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Technical Memorandum

REVISION 1

DATE: June 3, 2014

TO: Umar Alfaruq, CH2M Hill

CC: Mike Squire, Englishman River Water Service

FROM: Michelle Revesz, P.Eng.

RE: **ERWS WATER INTAKE, TREATMENT PLANT AND SUPPLY MAINS**
TM#4A: Distribution System Upgrades – Water Demands
Our File 468.010-300

1. Introduction

1.1 Scope

This memorandum (TM#4A) forms part of the technical deliverables for the design of the water supply intake for the proposed Englishman River Water Service (ERWS) Water Intake and Treatment Plant Project. The purpose of the memorandum is to summarize the existing water demands and to estimate future water demands for the design of upgrades to the transmission system (sizing typically governed by maximum day demands) to accommodate the water treatment plant.

The following items are described in this memorandum:

- Existing residential and ICI water demands;
- Existing service population and ICI population equivalents;
- Future development and population projections; and
- Future water demands.

1.2 Abbreviations and Definitions

ADD	Average Day Demand – The average demand for a one year period
BD	Base Demand – Generally indoor and industrial water demands that occur throughout the year, but can be easily measured during the winter months (November – March)
Bulk Meter	The meter that measures the volume of water into a water system.
CARL	Current Annual Real Losses – The volume of water losses as calculated by an AWWA water audit
ICI	Industrial, Commercial, Institutional
ILI	Infrastructure Leakage Index – The ratio of Current Annual Real Losses to Unavoidable Annual Real Losses. Used as a performance indicator for how well a water system is operating in terms of leakage.
MDD	Maximum Day Demand (24-hour average) within a year– MDD is comprised of BD and PSD
MLD	Million Liters per Day

NRW	Non-revenue water – Includes leakage, flushing, reservoir overflowing, construction uses from hydrants, and unauthorized usage. Note: excludes metered customers leakage and estimated un-metered residential demands
RDN	Regional District of Nanaimo
Res	Residential
PE	Population Equivalent
PHD	Peak Hour Demand
PSD	Peak Seasonal Demand – Seasonal demand on MDD
SD	Seasonal Demand – Water usage that occurs in the summer, generally for irrigation
Service Meter	The meter that measures the volume of water to an individual customer (i.e. a single residential customer)
WSA	Water Service Area
UARL	Unavoidable Annual Real Losses

1.2.1 References

The following references were used to estimate the existing water demands and develop the future water demands.

City of Parksville

1. City of Parksville – Daily Bulk Meter Usage for 2012 and 2013.
2. City of Parksville – 15-minute Bulk Meter Usage for 2012 and 2013.
3. City of Parksville – Annual Usage and MDD (2002 to 2012).
4. City of Parksville – Service Meter Data readings (Sept. 2012, Mar. 2013, and Sept. 2013).
5. City of Parksville GIS data, received on November 6, 2013.
6. Parksville Plan: A Vision for the Future, Bylaw 2013 No. 1492.
7. Statistics Canada National Household Survey 2011, Parksville Census Subdivision.

Nanoose Bay Peninsula WSA

8. Regional District of Nanaimo, *Water Service Area Annual Report 2012 - Nanoose Bay Peninsula Water System*, June 2013.
9. Regional District of Nanaimo, Nanoose Bay Official Community Plan, Bylaw No. 1400, 2005.
10. Regional District of Nanaimo, Land Use and Subdivision Bylaw No. 500, 1987.
11. Regional District of Nanaimo Land Use and Subdivision Amendment Bylaw No. 500.385, 2013.
12. Regional District of Nanaimo Land Use and Subdivision Amendment Bylaw No. 500.384, 2013.
13. Statistics Canada, National Household Survey 2011, Nanaimo E, Regional District Electoral Area.
14. Regional District of Nanaimo, Population Statistics, http://www.rdn.bc.ca/cms.asp?wpID=440.
15. Associated Engineering Et Al, Arrowsmith Water Service, Englishman River Water Intake, Treatment Facilities and Supply Mains, Phase 1- Conceptual Planning, Budgeting and Scheduling Final Summary Report. April 2011.

16. Koers & Associates Engineering Ltd., *RDN Nanoose Bay Peninsula Water System DCC Technical Report,* November 2013.
17. Single Family Residential Service Meter Data – September 2012 to September 2013.
18. ICI and Multi-Family Service Meter Data – October 2012 to October 2013.
19. Monthly groundwater Bulk Meter Usage – January 2012 to July 2013.
20. Morales Et. Al, Estimating Commercial, Industrial and Institutional Water Use on the Basis of Heated Floor Area, Journal AWWA, June 2011.

General

21. Metro Vancouver - Operations and Maintenance Department, Water Consumption Statistics Report, 2011 Edition.
22. Aquacraft, Analysis of Water Use in New Single Family Homes, January 2011.
23. Environment Canada, 2011 Municipal Water Use Report – Municipal Water Use 2009 Statistics.
24. AWWA M36 Manual, Water Audits and Loss Control Programs, Third Edition.
25. Kerr Wood Leidal, ERWS Water Intake, Treatment Plan and Supply Mains TM#4B: Distribution System Upgrades – Water Modeling, November 19, 2013.
26. Koers & Associates Engineering Ltd. – Reid Crowther & Partners Ltd., The Regional Water Supply System Englishman River Final Predesign Report, Finalized 1993.
27. Associated Engineering Et Al, Arrowsmith Water Service, Englishman River Water Intake, Treatment Facilities and Supply Mains, Phase 1- Conceptual Planning, Budgeting and Scheduling Final Summary Report. April 2011.

2. Existing Water Demands

2.1 Introduction

The Englishman River Water Service (ERWS) is comprised of two historically separate water systems:

- The Parksville water system which is owned and operated by the City of Parksville (Parksville); and
- The Nanoose Bay Peninsula Water Service Area (Nanoose Bay WSA), which is owned and operated by the Regional District of Nanaimo (RDN).

The two water systems generally operate independently during the winter months, when each system is supplied from independently owned groundwater wells. During the summer months, the Craig Bay Pump Station, which pumps water from the Parksville system to the Nanoose Bay WSA, connects the two water systems. Additional water is supplied from the Englishman River during the summer months.

RDN operates several other water utilities namely: French Creek WSA, Englishman River WSA, and the San Pareil WSA; these are not part of the ERWS. It is assumed that these WSA's will not be connected to the ERWS in the future.

The attached figure indicates the extent of the ERWS and the OCP land use designations.

2.2 Parksville

2.2.1 Bulk Meter Flows

Parksville's water supply is from two well fields (Springwood and Railway), with a combined capacity of 86.9 L/s (7.5 MLD) and from the Englishman River (Licence capacity 12,170 m^3/day (12.2 MLD)). The total source water capacity is 19.7 MLD.

The annual usage is summarized in the table below.

Table 2-1: City of Parksville Water Usage from Bulk Meters

Month	2012 Total (m^3)	2013 Total (m^3)	2013 Craig Bay Pump Station (m^3) (to Nanoose Bay WSA)	Parksville Annual Usage (m^3)	Parksville Annual Usage (MLD)
January	104,123	96,725		96,725	3.1
February	105,049	107,025		107,025	3.8
March	111,097	123,292		123,292	4.0
April	78,695	113,057		113,057	3.8
May	174,118	190,324		190,324	6.1
June	204,970	215,264	24,871	190,393	6.3
July	279,263	225,288(1)	60,738	218,525	7.0
August	311,412	329,960	52,018	277,942	9.0
September	238,091	208,318	29,770	215,151(2)	7.2
October	154,360	132,967	23	154,342	5.0
November	93,997			93,997	3.1
December	94,593			94,593	3.1
Total	**1,949,769**		**167,420**	**1,875,368**	**5.1**

Sources: City of Parksville Daily Flow data (January 1, 2012 to October 31, 2013).

