pump Station is equipped with a VFD. A second VFD drive would provide redundancy and symmetry in the station (which consists of 2 -200 HP pumps and 2-400 HP pumps). The VFD will also allow for better flow matching of supply to Treatment Plant to system demands.

Constraints:

Supporting Technical Memo: **TM #4 - Capital Project 4**

KWL, Kalamalka Lake Water Supply System Energy Efficiency Study, February 2011

Greater Vernon Water
2012 Master Water Plan

Proposed Capital Projects

Proposed Capital Project Name: **5- Kalamalka Lake Pump Station Capacity Redundancy Upgrade**

Category:	Distribution
Estimated Capital Cost:	$2,500,000
Driver	Capacity/Growth
% Domestic	100%
% Agricultural	
Timeframe (Years):	2021

Description of Project: Increase in station rated capacity from 46 to 60 MLD. Capacity may be increased via replacement of one of smaller 200 HP pumps (P1 or P4) with a larger pump or by addition of a fifth pump. The project may require structural addition to provide required space for larger replacement pump / new pump. Project Costs could increase considerably if project feasibility study requires station expansion (i.e. structural additions) to the pump station. This may be required as station space is currently very limited.

Factors that Impact Project Timing :

Justification: The Kalamalka Lake Pump Station delivers water to the Mission Hill Water Treatment Plant. With all four pumps on the station can deliver in excess of the MHWTP capacity (60 MLD). However, with the largest pump out of service the stations pumping capacity is reduced to approximately 46 MLD. This project would provide additional capacity to allow for operation with the largest pump out of service

Constraints:

Supporting Technical Memo: **TM #4 - Capital Project 5**

KWL, Kalamalka Lake Water Supply System Energy Efficiency Study, February 2011

Greater Vernon Water
2012 Master Water Plan

Proposed Capital Projects

Proposed Capital Project Name: **6- Mission Hill WTP Supply Main from Kal Lake Pump Station Twinning**

Category:	Transmission
Estimated Capital Cost:	$970,000
Driver	Capacity/Growth
% Domestic	100%
% Agricultural	
Timeframe (Years):	2021
Description of Project:	Twinning of existing 450 mm dia. Ductile Iron main joining Kalamalka Lake Pump Station with the Mission Hill Water Treatment Plant with a new 750 mm dia. main (850 m length).
Factors that Impact Project Timing :	
Justification:	Increases Supply capacity from Kalmalka Lake Pump Station. Replaces existing 300 mm dia. AC and 300 mm CI mains (abandon as part of project). At design flows (60 MLD) current velocities are about 2.7 m/s in existing pipes resulting in head loss of approx. 15 m and associated loss in supply pump capacity. Twinning would increase existing full capacity of KLPS (all four pumps) to 70 MLD from 64 MLD; and rated capacity (three pumps) to 48 MLD from 46 MLD existing).
Constraints:	
Supporting Technical Memo:	**TM #4 - Capital Project 6**

Greater Vernon Water
2012 Master Water Plan

Proposed Capital Projects

Proposed Capital Project Name: **7- McMechan Reservoir Dedicated Supply Main**

Category:	Transmission
Estimated Capital Cost:	$1,700,000
Driver	Capacity/Growth *and Water Quality (10%)*
% Domestic	100%
% Agricultural	
Timeframe (Years):	2014

Description of Project:
Preliminary sizing - 1610 m of 600 mm dia. based on MHWTP design capacity of 58 MLD. Includes section from 25 Ave & 17 St. and 39 Ave. Upsizing and including other sections of main between the Mission Hill Water Treatment Plant and McMechan Reservoir (total length of 5.7 km) may be warranted depending on sizing of MHWTP and design HGL to be achieved for zone.

Factors that Impact Project Timing :

Justification:
The current mains between the Mission Hill Water Treatment Plant and the McMechan Reservoir are undersized. The transmission system to McMechan is not dedicated but interconnected into the PZ480 grid. To supply /refill the McMechan Reservoir during peak demands the system is currently pressurized to a limit of approximately 494m HGL (i.e. 11 m above the TWL of the McMechan Reservoir). Currently, during peak demands the night time refill rate of the McMechan Reservoir is compromised by the need to work within this pressure limit. This limits the capability to effectively use balancing storage at the McMechan Reservoir. Transmission main improvements are required to transmit full plant capacity.
The project will:
- Increase supply capacity to McMechan Reservoir
- Reduce pumping costs
- Nominally reduce overall leakage and break frequency in the PZ480 zone by reducing operating pressures and pressure cycling (fatigue) of the pipe network

Constraints:

Supporting Technical Memo: **TM #4 - Capital Project 7**
KWL, Kalamalka Lake Water Supply System Energy Efficiency Study, February 2011

Greater Vernon Water
2012 Master Water Plan

Proposed Capital Projects

Proposed Capital Project Name: **8- PZ431 SW Vernon Reservoir**

Category:	Distribution
Estimated Capital Cost:	$1,500,000
Driver	Capacity/Growth
% Domestic	100%
% Agricultural	
Timeframe (Years):	2014

Description of Project: Replaces McMechan reservoir twining project. Addition of a new PZ431 SW Vernon Reservoir, approximate size 1,400 cu.m / 1.4 ML; TWL of 430 m matching existing pressure zone. Provides balancing storage local to PZ 431 Zone reducing peak demands from / to McMechan Reservoir and in the PZ 480 Zone. Location in undeveloped area bordering Valleyview Place / 15 Crescent at appropriate elevation. Project costs include preliminary allowance for 900 m of new 300 mm dia. watermain to connect Reservoir.

Factors that Impact Project Timing :

Justification: Existing McMechan Reservoir capacity of 13.7 ML does not allow for adequate balancing storage as demands increase. Locating reservoir at PZ431 elevation allows for local servicing of the PZ431 SW Vernon zone, reduces peak hour zone flows through the PZ480 Central Vernon Zone (reducing pressure losses / increasing pressures). Sizing contingent on supply philosophy for PZ 480 Zone and amount of emergency, fire, and balancing storage to be provided.

Constraints:

Supporting Technical Memo: **TM #4 - Capital Project 8**