Appendix A – References

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APPENDIX B

District of Coldstream
Agricultural Overview

District of Coldstream
AGRICULTURAL OVERVIEW

Corporate Name	The Corporation of the District of Coldstream
Date of Incorporation	December 21, 1906
Postal Address	9901 Kalamalka Road Coldstream, BC V1B 1L6
Phone	(250) 545-5304
Fax	(250) 545-4733
E-mail	info@districtofcoldstream.ca
Internet	http://www.districtofcoldstream.ca/

For additional information visit the Coldstream website.

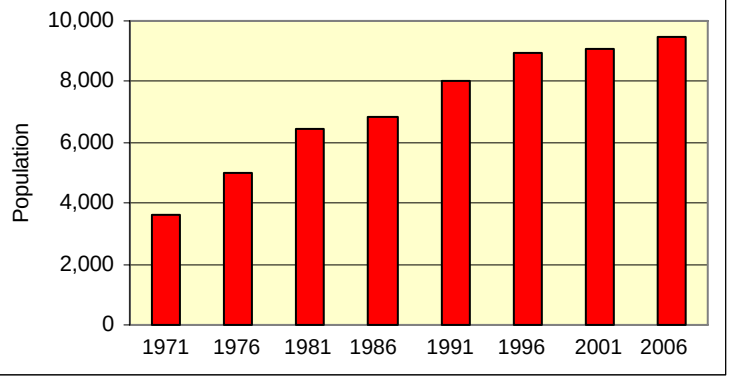
CONTENTS

2 District of Coldstream AGRICULTURAL OVERVIEW

• Population - 1971 to 2006[1]

1971	=	3,602
1976	=	4,995
1981	=	6,450
1986	=	6,872
1991	=	7,999
1996	=	8,975
2001	=	9,106
2006	=	9,471

Graph 1 Coldstream Population - 1971 to 2006 -



- Population Increase 1971 to 2006

= 5,869
= 168 persons / year on average

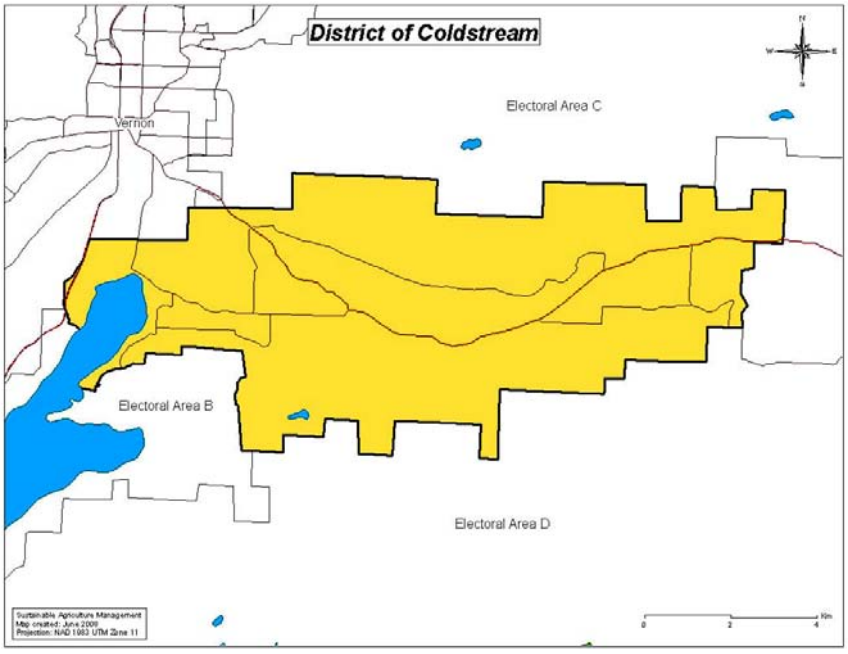
- 2006 Urban / Rural Split

Urban = 7,490 (79%)
Rural = 1,981 (21%)

There were 134 farms reported in the District of Coldstream in 2006. The District's farm population is estimated to be 402 persons or 4.2% of Coldstream's total 2006 population (based on the BC average of 3 persons per farm). A similar calculation provincially sets the farm population at approximately 1.5% of B.C.'s total 2006 population.

• Jurisdictional Area [2]

Land	=	6,429 ha
Water	=	276 ha
Total	=	6,705 ha



[1] Ministry of Municipal Affairs, "Statistics Relating to Regional and Municipal Governments in British Columbia" - 1990 & 1998 and Statistics Canada, Ottawa - http://www.statcan.ca/start.html

[2] Correspondence: Brittany Johnson, Statistics Officer; Ministry of Community Services (see: Table - 2006 Mun Land and Water Area.xls).

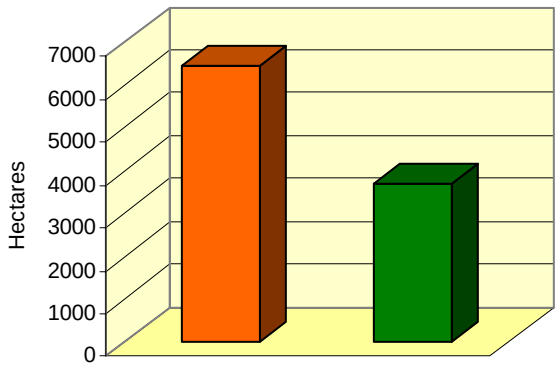
Data source: Statistics Canada standard or custom tabulations, 1996, 2001, 2006 Census of Agriculture, unless otherwise noted.

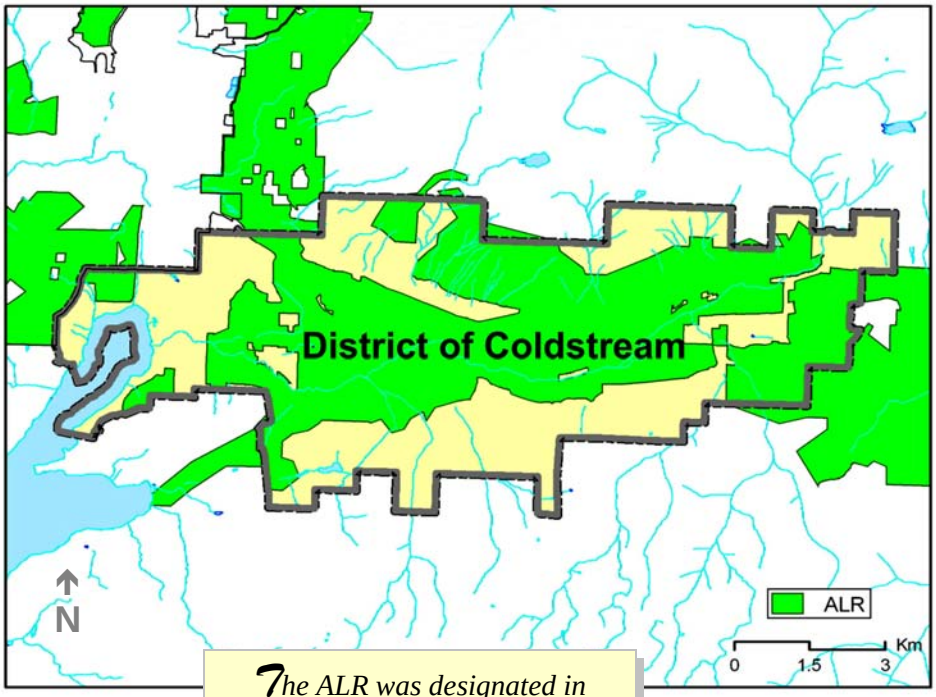
- **Agricultural Land Reserve (ALR)**

= 3,685 hectares [3]

Approximately 57% of Coldstream's land base is within the ALR and accounts for about 5.3% of land in the Agricultural Land Reserve within the Regional District of North Okanagan.

Graph 2 **Coldstream - Land & ALR Area -**





The ALR was designated in Coldstream on March 15, 1974 as part of the Regional District of North Okanagan's ALR Plan.

[3] Source: Agricultural Land Commission - ALR as of January 2008.

4 District of Coldstream AGRICULTURAL OVERVIEW

- **Total Area Farmed** [4]

1996	=	5,106 ha
2001	=	10,760 ha
2006	=	15,640 ha

- **Number of Farms** [5] **Reporting**

1996	=	152
2001	=	129
2006	=	134

- Average Farm Size (hectares)

	1996	2001	2006
District of Coldstream[6]	**33.6 ha**	**83.4 ha**	**116.7 ha**
Regional District of North Okanagan	49.3 ha	61.8 ha	62.5 ha
Okanagan[7]	38.7 ha	44.6 ha	48.9 ha
British Columbia	115.8 ha	127.5 ha	142.9 ha

- Farm Size

	1996		2001		2006	
	Farms	Percent	Farms	Percent	Farms	Percent
<4 ha (10 acres)	74	49%	43	33%	66	49%
4 to 52 ha (10 to 129 acres)	69	45%	79	61%	59	44%
52 to 161 ha (130 to 399 acres)	6	4%	5	4%	7	5%
>161 ha (400 acres & greater)	3	2%	2	2%	2	2%
Total	152	100%	129	100%	134	100%

[4] The amount of land farmed in Coldstream dramatically increase between 1996 and 2001 and again between 2001 and 2006. In fact the amount of land noted as being farmed in Coldstream is far more than the size of the District's jurisdictional area. The reason for this apparent discrepancy is due to the manner in which Statistics Canada reports on farm areas due to the **Headquarters Rule**. Because agricultural operations are often composed of numerous parcels of land in a number of locations, the "headquarters rule" assigns all data collected for the agricultral operation to the area where the farm headquarters is located.

[5] Over time, the census definition of "farm" or "farm operation" has changed. An explanation of these changes can be found at: http://www.statcan.ca/english/freepub/95-629-XIE/2007000/terms.htm#farm. In **2006**, an "agricultural operation" was defined as a farm, ranch or other agricultural operation producing agricultural products for sale or the intention of sale in the past 12 months. For a complete definition of agricultural operation and agricultural products, see: http://www.statcan.ca/english/agcensus2006/glossary.htm#gt3

[6] As noted in Footnote 4, the increase in the Average Farm Size is being affected by the Headquarters Rule.

[7] 'Okanagan' includes the Regional Districts of Okanagan-Similkameen, Central Okanagan and North Okanagan.

Data source: Statistics Canada standard or custom tabulations, 1996, 2001, 2006 Census of Agriculture, unless otherwise noted.

- **Tenure**[8]

	1996		2001		2006	
Farmland Owned	4,637 ha	(91%)	4,357 ha	(40%)	4,327 ha	(28%)
Farmland Leased, etc.	469 ha	(9%)	6,403 ha	(60%)	11,382 ha	(72%)
Total	5,106 ha	(100%)	10,760 ha	(100%)	15,709 ha	(100%)

Between 1996 and 2006 the amount of farmland owned remained relatively constant. The amount of farmland leased, however, displayed dramatic increases that were most likely influenced by the Headquarters Rule (see footnote #4) that was possibly associated with the leasing of range land beyond Coldstream's boundaries.

- Farmland Leased

	1996		2001		2006	
From governments	205 ha	(44%)	x[9] ha	na	x ha	na
From others	264 ha	(56%)	x ha	na	217 ha	(1.9%)
Crop shared from others	na[10]	na	78 ha	(1%)	x ha	na
Through other arrangements	na	na	na	na	23 ha.	(0.2%)
Total	469 ha	(100%)	6,403 ha	(100%)	11,382 ha	(100%)

[8] Note: Figures related to tenure for 2006 are not comparable to previous Census data due to a significant revision to the questionnaire and reformatting of the data by Statistics Canada. For this reason, the total area farmed in 2006 (p. 4) is not the same as the total in the Tenure table.

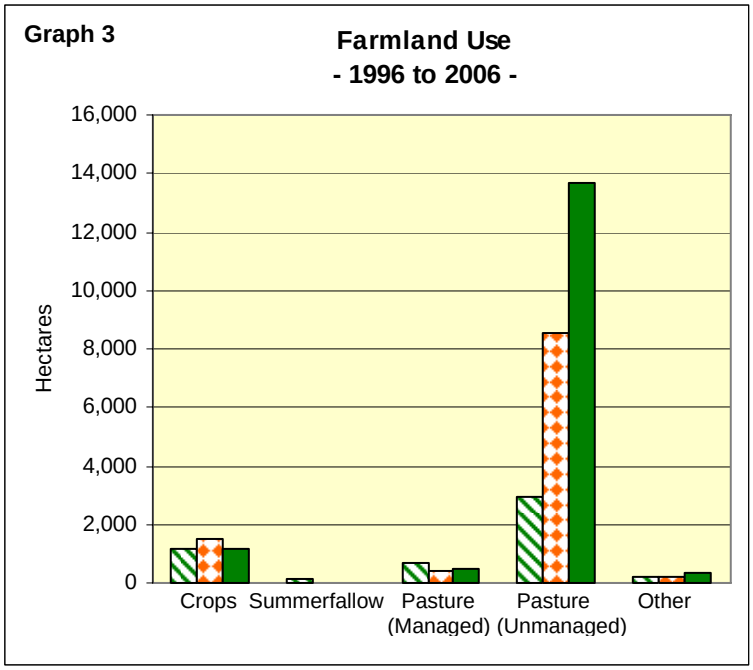
[9] Throughout the report 'x' indicates that farms are reporting but further information is not provided for reasons of confidentiality.

[10] "na" indicates that data was not available for the year and category in question.

Data source: Statistics Canada standard or custom tabulations, 1996, 2001, 2006 Census of Agriculture, unless otherwise noted.

- **Hectares of Farmland in:**

	1996		2001		2006	
	Farms	Hectares	Farms	Hectares	Farms	Hectares
Crops	112	1,171	103	1,529	102	1,130
Summerfallow	11	128	6	5	3	6
Pasture (managed)	50	674	39	408	35	491
Pasture (unmanaged)	49	2,949	39	8,580	45	13,675
Other[11]	115	185	96	239	88	338
Total[12]	na	5,107[13]	na	10,761[13]	na	15,640



Graph #3 and its associated table clearly indicate that the dramatic increase in farmland attributed to Coldstream by Census of Agriculture in 2001 and 2006 due to the "Headquarters Rule" was primarily in the form of unmanaged pasture.

[11] "Other" includes 'Other Unimproved Land', 'Other Improved Land' and 'Woodland'.

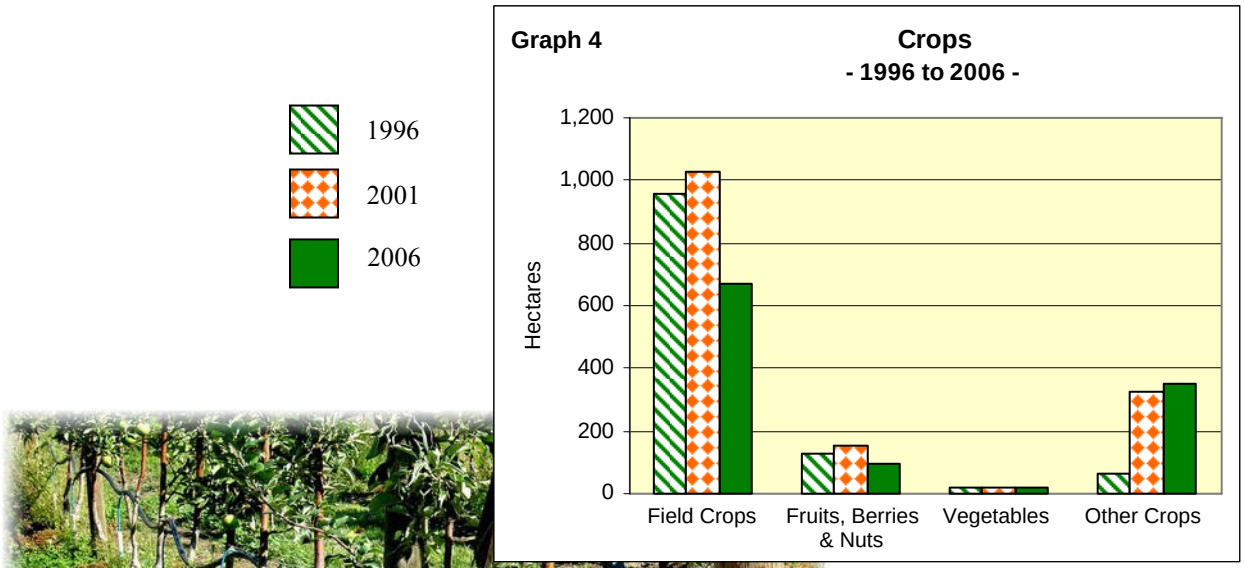
[12] Note: A total for the number of farms in each year is not provided to avoid double counting of mixed farms.