Notes:
- The total volume includes the volume of water to Parksville and to the Nanoose Bay WSA. Parksville's usage is calculated from the following formula:

- *Parksville Usage = Total Volume – Craig Bay Pump Station Volume*

- Annual Usage is from September 2012 to September 2013. Period generally matches meter reading period.
  1. 10 days of data was missing; therefore used July 2012. Scaled the volume to Nanoose Bay by 2012 volume to 2013 volume (129,010/167,420).
  2. Scale the volume to Nanoose Bay by 2012 volume to 2013 volume (129,010/167,420).

Base Demand

The Base Demand for Parksville was 38.4 L/s (3.3 MLD, 268.6 L/ca/day[1]), based on the winter bulk meter usage from December 1, 2012 to February 28, 2013.

Maximum Day Demand

The 2013 MDD occurred on July 29, 2013, with a flow of 129.9 L/s (11.2 MLD, 910 L/ca/d[1]). The highest MDD on record was in 2009 with a demand of 170.0 L/s (14.7 MLD, 1,268 L/ca/d[2]).

Average Day Demand

The average day demand for the annual usage was 59.5 L/s (5.1 MLD, 416 L/ca/day[1]).

2.2.2 Water Use from Service Meters

Parksville has universal service metering. The service meters are read twice a year in September and March. The water usage for Parksville from the service meters is summarized in the table below.

It is noted that the winter base demand (BD) cannot be accurately determined from the service meter readings alone, as the winter readings include shoulder season irrigation (mostly in September). The estimated winter base demand was prorated using the bulk meter data for Parksville.

Table 2-2: Water Usage from Service Meters - Parksville

Type	Number of Meters	Annual Usage (m^3)	ADD		Sep – Mar. Readings*	BD Metered (Estimated)**	
			(MLD)	(L/ca/d)	(MLD)	(MLD)	(L/ca/d)
Residential	5,660	1,126,009	3.1	250 (1)	2.5	1.9	156.4 (1)
ICI**	233	496,360	1.3		1.0	0.9	
Total	**5,893**	**1,622,369**	**4.4**		**3.5**	**2.8**	

Source: City of Parksville Meter Data
1. Assumes 2013 estimated residential population of 12,354.

Notes:
*Calculated from Sept. 2012 to Feb 2013 period, no. of meters is based on same period.
**BD corrected adjusts the winter service meter usage by a ratio of 0.787. The bulk meter base demand was 3,314 m^3/d while the average winter bulk meter usage for the meter reading period was 4,209 m^3/d. Assuming the proportion of usage for all customer classes and unaccounted for water remains constant for both periods, the service meter base demand was corrected by the ratio of Bulk Meter BD to Bulk Meter usage during the service meter reading period (3,314/4,209 = 0.787).

2.3 Nanoose Bay Water Service Area

2.3.1 Bulk Meters Flows

The Nanoose Bay WSA is supplied by ten groundwater wells and from Parksville during the summer months, via the Craig Bay Pump Station. The wells have a combined total capacity of 2.81 MLD and a sustainable supply capacity of 1.97 MLD.

The annual usage for the Nanoose Bay WSA is summarized in the table below.

[1] Assumes estimated 2013 population of 12,354.

[2] Assumes a 2009 population of 11,583 based on census data.

Table 2-3: Nanoose Bay WSA Water Usage from Bulk Meters

Month	2012 Groundwater Well (m^3)	2013 Groundwater Wells (m^3)	2013 Craig Bay Pump Station (m^3) (to Nanoose Bay WSA)	Nanoose Bay Annual Usage * (m^3)	Nanoose Bay Annual Usage (MLD)
January	36,937	29,074		29,074	0.9
February	34,294	28,462		28,462	1.0
March	37,377	41,068		41,068	1.3
April	37,670	41,646		41,646	1.4
May	52,718	49,120	24,871	73,991	2.4
June	41,365	41,204	60,738	101,942	3.0
July	71,547	73,539	52,018	125,557	4.1
August	70,426		29,770	100,197	3.2
September	55,315		23	55,338	1.8
October	49,329			49,329	1.6
November	29,853			29,853	1.0
December	31,211			31,211	1.0
Total	**548,044**		**167,420**	**707,667**	**1.9**

Sources:
- Regional District of Nanaimo Monthly Ground Water Data.
- City of Parksville 2013 Daily Flow Data for Craig Bay Pump Station.
*Note: Annual Usage is from September 2012 to September 2013. Period generally matches meter reading period.

Base Demand

The Base Demand for the Nanoose Bay WSA was 11.4 L/s (0.99 MLD), based on the monthly winter bulk meter usage from December 1, 2012 to February 28, 2013. For the fall-winter 8-month period, September through May, that corresponds approximately to the meter reading schedule, the average winter demand was 13.7 L/s (1.18 MLD).

Maximum Day Demand

Daily data was not available for the Nanoose Bay WSA; however, the maximum monthly demand was 4.1 MLD for July. The average monthly seasonal demand therefore was 3.1 MLD.

Average Demand

The Average Demand for the September 2012 to September 2013 period was 22.4 L/s (1.9 MLD, 373 L/ca/d[3]).

2.3.2 Water Use from Service Meters

The Nanoose Bay WSA has universal service metering. The meters for single-family residences are read twice a year (September and May). Meters for multi-family residences and ICI properties are read quarterly (September, January, March, and June). A summary of the metered usage is provided in the table below.

[3] Assumed a 2013 estimated population of 5,196.

Similar to the Parksville data, the metered winter base demand (BD) cannot be directly determined from the service meter readings alone, as the winter readings include shoulder season usage. The estimated winter base demand was prorated using the bulk meter data for the Nanoose Bay WSA.

Table 2-4: Water Usage from Service Meters – Nanoose Bay WSA

Type	No. of Meters	Annual Usage (m^3)	ADD		Sep – May Readings*	BD Metered (Estimated)**	
			(MLD)	(L/ca/d)	(MLD)	(MLD)	(L/ca/d)
Single Family*	2,053	524,828	1.4		0.89	0.75	
Multi-Family	325	66,269	0.2		0.12	0.10	
Total Residential			**1.6**	**305.4 (1)**	**1.01**	**0.85**	**163.1 (1)**
ICI	47	26,852	0.1		0.04	0.03	
Total	**2,425**	**617,949**	**1.7**		**1.05**	**0.88**	

Source: Regional District of Nanaimo Water Meter Data
1) Assumes 2013 estimated residential population of 5,196.

Notes:
*BD calculated from Sept. 2012 to May 2013 period, no. of meters is based on same period.
**BD corrected adjusts the BD service meter usage by a ratio of 0.838. The Bulk Meter usage during the meter-reading period was 1.18 MLD. To estimate the demands for each customer class, for the based demand period (Dec to March) the service meter usage was adjusted by the ratio of bulk meter usage BD to bulk meter usage during service meter reading period. (0.99 MLD/1.18MLD = 0.838).

3. Existing Demands and Unit Rates

3.1 Parksville

3.1.1 Population

The 2011 census population for Parksville is 11,977. The Parksville planning staff estimates that the existing (2013) population is 12,354.

Parksville is a tourist destination during the summer months and a haven for seniors during the winter months due to its mild climate. Water demands cannot be used to understand the transient population, due to seasonal (irrigation) water use. Dry weather sanitary flows are not impacted by seasonal water usage; therefore analysis of the winter and summer dry weather sanitary flows can provide an indication of seasonal populations.

The table below provides a summary of the average winter and summer dry weather sanitary flows, and the average annual water usage.

