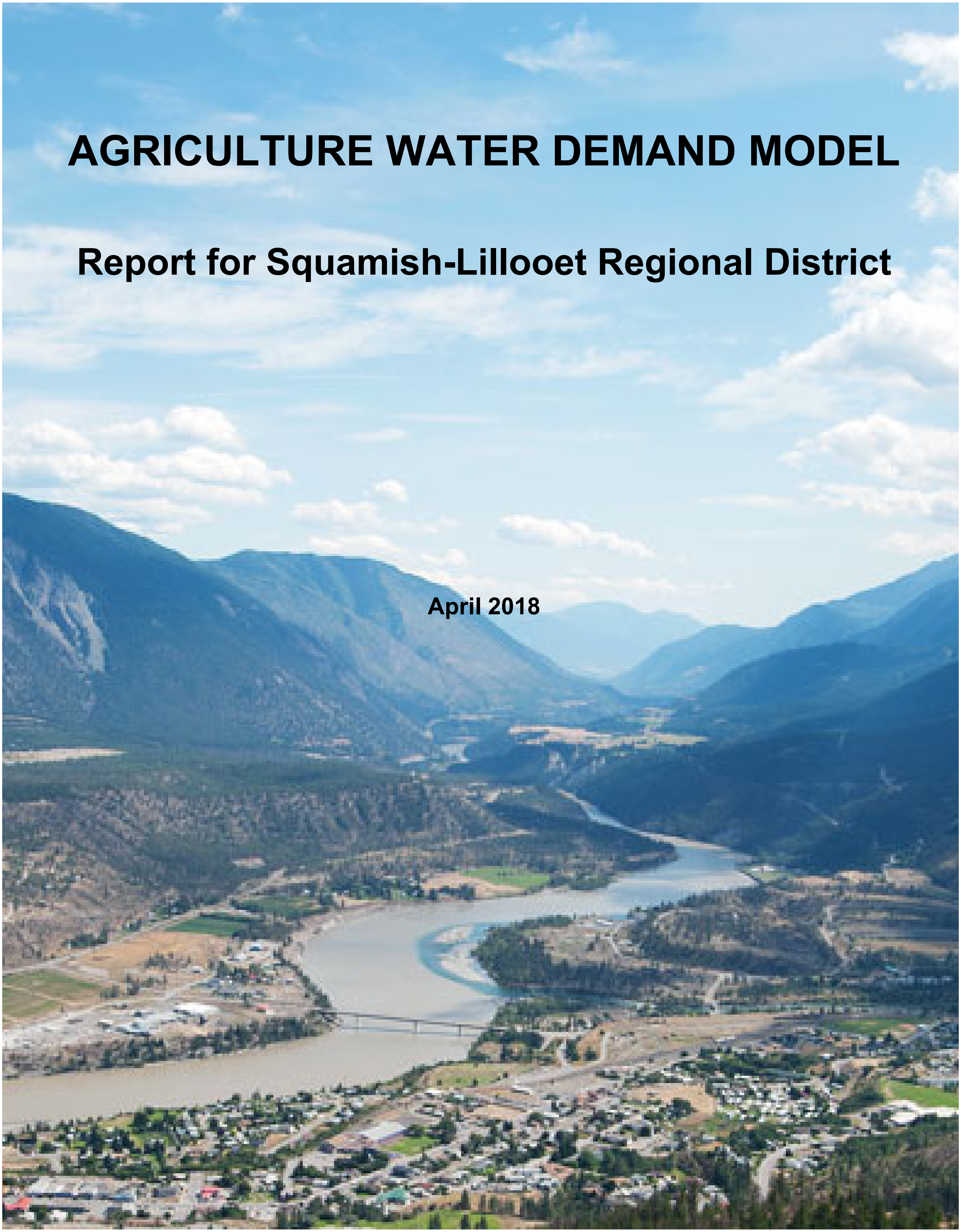
AGRICULTURE WATER DEMAND MODEL

Report for Squamish-Lillooet Regional District

April 2018



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DISCLAIMER

The data that is presented in this report provides the best estimates for agriculture water demand that can be generated at this time. While every effort has been made to ensure the accuracy and completeness of the information, the information should not be considered as final. The Governments of Canada and British Columbia are committed to working with industry partners. Opinions expressed in this document are those of the authors and not necessarily those of the Governments of Canada and British Columbia, the Investment Agriculture Foundation of BC, or other funding partners identified above.

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  Program Developer
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in the original development of the model algorithms, climate change scenarios and model development. Without their effort, the development of the model would not have been possible.

There are over twenty people that have been involved with the preparation and collection of data for the development of the Agriculture Water Demand Model in the project area. The authors wish to express appreciation to the following individuals for their contribution for the tasks noted.

Alex Cannon	Environment and Climate Change Canada	Climate data downscaling
Bill Taylor	Environment and Climate Change Canada	Climate data layer
Corrine Roesler	Ministry of Agriculture	GIS data coordination
Sam Lee	Ministry of Agriculture	GIS data preparation
Alison Fox	Ministry of Agriculture	Land Use Inventory
Tara Haynes	Contractor	Land Use Inventory

Background

The Agriculture Water Demand Model (AWDM) was developed in the Okanagan Watershed. It was developed in response to rapid population growth, drought conditions from climate change, and the overall increased demand for water. Many of the watersheds in British Columbia (BC) are fully allocated already or may be in the next 15 to 20 years. The AWDM helps to understand current agricultural water use and helps to fulfil the Province's commitment under the "*Living Water Smart – BC Water Plan*" to reserve water for agricultural lands. The Model can be used to establish agricultural water reserves throughout the various watersheds in BC by providing current and future agricultural water use data.

Climate change scenarios developed by the University of British Columbia (UBC) and the Summerland Research and Development Centre predict an increase in agricultural water demand due to warmer and longer summers and lower precipitation during summer months in the future.

The Model was developed to provide current and future agricultural water demands. The Model calculates water use on a property-by-property basis, and sums each property to obtain a total water demand for the entire basin or each sub-basin. Crop, irrigation system type, soil texture and climate data are used to calculate the water demand. Climate data from 2003 was used to present information on one of the hottest and driest years on record, and 1997 data was used to represent a wet year. Lands within the Agriculture Land Reserve (ALR), depicted in green in Figure 1, were included in the project.

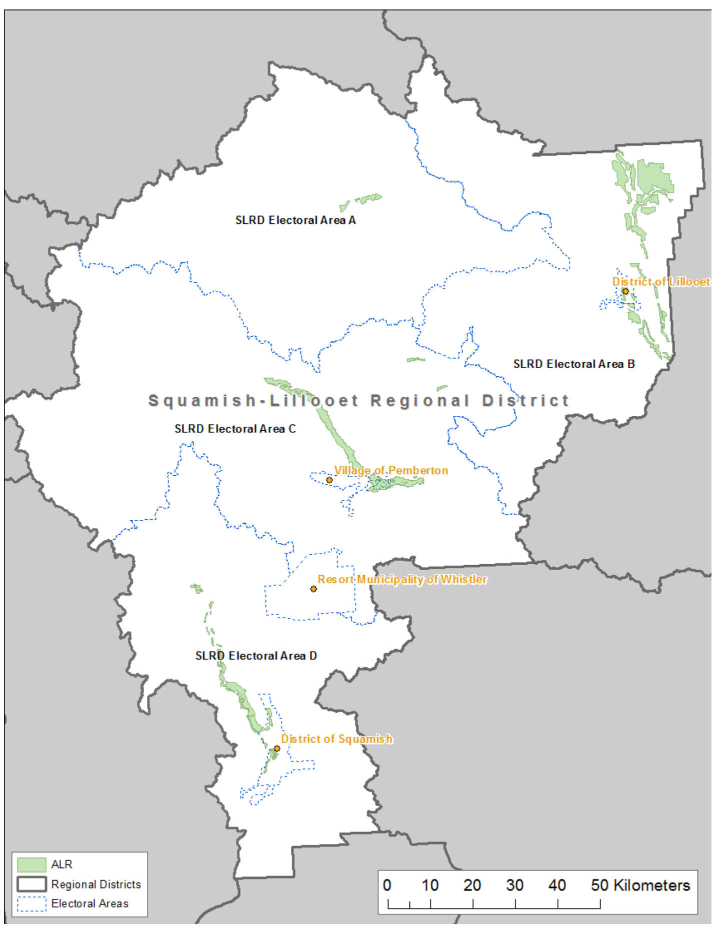

Figure 1 Map of Squamish-Lillooet Regional District (SLRD)

Methodology

The Model is based on a Geographic Information System (GIS) database that contains information on cropping, irrigation system type, soil texture and climate. An explanation of how the information was compiled for each is given below. The survey area included all properties within the ALR and areas that were zoned for agriculture by the local governments. The inventory was undertaken by Ministry of Agriculture (AGRI) staff, hired professional contractors and summer students.