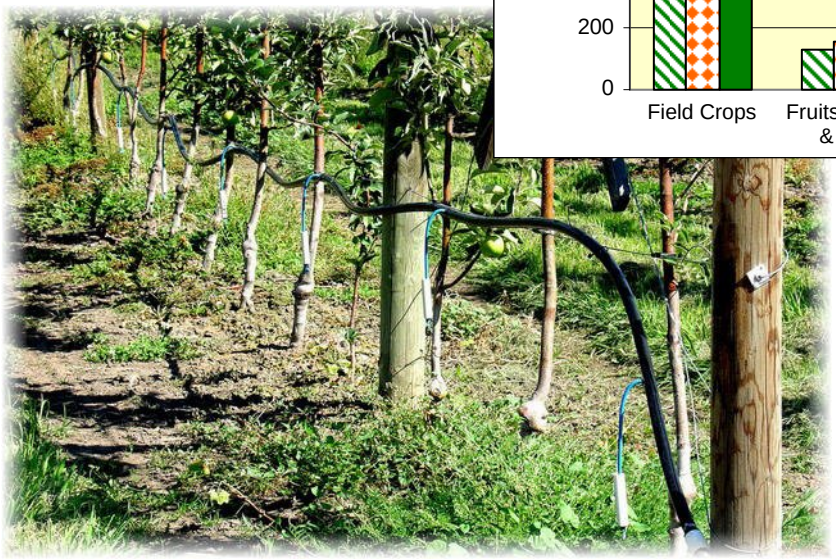
[13] A minor 1 hectare discrepancy of the Total Farmland in this table compared with the figure for 'Total Area Farmed' on page 4 is due to rounding.

Data source: Statistics Canada standard or custom tabulations, 1996, 2001, 2006 Census of Agriculture, unless otherwise noted.

- **Crops** (hectares)

	1996	2001	2006
Field Crops[14]	958	1,030	668
Tree Fruits	125	na	na
Berries & Grapes	4	na	na
Fruits, Berries & Nuts[15]	na	154	93
Vegetables	17	17	17
Other[16]	67	328	352
Total	1,171[17]	1,529	1,130





[14] Note: In the case of hectares in Field Crops, a total was not provided. In some cases, individual field crop area figures were not provided for reasons of confidentiality. As a result, the figures provided equal only the sum of those individual field crops in which Statistics Canada provide an area figure.

[15] In 1991 and 1996, data was split between 'Tree Fruits' and 'Berries & Grapes'. In 2001 & 2006, this data was grouped as Fruits, Berries & Nuts, resulting in no data being available (na) in this category in 1991 and 1996.

[16] "Other" Crops also account for area figures not provided due to confidentiality.

[17] Excluding Christmas tree area

Data source: Statistics Canada standard or custom tabulations, 1996, 2001, 2006 Census of Agriculture, unless otherwise noted.

AGRICULTURAL OVERVIEW

	1996		2001		2006	
	Farms	Hectares	Farms	Hectares	Farms	Hectares
• **Field Crops**[18]	**na**	**958**	**na**	**1,030**	**na**	**668**
Wheat	0	0	1	x[19]	0	0
Oats	2	x	2	x	0	0
Barley	2	x	0	0	0	0
Mixed Grains	0	0	1	x	0	0
Buckwheat	1	x	1	x	0	0
Rye	1	x	1	x	1	x
Corn for Silage	3	225	3	x	1	x
Alfalfa	56	495	49	614	50	447
All other Tame Hay & Fodder Crops	24	212	23	416	28	221
Flax Seed	0	0	0	0	1	x
Potatoes	1	x	1	x	0	0
Ginseng	0	0	6	9	3	x
Triticale	0	0	0	0	1	x
Other field crops	9	26	0	0	1	x

	1996		2001		2006	
Fruits, Berries & Nuts	Farms	Hectares	Farms	Hectares	Farms	Hectares
	45	**129**	**36**	**154**	**33**	**93**
Apples	32	115	26	134	24	82
Pears	13	3	3	1	7	1
Plums & Prunes	15	2	7	2	8	1
Sweet Cherries	15	2	7	6	8	4
Sour Cherries	3	x	1	x	0	0
Peaches	6	1	3	2	4	1
Apricots	9	1	1	x	3	0.4
Other tree fruits	6	x	na	na	na	na
Strawberries	6	3	3	2	2	x
Raspberries	7	x	1	0.4	3	1
Blueberries	1	x	3	x	1	x
Saskatoons	na	na	0	0	1	x
Grapes	0	0	2	x	3	x
Other fruits, berries & nuts	1	x	3	4	4	1

[18] Note: A total for the number of farms is not provided to avoid double counting in the case of mixed farms.
[19] 'x' indicates that there are farms reporting but further information is not provided due to confidentiality.

Data source: Statistics Canada standard or custom tabulations, 1996, 2001, 2006 Census of Agriculture, unless otherwise noted.

	1996		2001		2006	
	Farms	Hectares	Farms	Hectares	Farms	Hectares
• **Vegetables**	**16**	**17**	**12**	**17**	**11**	**17**
Sweet Corn	5	2	7	3	7	4
Tomatoes	7	1	4	2	6	1
Cucumbers	3	1	5	2	4	1
Green Peas	3	1	3	1	2	x
Green or Wax Beans	3	1	3	0.4	3	1
Cabbage	1	x	2	x	1	x
Cauliflower	1	x	2	x	1	x
Broccoli	1	x	3	0.4	1	x
Brussels Sprouts	0	0	0	0	1	x
Carrots	3	0.4	4	1	4	2
Beets	2	x	4	1	3	x
Radishes	1	x	1	x	2	x
Dry / Other Onions	3	0.4	2	x	3	x
Green (Bunching) Onions & Shallots	1	x	0	0	1	x
Lettuces	1	x	2	x	0	0
Spinach	1	x	2	x	1	x
Squash, Pumpkins & Zucchini	1	x	3	2	4	2
Rhubarb					na	na
Asparagus	3	3	2	x	0	0
Peppers	6	1	3	1	4	x
Other Vegetables	6	7	4	4	4	1

Data source: Statistics Canada standard or custom tabulations, 1996, 2001, 2006 Census of Agriculture, unless otherwise noted.

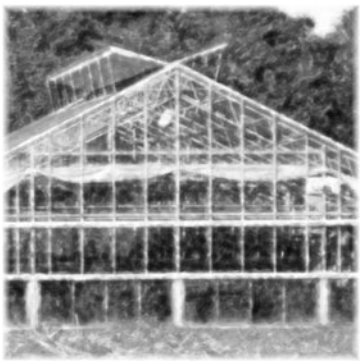
• Organic Farms

	Farms 2001	Farms 2006
Total	**1**	**0**
Fruits, Veg. or Greenhouse	1	0
Field Crops	1	0
Animal	0	0
Other	0	0

• Greenhouse Production

	1996 Farms	1996 Square Metres	1996 % of Total	2001 Farms	2001 Square Metres	2001 % of Total
Flowers	2	x	na	2	x	na
Vegetables	2	x	na	1	x	na
Other Greenhouse Products	1	x	na	0	0	0%
Area not in use on date of census	4	277	51 %	2	x	na
Total [20]	4	542	100%	2	x	100%

	2006 Farms	2006 Square Metres	2006 % of Total
Flowers	3	3,702	100%
Vegetables	0	0	0%
Other Greenhouse Products	0	0	0%
Area not in use on date of census	0	0	0%
Total [20]	3	3,702	100%



	1996 Farms	1996 Hectares	2001 Farms	2001 Hectares	2006 Farms	2006 Hectares
• **Nursery Products**	7	8	5	7	4	5
• **Sod Grown for Sale**	0	0	1	x	1	x
• **Christmas Trees**	4	2	1	x	4	5

[20] Note: A single greenhouse may be engaged in more than one form of production.

Data source: Statistics Canada standard or custom tabulations, 1996, 2001, 2006 Census of Agriculture, unless otherwise noted.

• Livestock

	1996		2001		2006	
	Farms	Livestock	Farms	Livestock	Farms	Livestock
Hens & Chickens	16	1,015	19	1,586	14	1,350
Turkeys	1	x	1	x	3	52
Total Other Poultry	12	155	4	45	2	x
Cattle & Calves	52	3,983	39	5,386	31	6,974
- Dairy Cows	5	117	3	200	2	x
- Beef Cows	27	1,320	23	1,568	18	2,740
Pigs	2	x	4	25	4	46
Sheep & Lambs	7	42	2	x	6	196
Horses & Ponies	51	482	41	353	51	442
Goats	4	18	4	113	5	9
Wild Boar	na	na	0	0	2	x
Bison	na	na	0	0	2	x
Rabbits	6	23	0	0	na	na
Llamas & Alpacas	2	x	3	5	2	x
Colonies of Bees for Honey	7	116	6	74	4	35

• Land Management Practices

	1996		2001		2006	
	Hectares	% of Farmland	Hectares	% of Farmland*	Hectares	% of Farmland*
• **Irrigation**	1,868	37%	1,791	17%	1,879	12%
• **Commercial Fertilizers**	1,258	25%	1,248	12%	1,138	7%
• **Manure**[21]	142	3%	149	1%	217	1%
• **Herbicides**	435	9%	1,593	15%	557	4%
• **Insecticides**	142	3%	115	1%	96	1%
• **Fungicides**	150	3%	140	1%	87	1%

* Note: It is highly likely that the 'Percent of Farmland' figures above for the years 2001 and 2006 have, in some cases, been skewed downwards because of the inclusion of farmlands not within the jurisdictional area of Coldstream due to the 'Headquarters Rule' discussed previously.

[21] In the case of some forms of manure application, data was not provided. Figures represent only where data is provided.

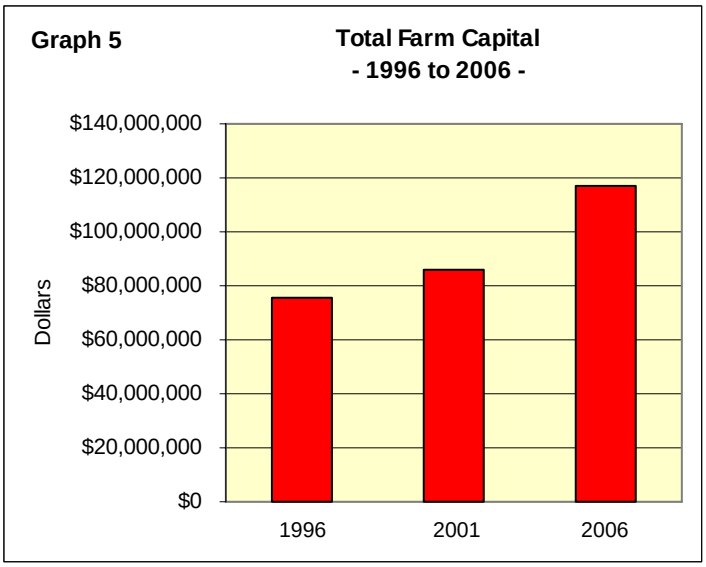
Data source: Statistics Canada standard or custom tabulations, 1996, 2001, 2006 Census of Agriculture, unless otherwise noted.

• Total Farm Capital

1996 = $75,348,630
2001 = $85,958,289
2006 = $117,387,839

Between 1996 and 2006, Coldstream's Total Farm Capital increased by over $41.7 million. Just over 90% of this increase was accounted for by increases in the value of land and buildings.

Graph 5 Total Farm Capital - 1996 to 2006 -

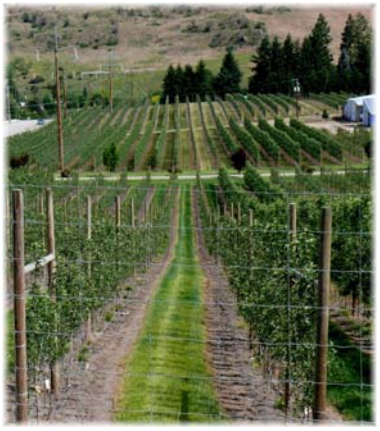


Division of Capital - 2006

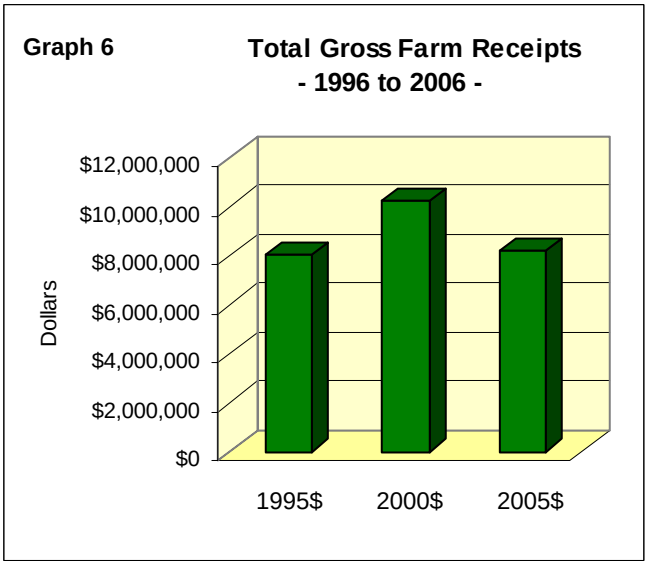
	Value ($)	% of Total
• Land and buildings	$104,515,833	89%
• Farm machinery & equipment	$8,199,848	7%
• Livestock & poultry	$4,672,358	4%

• Total Gross Farm Receipts

1996 = $8,053,286 (1995$)
2001 = $10,265,018 (2000$)
2006 = $8,229,284 (2005$)



Graph 6 Total Gross Farm Receipts - 1996 to 2006 -



Data source: Statistics Canada standard or custom tabulations, 1996, 2001, 2006 Census of Agriculture, unless otherwise noted.