Table 3-1: Parksville Sanitary Flows

Period	Dates	Sanitary Dry Weather Average Daily Flow (m^3/d)	Water Average Annual Daily Flow (m^3/d)
Winter	Jan. 9 – Jan. 22, 2013	5,271.1	
Summer	Jun. 28 – Aug. 1, 2013	5,205.4	
Annual			5,195.1
Sources: - FlowWorks Data for station 236R-Ocean Place Parksville – less Pacific Shores and French Creek Sanitary Flows. - City of Parksville Daily Flow data (Jan. 1, 2012 to Oct. 31, 2013). – Bulk Meter Data			

The average dry weather sanitary flow is higher than the average annual water flow, which may indicate inflow and infiltration into the sanitary sewers or meter inaccuracies. From the available data, it is concluded that analysis of the dry weather sanitary flow is not an accurate method to determine the transient population for Parksville.

The results of the analysis indicate that there is no significant variation in the dry weather flows. It could be concluded that there is no change in population between winter and summer, however from discussions with the Parksville Qualicum Beach Tourism Association, the existing transient population in the summer is estimated to be 10,447.

3.1.2 Existing Unit Rates

Non-Revenue Water (NRW)

Non-revenue water is the volume of water lost between the bulk water meters and the service meters. Table 3-2 summarizes the annual bulk and service meter water flows, and the NRW.

Table 3-2: Non-Revenue Water - Parksville

Flow Data	Annual Usage (m^3/yr)	Annual Usage (MLD)
Total Bulk Meter Usage	1,875,368	5.1
Total Service Meter Usage	1,622,369	4.4
Non-Revenue Water (NRW)	252,999	0.7
NRW (% of Total Bulk Meter Usage)		**13.5%**
Base demand – Bulk Meter		3.3
% of BD		21.0%

Environment Canada's 2011 Municipal Water Use Report reports that the average water loss rate in 2009 across Canada was 13.3%, which is inline with the water loss value calculated for Parksville.

Base and Seasonal Demands

The residential base demand for 2013 was calculated to be 156.4 L/ca/d. The per capita base demand is lower than most design criteria figures, however it is not considered un-realistic due to:

- The recent changes to the BC Building code;
- The success of the regional water conservation incentives (i.e. toilet replacement program, education

program);
- Parksville's transient population; and
- Design criteria generally contain safety factors.

The base demands are inline with benchmarks [22] 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).

For comparison the District of Saanich and the City of Richmond have estimated residential base demand of 203 L/ca/d and 208 L/ca/d, respectively. The lower base demand experienced for Parksville and the Nanoose Bay WSA could be attributed to the water rate structure, transient population or due to universal metering. The table below summarizes water rates for the subject areas.

Table 3-3: Summary of Single-Family Residential Water Rates (6 month period)

Jurisdiction		Base Rate/unit	Consumption Rate ($/m^3)						Notes
			Tier 1	Tier 2	Tier 3	Tier 4	Tier 5	Tier 6	
Parksville	Rates	$86.00	$0.60	$1.20	$2.00	$3.00	$1.68		Universally Metered
	Volume (m^3)		<60	120	160	400	>400		
RDN	Rates	$52.78	$0.94	$1.08	$1.37	$1.63	$2.17	$3.25	Universally Metered
	Volume (m^3)		127.4	254.8	382.2	509.6	637	>637	
Saanich	Rate	$22.50	$1.34						Universally Metered
Richmond	Rate	$72.00	$1.20						Not Universally Metered

The calculated irrigation rate for Parksville (on MDD) was 23,800 L/ha/day for 2013 (observed MDD less BD). The 2013 irrigation rate was less than historical values; therefore the 2009 MDD, which was the highest MDD on record, was used to estimate the irrigation rate for the demand forecast. Assuming that the irrigable area remained constant since 2009, the 2009 MDD irrigation rate was 34,300 L/ha/d.

3.2 Nanoose Bay Water Service Area

3.2.1 Population

Existing Population

The Nanoose Bay WSA is located in the Regional District of Nanaimo, Electoral Area E. The 2011 census for the Electoral Area E shows a population of 5,674 and 2,892 total dwelling units. Of the 2,892 dwelling units, 2,587 dwelling units were occupied. The average density is 1.96 capita/dwelling unit and 2.19 capita/occupied dwelling.

In 2013 there were 2,378 occupied residential dwellings (2,053 single-family residential units and 325 multi-family residential units) in the Nanoose Bay WSA. Assuming that single-family residential and multi-family residential use approximately the same amount of water indoors (i.e. Base Demand L/ca/d), the population densities were calculated to be 2.2 ca/dwelling and 1.95 ca/dwelling, respectively.

RDN staff indicated during the November 7, 2013 meeting that there is no significant transient population in the Nanoose Bay WSA; therefore the estimated existing population is 5,196.

Table 3-4: 2013 Population Estimate – Nanoose Bay WSA

Type	Population Density (ca/dwelling)	Number of Units	Residential Estimated Population	Estimated Population
Single Family	2.2	2,053	4,564	4,564
Multi-Family	1.95	325	632	632
ICI		47		196
Total		**2,378**	**5,196**	**5,392**
Note: Population equivalents are based on Base ICI usage.				

3.2.2 Existing Demands

Non-Revenue Water (NRW)

Non-Revenue Water (NRW) is the volume of water lost between the bulk water meters, and the service meters. The table below summarizes the annual water usage for the bulk and service meters, and the calculated NRW.

Table 3-5: Non-Revenue Water - Nanoose Bay WSA

Flow Data	Annual Usage (m^3/yr)	Annual Usage (MLD)
Total Bulk Meter Usage	707,667	1.94
Total Service Meter Usage	617,949	1.69
Non-Revenue Water (NRW)	89,718	0.25
NRW (% of Total Bulk Meter Usage)		**12.7%**
Base demand – Service Meter		0.88
% of BD		28%

Environment Canada's 2011 Municipal Water Use Report, reports that the average water loss rate in 2009 across Canada was 13.3%. The NRW calculated for Parksville (13.5%) and the Canadian average are in line with the NRW calculated for the Nanoose Bay WSA (12.7%).

Base and Seasonal Demands

The residential base demand was calculated to be 163.1 L/ca/day. The residential base demand is comparable to the Parksville's residential base demand of 156.4 L/ca/d.

As indicated the MDD for the Nanoose Bay WSA was not available; therefore the 2009 MDD irrigation rate for Parksville was used to estimate the future demands. The design irrigation rate is 34,300 L/ha/d.

4. Water Use Benchmarking

4.1 Historical Local Water Use

Much higher water demands were previously calculated for Parksville and the Nanoose Bay WSA in 1995 (from the Regional Water Supply System Englishman River Final Predesign Report). The average day demand and maximum day demand for the area were calculated to be 580 L/ca/d and 1,350 L/ca/d, respectively [26]. This 1995 pre-design report recommended 1,375 L/ca/day as a per capita rate for water demand projections.

4.2 Other Jurisdictions

Water usage for Parksville and Nanoose Bay WSA align with typical water usage in Canada. The table below summarizes the average annual usage for Parksville, Nanoose Bay WSA, Canada, British Columbia, and Metro Vancouver.

Table 4-1: Comparison of Annual Water Usage

Jurisdiction	Average Annual Water Consumption (L/ca/d)	
	Total	Residential
Parksville	416[3]	250[4]
RDN - Nanoose Bay	373[3]	305[4]
Metro Vancouver [1]	471	
Canada [2]	510	274
British Columbia [2]	606	353
Municipal Population between 5K -50K [2]	570	313

Sources:
1. Metro Vancouver Water Consumption Statistics Report, 2011
2. Environment Canada, 2011 Municipal Water Use Report, 2009 Statistics.
3. Calculated from bulk meter data.
4. Calculated from residential service meter data.

Note: Estimated populations are 12,354 and 5,196 for Parksville and RDN, respectively.

5. Future Demand Projection

5.1 Parksville

5.1.1 Future Development

Parksville's projected future development was based on the population projections provided by Parksville staff, Parksville's OCP, and from discussions with Parksville's planning staff during a meeting on November 7, 2013.