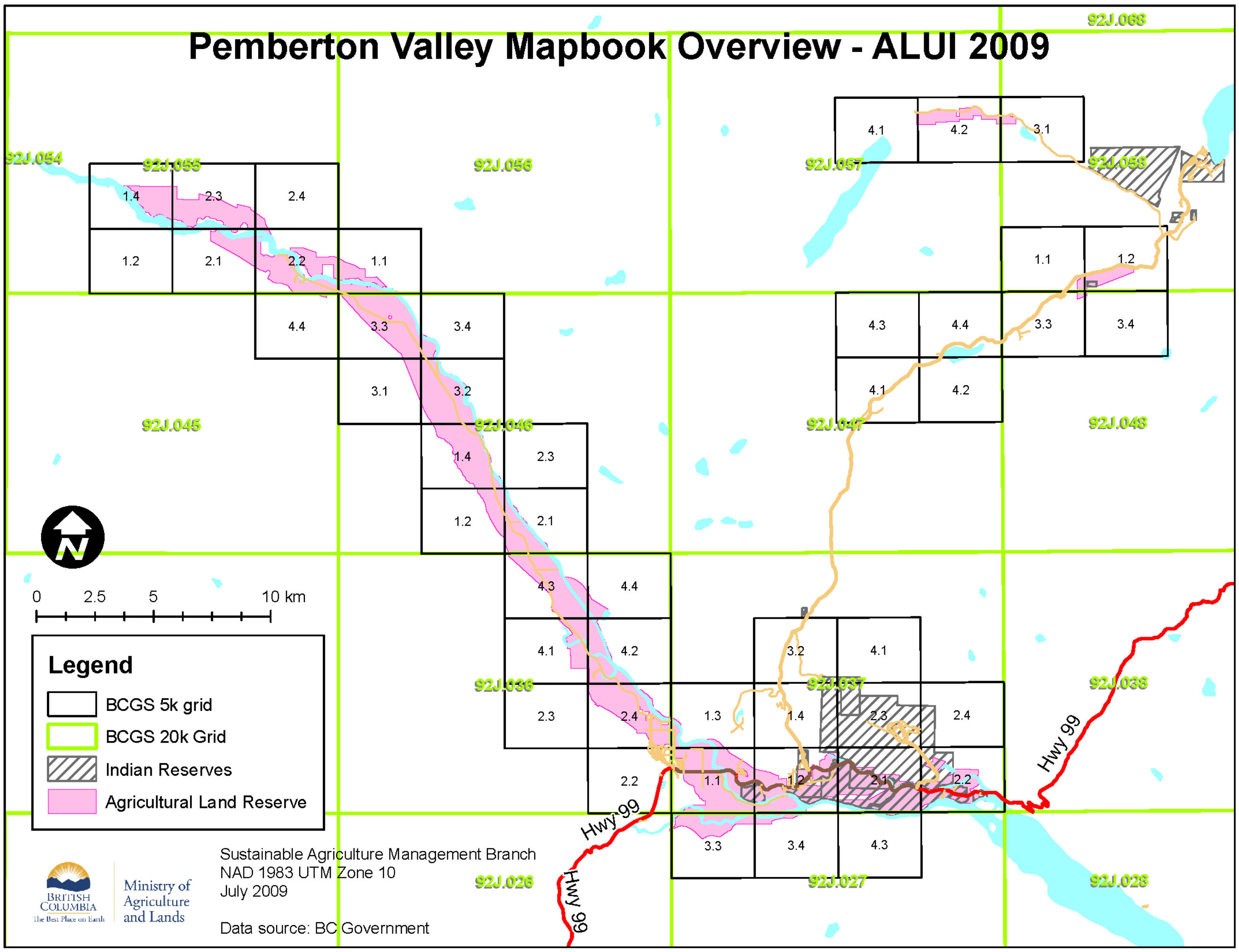

Figure 2 Map of the Project Area Overlaid with Map Sheets

Cadastre

Cadastre information was provided by the Integrated Cadastral Information Society (ICIS). A consultant was hired to unify all of the cadastral information into one seamless cover for the entire watershed. This process allows the Model to calculate water demand for each parcel and to report out on sub-basins, local governments, water purveyors or groundwater aquifers by summing the data for those areas. A GIS technician used aerial photographs to conduct an initial review of cropping information by cadastre, and divided the cadastre into polygons that separate farmstead and driveways from cropping areas. Different crops were also separated into different polygons if the difference could be identified on the aerial photographs. This data was entered into a database that was used by the field teams to conduct and complete the land use survey.

Land Use Survey

The survey maps and database were created by AGRI for the survey crew to enter data about each property. Surveys were done through the summer of 2017. The survey crew drove by each property where the team checked the database for accuracy using visual observation and the aerial photographs on the survey maps. A Professional Agrologist verified what was on the site, and a GIS technician altered the codes in the database as necessary (Figure 3). Corrections were handwritten on the maps during survey. The maps were then brought back to the office to have the hand-drawn lines digitized into the GIS system and have the additional polygons entered into the database.

Once acquired through the survey, the land use data was brought into the GIS to facilitate analysis and produce maps. Digital data, in the form of a database and GIS shapefiles (for maps), is available upon request through a data sharing agreement with the Ministry of Agriculture.

Figure 3 provides an example of a map sheet. The project area was divided into 229 map sheets. Each map sheet also had a key map to indicate where it was located.

The smallest unit for which water use is calculated are the polygons within each cadastre. A polygon is determined by a change in land use or irrigation system within a cadastre. Polygons are designated as blue lines within each cadastre as shown in Figures 4 and 5. The project area encompasses 8,367 parcels that are in or partially in the ALR. There are a total of 3,010 polygons (land covers) generated for the project area. Figure 4 provides an enhanced view of a cadastre containing three polygons. Each cadastre has a unique identifier as does each polygon. The polygon identifier is acknowledged by PolygonID. This allows the survey team to call up the cadastre in the database, review the number of polygons within the cadastre and ensure the land use is coded accurately for each polygon.

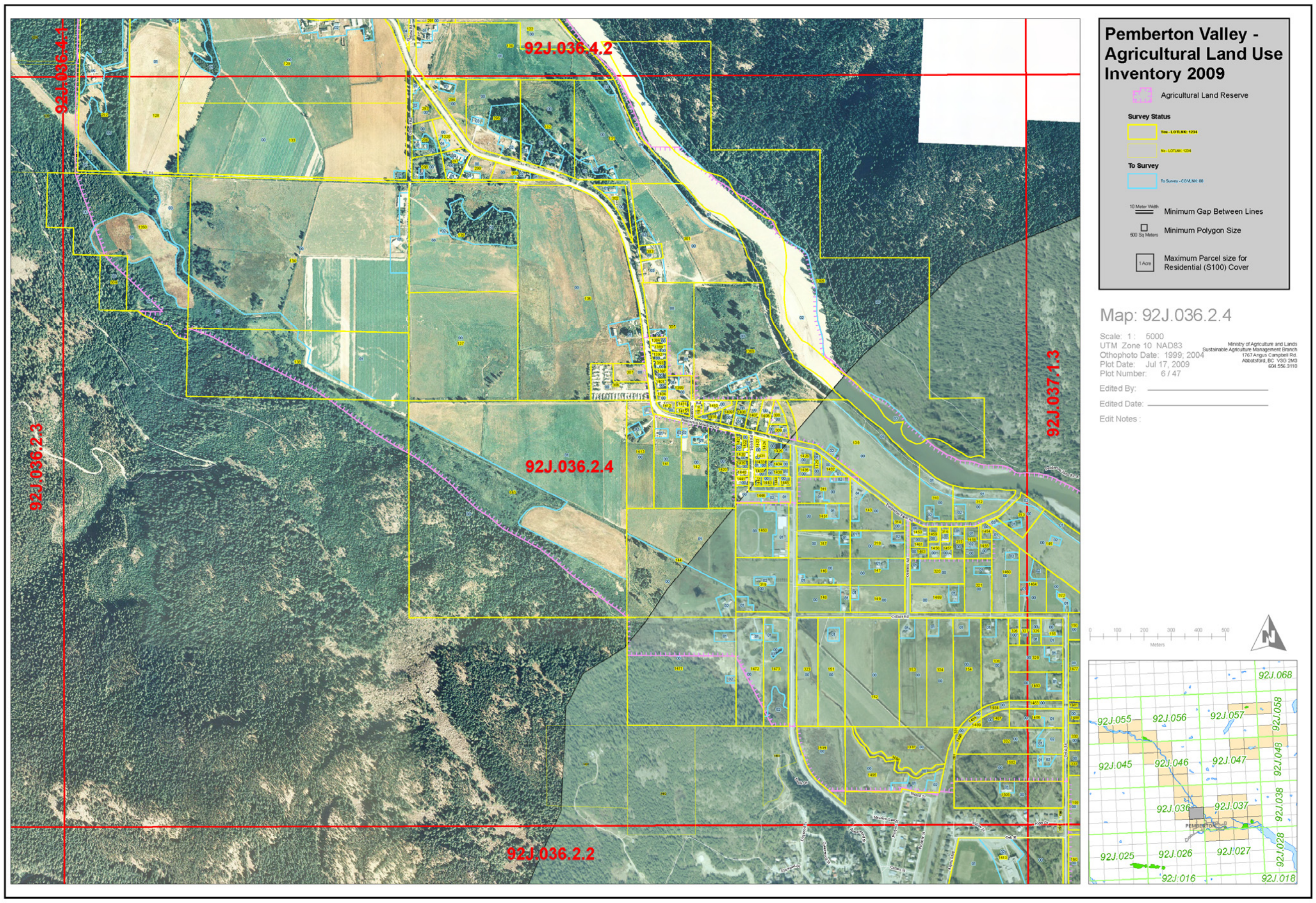

Figure 3 GIS Map Sheet

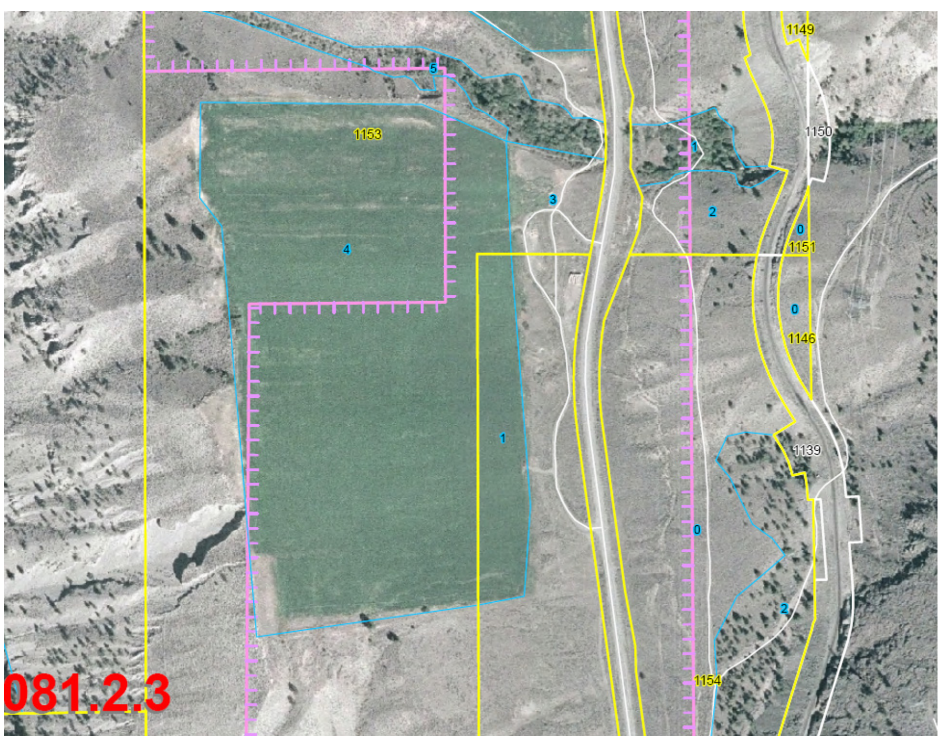

Figure 4 Cadastre with Polygons

Soil Information

Soil information was obtained digitally from the Ministry of Environment's Terrain and Soils Information System. The Computer Assisted Planning and Map Production application (CAPAMP) provided detailed (1:20,000 scale) soil surveys that were conducted in the Lower Mainland, on Southeast Vancouver Island, and in the Okanagan-Similkameen areas during the early 1980s. Products developed include soil survey reports, maps, agriculture capability and other related themes. Soil information required for this project was the soil texture (loam, etc.), the available water storage capacity and the peak infiltration rate for each texture type.