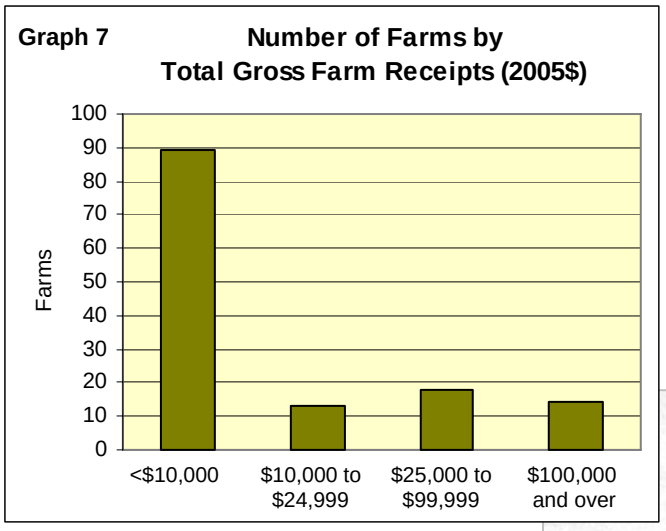
- Average Gross Farm Receipts per Farm

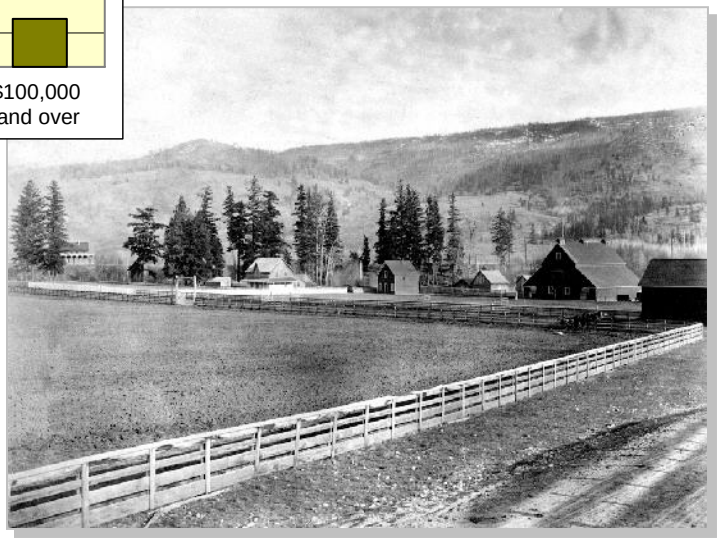
	1995	2000	2005
District of Coldstream	$52,982	$79,574	$61,413
Regional District of North Okanagan	$66,268	$71,484	$90,777
British Columbia	$84,233	$113,736	$133,641

- Number of Farms by Total Gross Farm Receipts 2005

	Coldstream		RD of North Okanagan		B.C.	
	Farms	% of Coldstream Total	Farms	% of RDNO Total	Farms	% of BC Total
< $10,000	89	66%	659	54%	9,466	48%
$10,000 - $24,999	13	10%	192	16%	3,194	16%
$25,000 - $99,999	18	13%	195	8%	3,629	18%
$100,000 and over	14	11%	181	15%	3,555	18%
Total	134	100%	1,227	100%	19,844	100%

Graph 7 **Number of Farms by Total Gross Farm Receipts (2005$)**





"Lord Aberdeen's Ranch "Coldstream" - (189-)

Source: BC Archives
Photographer/Artist: Halliday
Call No. A-07993

Data source: Statistics Canada standard or custom tabulations, 1996, 2001, 2006 Census of Agriculture, unless otherwise noted.

- **Total Operating Expenses & Cash Wages Paid**

		Expenses	Wages
1995$	=	$8,178,013	$1,744,613
2000$	=	$11,283,456	$1,938,949
2005$	=	$8,691,698	$1,988,305

	1995	2000	2005
• **Total Paid Labour** (weeks)	4,650	4,187	4,185
- **Year Round vs. Seasonal Paid Labour**			
% Year Round	63%	57%	35%
% Seasonal	37%	43%	65%
% Year Round British Columbia	57%	62%	63%

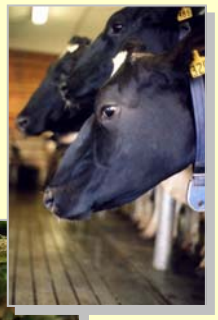
Data source: Statistics Canada standard or custom tabulations, 1996, 2001, 2006 Census of Agriculture, unless otherwise noted.

BC Agriculture - A Snapshot

B.C. - 2006 - Census of Agriculture		
No. of Farms	-	19,844
Total Area of Farms	-	2,835,458 ha

Agriculture is a significant and expanding industry in British Columbia with more than 290,000 people employed on farms, ranches, orchards, greenhouses, nurseries, as well as warehouses, veterinary offices, hatcheries, grocery stores, and other food-related services in 2006. The primary agriculture sector generates more than $782 million towards the province's total Gross Domestic Product. Although the industry is relatively small by itself, it contributes significantly to spinoffs in the food processing, food wholesaling, food retailing and food service sectors. This translates in total gross revenues for this industry of more than $36 billion a year.

Climatic conditions in the province make it possible for British Columbia farmers to grow a wide variety of crops - approximately 200 different commodities. The top farm commodities in terms of sales in 2006 B.C. were dairy, chicken, floriculture, cattle, nursery, greenhouse tomatoes, mushrooms, calves, and blueberries. Total farm cash receipts reached $2.3 billion in 2006 and total crop receipts reached over $1.1 billion in 2006. The livestock sector, which includes cattle, hogs, poultry, eggs, dairy, honey, fur and game-farm animals, reached $1.2 billion in 2006.



The **Southern Interior** is well-suited for the production of tree fruits and grapes. The **Fraser Valley** and southern **Vancouver Island**, with a cooler, wetter climate, are extremely favourable for the production of berries and vegetables. Most of the province's grain and oilseed crops are grown in the **Peace River** region.

Beef cattle are concentrated in the **North**, **Cariboo** and **Thompson-Okanagan** regions. Large dairy herds are found mostly in the **Lower Mainland**, southeastern **Vancouver Island** and the **Okanagan-Shuswap** area. Hog, poultry and egg production are concentrated in the **Lower Mainland**.

Nationally, in 2006, BC ranked 1st in receipts generated in four commodities

Commodity	BC Share of Canada's Gross Farm Receipts	National Ranking
Sweet Cherries	84.6%	1
Raspberries	58.1%	1
Blueberries	49.3%	1
Cranberries	45.0%	1

Nationally, B.C. ranked 2nd in a further eight agricultural commodities - greenhouse peppers, greenhouse tomatoes, nursery products, apples, grapes, mushrooms, floriculture and greenhouse cucumbers.

From: "Fast Stats - Agriculture, Aquaculture and Food 2007"'
Ministry of Agriculture and Lands

Sources:

- Statistics Canada, British Columbia Agriculture, 1986, Census Catalogue 96-112.
- Statistics Canada, Small Area Data British Columbia, July 1992.
- Statistics Canada, 1996 Census of Agriculture Profile Data - British Columbia.
- Statistics Canada, 2001 Census of Agriculture Profile Data - British Columbia
- Statistics Canada, 2006 Census of Agriculture - Farm Data Tables - British Columbia - Special Run
- Correspondence: Brittany Johnson, Statistics Officer, Ministry of Community Services.
- Ministry of Municipal Affairs, Municipal Statistics (Including Regional Districts), March , 1998
- Statistical Reports & Files of the Provincial Agricultural Land Commission.

Sources: Photos and Illustrations

All photos and illustrations are from the BC Ministry of Agricultural and Lands with the exception of:

- Page 3 - ALR Map produced by the Resource Management Branch. Data provided by Integrated Land Management Bureau, Ministry of Agriculture and Lands.
- Page 13 - B.C. Archives: Call No. A-07993

WANT MORE INFORMATION ABOUT AGRICULTURE IN B.C.?

See:

the Ministry of Agriculture and Lands at:

http://www.gov.bc.ca/al/

the Provincial Agricultural Land Commission at:

http://www.alc.gov.bc.ca/

Agriculture and Agri-Food Canada at:

http://www.agr.gc.ca/

Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

PLEASE NOTE:

Statistics Canada information is used with the permission of Statistics Canada. Users are forbidden to copy the data and re-disseminate them, in an original or modified form, for commercial purposes, without the express permission of Statistics Canada. Information on the availability of the wide range of data from Statistics Canada can be obtained from Statistic Canada's Regional Offices, its Web site at www.statscan.ca, and its toll-free access number 1-800-263-1136.

Planning strategy suggestions from the farming community:

Water:

- Goal: To ensure affordable water sufficient to serve agricultural needs.
- Suggested Strategies:
  - ensure agriculture has representation on Board of Greater Vernon Services (voting member?).
  - reserve water for agriculture.
  - make more irrigation water available and for a longer season.
  - support water system improvements required to provide a separate, untreated irrigation system for agriculture.
  - meter water use and provide affordable service.

Economy:

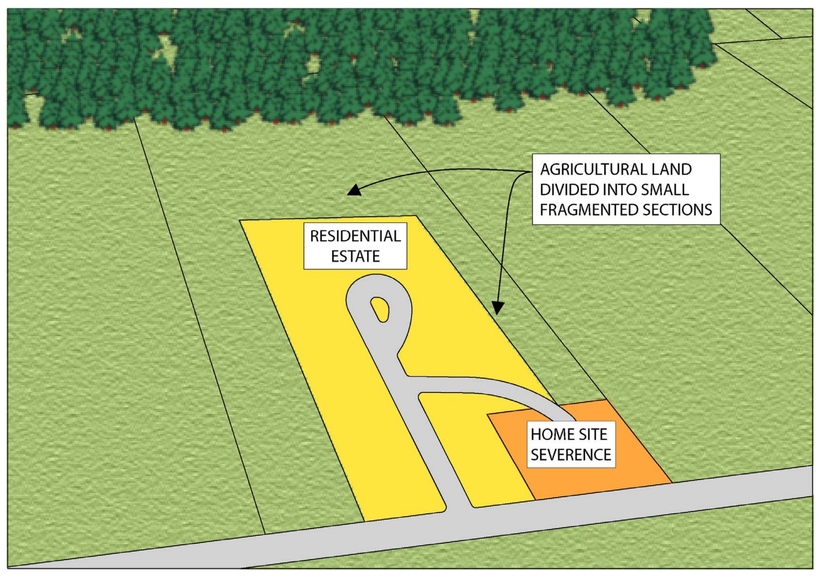
- Goal: To improve economic viability of local agriculture.
- Suggested Strategies:
  - explore opportunities to provide more affordable accommodation for farm workers.
  - consider economic development partnerships with other local areas to promote regional agriculture.
  - find ways to subsidize agriculture and lands in the ALR
  - encourage a buy local program.
  - establish Coldstream farmers market.

Managing Development:

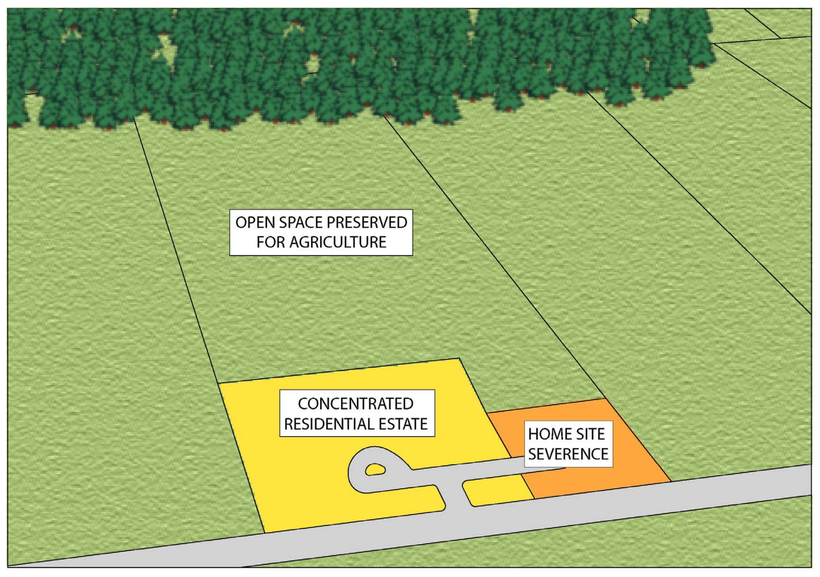
- Goal: To protect lands in the ALR for agricultural use.
- Suggested Strategies:
  - implement edge planning strategies.
  - establish policies that define the footprint for future building sites to optimize land available for future agricultural use (see illustration).
  - More relaxed municipal regulations (e.g. burning permits).
  - discourage non-farm use of ALR.
  - support the mandate of the Agricultural Land Commission.
  - ensure new hillside development areas are planned to maximize development opportunities on adjoining land where lands are not in the ALR.
  - raise community awareness of the role of agriculture and the nature of agricultural activities.

Managing Residential Building Footprints in Agricultural Areas

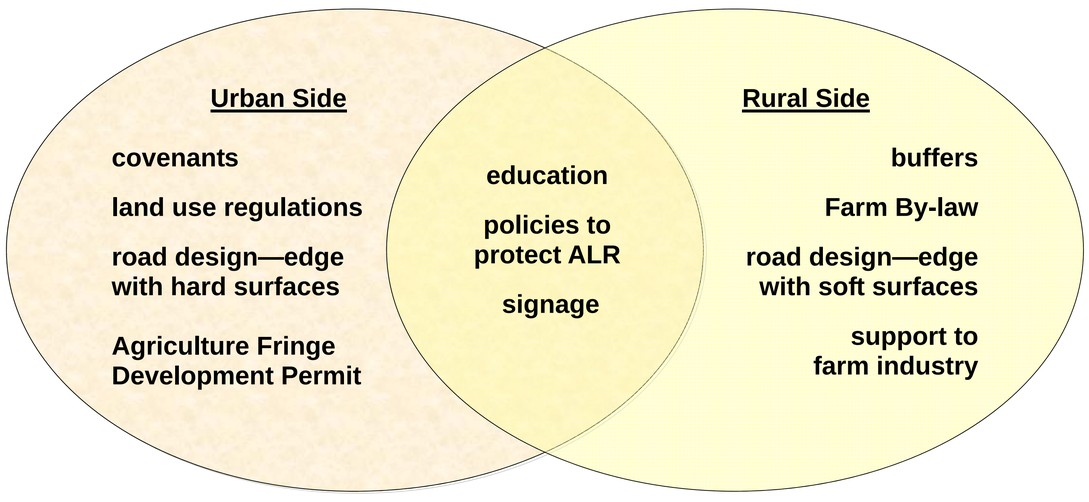
Conventional Rural Residential Estate



Conservation for Agriculture



Recommended Strategies for Edge Planning



District of Coldstream

Survey Results
Agricultural Plan

TRUE CONSULTING GROUP

APPENDIX C

Climate Change at Coldstream – Past and Future

CLIMATE CHANGE AT COLDSTREAM – PAST AND FUTURE

PREPARED BY DAVE WHITING, P.AG, MCIP AND CLARENCE LAI, A.AG

FEBRUARY 2009

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INTRODUCTION

This document provides information to the District of Coldstream regarding select climate variables associated with agriculture at Coldstream and in the North Okanagan Regional District. These variables are discussed in the context of historical data as well as predictive data associated with two different climate change scenarios. Climate variable information is conveyed using regional maps produced using data generated by ClimateBC, a computer/web based application that integrates climate scenarios with topographical data sets to produce spatial information for map production. Interpretations of the maps and historical data are provided from an agricultural production perspective.

COLDSTREAM'S CLIMATE

INSIGHTS FROM HISTORICAL DATA

The District of Coldstream has a mid-latitude steppe climate (Koeppen BSk) characterized by semi-arid conditions, and a monthly average temperature ranging from -5C to 19C. A weather station at Coldstream Ranch has a 105 year record of weather observation data. This data[i], collected over the past century and analyzed by the authors, indicate changes that are occurring to the North Okanagan climate. These climate changes are reflected in attributes of both temperatures and precipitation. These changes that are occurring provide context to potential climate change scenarios reflected in climate variable maps later in this appendix.

TEMPERATURE

Figure 1 indicates the trends in average annual maximum (red) temperatures and average annual minimum (blue) temperatures since 1902. Both graphs indicate an increase in average temperatures. It is interesting to note that the climate is getting warmer more as a result of higher night temperatures than higher day temperatures. This is consistent with either an increase in greenhouse gas concentrations or an increase in cloud cover, since both of these phenomena will diminish the amount of overnight cooling.