Parksville staff provided the residential growth projection and population estimates, see Table 5-1. The probable growth projection assumes a yearly increase in population by 1.53% per year in 2013, decreasing gradually over time to 0.69 % per year at 2035 and onward. For the high-growth scenario, the estimated population growth is constant at 1.8% per year.

From discussions with the Parksville Qualicum Beach Tourism Association, it is expected that within the next ten years the Sunrise Ridge Resort and the Parksville Beach Resort will re-develop, adding an additional 130 units (839 tourist population). Based on the projected number of units, the tourist population growth rate was estimated to be 0.8%. Table 5-1 summarizes the projected tourist populations assuming the growth rate remains constant to 2050.

Table 5-1: Projected Population – Parksville

Year	Estimated Residential Population		Estimated
	Probable Growth	High Growth	Tourist Population
2013 (Existing)	12,354		10,447
2018	13,228		10,769
2035	15,828		12,381
2050	17,548	24,017	13,902

Development within Parksville is expected to be a combination of new green-field development (at a gross density of 25 units/ha) and infill development (with density of 50 units/ha of additional lot area. The table below summarizes the expected development areas and residential units based on planning staff's knowledge. Timing of future development was based on the population projection.

Table 5-2: Projected Development - Parksville

Area	Residential No. Units		ICI PE	
	Probable Growth	High Growth	Probable Growth	High Growth
South of Greig Rd.	468	1,732		
East of Alberni Hwy., South of Despard Ave.	187	693		
East of Alberni Hwy., North of Despard Ave.	241	241		
West of Renz Rd.	338	338		
North of Stanhope Rd. at Island Hwy.	55	55		
Infill Development	1,308	2,772	1,583	3,554
Total	**2,597**	**5,832**	**1,583**	**3,554**

5.1.2 Water Demand Projection

Table 5-3 summarizes the results of the demand forecast. Appendix 1 provides a further breakdown of the projected water demands. For all forecasts the 2009 design irrigation rate of 34,300 L/ha/day was used, this compares to the 'observed' value of 23,800 L/ha/day from 2013. The irrigation rate is the key variable in overall water use.

The following additional assumptions are built into the demand projections:

- Existing residential indoor water use per capita stays constant over time (current rate is 156.4 L/ca/day);

- Future residential indoor water use per capita matches the benchmark data for new homes [22] (163.0 L/ca/d);
- Irrigated land area for residential usage is 65% of lot area (i.e. 35% for building(s)) up to a maximum lot size of 0.3 ha;
- Irrigated land area for ICI usages is 45% of lot area;
- Serviced ICI lot areas are increased at the same rate as the ICI base demand;
- Overall ICI base demand remains constant as a percentage of total base demand (34% of total); and
- NRW estimate remains constant over time at 21% of base demand.

Table 5-3: Parksville Water Demand Projections

Forecast Year	Population (ca)	Un-factored Demands			Factored Demands
		BD (MLD)	ADD (MLD)	MDD (MLD)	MDD (MLD)
2013 (Existing)	12,354	3.4	6.4	16.3	20.4
2018	13,228	3.6	6.7	17.1	21.4
2035	15,828	4.2	7.7	19.2	24.0
2050	17,548	4.7	8.4	20.8	26.0
2050 (high growth scenario)	24,017	6.4	10.8	25.7	32.1

A factored MDD (125% of projection) is also presented in the table above, which was applied to the projected water demands to account for:

- uncertainties in potential climate change and its effects on irrigation;
- uncertainty in future growth and population predictions;
- potential expansion of water service area boundaries; and
- changes in existing water use.

To demonstrate the effect of the tourist population, the table below summarizes the estimated tourist demands for the various design horizons. The water demand projections in Table 5-3 include the tourist component.

Table 5-4: Parksville Water Demand Projections

Forecast Year	Population (ca)	Tourist Population (ca)	Factored Demands	Tourism[(1)] SD (MLD)
			MDD (MLD)	
2013 (Existing)	12,354	10,447	20.4	1.6
2018	13,228	10,769	21.4	1.7
2035	15,828	12,381	24.0	1.9
2050	17,548	13,902	26.0	2.2
2050 (high growth scenario)	24,017	13,902	32.1	2.2
Note: (1) Demand included in ADD and MDD				

5.2 Nanoose Bay Water Service Area

5.2.1 Future Development

Two new developments are proposed for the Nanoose Bay WSA: Schooner Cove and the Lakes District. In addition, redevelopment of the Red Gap area and infill development through out the WSA is expected. Expansion of the Nanoose Bay WSA to areas outside of the current service area has not been included in the future development estimates.

The table below summarizes the projected number of lots and ICI gross floor area to be developed to the 2046 OCP build-out and the estimated number of vacant lots based on British Columbia Assessment Authority Actual Land Use codes.

Table 5-5: Projected Development to OCP Build-out 2046 – Nanoose Bay WSA

Development	Single Family No. Units	Multi-Family No. Units	Congregate Care	Total No. Units	Commercial Floor Area (m^2)	Institutional Floor Area (m^2)
Schooner Cove		360		360	2,325	
Lakes District	1,122	553	155	1,675	4,800	9,200
Red Gap	100	111		211	5,600	2,320
Infill	33			33		
Vacant Lots	300			300		
Total	**1,555**	**1,024**	**155**	**2,579**	**12,725**	**11,520**
Sources: Land Use and subdivision Bylaw(s). Koers & Associates Engineering Ltd., RDN Nanoose Bay Peninsula Water System DCC Technical Review, Nov. 2013. GIS Data: BCAA Codes and Parcel data.						

Based on the projected development, and estimated population densities (i.e. single family residential 2.2 ca/dwelling and Multi-family 1.95 ca/dwelling) the projected population for 2046 is estimated to be 10,799. The estimated annual growth rate is approximately a 2.2%.

The design horizon for the water treatment plant is 2050. Assuming that the annual growth rate remains constant, and that all new development beyond 2046 is infill development (i.e. no additional irrigated land) the 2050 projected population is 11,801. The table below summarizes the population projections for the Nanoose Bay WSA for the water treatment plant design horizons, and the 2046 OCP build out.

Table 5-6: Projected Population – Nanoose Bay WSA

Year	Estimated Population
2013 (Existing)	5,196
2018	5,805
2035	8,462
2046	10,799
2050	11,801
Assumes a constant growth Rate of 2.2%.	

5.2.2 Water Demand Projection

Table 5-7 summarizes the results of the demand forecast. Appendix 2 provides a further breakdown of the projected water demands. For all MDD forecasts a design irrigation rate of 34,300 L/ha/day was used.

The following additional assumptions are built into the demand projections:

- Existing indoor water use per capita stays constant over time (current rate is 163.1 L/ca/day);
- Future indoor water use per capita meet the benchmark data for new homes [22] (163.0 L/ca/day);
- Population growth remains at 2.2% over study duration (Existing to 2050);
- Population densities remain constant over the study duration:
  - Single Family Residential – 2.2 ca/dwelling, and
  - Multi-Family Residential – 1.95 ca/dwelling.
- No additional lot area will be serviced, except for the planned areas (Schooner Cover and Lakes District) and the current vacant lots. Other than these areas, additional dwelling units will be the result of infill.
- Lot coverage for irrigated land area is:
  - Residential – 45% - up to a maximum lot size of 0.3 ha;
  - Multi-Family – 20%; and
  - Commercial – 15%.
- ICI square footage is as provided in the DCC Technical Memorandum [16]. Water demands for future ICI usages are based on heated floor space as indicated in a journal published by the AWWA [20]. The application rates for ICI usage are as follows:

Non-Residential Use	MDD ($L/m^2/d$)	ADD ($L/m^2/d$)
Commercial	6.8	5.3
Institutional	4.1	3.2

- Leakage estimate remains constant over time at 28% of base demand.