The intersection of soil boundaries with the cadastre and land use polygons creates additional polygons that the Model uses to calculate water demand. Figure 5 shows how the land use information is divided into additional polygons using the soil boundaries. The Model calculates water demand using every different combination of crop, soil and irrigation system as identified by each polygon.

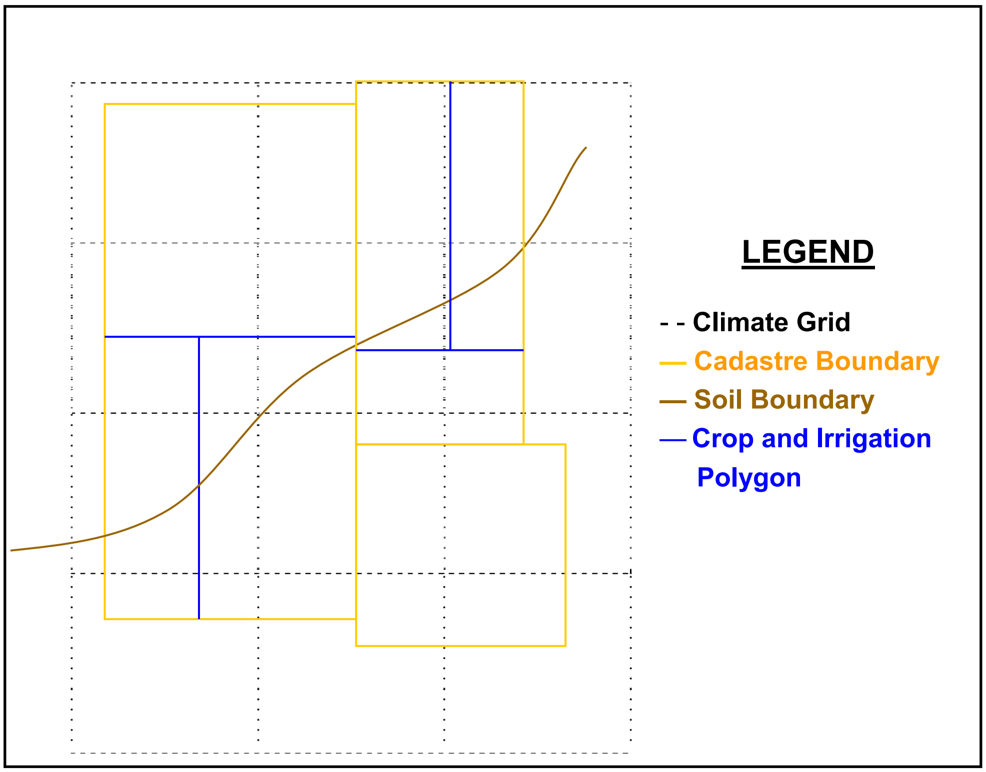

Figure 5 GIS Model Graphics

Climate Information

The agricultural water demand is calculated using climate, crop, irrigation system and soil information data. The climate in the interior region is quite diverse. The climate generally gets cooler and wetter from south to north and as elevation increases. To incorporate the climatic diversity, climate layers were developed for the entire region on a 500 m x 500 m grid. Each grid cell contains daily climate data, minimum and maximum temperature (T_{min} and T_{max}), and precipitation which allows the Model to calculate a daily reference evapotranspiration rate (ET_o) value. A range of agro-climatic indices such as growing degree days (GDD), corn heat units (CHU), frost free days and temperature sum (Tsum) can also be calculated for each grid cell based on temperature data. These values are used to determine seeding dates and the length of the growing season in the Model.

The climate dataset has been developed by using existing data from climate stations in and around the project area from 1961 to 2010. This climate dataset was then interpolated to provide a climate data layer for the entire watershed on the 500 m x 500 m grid. A detailed description of the Model can be obtained by contacting the authors. The climate grid cell that is prominent for a cadastre boundary is assigned to that cadastre. Additional polygons are not generated with the climate grid.

The attributes attached to each climate grid cell include:

- Latitude
- Longitude
- Elevation
- Aspect
- Slope
- Daily Precipitation
- Daily T_{min} and T_{max}

A climate database contains T_{min}, T_{max}, T_{mean} and Precipitation for each day of the year from 1961 until 2006. The parameters that need to be selected, calculated and stored within the Model are evapotranspiration (ET_o), Tsum of 600 (for Kamloops), effective precipitation (EP), frost free days, GDD with base temperatures of 5 ºC and 10 ºC, CHU, and first frost date. These climate and crop parameters are used to determine the growing season length as well as the beginning and end of the growing season in Julian day.

Model Calculations

The model calculates the water demand for each polygon by using crop, irrigation, soil and climate parameters as explained below. Each polygon has been assigned an ID number as mentioned previously.

Crop

The CropID is an attribute of the PolygonID as each polygon will contain a single crop. The crop information (observed during the land use survey) has been collected and stored with PolygonID as part of the land use survey. CropID will provide cropping attributes to the Model for calculating water use for each polygon. CropID along with the climate data will also be used to calculate the growing season length and the beginning and end of the growing season. The attributes for CropID include rooting depth, availability coefficient, crop coefficient and a drip factor.

Rooting depth is the rooting depth for a mature crop in a deep soil.

An availability coefficient is assigned to each crop. The availability coefficient is used with the IrrigID to determine the soil moisture available to the crop for each PolygonID.

The crop coefficient adjusts the calculated ET_o for the stages of crop growth during the growing season. Crop coefficient curves have been developed for every crop. The crop coefficient curve allows the Model to calculate water demand with an adjusted daily ET_o value throughout the growing season.

The drip factor is used in the water use calculation for polygons where drip irrigation systems are used. Since the Model calculates water use by area, the drip factor adjusts the percentage of area irrigated by the drip system for that crop.

Irrigation

The IrrigID is an attribute of the PolygonID as each polygon will have a single irrigation system type operating. The irrigation information has been collected and stored (as observed during the land use survey) with the land use data. The land use survey determined if a polygon had an irrigation system operating, what the system type was, and if the system was being used. The IrrigID has an irrigation efficiency listed as an attribute.

Two of the IrrigID, Overtreedrip and Overtreemicro are polygons that have two systems in place. Two irrigation ID's occur when an overhead irrigation system has been retained to provide crop cooling or frost protection. In this case, the efficiencies used in the Model are the drip and microsprinkler efficiencies.

Soil

The soil layer came from CAPAMP at the Ministry of Environment. In addition, soil data provided by Agriculture and Agri-Food Canada (AAFC) was also used to generate multiple soil layers within each polygon. Each parcel was assigned the most predominant soil polygon, and then for each crop field within that soil polygon, the most predominant texture within the crop's rooting depth was determined and assigned to the crop field.

Note that textures could repeat at different depths – the combined total of the thicknesses determined the most predominant texture. For example, a layer of 20 cm sand, followed by 40 cm clay and then 30 cm of sand would have sand be designated at the predominant soil texture.

The attributes attached to the SoilID is the Available Water Storage Capacity (AWSC) which is calculated using the soil texture and crop rooting depth.

The Maximum Soil Water Deficit (MSWD) is calculated to decide the parameters for the algorithm that is used to determine the Irrigation Requirement (IR). The Soil Moisture Deficit at the beginning of the season is calculated using the same terms as the MSWD.

Climate

The climate data in the Model is used to calculate a daily reference evapotranspiration rate (ET_o) for each climate grid cell. The data that is required to calculate this value are:

- Elevation, metres (m)
- Latitude, degrees (^{o})
- Minimum Temperature, degree Celsius (^{o}C)
- Maximum Temperature, degree Celsius (^{o}C)
- Classification as Coastal or Interior
- Classification as Arid or Humid
- Julian Day

Data that is assumed or are constants in this calculation are:

• Wind speed	2 m/s
• Albedo or canopy reflection coefficient,	0.23
• Solar constant, G_{sc}	0.082 $MJ^{-2}min^{-1}$
• Interior and Coastal coefficients, K_{Rs}	0.16 for interior locations 0.19 for coastal locations
• Humid and arid region coefficients, K_o	0 °C for humid/sub-humid climates 2 °C for arid/semi-arid climates

Livestock Water Use

The Model calculates an estimated livestock water demand using agricultural census data and an estimate of the water use per animal. Water use for each animal type is calculated a bit differently depending on requirements. For example, for a dairy milking cow, the water demand for each animal includes, drinking, preparation for milking, pen and barn cleaning, milking system washout, bulk tank washout and milking parlor washing. However, for a dry dairy cow, the demand only includes drinking and pen and barn cleaning.

The water use is estimated on a daily basis per animal even though the facility is not cleaned daily. For example, for a broiler operation, the water use for cleaning a barn is calculated as 4 hours of pressure washing per cycle at a 10 gpm flow rate, multiplied by 6 cycles per barn with each barn holding 50,000 birds. On a daily basis, this is quite small with a value of 0.01 litres per day per bird applied.