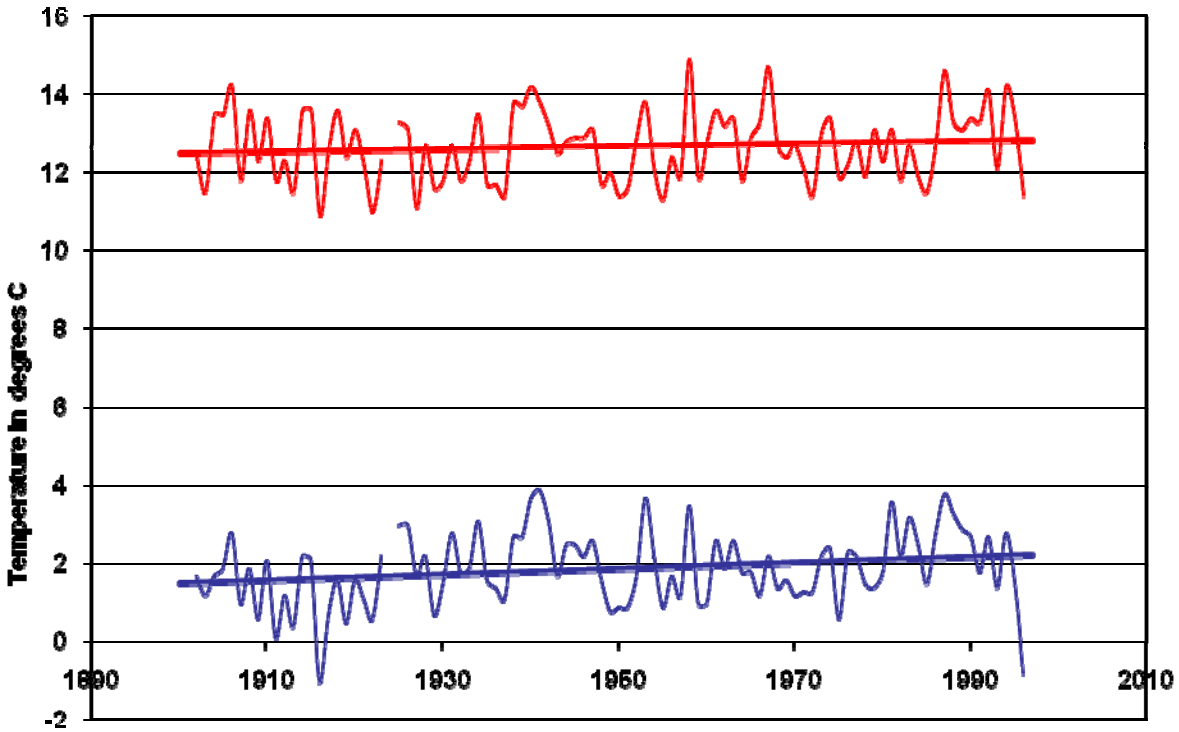


Figure 1 Trends in Annual Average Max. and Min. Temperatures at Coldstream Ranch

Temperature Variability

Deriving average temperatures is independent of the variation in the measurements. Over a period of time, average temperatures can remain constant while there can be changes to the variability of the data reflecting an increased magnitude of extreme temperature events. To ascertain if the variability of temperature has changed over time, an analysis has been undertaken to determine if the magnitude of the difference of extreme high and low temperature events from the mean August maximum and January minimum respectively are increasing or decreasing.

Using the temperature data recorded at Coldstream Ranch, records of the extreme maximum temperature for August and the extreme minimum temperature for January were selected for each year from 1900 to 1997. The difference between each maximum and minimum temperature value and the mean August maximum and January minimum temperatures respectively was derived. These values are plotted in Figures 2 and 3 respectively.

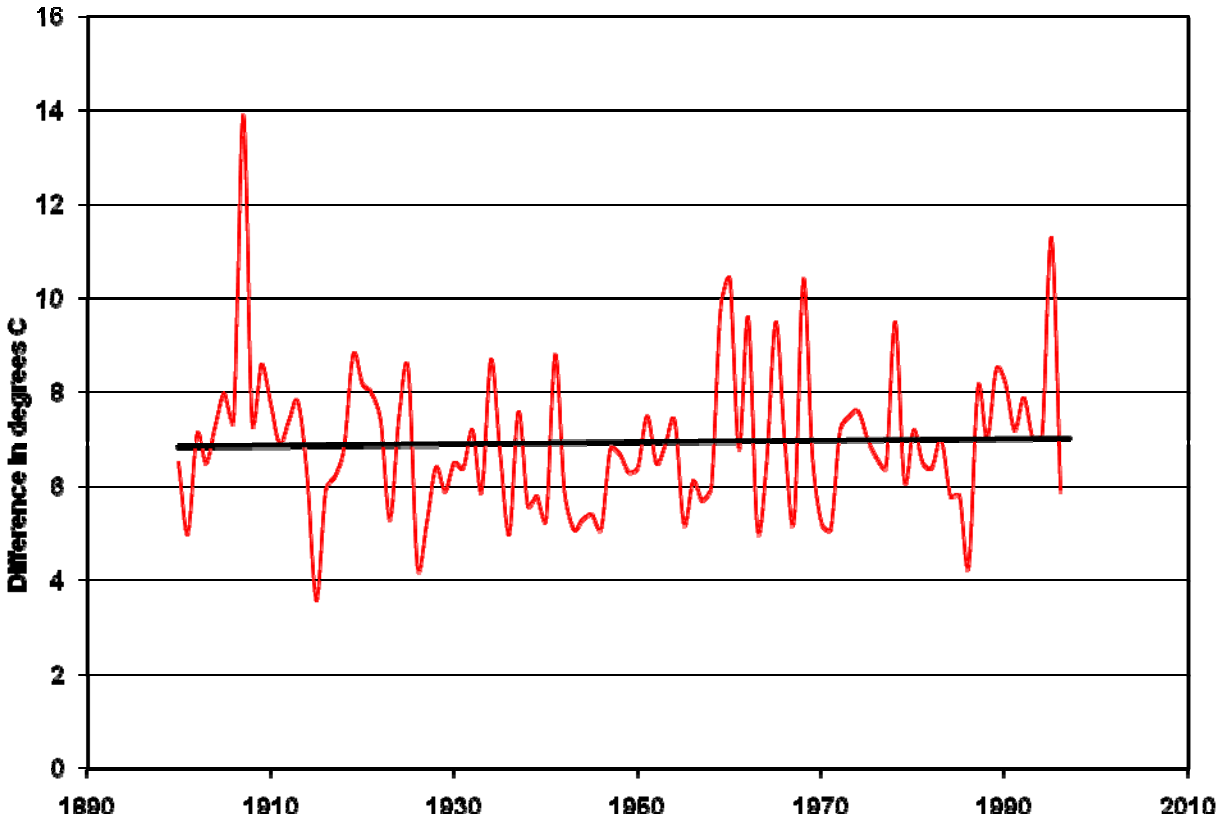


Figure 2 Variability in Extreme Maximum August Temperatures at Coldstream Ranch

The analysis reveals that the variability of extreme daily maximum temperatures in August has changed very little in the past century. The probability of extreme high temperatures in August does not appear to be increasing.

A similar analysis for extreme minimum temperatures for January is shown in Figure 3. In this case, the variability of extreme minimum temperatures is decreasing. On average, extreme January minimum temperatures are now approximately 1.5 Celsius degrees closer to the January average. Again this phenomenon may be attributed to the increase in cloud cover and associated insulating effect.

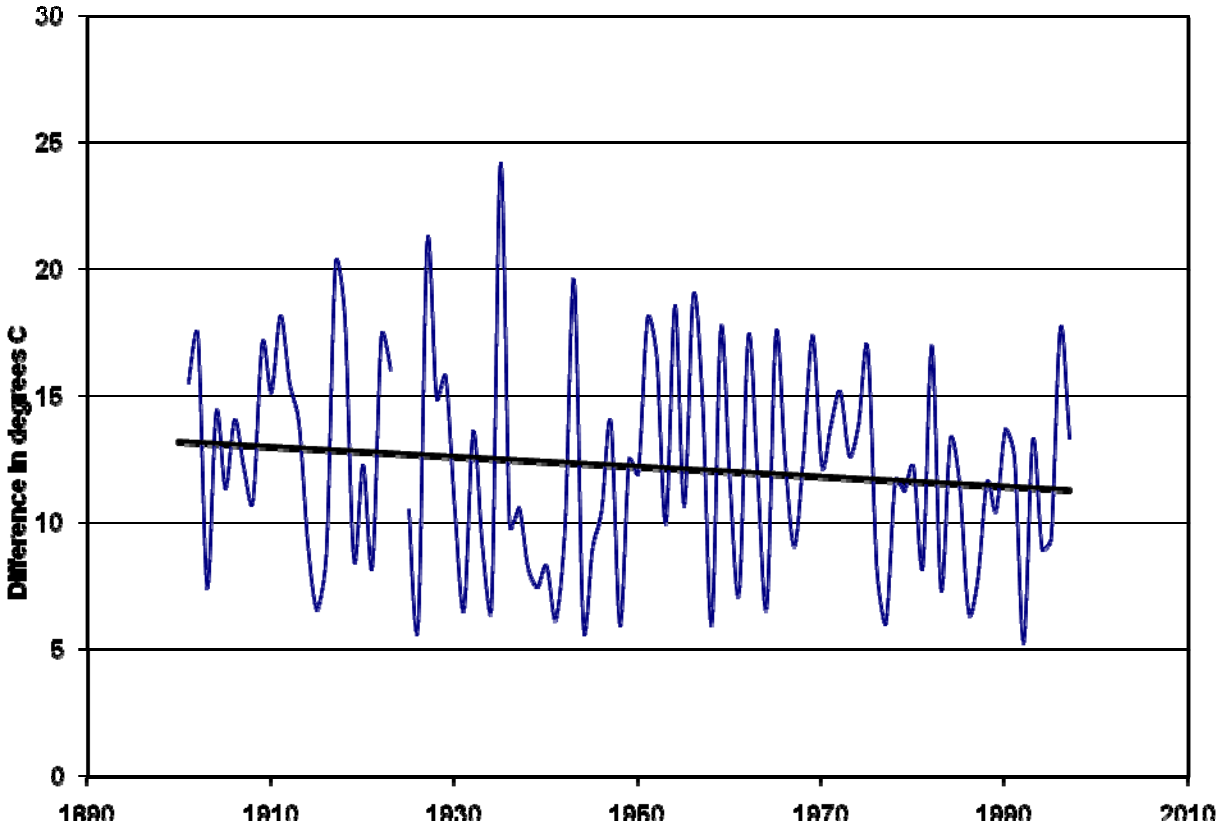


Figure 3 Variability in Extreme Minimum January Temperatures at Coldstream Ranch

PRECIPITATION

As well as getting warmer, the District of Coldstream's climate is also getting wetter. This may reflect a larger global trend towards an increase in precipitation believed to be a natural consequence of the hydrological cycle in response to rising global temperatures. Figure 4 shows an approximate 30% increase in annual precipitation over the past century at the Coldstream Ranch.

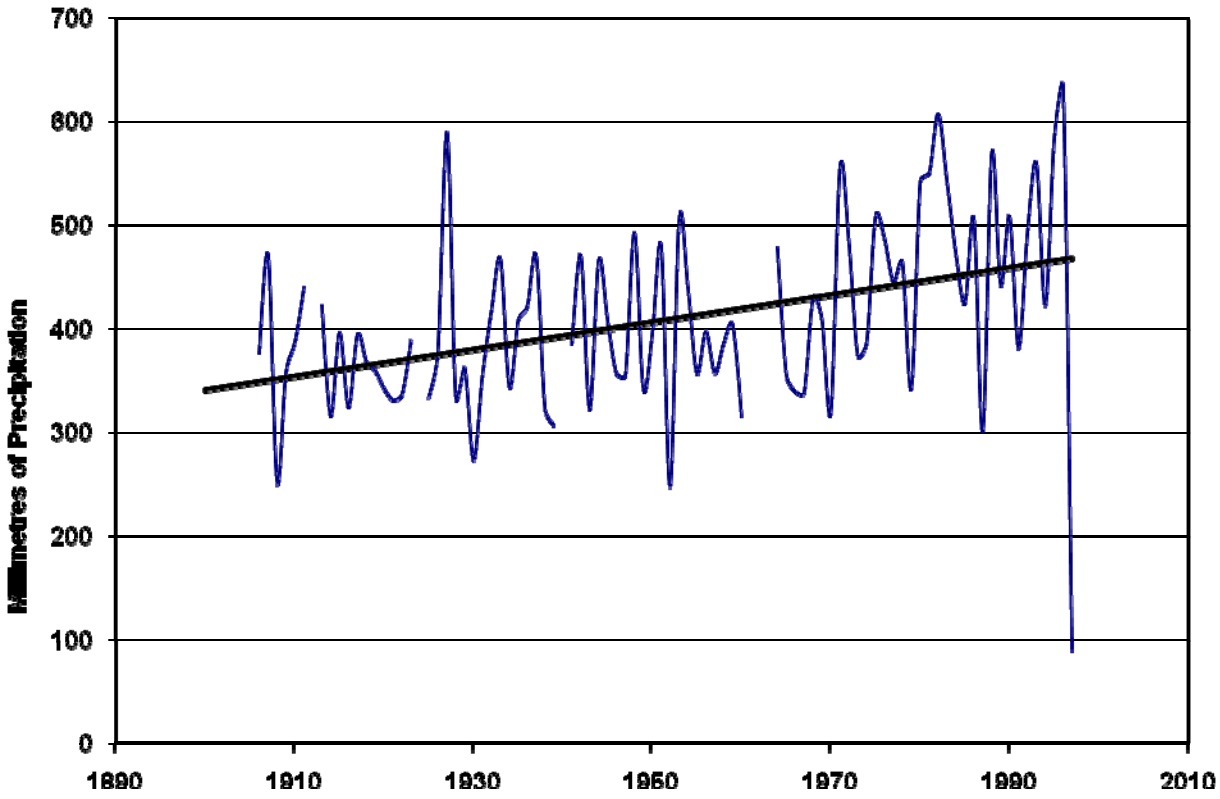


Figure 4 Annual Precipitation at Coldstream Ranch

The following chart shows how the precipitation record has been distributed over the four seasons: winter (December-February), fall (September-November), spring (March-May) and summer (June-August). It is important to note that all seasons are showing a trend of increased precipitation.

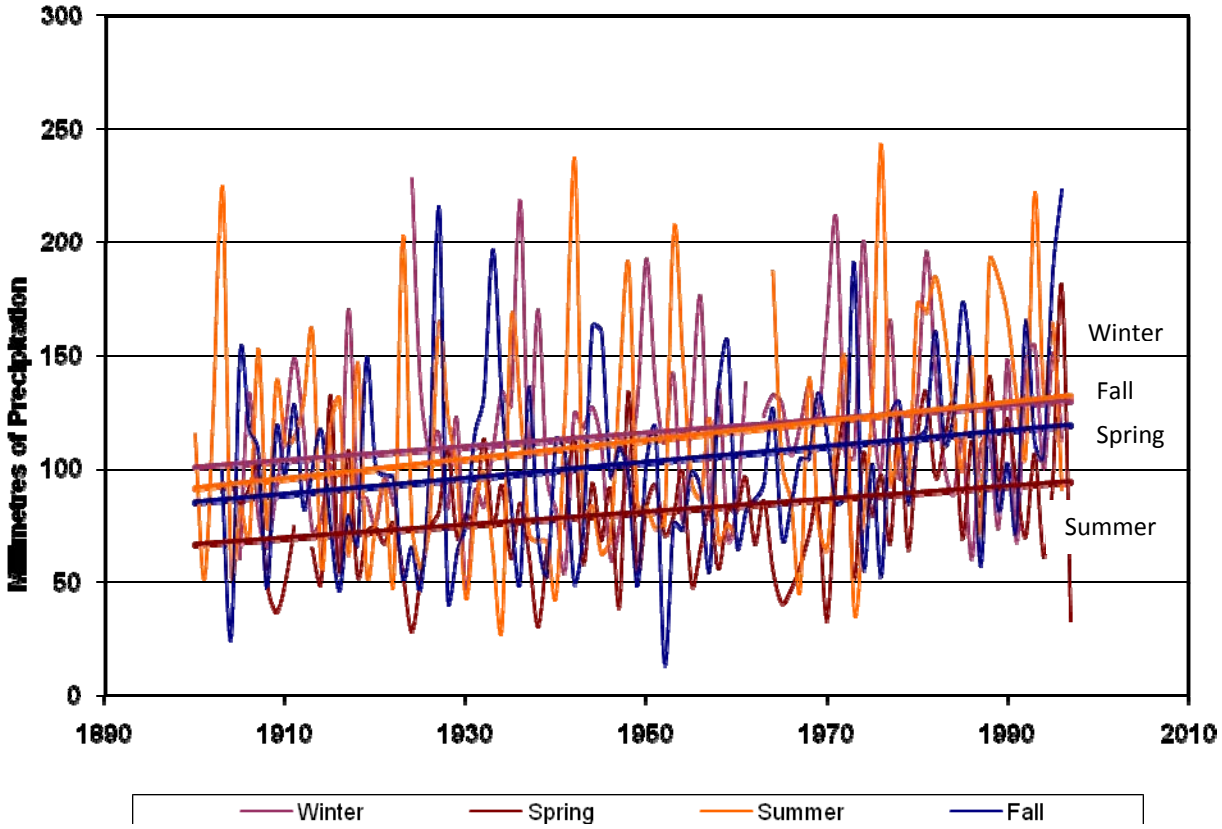


Figure 5 Seasonal Precipitation at Coldstream Ranch

The relative contribution of precipitation to the annual total from each season is reflected in Figure 6. It shows how the relative contribution of the seasons to annual precipitation is slowly changing. The proportion of the contribution to the annual total from the winter is increasing at the expense of the fall proportion of the contribution to the annual total. This probably reflects a seasonal shift in global circulation patterns, particularly the arrival of mid-latitude cyclones on the West Coast.

