



Fraser Basin Council



Natural Resources
Canada

Ressources naturelles
Canada

Canada

Cariboo-Chilcotin Climate Change Adaptation Strategy

29 September 2011



Table of Contents

Chapter/ Appendix	Title	Page
	Acknowledgements	1
1	Context, purpose and objectives, limitations	1
SECTION 1 – Past and Future Climate		4
2	Past climate trends	4
3	Future projected climate	6
4	Impacts and vulnerabilities of a changing climate – general	7
SECTION 2 – Local Government Services		8
5	Local government services and relevancy to adaptation	8
6	Recommendations to address impacts/vulnerabilities of a changing climate to local government services	10
SECTION 3 – Regional Development Strategy		14
7	Regional development strategy and relevancy to adaptation	14
8	Recommendations to address a changing climate in regional development strategy	15
SECTION 4 – Other opportunities and conclusions		19
9	Other regional and community plans and processes	19
10	Lessons learned for other regional districts in BC	20
11	Conclusions	21
References		22
Appendices		23
1	Low-moderate relevance to climate change adaptation	23
2	Web resources	24
3	Sub-regional workshops summary	25

Acknowledgements

Funding for this strategy is from Natural Resources Canada, Regional Adaptation Collaborative. Janis Bell, Chief Administrative Officer and Rick Hodgson, Deputy Chief Administrative Officer, Cariboo Regional District are acknowledged for their in-kind support, guidance and direction in designing this project and its deliverables.

The Cariboo Regional District, City of Quesnel, District of Wells, City of Williams Lake and District of 100 Mile House are acknowledged for the in-kind support of staff and elected officials at workshops, individual meetings, and input by email or phone calls.

The Columbia Basin Trust is acknowledged for ideas and concepts that are included in the executive summary and lessons learned. Plan2Adapt was used for projected climate scenarios.

The Planners' Working Group was created as a result of this project, and is acknowledged for the guidance provided. It consists of planners and their staff from all local governments: Rick Brundrige, Tanya Turner, Joanne Doddridge and Liliana Dragowska with participation from Nigel Whitehead and Brianna van de Wijngaard. The working group met monthly from February through July to provide guidance, advice and specific feedback on the strategy, as well as to help design the spring workshop.

Chapter 1 – Context, purpose and objectives, limitations

This strategy is the culmination of a 2 year long case study that is part of the British Columbia Regional Adaptation Collaborative (RAC). It is one of over 20 projects taking place in BC that are funded by Natural Resources Canada. The BC RAC is linked with RACs taking place in other regions across Canada, with an objective of helping communities and industries adapt to a changing climate.

The Cariboo Regional District (CRD) is initiating a Regional Development Strategy (RDS) in the near future, based on what is legally referred to as a Regional Growth Strategy (RGS). The RDS will take up to 5 years to develop, and the strategy will outline a plan for development looking forward over the next 20 years.

The CRD was invited to participate in the RAC project, with the hopes of assessing how a rural, interior regional district is adapting to climate change. Given the intent of initiating a RDS in the near future, the CRD agreed to participate. Fraser Basin Council worked with CRD staff and designed the RAC project as a climate change adaptation strategy ("the strategy") to help to create a RDS that helps the region plan for the medium-term by incorporating the projected long-term climate scenarios. As part of the strategy, key lessons learned will be shared that other regional districts can apply as they begin considering climate change adaptation into their own plans and strategies.

The strategy focuses on how the CRD, including its member municipalities, can effectively adapt to climate change. The strategy looks at the 30-70 year horizon, and uses a variety of quantitative climate change scenarios to assess future conditions to inform an adaptation strategy. The intent is to incorporate the strategy into the RDS as it is developed over the next few years. The strategy will help to apply a climate change adaptation lens at the beginning of the RDS process.