For all cases, the daily livestock demand is applied to the farm location. However, in the case of beef, the livestock spend quite a bit of the year on the range. Since the actual location of the animals cannot be ascertained, the water demand is applied to the home farm location, even though most of the demand will not be from this location. Therefore, the animal water demand on a watershed scale will work fine but not when the demand is segregated into sub-watersheds or groundwater areas.

The estimates used for each livestock are shown in Table 1.

Table 1 Livestock Water Demand (Litres/day)

Animal Type	Drinking	Milking Preparation	Barn Component	Total
Milking Dairy Cow	65	5	15	85
Dry Cow	45		5	50
Swine	12		0.5	12.5
Poultry – Broiler	0.16		0.01	0.17
Poultry – Layer	0.08		0.01	0.09
Turkeys	0.35		0.01	0.36
Goats	8			8
Sheep	8			8
Beef – range, steer, bull, heifer	50			50
Horses	50			50

Land Use Results

A summary of the land area and the inventoried project area are shown in Table 2. The inventoried area includes parcels that are in and partially in the Agricultural Land Reserve (ALR).

Table 2 Overview of the Land and Inventoried Area

Area Type	Area (ha)
Squamish-Lillooet Regional District (SLRD)	
Total Area	782,800
Area of Water Feature	19,769
Area of Land (excluding water features)	763,031
ALR Area	10,741
Inventoried Area	
Total Inventoried Area	22,785

The primary agricultural use of the ARL area is shown in Table 3. Refer to the Agricultural Land Use Inventory (ALUI) report for details.

Table 3 Summary of Primary Agricultural Activities within the ALR where Primary Land Use is agriculture in the Project Area

Primary Agriculture Activity	Total Land Cover (ha)
Forage	10,263
Pasture and Grass	3,885
Cereal	2,557
Natural Pasture and Rangeland	2,045
Turf	940
Tree Fruits	403
Inactive	291
Nursery and Greenhouse	185
Vegetables	156
Berries	175
Other	10
Total	**20,755**

Figures 6 and 7 show the areas of water and land parcels in the basin graphically.

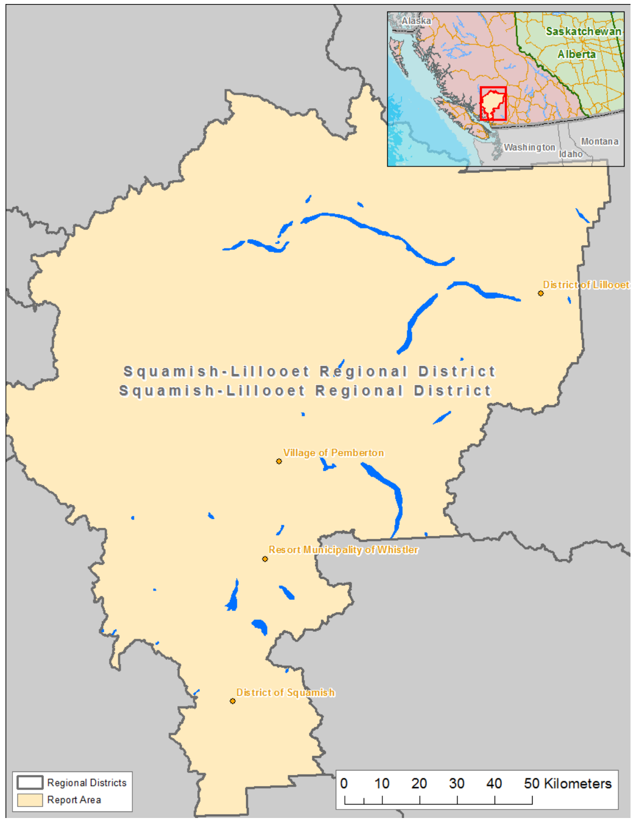

Figure 6 Water Areas in the Project Area

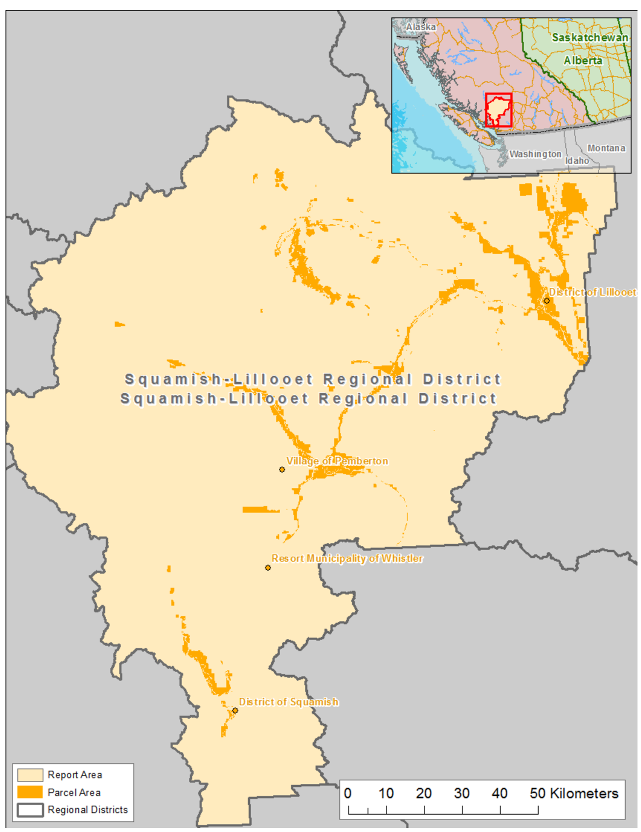

Figure 7 Land Parcels in the Project Area

Agricultural Water Demand Results

The Model has a reporting feature that can save and generate reports for many different scenarios that have been pre-developed. This report will provide a summary of the reported data in the Appendices. Climate data from 1997 and 2003 were chosen as they represent a relatively wet year and dry year respectively. Most reports are based on the 2003 data since the maximum current demand can then be presented. Scenarios using climate change information in the 2050's is also presented.

Annual Crop Water Demand – Tables A and B

The Model can use three different irrigation management factors, good, average and poor. Unless otherwise noted, average management were used in the tables. Appendix Table A provides the annual irrigation water demand for current crop and irrigation systems used for the year 2003 using average irrigation management, and Table B provides the same data for 1997.

Where a crop was not established, the acreage was assigned a forage crop so that the Model could determine a water demand. The total irrigated acreage in SLRD is 2,196 hectares (ha), including 1,055 ha of forage and 554 ha of pasture/grass crops (alfalfa, forage corn, grass, legume and pasture). In SLRD, 1,633 ha is supplied by licensed surface water sources, and 562 ha is irrigated with groundwater.

The total annual irrigation demand was 20,459,942 m^3 in 2003, and dropped to 13,819,935 m^3 in 1997. During a wet year like 1997, the demand was only 67% of a hot dry year like 2003.

In addition, the Model also calculates demand based on relatively good practices. As such, actual use may actually be higher or lower than what is calculated by the Model.

Please note that Lillooet is one of the hottest parts of the country, and Pemberton is cooler being closer to the coast. The average irrigation requirements in these tables will reflect the true average if the crops are listed for Lillooet and Pemberton separately.

Annual Water Demand by Irrigation System – Table C

The crop irrigation demand can also be reported by irrigation system type as shown in Table C. The more efficient irrigation system for vegetable is drip (including overtreedrip) which irrigates 17 ha in the project area, and for forage is low-pressure pivots which are used on 140 ha in this area. There is also a large portion of the forage irrigated by less efficient sprinkler systems (including travelling guns, wheeline and handline). Sprinkler, wheeline, handline and travelling guns irrigate 1,562 ha (71%) of the agricultural crops.

Annual Water Demand by Soil Texture – Table D

Table D provides annual water demand by soil texture. Where soil texture data is missing, the soil texture has been defaulted to sandy loam. The defaults are shown in Table D.

Annual Water Demand by Aquifer – Table E

The model calculates water demand on a property by property basis and can summarize the data for each aquifer in the project area. Table E provides an estimated water demand for each aquifer.

Annual Water Demand by Local Government – Table F

The model calculates water demand on a property by property basis and can summarize the data for each local government in the project area. Table F provides an estimated water demand for each local government.

Irrigation Management Factors – Table G

The Model can estimate water demand based on poor, average and good irrigation management factors. This is accomplished by developing an irrigation management factor for each crop, soil and irrigation system combination based on subjective decision and percolation rates. The Maximum Soil Water Deficit (MSWD) is the maximum amount of water that can be stored in the soil within the crop rooting zone. An irrigation system applying more water than what can be stored will result in percolation beyond the crop's rooting depth. Irrigation systems with high application rates will have a probability of higher percolation rates, a stationary gun for instance.

For each soil class, a range of four MSWD are provided, which reflect a range of crop rooting depths. An irrigation management factor, which determines the amount of leaching, is established for each of the MSWD values for the soil types (Table 4). The management factor is based on irrigation expertise as to how the various irrigation systems are able to operate. For example, Table 5 indicates that for a loam soil and a MSWD of 38 mm, a solid set overtree system has a management factor of 0.10 for good management while the drip system has a management factor of 0.05. This indicates that it is easier to prevent percolation with a drip system than it is with a solid set sprinkler system. For poor management, the factors are higher.

There are a total of 1,344 irrigation management factors established for the 16 different soil textures, MSWD and 21 different irrigation system combinations used in the Model.

Table 4 Irrigation Management Factors

Soil Texture	MSWD	Solid Set Overtree			Drip		
		Good	Average	Poor	Good	Average	Poor
Loam	38	0.10	0.15	0.20	0.05	0.10	0.15
	50	0.05	0.10	0.15	0.05	0.075	0.10
	75	0.05	0.10	0.15	0.05	0.075	0.10
	100	0.05	0.075	0.10	0.05	0.075	0.10
Sandy loam	25	0.20	0.225	0.25	0.10	0.15	0.20
	38	0.10	0.15	0.20	0.10	0.125	0.15
	50	0.05	0.10	0.15	0.05	0.10	0.10
	75	0.05	0.10	0.15	0.05	0.075	0.10

The management factors increase as the MSWD decreases because there is less soil storage potential in the crop rooting depth. For irrigation systems such as guns, operating on a pasture which has a shallow rooting depth, on a sandy soil which cannot store much water, the poor irrigation management factor may be as high as 0.50.