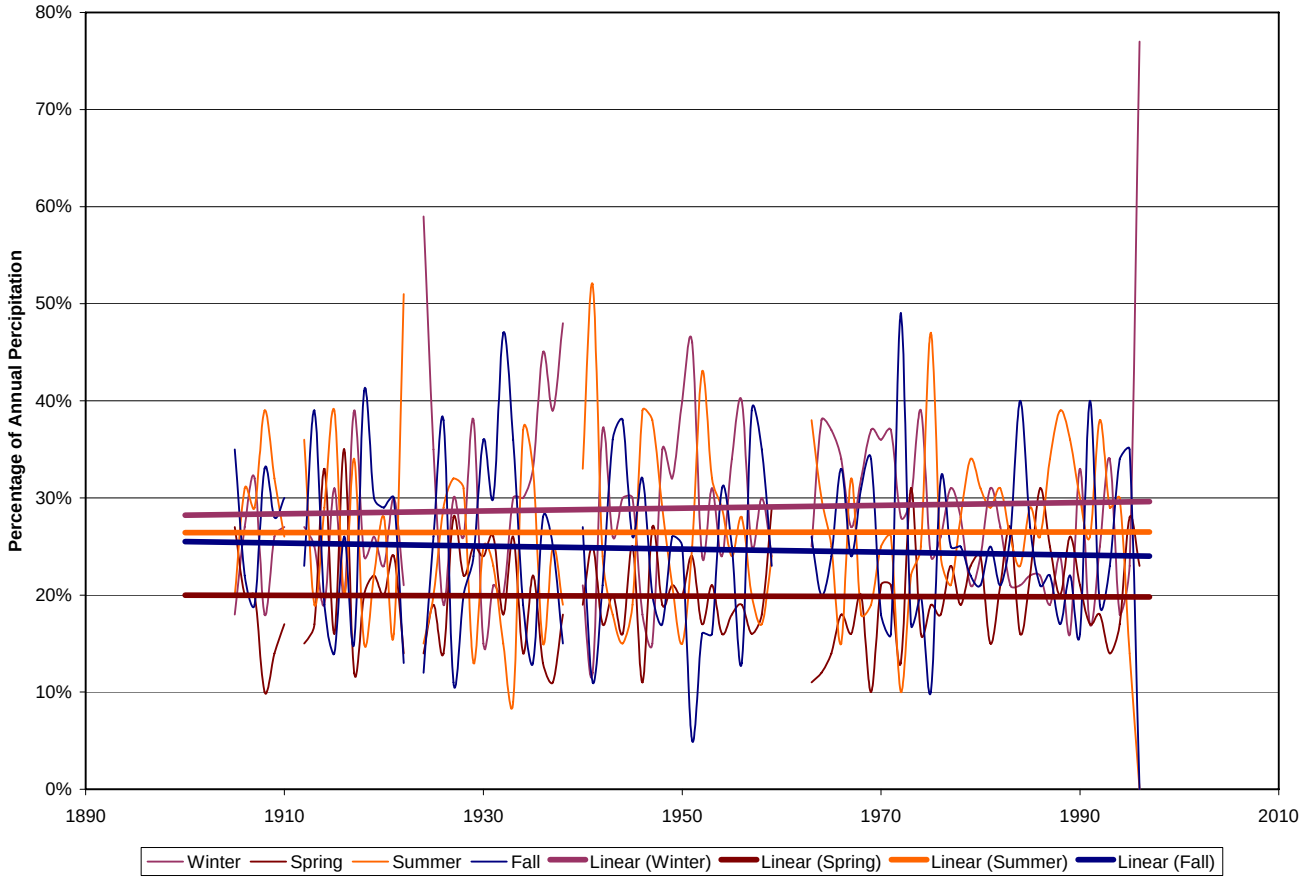


Figure 6 Relative Contribution of Seasonal Precipitation to Annual Precipitation at Coldstream Ranch

INSIGHTS FROM PREDICTIVE DATA

THE CLIMATE BC APPLICATION TOOL

The following maps are derived from historic climate data associated with temperature and precipitation between 1961 and 1990 and predictive climate data using the ClimateBC v 3.2 program[ii] jointly developed by the Province of British Columbia and University of British Columbia scientists. The program allows for a number of different climate variables pertinent to agricultural production to be calculated or derived for a geographical area. The program also provides for the production of climate variables based on future climate data sets generated by various global circulation models and climate change scenarios.

Four sets of maps produced by the Climate BC program follow, each reflecting the regional distribution of a climate variable important to North Okanagan agriculture:

- Mean Annual Temperature
  This climate variable is calculated by averaging the twelve monthly average temperatures. The average monthly temperatures are calculated by determining the mean of the daily temperatures within the month. Mean daily temperature is the average of the highest and lowest temperature in a 24-hour period.

- Number of Frost Free Days
  Frost-free period can be defined as the number of days between the average last spring frost date and the average first fall frost date.

- Precipitation as Snow
  This is the total annual precipitation as snow in millimeters

- Summer Precipitation
  This is the total precipitation for the months of June, July and August

The predictive maps reflect the 2050s time period (2040 – 2069).

Each group of maps contains a map showing the climate variable based on historical data (1961-1990 Normals) and two maps of predicted climate data based on two global climate change storylines-scenarios , A1F1 and B2 being applied to the Canadian Global Circulation Model 2 (CGCM2).

The storylines/scenarios are a tool to explore how developments in the global environment in the 21st century will affect the production of greenhouse gases. Each storyline/scenario represents different demographic, social, economic, technological, and environmental development.

The A1F1 storyline emphasizes a future world of very rapid economic development, global population that peaks in mid-century and declines thereafter, and rapid introduction of new and more efficient fossil fuel technologies. The B2 storyline emphasizes a future world of intermediate economic development with continuously increasing population. It is a world where there is a strong emphasis on local solutions to economic, social and environmental sustainability. The two storylines are considered equally valid with no assigned probabilities of occurrence.

Characteristics of the two storylines are summarized in the table below[iii]:

	Global Climate Storyline A1F1	Global Climate Storyline B2
World	• Market-orientated	• Local solutions
Economy	• Fastest per capita growth	• Intermediate growth
Population	• 2050 peak, then decline	• Continuously increasing
Governance	• Strong regional interactions, income convergence	• Local and regional solutions to environmental protection and social equity
Technology	• Rapid introduction of new and more efficient technologies • Fossil energy intensive	• Less rapid introduction of new and more efficient technologies • More diverse energy technology

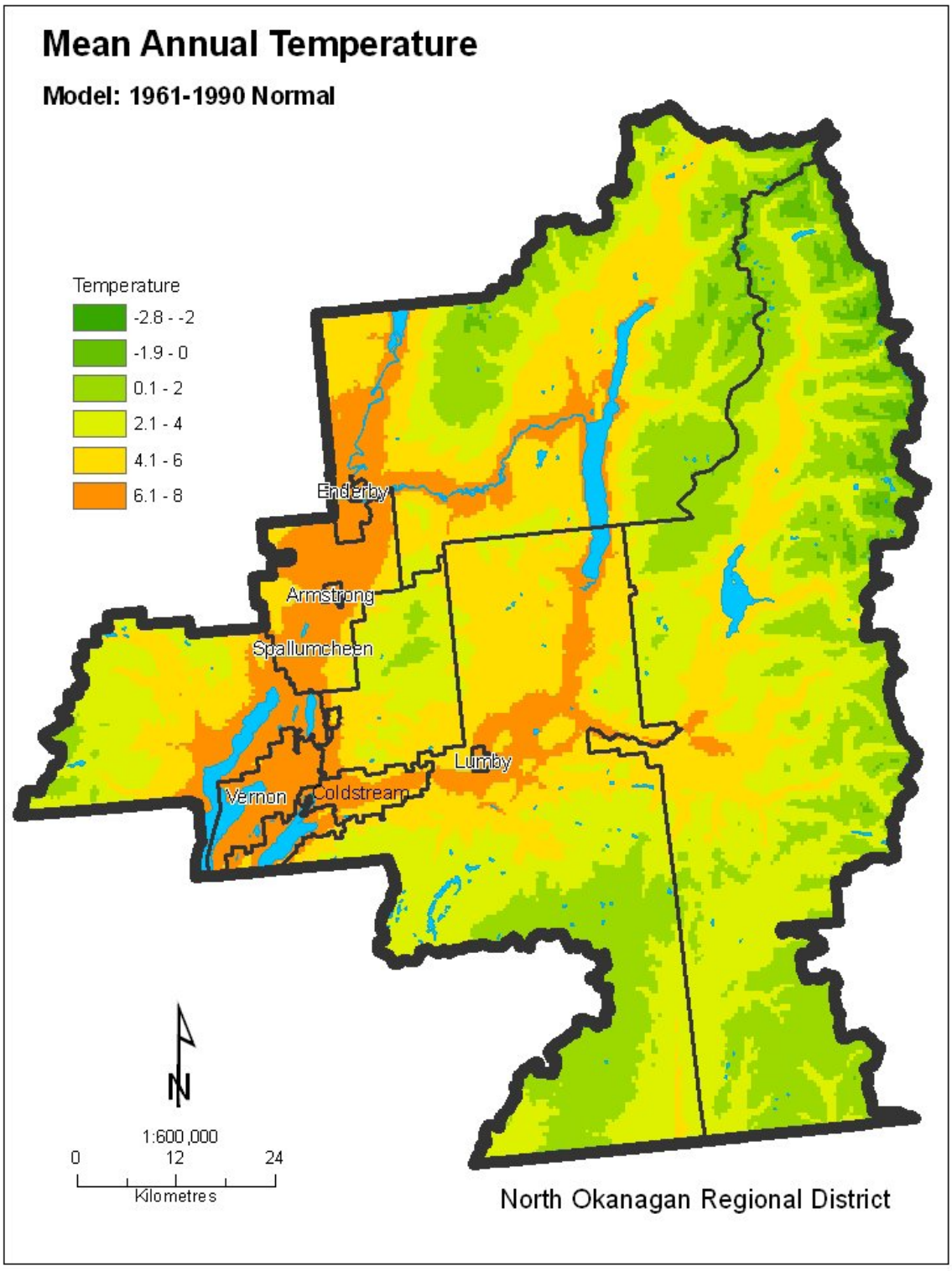
The ClimateBC tool allows the users to input single or multiple geographic locations that generate spatial data that can be used for producing maps or graphs.. This information can be displayed on maps and interpreted broadly at a regional scale but caution should be exercised when interpreting these maps for small specific areas such as a farm or community.

When interpreting the maps from an agricultural production perspective, it is important to note that soil types and topography are significant factors that affect the agricultural potential of land. These factors are not reflected in the maps.

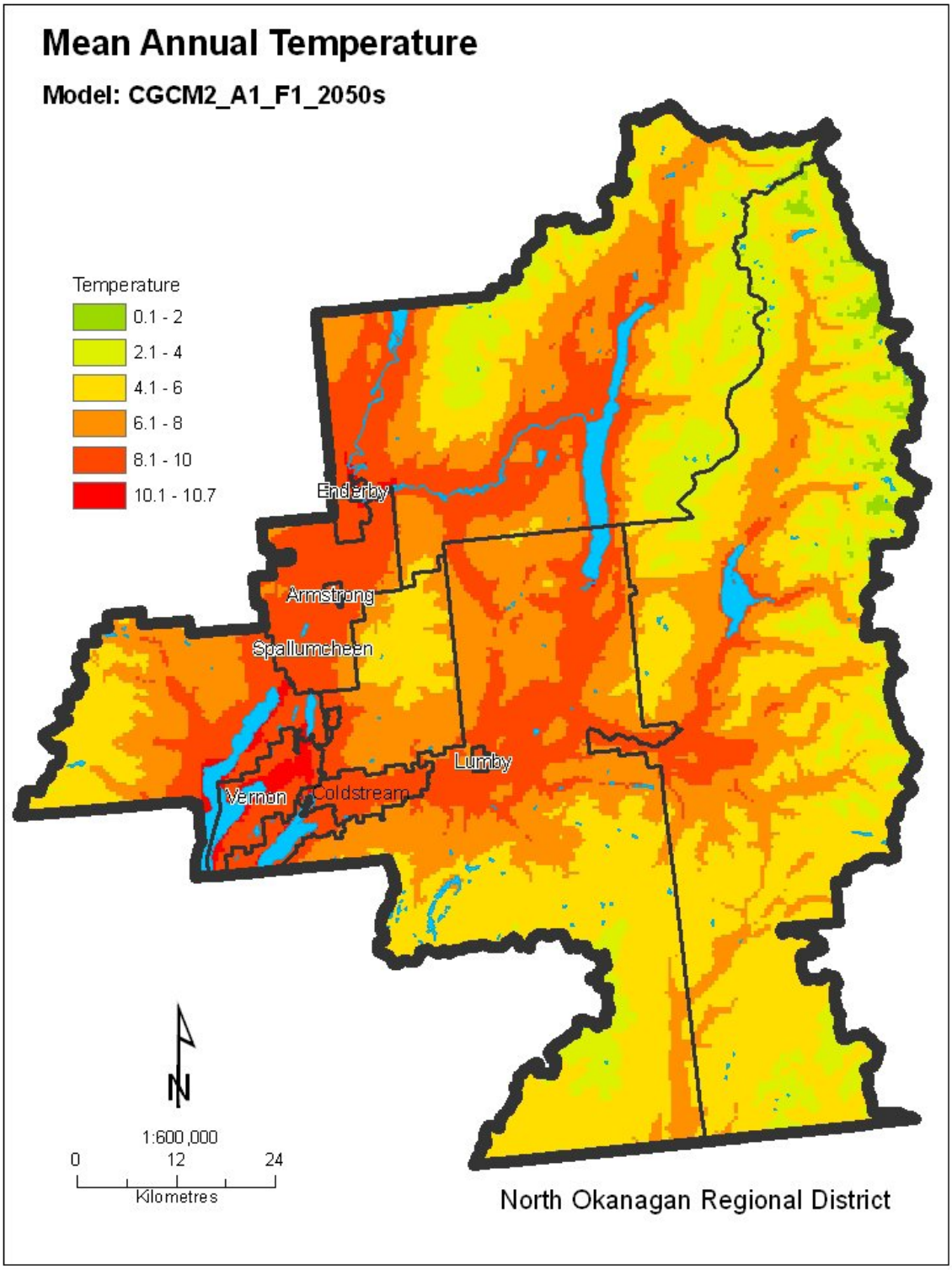
CLIMATE VARIABLE MAPS

The following maps are derived by displaying the data generated by the ClimateBC tool in a Geographical Information System (GIS). One of the inputs into the ClimateBC model is land elevation. This study used a 20 metre interval.