Table 5-7: Nanoose Bay WSA- Water Demand Projections

Forecast Year	Population (ca)	Un-factored Demands			Factored Demands
		BD (MLD)	ADD (MLD)	MDD (MLD)	MDD (MLD)
2013 (Existing)	5,196	1.1	2.4	6.6	7.6
2018	5,805	1.3	2.6	7.0	8.1
2035	8,462	1.9	3.5	8.6	9.9
2050	11,801	2.6	4.5	10.5	12.1

A safety factor was applied to the projected water demands, indicated in the above table, to account for:

- uncertainties in potential climate change and its effects on irrigation;

- uncertainty in future growth and population predictions;
- potential expansion of water service area boundaries; and
- changes in existing water use.

At the request of RDN staff, a 15% safety factor was applied to the projected water demands. The safety factor is lower than the value utilized by Parksville, but the value was inline with RDN's current design philosophy. The reduced safety factor will reduce the extents of the water system upgrades, reducing capital costs.

5.3 Summary

The projected water demands for Parksville and Nanoose Bay WSA are summarized in the table below.

Table 5-8: ERWS – Water Demand Projections

Forecast Year	Population (ca)	Un-factored Demands			Factored
		BD (MLD)	ADD (MLD)	MDD (MLD)	MDD (MLD)
2013 (Existing)	17,550	4.5	8.8	22.9	28.0
2018	19,033	4.9	9.3	24.1	29.5
2035	24,290	6.1	11.2	27.8	33.9
2050	29,349	7.3	12.9	31.3	38.1
2050 (high growth scenario)	35,818	9.0	15.3	36.2	44.2

Figure 5-1, indicates the BD, ADD, MDD and the factored MDD for the projected design horizon. Note that the dashed lines indicate the high growth scenario.

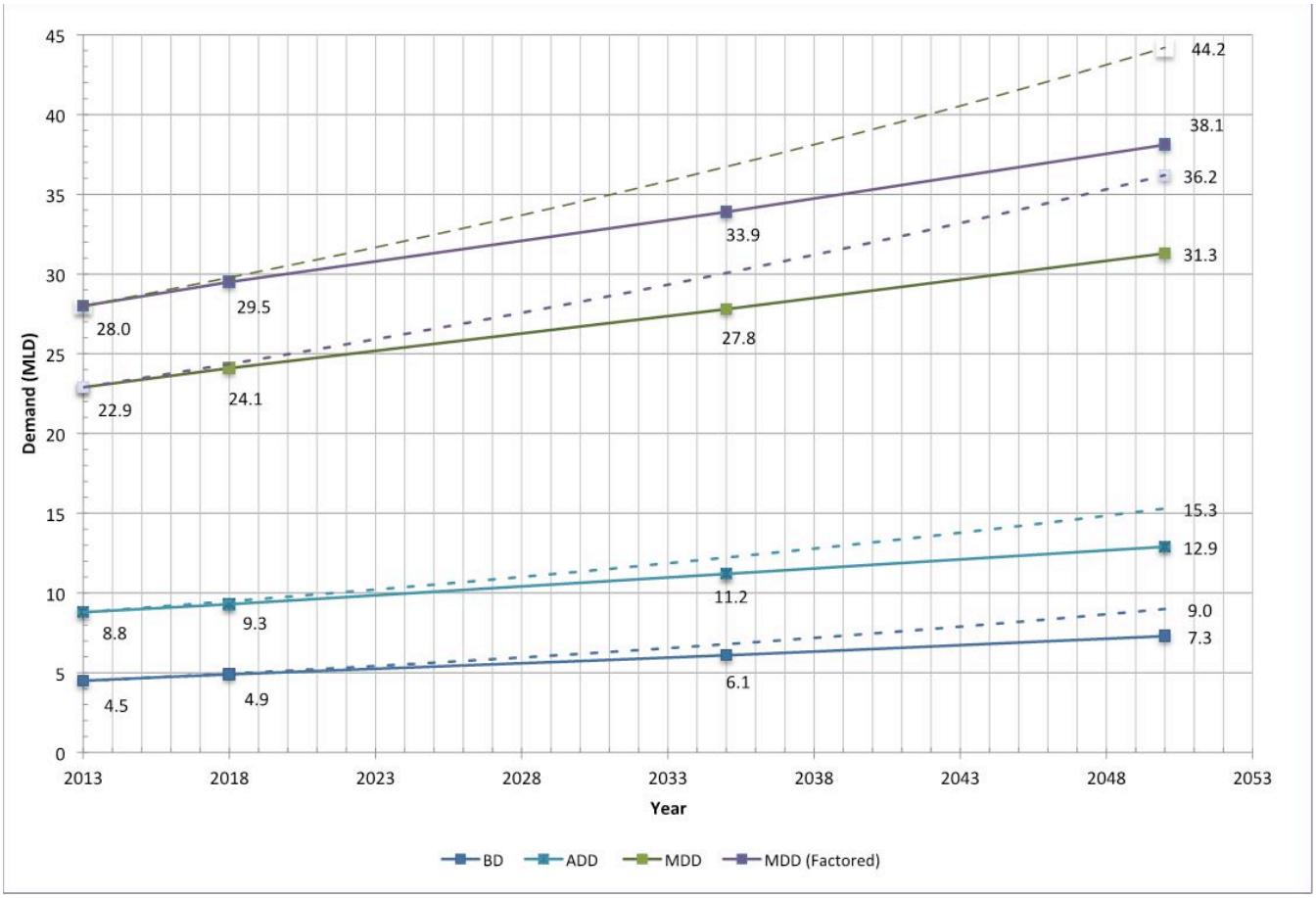


Figure 5-1: EWRS – Water Demand Projections

The figure below indicated the division of water use, by customer class (e.g., Residential, ICI) and demand type (i.e., Base Demand, Seasonal Demand) for the 2050 MDD High Growth scenario for the ERWS.

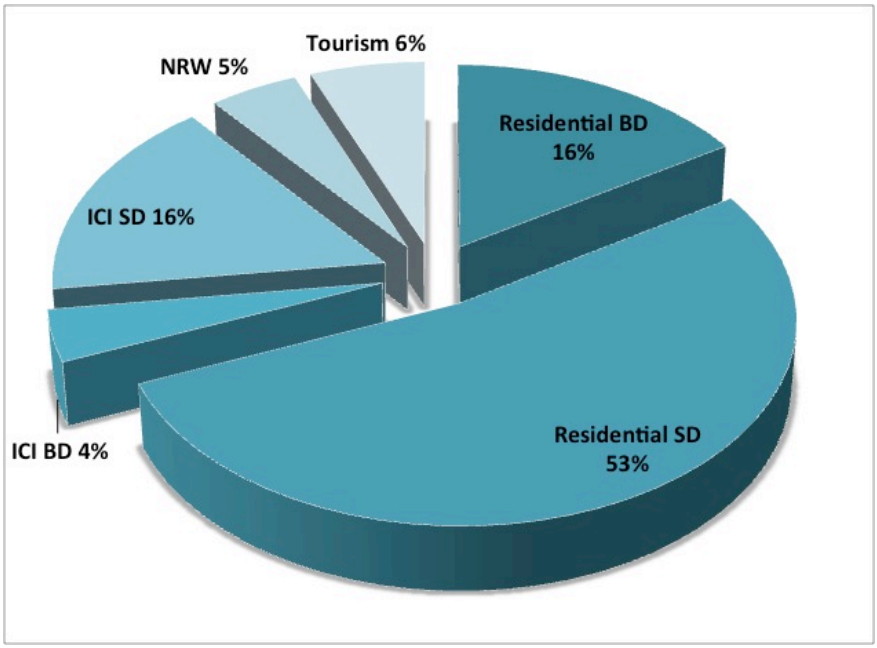


Figure 5-2: ERWS Demands Split for 2050 High Growth MDD

6. Conclusions

Assuming a design irrigation rate of 34,300 L/ha/day, the estimated existing maximum day demands for Parksville and Nanoose Bay WSA are:

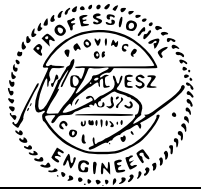
- Parksville: 16.3 MLD
- Nanoose Bay WSA: 6.6 MLD
- Total: 22.9 MLD

The recommended factored design flows for the Englishman River Water Treatment Plant, for a 2050 design horizon are:

- Parksville: 32.1 MLD
- Nanoose Bay WSA: 12.1 MLD
- Total: 44.2 MLD

KERR WOOD LEIDAL ASSOCIATES LTD.