The management factor used in the Model assumes all losses are deep percolation while it is likely that some losses will occur as runoff as well.

Table G provides an overview of the impacts on the management factors and irrigation systems used. Since a large portion of the crops in the region are forage crops most of which are currently irrigated with sprinkler system which need to be run almost non-stop especially in peak season, the impacts of improved management are not significant (5% in total water use reduction). A further reduction could be achieved by improving irrigation efficiencies as shown in Table H.

This table also provides percolation rates based on good, average and poor management using 2003 climate data. In summary, good management is 2,803,457 m^3, average is 3,338,709 $m^3$and poor management is 3,873,961 m^3. Percolation rates for poor management are 28% higher than for good management.

Deep Percolation – Table H

The percolation rates vary by crop, irrigation system type, soil and the management factor used. Table H shows the deep percolation amounts by irrigation system type for average management. The last column provides a good indication of the average percolation per hectare for the various irrigation system types. For example, drip irrigation systems have only about 28% of the percolation rates of gun systems.

Improved Irrigation Efficiency and Good Management – Table I

There is an opportunity to reduce water use by converting irrigation systems to a higher efficiency for some crops. For example, drip systems could be used for all fruit crops, vegetable crops and some of the other horticultural crops, but not forage crops. In addition, using better management such as irrigation scheduling techniques will also reduce water use, especially for forage where drip conversion is not possible. Table I provides a scenario of water demand if all sprinkler systems are converted to drip systems for horticultural crops in the project area, as well as converting irrigation systems to low-pressure pivot systems for forage fields over 10 ha, using good irrigation management. In this case, the water demand for 2003 would reduce from 20,459,942 m^3 to 15,251,589 m^3 (25% reduction).

Livestock Water Use – Table J

The Model provides an estimate of water use for livestock. The estimate is based on the number of animals in the project area as determined by the latest census, the drinking water required for each animal per day and the barn or milking parlour wash water. Values used are shown in Table J. For the project area, the amount of livestock water is estimated at 75,490 m^3.

Climate Change Water Demand for 2050 – Table K

The Model also has access to climate change information until the year 2100. While data can be run for each year, three driest years in the 2050's were selected to give a representation of climate change. Figure 8 shows the climate data results which indicate that 2053, 2056, and 2059 generate the highest annual ET_o and lowest annual precipitation. These three years were used in this report.

Table K provides the results of climate change on irrigation demand for the three years selected using current crops and irrigation systems. Current crops and irrigation systems are used to show the increase due to climate change only, with no other changes taking place.

Figure 8 shows all of the climate change scenario runs for the Okanagan using 12 climate models from 1960 to 2100. This work was compiled by Denise Neilsen at the Agriculture and Agri-Food Canada – Summerland Research and Development Centre. There is a lot of scatter in this figure, but it is obvious that there is a trend of increasing water demand.

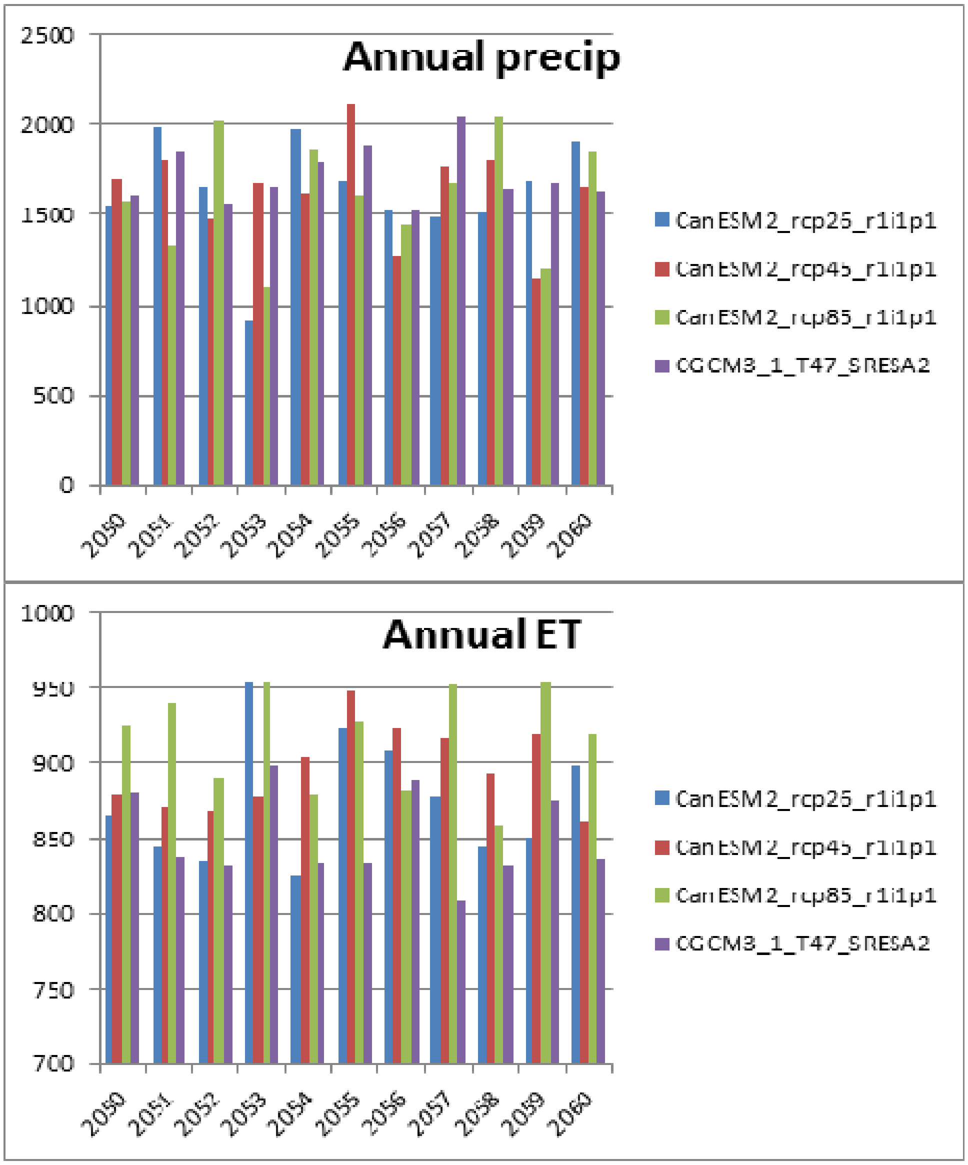

Figure 8 Annual ET and Effective Precipation in 2050's

The three climate change models used in this report are access1 rcp85, canESM2 rcp85 and cnrm-cm5 rcp85. Running only three climate change models on three selected future years in the project area is not sufficient to provide a trend like in Figure 9. What the results do show is that in an extreme climate scenario, it is possible to have an annual water demand that is 30% higher than what was experienced in 2003 based on canESM2 rcp85 climate model in 2053. More runs of the climate change models will be required to better estimate a climate change trend for the region.

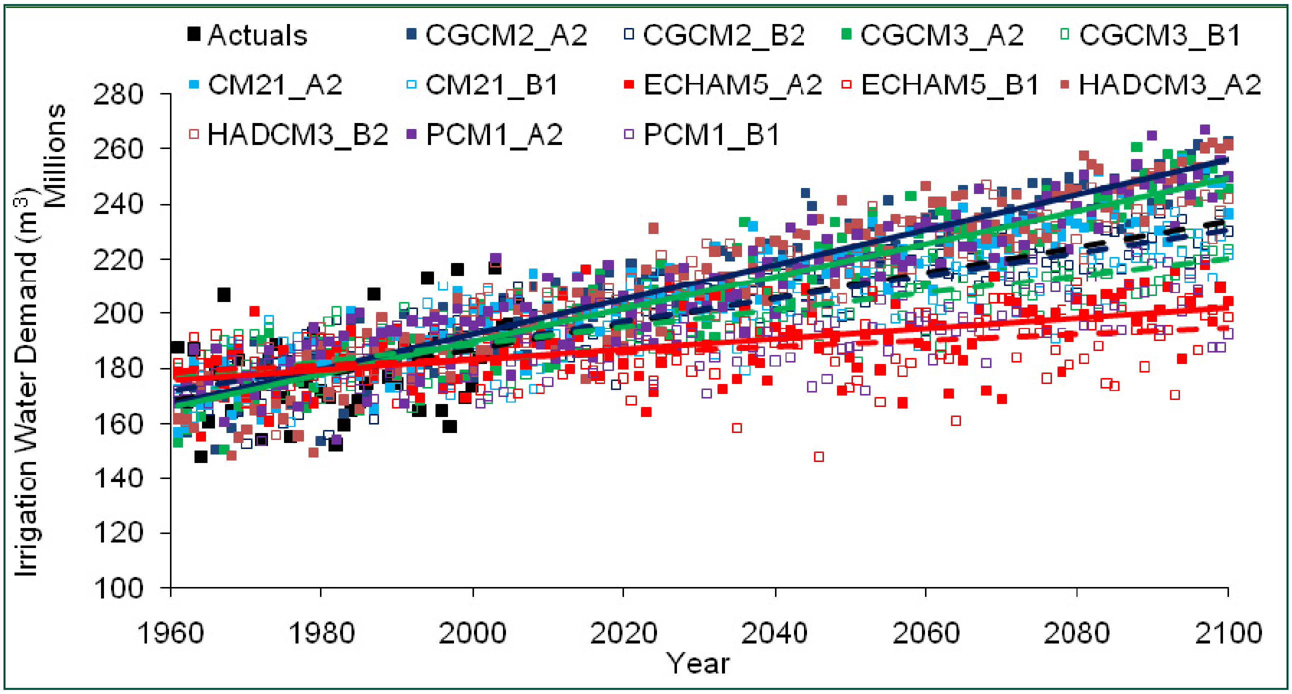

Figure 9 Future Irrigation Demand for All Outdoor Uses in the Okanagan in Response to Observed Climate Data (Actuals) and Future Climate Data Projected from a Range of Global Climate Models