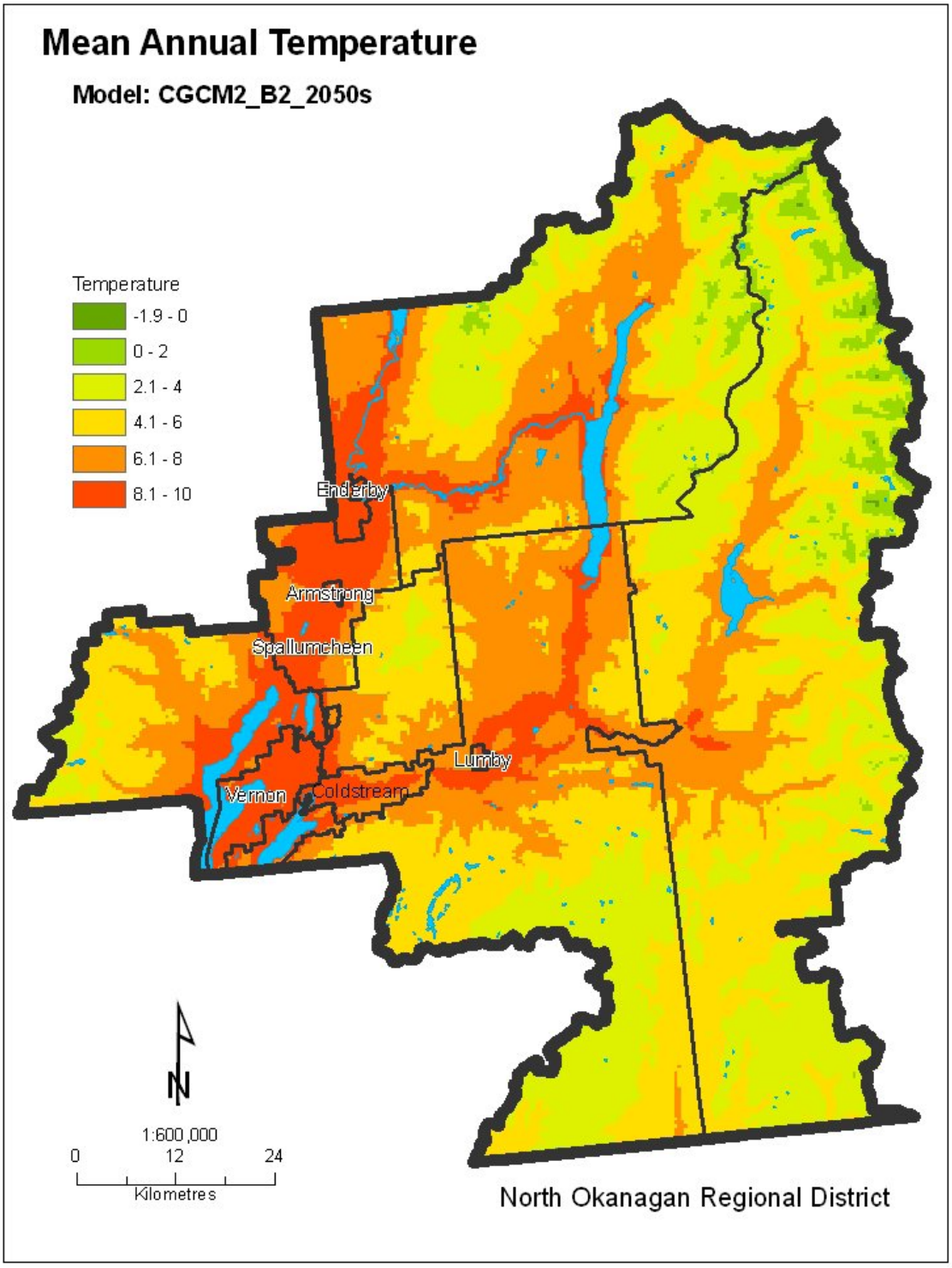
Two climate variables, Mean Annual Temperature and Number of Frost Free Days, are associated with temperature. Two climate variables, Precipitation as Snow is associated with both precipitation and temperature. For each climate variables three maps have been produced – Climate Normal (1960 – 1990) which is based on historical information and two potential global climate change models (A1F1 and B2) which are based on predictive information.



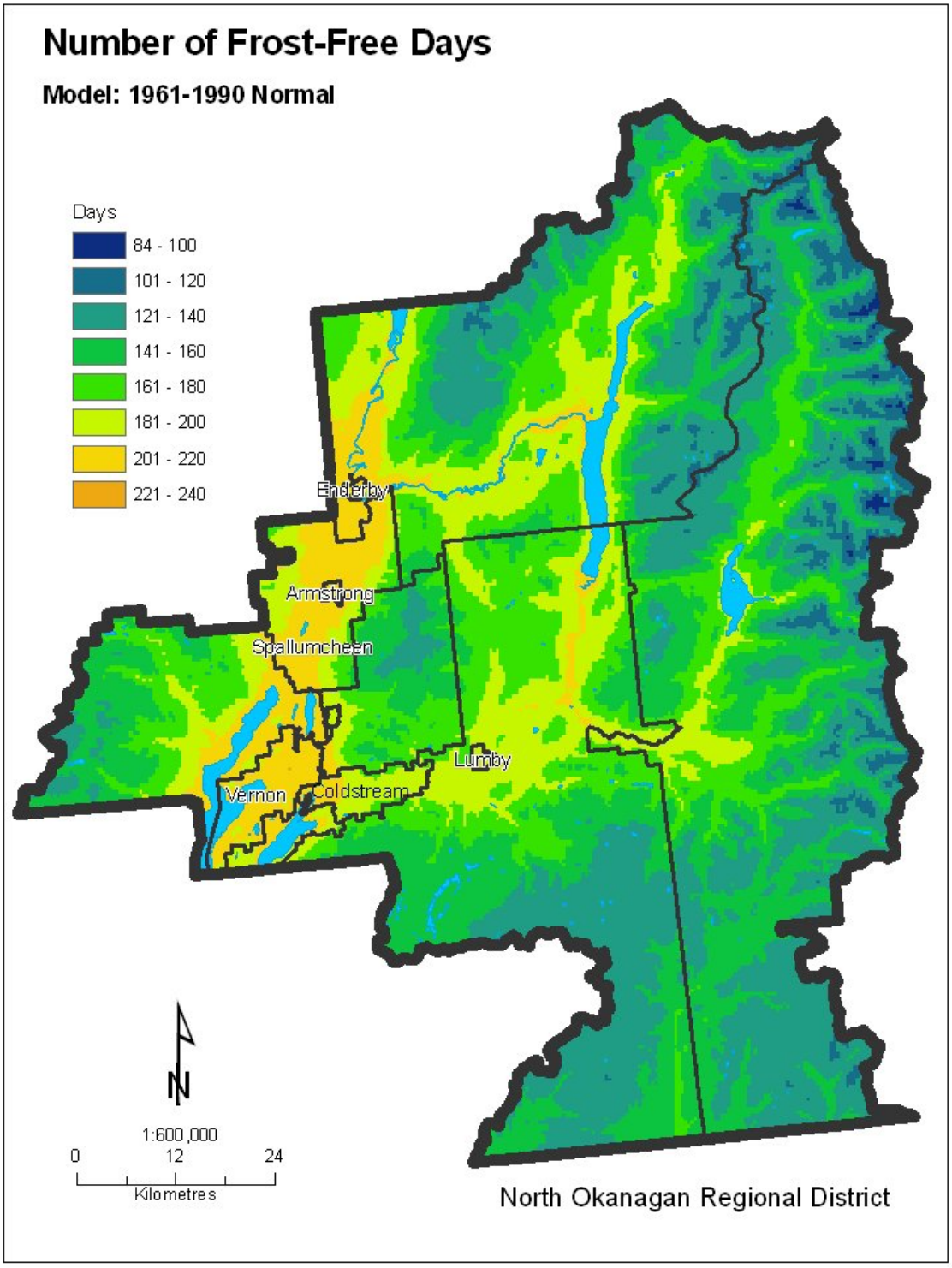
Map 1 Mean Annual Temperature Normal (1960 - 1990)



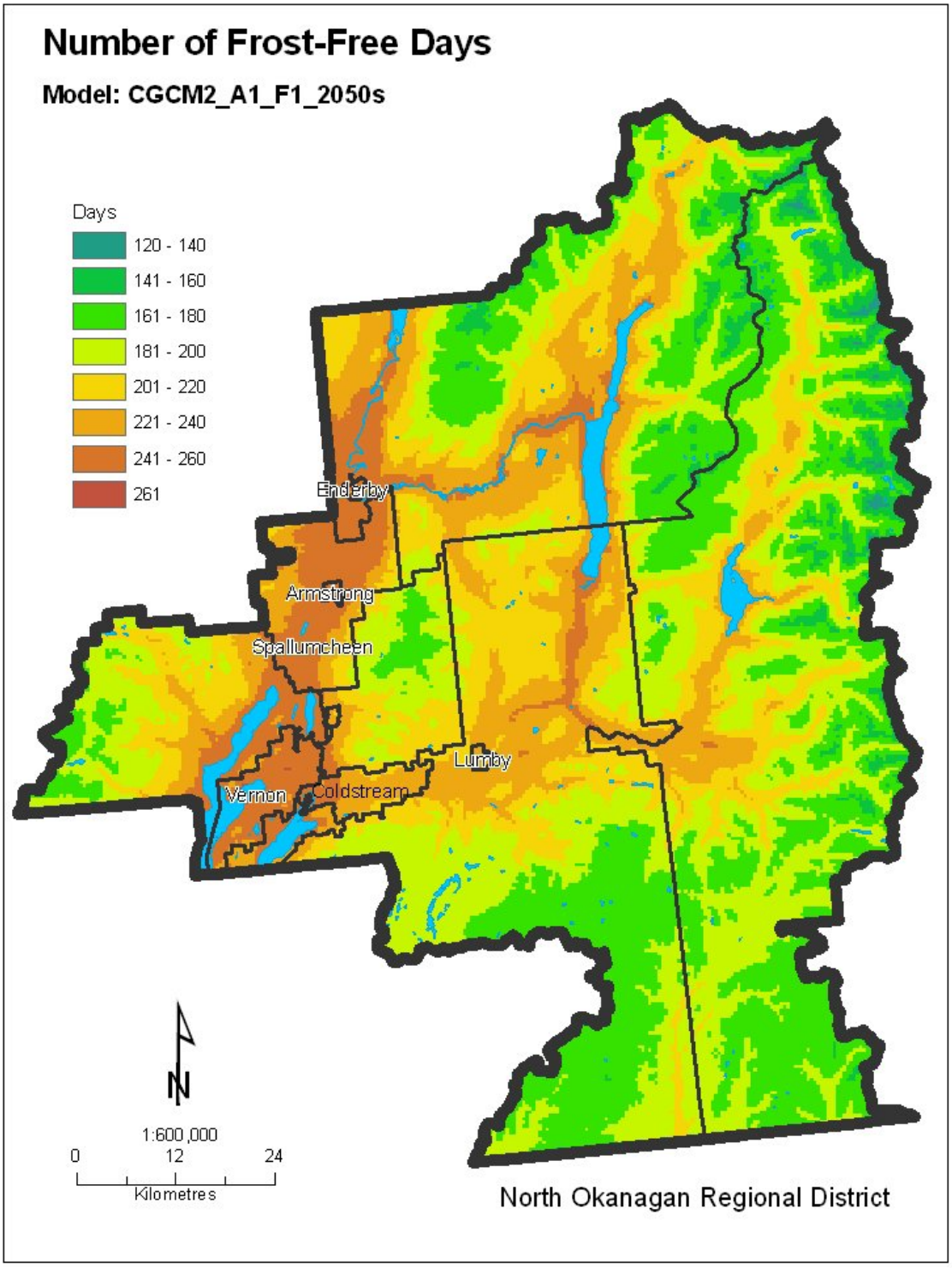
Map 2 Predicted Mean Annual Temperature CGCM2 A1F1 (2050)



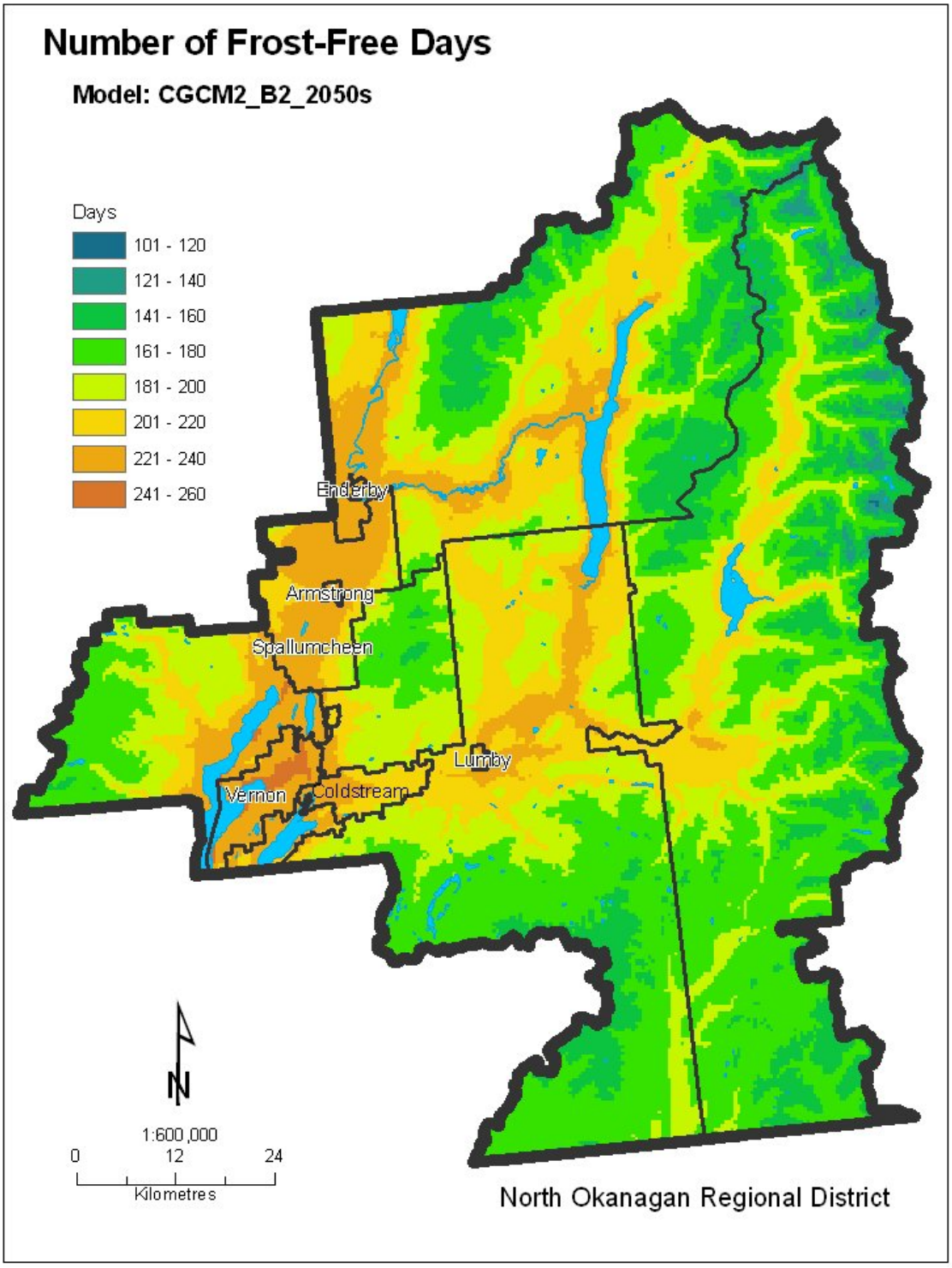
Map 3 Predicted Mean Annual Temperature CGCM2 B2 (2050)