Prepared by:



Michelle Revesz, P.Eng.
Project Engineer

Reviewed by:

Neal Whiteside, M.A.Sc., P.Eng.
Project Manager

MDR/am
Encls: Figure 1: Overall OPC and Water Systems
Appendix 1: Parksville Projected Water Demands
Appendix 2: Nanoose Bay WSA Projected Water Demands

Statement of Limitations

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Revision History

Revision #	Date	Status	Revision Description	Author
0			Original	MDR
1	Dec. 2, 2013	Interim Draft		NW
2	Dec. 6, 2013	Draft	Incorporate Client Comments	MDR
3	Jan. 27, 2014	Final	Incorporate Client Comments. Updated demands	MDR
4	June 3, 2014	Revised Final	Incorporate Client Comments. Updated demands for RDN	MDR

Town of Qualicum Beach

City of Parksville

Parksville Bay

Salish Sea - Strait of Georgia

Craig Bay

Northwest Bay

Nanoose Bay (RDN)

Nanoose Harbour

N

RDN - OCP

- Coast Residential
- Multi-Residential
- Neighbourhood Residential
- French Creek Mixed Use
- Parkland / Greenspace / NaturalArea
- Commercial
- Rural Residential
- Rural Residential 1
- Rural Residential 2
- Rural Residential 3
- Wembley Neighbourhood Centre
- French Creek Harbour
- Industrial
- Red Gap Village
- Schooner Cove Neighbourhood Centre
- The Lakes District Neighbourhood Plan Area
- Fairwinds
- Tourist Commercial Lands
- Rural
- Rural Resource
- Resource Lands within FLR
- Resource Lands within ALR
- Resource
- Park Lands
- Transportation Corridor

City of Parksville - OCP

- 01 - Single Unit Residential
- 02 - Transitional Residential
- 03 - Multi-Unit Residential
- 04 - Downtown Core
- 05 - Commercial
- 06.1- Mixed Use (Edge)
- 06.2 - Mixed Use (Commercial)
- 06.3 - Mixed Use (Tourist Commercial)
- 07 - Tourist Commercial
- 08 - Downtown Waterfront
- 09 - Shopping Centre Commercial
- 10 - Neighbourhood Commercial
- 11 - Local Grocery
- 12.1 - Industrial
- 12.2 - Industrial (Service)
- 14 - Resort Lands
- 13.1 - Community Use
- 13.2 - Parks and Openspace
- 15 - Estuary
- 16 - Restricted Recreation
- 17 - Agriculture

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Author: JLau

ERWS
Water Intake, Treatment Plant and Supply Mains

Legend

- Electoral Boundary
- Water System

Reference: GIS background data from The City of Parksville and the Regional District of Nanaimo.

KERR WOOD LEIDAL consulting engineers

1,000 0 1,000 (m)

Project No.	Date
468-010	December 2013

Overall OCP and Water System

PARKSVILLE - GROWTH TO YR-2050 (HIGH GROWTH SCENARIO - 24,017 ca)

	AREA	Base Demand																Peak Seasonal Demand												ADD	MDD
		Residential									ICI				NRW		BD	Residential					Tourism		ICI					PSD		
		Population (ca)	Dwelling Units	Lot Area	% BUILT-OUT	Net Lot Area	DU/density (du/ha)	Rate (L/ca/day)	ca/DU	Total (MLD)	PE	Lot Area	Rate (L/PE/day)	Total (MLD)	(% of BD)	Total (MLD)	Total (MLD)	Lot Area (ha)	Lot Coverage	Irrigable Lot Area (ha)	Rate (L/ha/day)	Total (MLD)	Tourist Population	Total (MLD)	Lot Area	Lot Coverage	Irrigable Lot Area (ha)	Rate (L/ha/day)	Total (MLD)	Total (MLD)	Total (MLD)	Total (MLD)
	Existing	12,354	5,645	482.0		354.8	11.71	156.4	2.2	1.9	5,415	223	156	0.8	21%	0.6	**3.4**	354.8	65%	230.6	34,300	7.9	10,447	1.6	223	45%	100	34,300	3.4	13.0	6.4	16.3
1	South of Greig Rd.	3,464	1,732	69.3	100%	55.4	25.00	163	2.0	0.6					21%	0.1	**0.7**	55.4	65%	36.0	34,300	1.2		-					-	1.2	1.0	1.9
2	East of Alberni Hwy., South of Despard Ave.	1,386	693	27.7	100%	22.2	25.00	163	2.0	0.2					21%	0.0	**0.3**	22.2	65%	14.4	34,300	0.5		-					-	0.5	0.4	0.8
3	East of Alberni Hwy., North of Despard Ave.	483	241	9.7	100%	7.7	25.00	163	2.0	0.1					21%	0.0	**0.1**	7.7	65%	5.0	34,300	0.2		-					-	0.2	0.1	0.3
4	West of Renz Rd.	676	338	13.5	100%	10.8	25.00	163	2.0	0.1					21%	0.0	**0.1**	10.8	65%	7.0	34,300	0.2		-					-	0.2	0.2	0.4
5	North of Stanhope Rd at Island Hwy.	110	55	2.2	100%	1.8	25.00	163	2.0	0.0					21%	0.0	**0.0**	1.8	65%	1.1	34,300	0.0		-					-	0.0	0.0	0.1
6	Residential Infill	5,545	2,772	55.4	100%	55.4	50.00	163	2.0	0.9					21%	0.2	**1.1**	55.4	65%	36.0	34,300	1.2	3,455	0.6					-	1.8	1.5	2.9
7	ICI Infill									-	3,554	152	163	0.6	21%	0.1	**0.7**	-						-	152	45%	68.6	34,300	2.4	2.4	1.2	3.1
	Total	**24,017**	11,477	659.9		508.1				3.8	8,969	375		1.4		1.1	**6.4**	508.1		330.27		11.3	13,902	2.2	375		100		5.8	19.3	10.8	25.7

PARKSVILLE - GROWTH TO YR-2050 (MOST PROBABLE GROWTH SCENARIO 17,548 ca)