Agricultural Buildout Crop Water Demand Using 2003 Climate Data – Table L

An agricultural irrigated buildout scenario was developed that looked at potential agricultural lands that could be irrigated in the future. The rules used to establish where potential additional agricultural lands were located are as follows:

- within 1,000 m of water supply (lake)
- within 1,000 m of water supply (water course)
- within 1,000 m of water supply (wetland)
- within 1,000 m of high productivity aquifer
- within 1,000 m of water purveyor
- within 125 m elevation from the surface water source to the property
- with Ag Capability class 1-4 only where available
- must be within the ALR
- below 750 m average elevation
- must be private ownership

Physical structure (e.g., farmstead, houses) are not considered to be available for the buildout scenario. For the areas that are determined to be eligible for future buildout, a crop and irrigation system need to be applied. Where a crop already existed in the land use inventory, that crop would remain and an irrigation system assigned. If no crop existed, then a crop and an irrigation system are assigned as per the criteria below:

- 50% Vegetable – 80% sprinkler, 20% travelling gun
- 50% Forage – 90% drip, 10% sprinkler

Figure 10 indicates the location of agricultural land that is currently irrigated (red) and the land that can be potentially irrigated (blue). Based on the scenario provided for the project area, the additional agricultural land that could be irrigated is 3,418 ha, which is an increase in irrigated acreage of 156%. The water demand for a year like 2003 would then be about 43 million m^3 assuming efficient irrigation systems and good management. Figure 10 can be provided in a larger scale by contacting the Ministry of Agriculture.

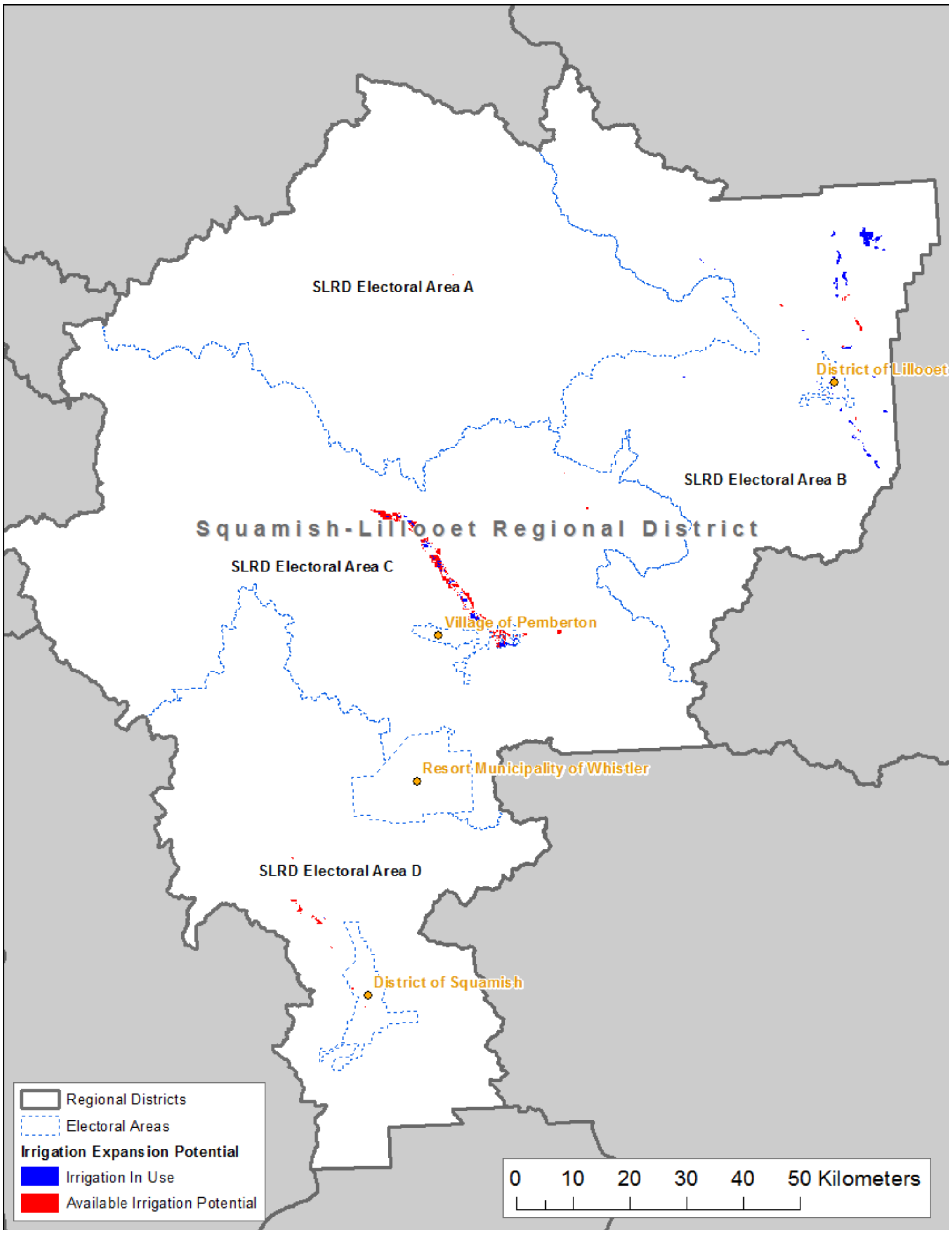

Figure 10 Irrigation Expansion Potential for the Project Area

Agricultural Buildout Crop Water Demand for 2050 – Table M

The same irrigation expansion and cropping scenario used to generate the values in Table L were used to generate the climate change water demand shown in Table M. See discussion under Table K section. When climate change is added to the buildout scenario, the water demand increases from 43 million m^3 to 51 million m^3 (a further 20% increase) based on climate change model canESM2 rcp85 in 2053 using the highest potential scenario.

Irrigation Systems Used for the Buildout Scenario for 2003 – Table N

Table N provides an account of the irrigation systems used by area for the buildout scenario in the previous two examples. Note that pivot irrigation (especially low-pressure type) is expected to be used for forage field over 10 ha in size to be economically feasible.

Water Demand for the Buildout Area by Aquifer 2003 Climate Data – Table O

Table O provides the water demand by aquifer for the buildout scenario used in this report. Comparing these values with the result in Table E will provide information on the possible increased water demand from groundwater source for the projected irrigated areas. The Model does not determine that there is sufficient groundwater available, only that this would be the potential demand. Note that all the aquifers in this project area have low productivity of groundwater based on the information from BC Ministry of Environment.

Water Demand for the Buildout Area by Local Government 2003 Climate Data – Table P

Table P provides the water demand by local government for the buildout scenario used in this report. Comparing these values with the result in Table F will provide information on the possible increased water demand from groundwater source for the projected irrigated areas.

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Appendix Tables

Appendix Table A   2003 Water Demand by Crop with Average Management

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Appendix Table C   2003 Water Demand by Irrigation System with Average Management

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Appendix Table K Climate Change Water Demand Circa 2050 for a High Demand Year with Good Management using Current Crops and Irrigation Systems

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Appendix Table N Buildout Irrigation System Demand for 2003 Climate Data and Good Management

Appendix Table O Buildout Water Demand by Aquifer for 2003 Climate Data and Good Management

Appendix Table P Buildout Water Demand by Local Government for 2003 Climate Data and Good Management

Appendix Table A 2003 Water Demand by Crop with Average Management

Water Source	Surface Water			Reclaimed Water			Groundwater			Total		
Agriculture Crop Group	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**
Apple	3.4	28,292	832	-	-	-	2.8	27,286	978	6.2	**55,578**	898
Berry	0.2	777	418	-	-	-	0.2	1,241	505	0.4	**2,018**	467
Cranberry	65.3	563,236	862	-	-	-	-	-	-	65.3	**563,236**	862
Forage	767.6	8,239,656	1,073	-	-	-	288.2	2,249,582	781	1,055.7	**10,489,238**	994
Fruit	-	-	-	-	-	-	3.5	14,846	422	3.5	**14,846**	422
Golf	27.1	244,590	903	-	-	-	89.1	776,997	872	116.2	**1,021,588**	879
Grape	0.9	4,078	462	-	-	-	12.1	63,070	521	13.0	**67,149**	517
Nursery Shrubs/Trees	-	-	-	-	-	-	4.9	32,817	676	4.9	**32,817**	676
Pasture/Grass	517.7	5,437,767	1,050	-	-	-	36.6	309,485	845	554.4	**5,747,251**	1,037
Recreational Turf	-	-	-	-	-	-	2.8	25,425	919	2.8	**25,425**	919
Strawberry	-	-	-	-	-	-	1.7	10,313	610	1.7	**10,313**	610
Vegetable	251.3	1,654,527	658	-	-	-	117.9	754,558	640	369.2	**2,409,085**	653
TOTALS	1,633.7	**16,174,521**	990	-	-	-	562.8	**4,285,421**	761	2,196.5	**20,459,942**	931

Appendix Table B 1997 Water Demand by Crop with Average Management

Water Source	Surface Water			Reclaimed Water			Groundwater			Total		
Agriculture Crop Group	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**
Apple	3.4	16,266	478	-	-	-	2.8	18,283	655	6.2	**34,549**	558
Berry	0.2	398	214	-	-	-	0.2	897	365	0.4	**1,295**	300
Cranberry	65.3	446,856	684	-	-	-	-	-	-	65.3	**446,856**	684
Forage	767.6	5,634,898	734	-	-	-	288.2	1,438,568	499	1,055.7	**7,073,466**	670
Fruit	-	-	-	-	-	-	3.5	8,175	233	3.5	**8,175**	233
Golf	27.1	184,332	681	-	-	-	89.1	581,552	653	116.2	**765,884**	659
Grape	0.9	2,091	237	-	-	-	12.1	37,079	306	13.0	**39,171**	302
Nursery Shrubs/Trees	-	-	-	-	-	-	4.9	19,228	396	4.9	**19,228**	396
Pasture/Grass	517.7	3,378,254	653	-	-	-	36.6	217,948	595	554.4	**3,596,202**	649
Recreational Turf	-	-	-	-	-	-	2.8	20,015	723	2.8	**20,015**	723
Strawberry	-	-	-	-	-	-	1.7	7,115	421	1.7	**7,115**	421
Vegetable	251.3	1,237,213	492	-	-	-	117.9	570,766	484	369.2	**1,807,979**	490
TOTALS	1,633.5	**10,900,307**	667	-	-	-	559.7	**2,919,628**	522	2,193.2	**13,819,935**	630