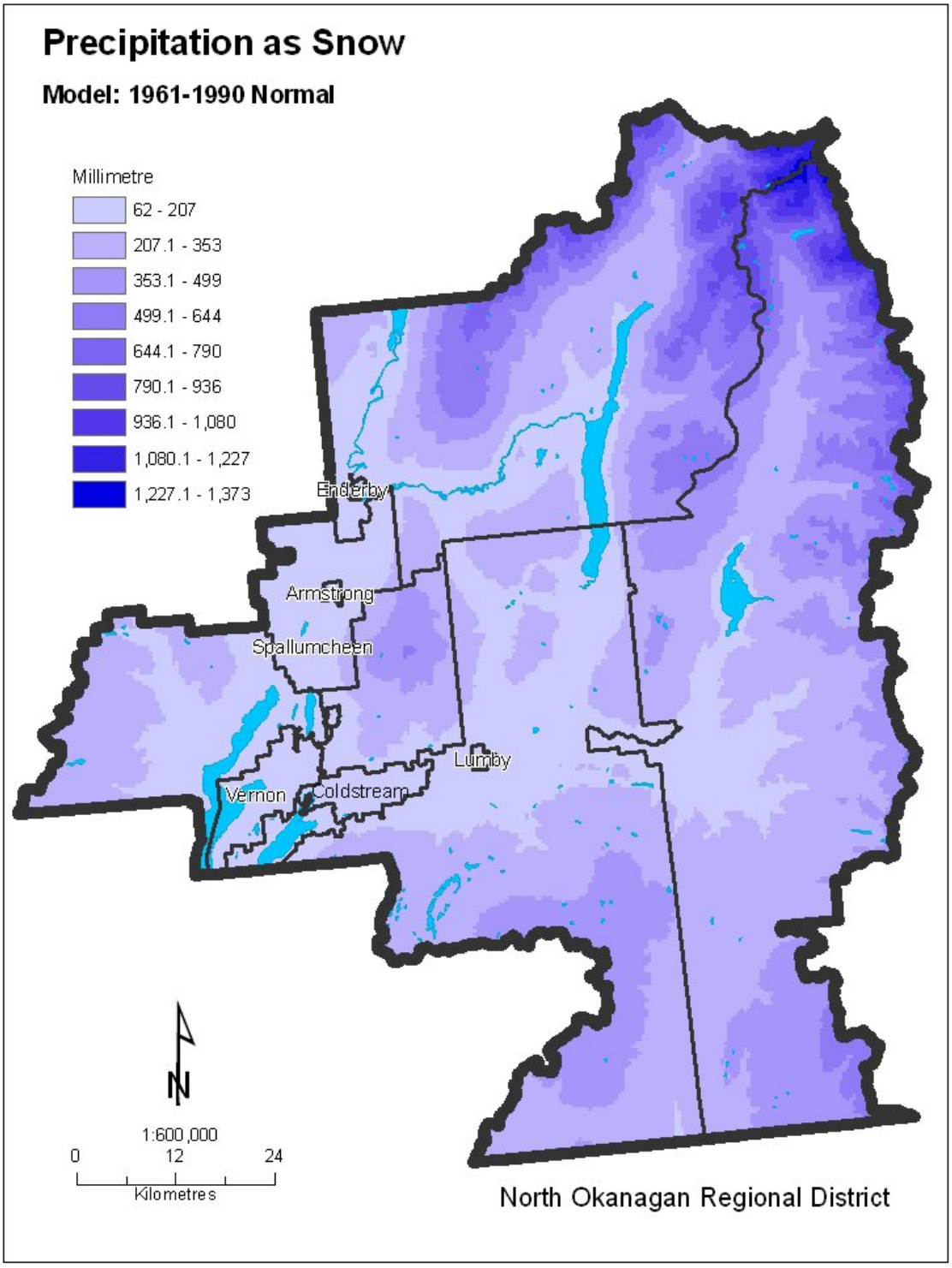
Map 4 Frost Free Days Normal (1960 - 1990)



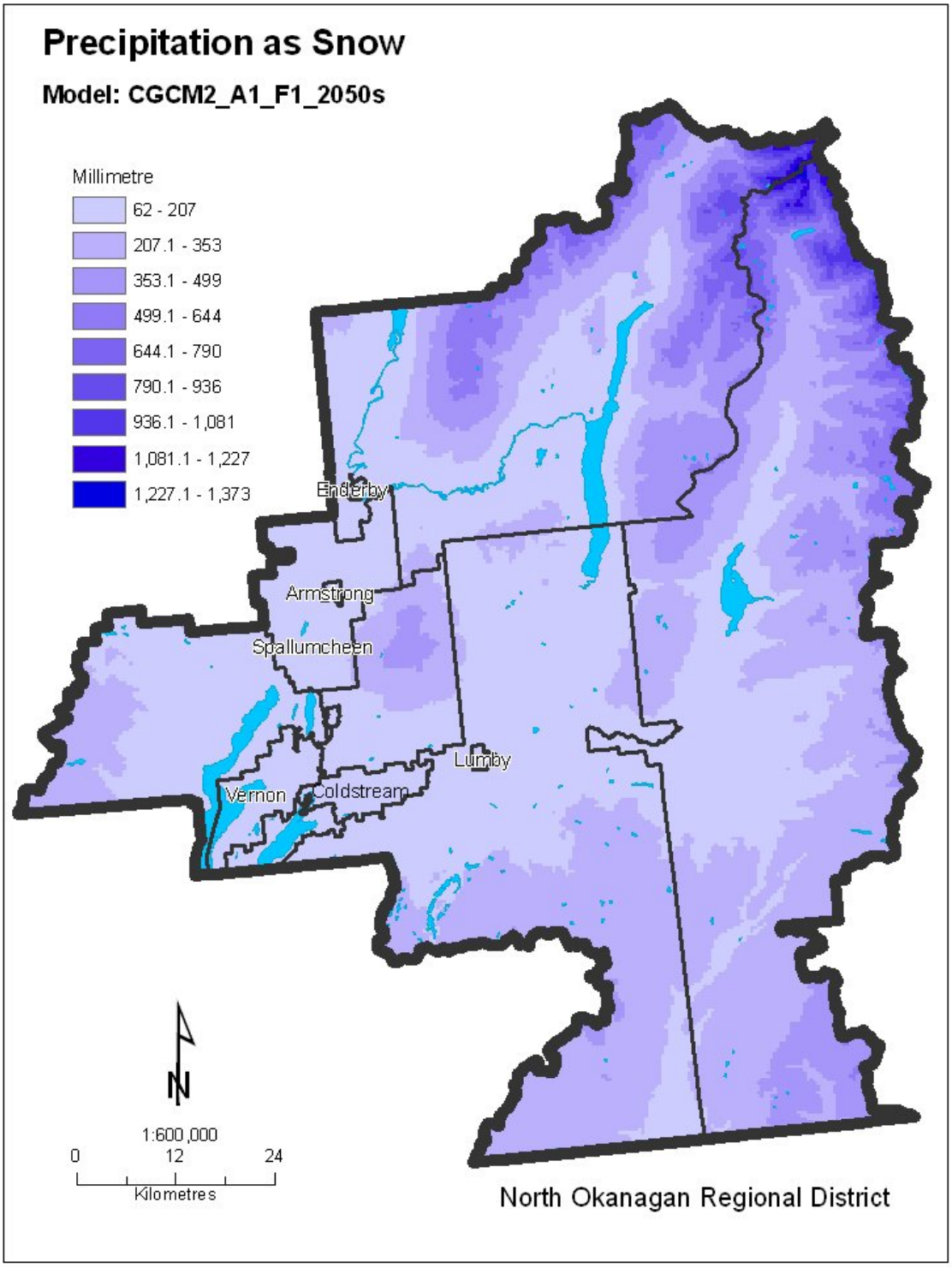
Map 5 Predicted Frost Free Days CGCM2_A1F1(2050)



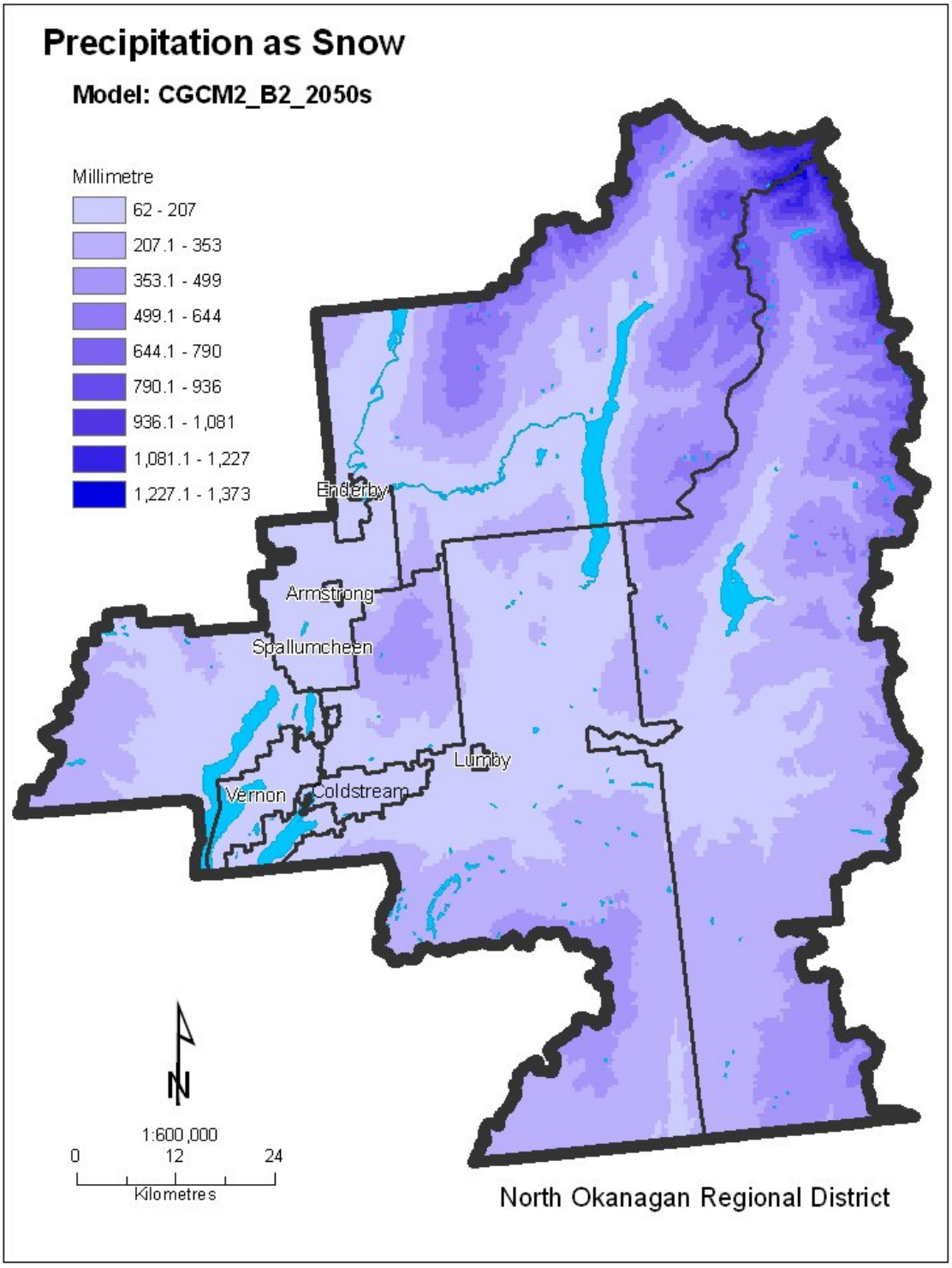
Map 6 Predicted Frost Free Days CGCM2 B2 (2050)



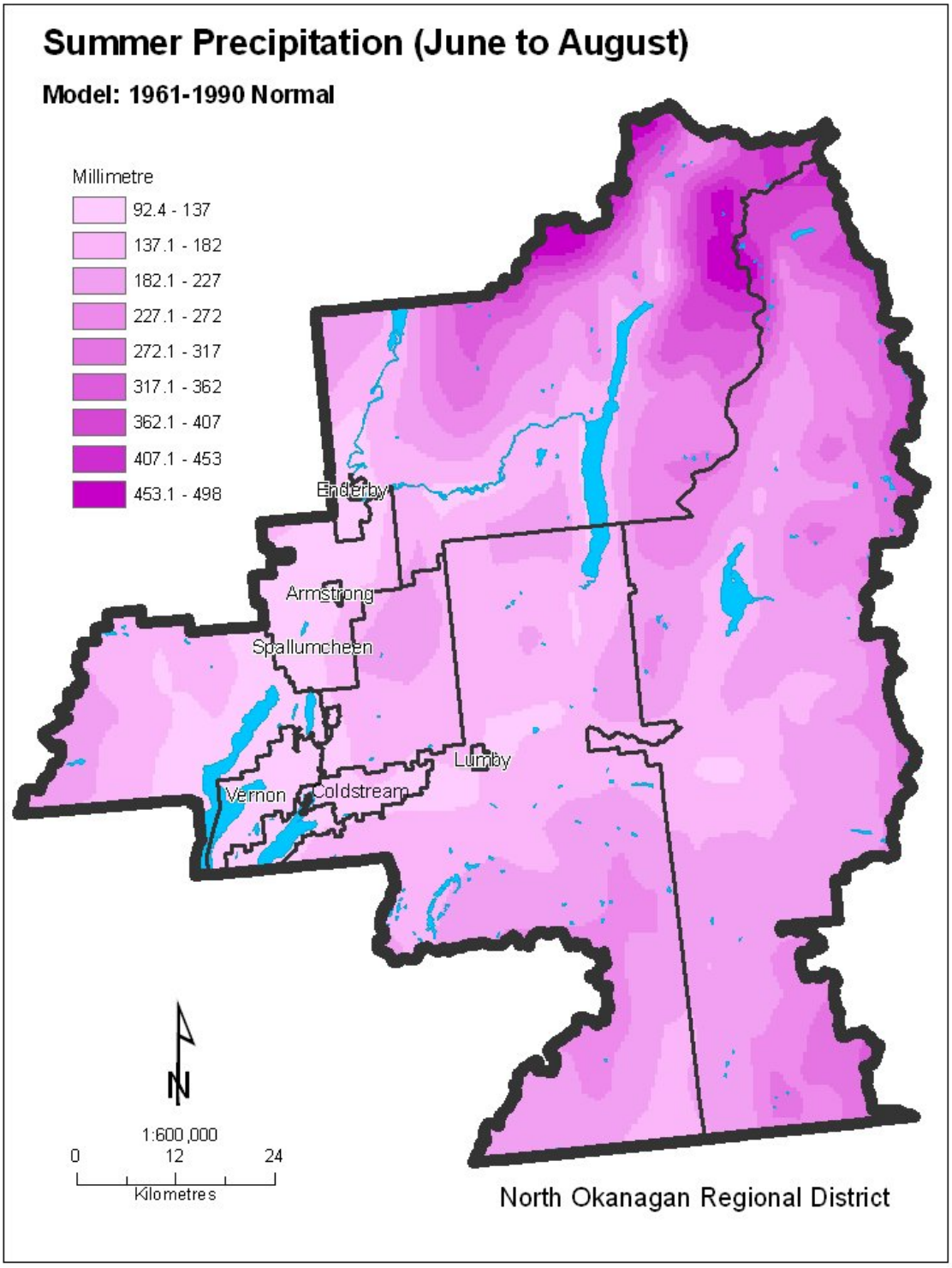
Map 7 Precipitation as Snow Normal (1960 - 1990)