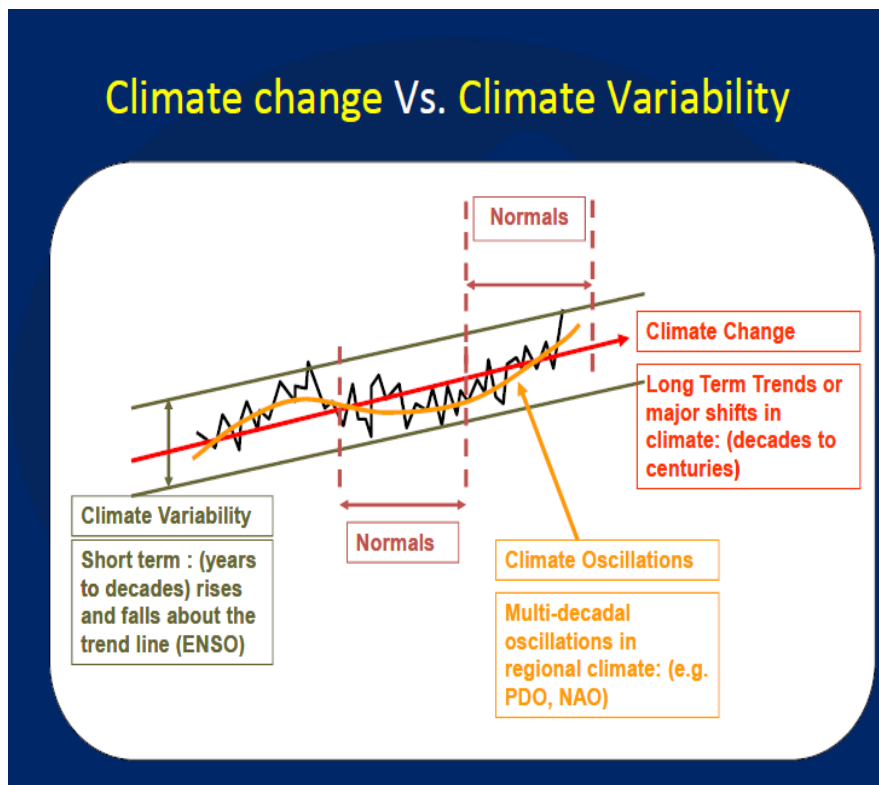


Figure 1. Climate Change vs. Climate Variability

Figure 1 is an explanation of climate change vs. climate variability. The key variable is time – while weather is days to weeks, climate variability is years to decades, and climate change are shifts from decades to centuries. Image is courtesy of Trevor Murdock (Pacific Climate Impacts Consortium) and Rick Lee.

This strategy primarily addresses climate change adaptation, not mitigation. Adaptation is defined as *the adjustment in systems in response to actual or expected climatic stimuli and their effects, which moderates harm or exploits beneficial opportunities* and mitigation as *human intervention to reduce the anthropogenic forcing of the climate system, including strategies to reduce greenhouse gas sources and enhance sinks* (IPCC, 2007). Although adaptation and mitigation are complementary, and some actions address both, the focus of this strategy is adaptation. This strategy also does not debate the causes of a changing climate – it acknowledges that climate is changing, and opens up discussion on how we can adapt.

When most people think or talk about climate change, they refer to mitigation; however, adaptation is an appropriate and important response at a local and regional scale for many reasons, as discussed by Picketts, Dyer and Curry (2009). Some reasons that many communities are undertaking adaptation include:

- small organizations can move quickly to create adaptation strategies
- adaptation strategies can be 'tailor made' to the specific needs of an area
- adaptation can readily occur from the bottom up, with input from local stakeholders

Adaptation is different than mitigation, which tends to require large organizations (such as countries), takes a long time to enact and is focused on addressing global problems. One thing that is important to note is that both adaptation and mitigation have the same underlying goal: reducing the negative impacts of climate change. Some of the main similarities and differences between adaptation and mitigation are summarized in the following table:

Table 1. Similarities and Differences Between Adaptation and Mitigation (Swart and Raes, 2007)

	Adaptation	Mitigation
Definition	Adjustments to respond to actual or expected changes in the climate.	Actions to reduce GHG concentrations or allow earth to absorb more GHGs.
Focus	Effects of climate change	Causes of climate change
Spatial Scale	Avoiding local damage	Avoiding global changes
Time Scale	Short term benefit by reducing vulnerability	Long term benefit by reducing causes of further change
Benefits	Benefits those that implement actions	Benefits others
Underlying goal	Reducing the negative consequences of climate change	
Limitations	Limited by technology and peoples' willingness to make change	

While many of the climate change adaptation issues in the Cariboo-Chilcotin region relate to the natural environment, this strategy addresses local government services and issues, not natural resource management issues. Therefore the limitations of this strategy are that it is not all-encompassing of all climate change related matters facing the region.