Appendix Table C 2003 Water Demand by Irrigation System with Average Management												
Water Source	**Surface Water**			**Reclaimed Water**			**Groundwater**			**Total**		
Agriculture Irrigation System	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**
Drip	0.1	488	445	-	-	-	6.8	27,347	404	6.9	**27,835**	405
Flood	394.2	4,363,612	1,107	-	-	-	-	-	-	394.2	**4,363,612**	1,107
Gun	20.0	240,909	1,203	-	-	-	-	-	-	20.0	**240,909**	1,203
Handline	330.6	3,539,141	1,071	-	-	-	108.2	965,902	893	438.7	**4,505,042**	1,027
Landscapesprinkler	1.2	10,267	848	-	-	-	0.1	457	851	1.3	**10,724**	848
Microsprinkler	0.2	1,597	790	-	-	-	3.0	18,682	630	3.2	**20,279**	640
Overtreedrip	0.9	4,078	462	-	-	-	9.5	51,926	549	10.3	**56,005**	541
Pivot	25.1	310,861	1,240	-	-	-	-	-	-	25.1	**310,861**	1,240
PivotLP	140.2	1,364,872	974	-	-	-	0.2	1,941	1,006	140.4	**1,366,813**	974
SDI	-	-	-	-	-	-	3.6	21,417	589	3.6	**21,417**	589
Sprinkler	196.7	1,519,178	772	-	-	-	149.7	1,167,122	780	346.4	**2,686,300**	776
Ssovertree	-	-	-	-	-	-	4.9	32,817	676	4.9	**32,817**	676
Sssprinkler	1.3	11,854	903	-	-	-	6.3	56,235	891	7.6	**68,089**	893
Ssundertree	1.0	7,570	736	-	-	-	15.9	97,071	611	16.9	**104,641**	619
Travgun	191.0	1,406,251	736	-	-	-	100.6	777,692	773	291.6	**2,183,943**	749
Wheelline	331.2	3,393,843	1,025	-	-	-	154.3	1,066,813	692	485.4	**4,460,656**	919
TOTALS	1,633.7	**16,174,521**	990	-	-	-	562.8	**4,285,421**	761	2,196.5	**20,459,942**	931

Appendix Table D 2003 Water Demand by Soil Texture with Average Management

Water Source	Surface Water			Reclaimed Water			Groundwater			Total		
Agriculture Irrigation System	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**
Cultured Medium	0.2	1,597	790	-	-	-	3.1	19,802	648	3.3	**21,399**	657
Loam	451.3	4,639,184	1,028	-	-	-	129.8	908,763	700	581.1	**5,547,947**	955
Loamy Sand	161.9	1,706,122	1,054	-	-	-	8.8	84,112	958	170.7	**1,790,234**	1,049
Organic	18.1	127,050	704	-	-	-	17.6	134,965	768	35.6	**262,014**	736
Sand	429.5	5,109,752	1,190	-	-	-	62.0	630,202	1,017	491.5	**5,739,954**	1,168
Sandy Loam	107.7	890,959	827	-	-	-	97.6	778,749	798	205.4	**1,669,709**	813
Sandy Loam (defaulted)	120.3	1,189,010	988	-	-	-	37.5	349,492	932	157.8	**1,538,501**	975
Silt	0.2	1,571	734	-	-	-	-	98	783	0.2	**1,669**	737
Silt Loam	204.9	1,668,334	814	-	-	-	78.4	517,511	660	283.3	**2,185,846**	771
Silty Clay Loam	139.5	840,942	603	-	-	-	128.0	861,727	673	267.6	**1,702,669**	636
TOTALS	1,633.7	**16,174,521**	990	-	-	-	562.8	**4,285,421**	761	2,196.5	**20,459,942**	931

Appendix Table E 2003 Water Demand by Aquifer with Average Management

Water Source	Surface Water			Reclaimed Water			Groundwater			Total		
Aquifer	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**
Unknown	1,458.6	14,743,226	1,011	-	-	-	361.6	2,728,767	755	1,820.2	**17,471,993**	960
22 km north along the	0.5	2,357	479	-	-	-	1.5	8,024	537	2.0	**10,381**	523
Lillooet	31.4	392,946	1,252	-	-	-	26.6	192,494	724	58.0	**585,440**	1,010
Mamquam Valley	-	-	-	-	-	-	0.1	821	1,355	0.1	**821**	1,355
Pemberton	140.3	1,008,993	719	-	-	-	167.0	1,318,430	789	307.3	**2,327,424**	757
Seton Portage	2.9	26,999	928	-	-	-	-	-	-	2.9	**26,999**	928
Squamish River	-	-	-	-	-	-	6.0	36,885	612	6.0	**36,885**	612
TOTALS	1,633.7	**16,174,521**	990	-	-	-	562.8	**4,285,421**	761	2,196.5	**20,459,942**	931

Appendix Table F   2003 Water Demand by Local Government with Average Management

Water Source	Surface Water			Reclaimed Water			Groundwater			Total		
Local Government	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**
Bridge River First Nations	16.2	146,355	905	-	-	-	0.2	1,634	833	16.4	**147,988**	904
District of Squamish	0.5	2,357	479	-	-	-	7.6	46,108	604	8.1	**48,464**	597
Lillooet	84.0	1,044,918	1,243	-	-	-	31.8	258,555	812	115.9	**1,303,473**	1,125
Pemberton	27.1	244,590	903	-	-	-	89.1	776,997	872	116.2	**1,021,588**	879
SLRD	1,489.4	14,596,310	980	-	-	-	384.3	2,634,918	1,044	1,873.6	**17,231,228**	921
Titqet First Nations	-	-	-	-	-	-	5.7	54,919	956	5.7	**54,919**	956
Xaxlip First Nations	16.5	139,991	848	-	-	-	44.0	512,291	1,164	60.5	**652,282**	1,078
TOTALS	1,633.7	**16,174,521**	990	-	-	-	562.8	**4,285,421**	761	2,196.5	**20,459,942**	931

Appendix Table G   2003 Management Comparison on Irrigation Demand and Percolation Volumes

Water Source	Surface Water				Reclaimed Water				Groundwater				Total				
Agriculture Management	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**	**Deep Percolation (m^3)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**	**Deep Percolation (m^3)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**	**Deep Percolation (m^3)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**	**Deep Percolation (m^3)**	**Percolation (m^3/ha)**
Poor	1,633.7	16,606,182	1,016	3,214,808	-	-	-	-	562.8	4,405,341	783	659,153	2,196.5	21,011,523	957	3,873,961	1,764
Average	1,633.7	16,190,850	991	2,799,476	-	-	-	-	562.8	4,285,421	761	539,233	2,196.5	20,476,271	932	3,338,709	1,520
Good	1,633.7	15,775,518	966	2,384,144	-	-	-	-	562.8	4,165,501	740	419,313	2,196.5	19,941,019	908	2,803,457	1,276

Appendix Table H 2003 Percolation Volumes by Irrigation System with Average Management

Water Source	Surface Water			Reclaimed Water			Groundwater			Total			
Agriculture Irrigation System	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Deep Percolation (m^3)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Deep Percolation (m^3)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Deep Percolation (m^3)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Deep Percolation (m^3)**	**Percolation (m^3/ha)**
Drip	0.1	488	61	-	-	-	6.8	27,347	3,300	6.9	27,835	**3,361**	487
Flood	394.2	4,363,612	1,088,134	-	-	-	-	-	-	394.2	4,363,612	**1,088,134**	2,760
Gun	20.0	240,909	34,034	-	-	-	-	-	-	20.0	240,909	**34,034**	1,702
Handline	330.6	3,539,141	615,693	-	-	-	108.2	965,902	130,426	438.7	4,505,042	**746,119**	1,701
Landscapesprinkler	1.2	10,267	1,478	-	-	-	0.1	457	97	1.3	10,724	**1,575**	1,212
Microsprinkler	0.2	1,597	137	-	-	-	3.0	18,682	1,693	3.2	20,279	**1,829**	572
Overtreedrip	0.9	4,078	248	-	-	-	9.5	51,926	6,456	10.3	56,005	**6,704**	651
Pivot	25.1	310,861	33,707	-	-	-	-	-	-	25.1	310,861	**33,707**	1,343
PivotLP	140.2	1,364,872	162,077	-	-	-	0.2	1,941	244	140.4	1,366,813	**162,320**	1,156
SDI	-	-	-	-	-	-	3.6	21,417	2,711	3.6	21,417	**2,711**	753
Sprinkler	196.7	1,519,178	193,554	-	-	-	149.7	1,167,122	156,231	346.4	2,686,300	**349,785**	1,010
Ssovertree	-	-	-	-	-	-	4.9	32,817	3,530	4.9	32,817	**3,530**	720
Sssprinkler	1.3	11,854	1,493	-	-	-	6.3	56,235	7,598	7.6	68,089	**9,092**	1,196
Ssundertree	1.0	7,570	790	-	-	-	15.9	97,071	11,289	16.9	104,641	**12,079**	715
Travgun	191.0	1,406,251	166,677	-	-	-	100.6	777,692	88,516	291.6	2,183,943	**255,193**	875
Wheelline	331.2	3,393,843	501,392	-	-	-	154.3	1,066,813	127,143	485.4	4,460,656	**628,535**	1,295
TOTALS	1,633.7	16,174,521	**2,799,476**	-	-	-	562.8	4,285,421	**539,233**	2,196.5	20,459,942	**3,338,709**	1,520

Appendix Table I 2003 Crop Water Demand for Improved Irrigation System Efficiency and Good Management