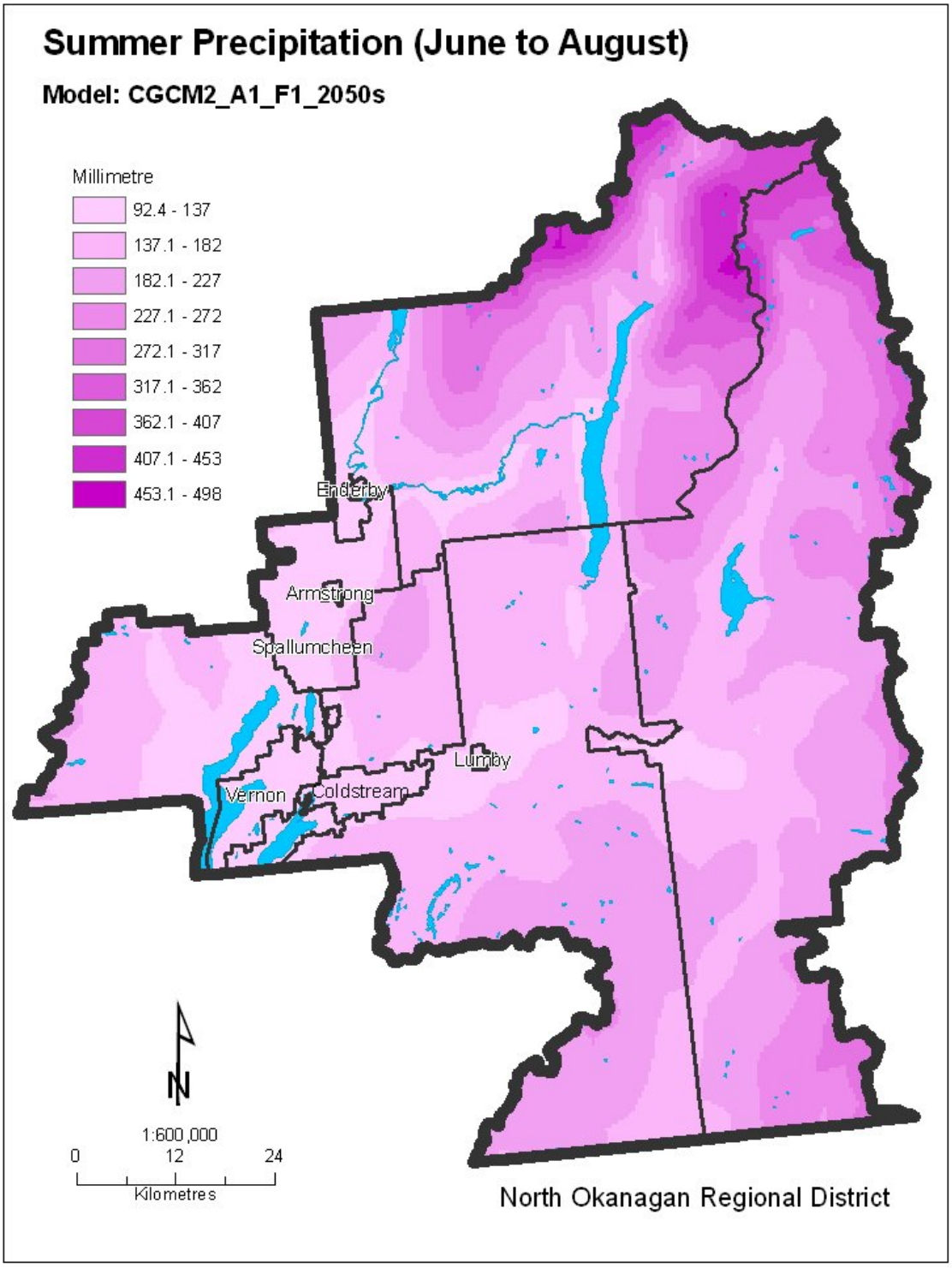
Map 8 Predicted Precipitation as Snow CGCM2_A1F1



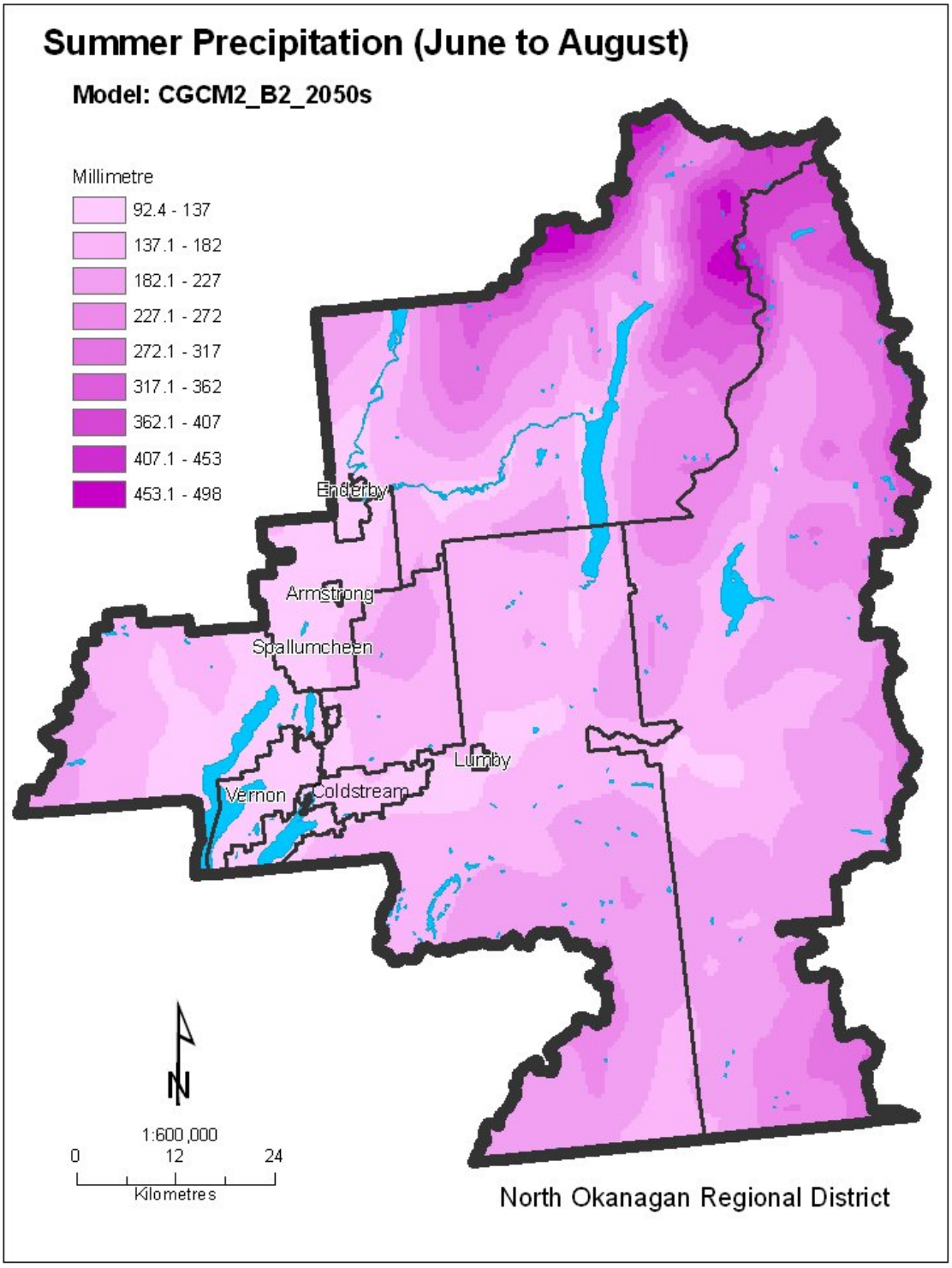
Map 9 Predicted Precipitation as Snow CGCM2 B2 (2050)



Map 10 Spring Precipitation Normal (1960 - 1990)



Map 11 Predicted Summer Precipitation CGCM2 A1F1 (2050)



Map 12 Predicted Summer Precipitation CGCM2 B2 (2050)

How climate variables differ from the maps of climate normals (1960 – 1990) under a "conservative" climate change scenarios (B2) and under a more drastic scenario (A1F1) are reflected in a general manner in the table below. These figures are for the District of Coldstream derived from the climate variable maps.

		Normal (1960-1990)	Future Scenario A1F1	Future Scenario B2
	Mean Annual Temperature (°C)	6.1 – 8.0	8.1 – 10.0	6.1- 8.0 East 8.1 – 10.0 West
	Number of Frost Free Days	181-200	221-240	201-220 East 221-240 West
	Precipitation as Snow(mm)	62-207	62-207	62-207
	Summer Precipitation (mm)	92-137	92-137	92-137

KEY FINDINGS

Agriculture is often considered to be among one of the most vulnerable economic sectors to the risks and impacts of climate change.[iv] For agricultural producers in general, climate change impacts can be summarized as:

- Crop/livestock losses due to extreme events
- Crop/livestock losses due to altered levels of soil moisture
- Crop/livestock losses due to change and severity of pests
- Crop/livestock losses due to increased variability in weather
- Increased opportunities for growing new varieties and finding new markets

The climate variable maps in this study inform decision makers regarding some climate change impacts associated with some of the above impact categories. Other potential impacts of climate change on North Okanagan agriculture could be investigated in further research.

Based on the observations of the historical data from Coldstream Ranch and on the predictive climate variable maps and associated tables, some potential impacts of climate change on future agricultural production in the District can be identified.

- The climate of Coldstream will continue to become warmer. The ClimateBC model predicts an increase from historical normals in Mean Annual Temperature of between 2.0 and 4.0 C° by the 2050s across the District depending on the climate change scenario and local micro-climates. The warming climate is primarily as a result of warmer nights resulting from increased cloud cover.
- The ClimateBC model predicts an increase in frost free days from historical normals of between 20 and 40 days depending on the climate change scenario and topography.
- Potential impacts on agriculture include:
    - Higher crop productivity
    - Higher rates of evapo-transpiration and associated water demand
    - Longer irrigation season
    - Greater range of potential crops including :

        - increase of tropical species in greenhouse operations
        - grape and soft fruit production
    - increased number of hay harvests
    - Increased wildfire hazard
    - Decreased winter heating costs associated with greenhouse operations and poultry and livestock facilities
    - Increased summer cooling costs associated with greenhouse operations and poultry and livestock facilities
- Low temperatures appear to be becoming less variable and there is a reduced frequency of extreme cold events. Variability of low temperature appears to be decreasing at different temporal scales – annual, seasonal and daily. The potential impacts of low temperature variability on agriculture include:
    - Decreased potential for crop damage from extreme cold
    - Winter survival, and more life cycles, of pests and diseases
    - Greater variety of pests and diseases
- Summer precipitation, as predicted by the climate variable maps, shows little change from the map showing 1960 – 1990 normals. This is consistent with the graph of historical data of summer precipitation (Figure 5) over the past 100 years. The increasing precipitation shown historically in the graph falls within the category (92-137 mm). Consistent precipitation, in conjunction with higher summer temperatures, will result in an increase in evapo-transpiration. This will result in an increased demand for supplementary irrigation of agricultural crops. The increased demand may be tempered slightly by greater summer precipitation.
- Precipitation as snow reflects the interplay of temperature and precipitation. At high elevations, climate change can result in more snow as a result of an increase of precipitation where temperatures are below freezing. At lower elevations climate change can result in less precipitation as snow due to the precipitation occurring at temperatures above freezing. In the case of Coldstream, the ClimateBC model does not indicate change from the 1960 – 1990 normals in the precipitation as snow. The categories on the maps are too large to indicate the changes. It is important to note, however, in the areas of the Okanagan Highlands both North and South of Coldstream within the watersheds managed for Coldstream irrigation, the ClimateBC model indicates a decrease in precipitation as snow. This could influence the optimal management of the irrigation reservoirs.

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[i] Environment Canada Climate Data http://climate.weatheroffice.ec.gc.ca/climateData/canada_e.html

[ii] A description of the ClimateBC program is available in The Climate Network, Vol 10, No.1, April 2005 published by the Canadian Institute for Climate Studies http://www.genetics.forestry.ubc.ca/cfcg/res_climate-models/CICS%20Newsletter%200405%5B1%5D.pdf

iii IPCC Special Report on Emissions Scenarios www.grida.no/climate/ipcc/emission/003.htm

[iv] Agricultural Adaptation in a Changing Climate, Summary Report for March 1, 2002 Workshop, University of Guelph

Appendix D – Agricultural Survey – General Comments

1. Relations with Government (Local and {Provincial)

- good service from District with watermain breakage
- burning permit should be weekends as well.
- burning permit should not leave room for interpretation.
- need burning opportunity in fall – spring burn is of wet wood that produces more smoke.
- waive income requirement for farm status.
- burning permit should not be restricted
- government needs to subsidize ALR land to make farming profitable.
- agricultural plan must be productive not more regulation.
- frustrated with proving farm status each year.
- local farmers need relaxation in farm signs to promote agriculture – e.g. allow off-site signs.
- urban residents have better access to municipal regulations (e.g. complain about burning) that farmers (e.g. dog control).
- farming can't be viable with restrictions on normal activities (e.g. burning, irrigation).
- should be allowed to burn.
- APC should have one representative that is a bonafide farmer.
- municipal resident receive most of the government support.
- farmers are over regulated.
- take land out of the ALR.
- Coldstream should keep costs for farmers under control to encourage farmers to maintain rural lifestyle.
- maintain District of Coldstream as separate municipality.
- District needs to tax lands that are fallow.
- governments need to co-ordinate their tax policy.
- make agricultural plan – viable, realistic & practical – without loop holes for development.

2. Recreation to Support Rural Lifestyle

- need horse trails.

3. Infrastructure for Agriculture

- irrigation period is too short.
- need place to dispose of dead animals.
- fewer trails for riding now.
- roads not safe for inexperienced rider.
- need more water in order to add more trees.
- meters and backflow preventers should belong to the municipality.
- shouldn't use treated water for agriculture.
- need to address accommodations for seasonal workers.
- farmers need more control of the water.
- small properties used to grow own food but are very sensitive to water price.
- extend irrigation season (earlier in spring & later in fall).
- all ALR land should have access to water to encourage farming.

4. Environmental Management

- need to protect water (streams, lake) from intensive livestock holding.
- need to preserve agriculture and green space.
- educate public rather than restrict farmers (e.g. burning).
- don't allow construction of non-farm buildings or gravel coverage of lot.
- the "potential" for agriculture must be protected.

5. Rural/Urban Conflicts

- irregular parcel size makes farming difficult & there are too many neighbors.
- want to be able to subdivide, need more small acreages, or small acreage owners need to supplement their income from off-property.
- limit new development to hillsides.
- educate public rather than restrict farmers (e.g. burning).
- urban neighbors complain about farm activities.
- re-enforce value of agriculture & discourage encroachment of urban uses & services.
- problems of farming are particularly difficult next to school because of limitations on spraying and burning.
- public is poorly educated.
- education regarding noxious weeds.

6. Economic and Business Development for Agriculture

- need local opportunities for farmers to take action to make things work – not just complaining.
- promote ALR for local food production.
- should be growing more food for local consumption, not just for cattle.
- need start-up support for local producers.
- help farmers with action plan – how to get started, possible opportunities, horseradish, dwarf trees, shrubs, Christmas trees, asparagus and berries.
- high input costs not reflected in product cost therefore profit margins shrinking.
- zoning restrictions for non-farmers uses make it hard for farmers to supplement income.
- key to farming success is high quality product and buy local program.
- need to grow our own Canadian food so that we need to keep our own land.
- should be promoting local "organic" produce.
- create a local market at Coldstream Elementary.
- bed & breakfast zoning, organic dairy, local slaughter facilities, branding of local produce.
- directory of local producers.
- food security & local food is important.
- need centralized farmers market area.
- support farm gate sales.

7. Global Economic Conditions

- high input costs not reflected in product cost therefore profit margins shrinking.
- US/Canada Free Trade is killing agriculture.