	AREA	Base Demand																Peak Seasonal Demand												ADD	MDD
		Residential									ICI				NRW		BD	Residential					Tourism		ICI					PSD		
		Population (ca)	Dwelling Units	Lot Area	% BUILT-OUT	Net Lot Area	DU/density (du/ha)	Rate (L/ca/day)	ca/DU	Total (MLD)	PE	Lot Area	Rate (L/PE/day)	Total (MLD)	(% of BD)	Total (MLD)	Total (MLD)	Lot Area (ha)	Lot Coverage	Irrigable Lot Area (ha)	Rate (L/ha/day)	Total (MLD)	Tourist Population	Total (MLD)	Lot Area	Lot Coverage	Irrigable Lot Area (ha)	Rate (L/ha/day)	Total (MLD)	Total (MLD)	Total (MLD)	Total (MLD)
	Existing	12,354	5,645	482.0		354.8	11.71	156	2.2	1.9	5,415	223	156	0.8	21%	0.6	**3.4**	354.8	65%	230.6	34,300	7.9	10,447	1.6	223	45%	100	34,300	3.4	13.0	6.4	16.3
1	Greig Rd	935	468	69.3	27%	15.0	25.00	163	2.0	0.2					21%	0.0	**0.2**	15.0	65%	9.7	34,300	0.3		-					-	0.3	0.3	0.5
2	East of Alberni Hwy., South of Despard Ave.	374	187	27.7	27%	6.0	25.00	163	2.0	0.1					21%	0.0	**0.1**	6.0	65%	3.9	34,300	0.1		-					-	0.1	0.1	0.2
3	East of Alberni Hwy., North of Despard Ave.	483	241	9.7	100%	7.7	25.00	163	2.0	0.1					21%	0.0	**0.1**	7.7	65%	5.0	34,300	0.2		-					-	0.2	0.1	0.3
4	Humphrey Rd	676	338	13.5	100%	10.8	25.00	163	2.0	0.1					21%	0.0	**0.1**	10.8	65%	7.0	34,300	0.2		-					-	0.2	0.2	0.4
5	North of Stanhope Rd at Island Hwy.	110	55	2.2	100%	2.2	25.00	163	2.0	0.0					21%	0.0	**0.0**	2.2	65%	1.4	34,300	0.0		-					-	0.0	0.0	0.1
6	Residential Infill	2,616	1,308	26.2	100%	26.2	50.00	163	2.0	0.4					21%	0.1	**0.5**	26.2	65%	17.0	34,300	0.6	3,455	0.6					-	1.1	0.8	1.7
7	ICI Infill									-	1,583	65	156	0.2	21%	0.1	**0.3**	-						-	65	45%	29.3	34,300	1.0	1.0	0.5	1.3
	Total	**17,548**	8,242	630.6		422.6				2.8	6,998	288		1.1		0.8	**4.7**	422.6		274.70		9.4	13,902	2.2	223		100		4.45	16.1	8.4	20.8

PARKSVILLE - GROWTH TO YR-2035 MOST PROBABLE GROWTH SCENARIO, 15828 ca)

	AREA	Base Demand																Peak Seasonal Demand												ADD	MDD
		Residential									ICI				NRW		BD	Residential					Tourism		ICI					PSD		
		Population (ca)	Dwelling Units	Lot Area	% BUILT-OUT	Net Lot Area	DU/density (du/ha)	Rate (L/ca/day)	ca/DU	Total (MLD)	PE	Lot Area	Rate (L/PE/day)	Total (MLD)	(% of BD)	Total (MLD)	Total (MLD)	Lot Area (ha)	Lot Coverage	Irrigable Lot Area (ha)	Rate (L/ha/day)	Total (MLD)	Tourist Population	Total (MLD)	Lot Area	Lot Coverage	Irrigable Lot Area (ha)	Rate (L/ha/day)	Total (MLD)	Total (MLD)	Total (MLD)	Total (MLD)
	Existing	12,354	5,645	482.0		354.8	11.71	156	2.2	1.9	5,415	223	156	0.8	21%	0.6	**3.4**	354.8	65%	230.6	34,300	7.9	10,447	1.6	223	45%	100	34,300	3.4	13.0	6.4	16.3
1	South of Greig Rd.	-	-	69.3	0%	-	25.00	163	2.0	-					21%	-	**-**	-	65%	-	34,300	-		-					-	-	-	-
2	East of Alberni Hwy., South of Despard Ave.	-	-	27.7	0%	-	25.00	163	2.0	-					21%	-	**-**	-	65%	-	34,300	-		-					-	-	-	-
3	East of Alberni Hwy., North of Despard Ave.	483	241	9.7	100%	7.7	25.00	163	2.0	0.1					21%	0.0	**0.1**	7.7	65%	5.0	34,300	0.2		-					-	0.2	0.1	0.3
4	West of Renz Rd.	676	338	13.5	100%	10.8	25.00	163	2.0	0.1					21%	0.0	**0.1**	10.8	65%	7.0	34,300	0.2		-					-	0.2	0.2	0.4
5	North of Stanhope Rd at Island Hwy.	110	55	2.2	100%	2.2	25.00	163	2.0	0.0					21%	0.0	**0.0**	2.2	65%	1.4	34,300	0.0		-					-	0.0	0.0	0.1
6	Residential Infill	2,206	1,103	22.1	100%	22.1	50.00	163	2.0	0.4					21%	0.1	**0.4**	22.1	65%	14.3	34,300	0.5	1,935	0.3					-	0.8	0.6	1.2
7	ICI Infill									-	1,059	44	156	0.2	21%	0.0	**0.2**	-						-	44	45%	20	34,300	0.7	0.7	0.4	0.9
	Total	**15,828**	7,382	626.5		397.6				2.5	6,473	266		1.0		0.7	**4.2**	397.6		258.4		8.9	12,382	1.9	223		100		4.1	14.9	7.7	19.2

PARKSVILLE - GROWTH TO YR-2018 MOST PROBABLE GROWTH SCENARIO, 13,228 ca)

	AREA	Base Demand																Peak Seasonal Demand												ADD	MDD
		Residential									ICI				NRW		BD	Residential					Tourism		ICI					PSD		
		Population (ca)	Dwelling Units	Lot Area	% BUILT-OUT	Net Lot Area	DU/density (du/ha)	Rate (L/ca/day)	ca/DU	Total (MLD)	PE	Lot Area	Rate (L/PE/day)	Total (MLD)	(% of BD)	Total (MLD)	Total (MLD)	Lot Area (ha)	Lot Coverage	Irrigable Lot Area (ha)	Rate (L/ha/day)	Total (MLD)	Tourist Population	Total (MLD)	Lot Area	Lot Coverage	Irrigable Lot Area (ha)	Rate (L/ha/day)	Total (MLD)	Total (MLD)	Total (MLD)	Total (MLD)
	Existing	12,354	5,645	482.0		354.8	11.71	156	2.2	1.9	5,415	223	156	0.8	21%	0.6	**3.4**	354.8	65%	230.6	34,300	7.9	10,447	1.6	223	45%	100	34,300	3.4	13.0	6.4	16.3
1	South of Greig Rd.	-	-	69.3	0%	-	25.00	163	2.0	-					21%	-	**-**	-	65%	-	34,300	-		-					-	-	-	-
2	East of Alberni Hwy., South of Despard Ave.	-	-	27.7	0%	-	25.00	163	2.0	-					21%	-	**-**	-	65%	-	34,300	-		-					-	-	-	-
3	East of Alberni Hwy., North of Despard Ave.	241	121	9.7	50%	3.9	25.00	163	2.0	0.0					21%	0.0	**0.0**	3.9	65%	2.5	34,300	0.1		-					-	0.1	0.1	0.1
4	West of Renz Rd.	338	169	13.5	50%	5.4	25.00	163	2.0	0.1					21%	0.0	**0.1**	5.4	65%	3.5	34,300	0.1		-					-	0.1	0.1	0.2
5	North of Stanhope Rd at Island Hwy.	55	28	2.2	50%	0.9	25.00	163	2.0	0.0					21%	0.0	**0.0**	0.9	65%	0.6	34,300	0.0		-					-	0.0	0.0	0.0
6	Residential Infill	240	120	2.4	100%	2.4	50.00	163	2.0	0.0					21%	0.0	**0.0**	2.4	65%	1.6	34,300	0.1	323	0.1					-	0.1	0.1	0.2
7	ICI Infill									-	266	11	156	0.0	21%	0.0	**0.1**	-				-		-	11	45%	5	34,300	0.2	0.2	0.1	0.2
	Total	**13,228**	6,082	606.8		367.3				2.1	5,681	234		0.9		0.6	**3.6**	367.3		238.8		8.2	10,770	1.7	223		100		3.6	13.5	6.7	17.1

0000-0999:0400-0499:468-010:400-Work:Water Demands:May 30 submission:[20140120-parksvillemeterdata.xlsx]Report Table

Nanoose Bay WSA - YR- 2050 (Population 11,801)