The following were the guiding principles for the development of this strategy:

- Look at the big picture, for the long term – purpose is to guide the RDS
- Usable – keep practical and tangible
- Succinct – put details in appendices; aim to keep the strategy brief and readable
- Examples – include examples of adaptation best practices from other areas in Canada and the world
- Target the lay-person – keep it accessible, non-technical
- Acknowledge local knowledge

This strategy is built almost entirely on input received at workshops that engaged local governments and other stakeholders. These workshops were as follows:

- Adapting to Climate Change in the Cariboo-Chilcotin – 3 March 2009
- Climate Change Adaptation – North Cariboo Sub-regional Workshop, 17 Nov 2010
- Climate Change Adaptation – South Cariboo Sub-regional Workshop, 1 Dec 2010
- Climate Change Adaptation – Central Cariboo Sub-regional Workshop, 16 Dec 2010
- Climate Change Adaptation – Region-wide Workshop, 28 April 2011

See Appendix 3 for a summary of the sub-regional workshops held in November and December 2010.

SECTION 1 – Past and future climate

Chapter 2 – Past climate trends

Although there is limited long-term data, the climate in the Cariboo-Chilcotin has been warming over the past 50 years (Table 2). Notably, winters are warming more quickly than summers or the annual average temperatures, and winter precipitation is decreasing with annual averages about the same. It has been stated that “it’s not necessarily getting hotter, but winters are getting less cold.” While this statement is counter-intuitive, it makes one think that the overall temperature is rising, just not in the season where the temperature changes are most associated with heat.

Table 2. Past climate data.

Station Name	Element	Winter – change from 1950-2001	Annual – change from 1950-2001
Quesnel	Minimum temperature	+3.5C	-
	Average temperature	-	+1.7C
	Precipitation	-22%	+0.2%
Tatlayoko Lake	Minimum temperature	+1.5C	-
	Average temperature	-	+1.1C
	Precipitation	-26%	+13%
Barkerville	Minimum temperature	+1.2C	-
	Average temperature	-	+1.2C
	Precipitation	-28%	-29%
Prince George	Minimum temperature	+3.8C	-
	Average temperature	-	+1.8C
	Precipitation	-19%	-4%
Kamloops	Minimum temperature	+2.9C	-
	Average temperature	-	+1.7C
	Precipitation	-24%	+20%

Climate is changing, but just as importantly, it’s variable. Climate has always been variable both year-to-year, and spatially. The general trend of a changing climate is warmer winters, less precipitation as snow, and more frequent extreme events. However, the current variability appears as significant, and can present just as many challenges as the long term trend.

Some of the comments, anecdotes and narratives from participants at the fall sub-regional workshops on how the weather patterns have shifted in their lifetimes are as follows:

- Winters aren’t as cold, but summers aren’t necessarily hotter – winters up to the mid 1990s had at least a 2 week period with low temperatures near -40C
- Ice thickness on Canim Lake was 25 inches in the mid 1980s, and now is 8 inches maximum
- Significant variation and a notable reduction in snow levels over the past 10 years, compared to the 1980s and 1990s
- Gardening season has shifted – springs are cool, falls are warm for longer
- Changes in transportation maintenance – more freeze-thaw cycles, rather than one freeze in early winter and thaw in spring

Reality Check – “I don’t believe in climate change...”

The following are some recent examples of a changing climate and the challenges that have been presented for the Cariboo-Chilcotin:

- *The Mountain Pine Beetle epidemic* – warmer winters in the mid-1990s allowed for increased survival of beetle larvae, killing our timber supply and creating devastating challenges to the largest industry in the region.
- *Intensity of wildfires* – while fire has always been a part of the ecosystem, the intensity of recent wildfires and the potential for large wildfires as a result of dead pine on the landscape has increased. Also, warmer nighttime temperatures have maintained fire activity at night, as compared to lower nighttime temperatures with higher humidity that would slow fire activity at night.
- *Peak flow changes* – as a result of the MPB epidemic, there are significant hydrological changes in certain watersheds, including flooding, and impacts on ranching and power generation in the Big Creek watershed.
- *Declining lake levels* – changes in precipitation patterns have caused a reduction in the 108 Mile Lake level, and 2 years of water restrictions in the Chimney Valley watershed.
- *Cariboo Marathon* – a significant winter event drawing cross-country skiers from around the province, it was cancelled several times in the 2000s due to lack of snow at 99 Mile Hill. The marathon was moved to this location in the early 1990s from other lower elevation sites for more reliable snow conditions.
- *West Nile virus* – warmer conditions have allowed the survival of the virus in many areas of BC, including the Cariboo where it is not yet confirmed but highly suspected.
- *January 2005 rain event* – caused major flooding in Horsefly and other areas of the Cariboo-Chilcotin, as well as freezing rain and frost heaving.
- *Impacts on logging season* – less winter timber harvesting, earlier spring breakup. Even in this wet summer of 2011, what is traditionally summer operating ground is not dry enough for timber harvesting with heavy equipment.