Water Source	Surface Water			Reclaimed Water			Groundwater			Total		
Agriculture Crop Group	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg. Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg. Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg. Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg. Req. (mm)
Apple	3.4	17,133	504	-	-	-	2.8	16,124	578	6.2	**33,257**	537
Berry	0.2	760	408	-	-	-	0.2	1,241	505	0.4	**2,001**	463
Cranberry	65.3	550,934	844	-	-	-	-	-	-	65.3	**550,934**	844
Forage	767.6	7,053,129	919	-	-	-	288.2	2,009,085	697	1,055.7	**9,062,214**	858
Fruit	-	-	-	-	-	-	3.5	14,617	416	3.5	**14,617**	416
Golf	27.1	241,072	890	-	-	-	89.1	762,958	856	116.2	**1,004,030**	864
Grape	0.9	3,996	453	-	-	-	12.1	60,924	503	13.0	**64,920**	500
Nursery Shrubs/Trees	-	-	-	-	-	-	4.9	31,430	647	4.9	**31,430**	647
Pasture/Grass	517.7	2,888,459	558	-	-	-	36.6	276,415	755	554.4	**3,164,873**	571
Recreational Turf	-	-	-	-	-	-	2.8	25,416	918	2.8	**25,416**	918
Strawberry	-	-	-	-	-	-	1.7	10,091	597	1.7	**10,091**	597
Vegetable	251.3	864,382	344	-	-	-	117.9	423,423	359	369.2	**1,287,805**	349
TOTALS	1,633.5	**11,619,864**	711	-	-	-	559.7	**3,631,726**	649	2,193.2	**15,251,589**	695

Appendix Table J 2003 Water Demand by Animal Type

Animal Type	Demand (m^3)
Beef	53,199
Dairy - dry	1,177
Dairy - milking	3,061
Goats	780
Horses	14,563
Poultry - broiler	435
Poultry - laying	230
Sheep	1,264
Swine	780
TOTALS	**75,490**

Appendix Table K Climate Change Water Demand Circa 2050 for High Demand Year with Good Management Using Current Crops and Irrigation Systems

Climate Change	Access1 rcp85			CanESM2 rcp85			cnrm-cm5 rcp45			Average		
Year	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg. Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg. Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg. Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg. Req. (mm)
2053	2,196.5	23,163,797	1,055	2,196.5	26,569,024	1,210	2,196.5	21,108,800	961	2,196.5	23,613,874	1,075
2056	2,196.5	21,174,254	964	2,196.5	17,298,331	788	2,196.5	12,531,262	571	2,196.5	17,001,282	774
2059	2,196.5	16,662,906	759	2,196.5	23,985,392	1,092	2,196.5	15,953,848	726	2,196.5	18,867,382	859
Average	2,196.5	20,333,652	926	2,196.5	22,617,582	1,030	2,196.5	16,531,303	753	2,196.5	19,827,513	903

Appendix Table L Buildout Crop Water Demand for 2003 Climate Data with Good Management

Water Source	Surface Water			Reclaimed Water			Groundwater			Total		
Agriculture Crop Group	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg. Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg. Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg. Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg. Req. (mm)
Apple	3.4	26,852	790	-	-	-	2.8	26,164	937	6.2	**53,015**	856
Berry	0.2	760	408	-	-	-	0.2	1,241	505	0.4	**2,001**	463
Cranberry	171.3	1,488,518	869	-	-	-	0.3	3,051	899	171.6	**1,491,568**	869
Forage	2,057.1	17,117,849	832	-	-	-	584.9	4,329,663	740	2,642.0	**21,447,512**	812
Fruit	-	-	-	-	-	-	3.5	14,617	416	3.5	**14,617**	416
Golf	27.1	241,072	890	-	-	-	89.1	762,958	856	116.2	**1,004,030**	864
Grape	0.9	3,996	453	-	-	-	12.1	60,924	503	13.0	**64,920**	500
Nursery Shrubs/Trees	-	-	-	-	-	-	4.9	31,430	647	4.9	**31,430**	647
Pasture/Grass	1,592.3	12,770,427	802	-	-	-	132.5	1,041,849	786	1,724.8	**13,812,276**	801
Recreational Turf	1.0	9,793	938	-	-	-	2.8	25,416	918	3.8	**35,209**	924
Strawberry	-	-	-	-	-	-	1.7	10,091	597	1.7	**10,091**	597
Vegetable	763.8	4,461,214	584	-	-	-	159.2	1,003,224	630	923.0	**5,464,438**	592
TOTALS	4,617.1	**36,120,480**	782	-	-	-	994.1	**7,310,628**	735	5,611.2	**43,431,108**	774

Appendix Table M Buildout Crop Water Demand for Climate Change Data Circa 2050 and Good Management

Climate Change	Access1 rcp85			CanESM2 rcp85			cnrm-cm5 rcp45			Average		
Year	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg. Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg. Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg. Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg. Req. (mm)
2053	5,614.4	48,168,855	858	4,859.4	51,903,815	1,068	5,614.4	43,699,224	778	5,362.7	**47,923,965**	901
2056	5,614.4	45,706,546	814	4,859.4	32,304,343	665	5,614.4	26,063,512	464	5,362.7	**34,691,467**	648
2059	5,614.4	35,568,222	634	4,859.4	44,380,396	913	5,614.4	32,207,267	574	5,362.7	**37,385,295**	707
Average	5,614.4	**43,147,874**	769	4,859.4	**42,862,851**	882	5,614.4	**33,990,001**	605	5,362.7	**40,000,242**	752

Appendix Table N Buildout Irrigation System Demand for 2003 Climate Data and Good Management

Water Source	Surface Water			Reclaimed Water			Groundwater			Total		
Agriculture Irrigation System	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg. Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg. Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg. Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg. Req. (mm)
Drip	125.5	316,671	252	-	-	-	6.8	26,227	388	132.3	**342,898**	259
Flood	394.2	4,363,612	1,107	-	-	-	-	-	-	394.2	**4,363,612**	1,107
Gun	20.0	236,047	1,178	-	-	-	-	-	-	20.0	**236,047**	1,178
Handline	419.5	4,251,333	1,013	-	-	-	138.1	1,200,079	869	557.7	**5,451,412**	978
Landscapesprinkler	1.2	9,633	795	-	-	-	0.1	448	835	1.3	**10,082**	797
Microsprinkler	0.2	1,529	756	-	-	-	3.0	17,835	601	3.2	**19,364**	611
Overtreedrip	0.9	3,996	453	-	-	-	9.5	49,813	527	10.3	**53,809**	520
Pivot	25.1	304,120	1,213	-	-	-	-	-	-	25.1	**304,120**	1,213
PivotLP	140.2	1,317,464	940	-	-	-	0.2	1,859	964	140.4	**1,319,324**	940
SDI	-	-	-	-	-	-	3.6	20,513	564	3.6	**20,513**	564
Sprinkler	2,268.0	15,369,632	678	-	-	-	381.1	2,841,083	746	2,649.0	**18,210,714**	687
Ssovertree	-	-	-	-	-	-	4.9	31,430	647	4.9	**31,430**	647
Sssprinkler	1.5	12,813	835	-	-	-	6.3	52,738	836	7.8	**65,551**	836
Ssundertree	1.0	7,096	690	-	-	-	15.9	93,402	588	16.9	**100,498**	594
Travgun	849.8	6,190,222	728	-	-	-	263.2	1,855,696	705	1,112.9	**8,045,919**	723
Wheelline	370.1	3,737,841	1,010	-	-	-	164.6	1,138,459	691	534.8	**4,876,300**	912
TOTALS	4,617.3	**36,122,009**	782	-	-	-	997.2	**7,329,583**	735	5,614.4	**43,451,592**	774

Appendix Table O Buildout Demand by Aquifer for 2003 Climate Data and Good Management

Water Source	Surface Water			Reclaimed Water			Groundwater			Total		
Aquifer	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**
Unknown	4,213.6	33,119,798	786	-	-	-	605.4	4,405,411	728	4,819.0	**37,525,209**	779
22 km north along the	2.3	10,178	439	-	-	-	1.5	7,512	503	3.8	**17,690**	464
Cheekye Fan	0.8	5,258	695	-	-	-	-	-	-	0.8	**5,258**	695
Lillooet	35.0	412,627	1,179	-	-	-	26.6	184,852	696	61.6	**597,479**	970
Mamquam Valley	-	-	-	-	-	-	0.1	821	1,355	0.1	**821**	1,355
Pemberton	361.2	2,542,001	704	-	-	-	357.6	2,694,196	753	718.8	**5,236,196**	728
Seton Portage	3.1	27,030	863	-	-	-	-	-	-	3.1	**27,030**	863
Squamish River	1.2	5,118	411	-	-	-	6.0	36,792	610	7.3	**41,909**	576
TOTALS	4,617.3	**36,122,009**	782	-	-	-	997.2	**7,329,583**	735	5,614.4	**43,451,592**	774

Appendix Table P Buildout Demand by Local Government for 2003 Climate Data and Good Management

Water Source	Surface Water			Reclaimed Water			Groundwater			Total		
Local Government	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg. Req. (mm)**
Bridge River First Nations	16.2	138,090	854	-	-	-	18.3	156,697	858	34.4	**294,787**	856
Cayoose Creek First Nations	3.9	35,476	904	-	-	-	-	-	-	3.9	**35,476**	904
District of Squamish	18.1	104,277	575	-	-	-	7.6	45,497	596	25.8	**149,774**	581
Lillooet	84.0	1,006,921	1,198	-	-	-	31.8	248,080	779	115.9	**1,255,000**	1,083
Pemberton	104.0	716,280	689	-	-	-	147.8	1,184,112	801	251.7	**1,900,393**	755
Seton Lake First Nations	0.2	1,702	770	-	-	-	-	-	-	0.2	**1,702**	770
SLRD	4,291.3	33,162,483	792	-	-	-	724.8	4,992,663	691	5,016.1	**38,155,146**	777
Titqet First Nations	4.9	64,034	1,298	-	-	-	5.7	52,673	917	10.7	**116,707**	1,093
Xaxlip First Nations	94.5	892,746	945	-	-	-	61.2	649,861	1,063	155.7	**1,542,607**	991
TOTALS	4,617.3	**36,122,009**	782	-	-	-	997.2	**7,329,583**	735	5,614.4	**43,451,592**	774