Development	Single Family Residential							Multi-Family Residential							ICI							NRW		Total					
	% Build-out	Dwelling Units	Population (ca)	Lot Area (ha)	Irrigation Area (ha)	BD (MLD)	SD (MLD)	% Build-out	Dwelling Units	Population (ca)	Lot Area (ha)	Irrigation Area (ha)	BD (MLD)	SD (MLD)	% Build-out	Building area (sq. m)	Population Equivalents (ca)	Lot Area (ha)	Irrigation Area (ha)	BD (MLD)	SD (MLD)	Sub-Total BD	BD (MLD)	Residential Population (ca)	Irrigation Area (ha)	BD (MLD)	SD (MLD)	ADD (MLD)	MDD (MLD)
Existing	100%	2,053	4,564	452	153	0.7	5.2	100%	325	632	21.0	4.2	0.1	0.1	100%	-	196	14.3	2.1	0.0	0.1	0.9	0.2	5,196	158.9	1.1	5.5	2.4	6.6
Schooner Cove	100%	-	-	-	-	-	-	100%	360	700	3.3	0.7	0.1	0.0	100%	2,325.0	76	-	-	0.0	0.0	0.1	0.0	700	0.7	0.2	0.0	0.2	0.2
Lakes District	100%	1,122	2,494	103	46	0.4	1.6	100%	553	1,076	2.5	0.5	0.2	0.0	100%	14,000.0	336	-	-	0.1	0.0	0.6	0.2	3,570	46.9	0.8	1.6	1.2	2.4
Red Gap - Infill	100%	100	222	-	-	0.0	-	100%	111	216	-	-	0.0	-	100%	7,920.0	228	-	-	0.0	0.0	0.1	0.0	438	-	0.1	0.0	0.1	0.1
WSA - Infill Development	1465%	483	1,075	-	-	0.2	-	100%	-	-	-	-	-	-	100%	-	-	-	-	-	-	0.2	0.0	1,075	-	0.2	-	0.2	0.2
WSA - Vacant Lots	100%	300	667	51	23	0.1	0.8	100%	-	-	-	-	-	-	100%	-	-	-	-	-	-	0.1	0.0	667	22.9	0.1	0.8	0.3	0.9
Congregate Care Facility	100%	-	-	-	-	-	-	100%	-	155	-	-	0.0	-	100%	-	-	-	-	-	-	0.0	0.0	155	-	0.0	-	0.0	0.0
Total	**0%**	**4,058**	**9,022**	**606**	**222**	**1.5**	**7.6**	**0%**	**1,349**	**2,779**	**26.8**	**5.4**	**0.5**	**0.2**	**0%**	**24,245.0**	**836**	**14.3**	**2.1**	**0.1**	**0.1**	**2.1**	**0.6**	**11,801**	**229.3**	**2.6**	**7.9**	**4.5**	**10.5**

Nanoose Bay WSA - YR- 2035 (Population 8,462)

Development	Single Family Residential							Multi-Family Residential							ICI							NRW		Total					
	% Build-out	Dwelling Units	Population (ca)	Lot Area (ha)	Irrigation Area (ha)	BD (MLD)	SD (MLD)	% Build-out	Dwelling Units	Population (ca)	Lot Area (ha)	Irrigation Area (ha)	BD (MLD)	SD (MLD)	% Build-out	Building area (sq. m)	Population Equivalents (ca)	Lot Area (ha)	Irrigation Area (ha)	BD (MLD)	SD (MLD)	Sub-Total BD	BD (MLD)	Residential Population (ca)	Irrigation Area (ha)	BD (MLD)	SD (MLD)	ADD (MLD)	MDD (MLD)
Existing	100%	2,053	4,564	452	153	0.7	5.2	100%	325	632	21.0	4.2	0.1	0.1	100%	-	196	14.3	2.1	0.0	0.1	0.9	0.2	5,196	158.9	1.1	5.5	2.4	6.6
Schooner Cove	100%	-	-	-	-	-	-	100%	360	700	3.3	0.7	0.1	0.0	100%	2,325.0	76	-	-	0.0	0.0	0.1	0.0	700	0.7	0.2	0.0	0.2	0.2
Lakes District	50%	561	1,247	52	23	0.2	0.8	50%	277	538	2.5	0.3	0.1	0.0	75%	10,500.0	252	-	-	0.0	0.0	0.3	0.1	1,785	23.4	0.4	0.8	0.6	1.2
Red Gap - Infill	50%	50	111	-	-	0.0	-	67%	74	145	-	-	0.0	-	100%	7,920.0	228	-	-	0.0	0.0	0.1	0.0	256	-	0.1	0.0	0.1	0.1
WSA - Infill Development	50%	17	37	-	-	0.0	-	50%	-	-	-	-	-	-	100%	-	-	-	-	-	-	0.0	0.0	37	-	0.0	-	0.0	0.0
WSA - Vacant Lots	50%	150	333	25	11	0.1	0.4	50%	-	-	-	-	-	-	100%	-	-	-	-	-	-	0.1	0.0	333	11.4	0.1	0.4	0.2	0.5
Congregate Care Facility	100%	-	-	-	-	-	-	100%	-	155	-	-	0.0	-	100%	-	-	-	-	-	-	0.0	0.0	155	-	0.0	-	0.0	0.0
Total		**2,831**	**6,292**	**529**	**187**	**1.0**	**6.4**		**1,036**	**2,170**	**26.8**	**5.1**	**0.4**	**0.2**		**20,745.0**	**752**	**14.3**	**2.1**	**0.1**	**0.1**	**1.5**	**0.4**	**8,462**	**194.4**	**1.9**	**6.7**	**3.5**	**8.6**

Nanoose Bay WSA - YR- 2018 (Population 5,805)

Development	Single Family Residential							Multi-Family Residential							ICI							NRW		Total					
	% Build-out	Dwelling Units	Population (ca)	Lot Area (ha)	Irrigation Area (ha)	BD (MLD)	SD (MLD)	% Build-out	Dwelling Units	Population (ca)	Lot Area (ha)	Irrigation Area (ha)	BD (MLD)	SD (MLD)	% Build-out	Building area (sq. m)	Population Equivalents (ca)	Lot Area (ha)	Irrigation Area (ha)	BD (MLD)	SD (MLD)	Sub-Total BD	BD (MLD)	Residential Population (ca)	Irrigation Area (ha)	BD (MLD)	SD (MLD)	ADD (MLD)	MDD (MLD)
Existing	100%	2,053	4,564	452	153	0.7	5.2	100%	325	632	21.0	4.2	0.1	0.1	100%	-	196	14.3	2.1	0.0	0.1	0.9	0.2	5,196	158.9	1.1	5.5	2.4	6.6
Schooner Cove	0%	-	-	-	-	-	-	55%	198	385	3.3	0.4	0.1	0.0	50%	1,162.5	38	-	-	0.0	0.0	0.1	0.0	385	0.4	0.1	0.0	0.1	0.1
Lakes District	0%	-	-	-	-	-	-	0%	-	-	2.5	-	-	-	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Red Gap - Infill	0%	-	-	-	-	-	-	0%	-	-	-	-	-	-	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WSA - Infill Development	0%	-	-	-	-	-	-	0%	-	-	-	-	-	-	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WSA - Vacant Lots	34%	101	224	17	8	0.0	0.3	0%	-	-	-	-	-	-	0%	-	-	-	-	-	-	0.0	0.0	224	7.7	0.0	0.3	0.1	0.3
Congregate Care Facility	0%	-	-	-	-	-	-	0%	-	-	-	-	-	-	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total		**2,154**	**4,788**	**469**	**160**	**0.781**	**5.5**		**523**	**1,017**	**26.8**	**4.6**	**0.166**	**0.2**		**1,162.5**	**234**	**14.3**	**2.1**	**0.0**	**0.1**	**1.0**	**0.3**	**5,805**	**167.0**	**1.3**	**5.7**	**2.6**	**7.0**