While not all of the impacts noted above can be fully attributed to just a changing climate (e.g., other anthropogenic influences are involved such as management and manipulation of natural resources and ecosystems), they are examples of changes that have arisen due in large part to the apparently minor changes in temperature and precipitation over the past 50 years.

If annual temperature increases of about 1.5C over the past 50 years have caused the impacts noted above, what will be the impacts and how will we adapt to the projected climate scenarios by the 2050s? By the 2080s?

Chapter 3 – Future projected climate

The following are the projections of a future climate from the *Preliminary Analysis of Climate Change in the Cariboo-Chilcotin Area of British Columbia* (Dawson, Werner and Murdock, 2008)(Table 3). These projections are based on the averages of 15 Global Climate Model outputs using 2 different greenhouse gas emissions scenarios. The limitations are that these are projections, or model outputs, and not predictions; and that these were done on a region-wide scale.

Table 3. Projected climate.

Climate variable	Projected change in 2050s* median (range)	Projected change in 2080s* Median (range)	General expected impacts
Temperature	<ul style="list-style-type: none"> ▪ Annual +1.8C (+1.2C to +2.5C) ▪ Summer +1.8C (+1.2C to +2.5C) ▪ Winter +1.8C (+0.6C to +2.8C) 	<ul style="list-style-type: none"> ▪ Annual +2.6C (+1.6C to +4.0C) ▪ Summer +2.8C (+1.8C to +4.3C) ▪ Winter +2.6C (+1.6C to +4.6C) 	<ul style="list-style-type: none"> ▪ Increased glacial melt ▪ More frequent freezing rain events ▪ Very few very cold winters ▪ Increased forest fires ▪ Increase in forest and agricultural pests, diseases ▪ Increase in freeze-thaw events
Precipitation	<ul style="list-style-type: none"> ▪ Annual +6% (0% to +12%) ▪ Summer -7% (-15% to +4%) ▪ Winter +8% (-2% to +14%) 	<ul style="list-style-type: none"> ▪ Annual +8% (+5% to +18%) ▪ Summer -6% (-22% to +3%) ▪ Winter +11% (+5% to +21%) 	<ul style="list-style-type: none"> ▪ Decreased late summer stream flow ▪ Soil water decrease in summer ▪ Changes to aquatic ecosystems ▪ Changes to ecosystems affecting wildlife habitat ▪ Scarce water supply, competing demands ▪ Increased frequency of extreme events
Snowfall	<ul style="list-style-type: none"> ▪ Winter -9% (-15% to +2%) ▪ Spring -55% (-74% to -17%) 	<ul style="list-style-type: none"> ▪ Winter -11% (-29% to -1%) ▪ Spring -75% (-87% to -16%) 	<ul style="list-style-type: none"> ▪ Less precipitation as snow ▪ Less water storage in nature ▪ Earlier and increased peak flow of spring stream runoff
Growing degree days (GDD)	<ul style="list-style-type: none"> ▪ +306 degree days (+170 to +465) 	<ul style="list-style-type: none"> ▪ +518 degree days (+279 to +820) 	<ul style="list-style-type: none"> ▪ Increase in the area with 1500-2000 GDD in low elevation valleys (similar to Westwold-Salmon Arm currently) ▪ Increase in area with 1000-1500 GDD in plateau areas ▪ Increased agricultural opportunities – new areas, and new crops
Frost free days	<ul style="list-style-type: none"> ▪ +23 days (-13 to +33 days) 	<ul style="list-style-type: none"> ▪ +35 days (+19 to +55 days) 	<ul style="list-style-type: none"> ▪ Longer growing season

*change projected from 1961-1990 baseline data

The following are the anticipated sub-regional variations based on workshop participants anecdotal information and history in the region:

- All sub-regions anticipate **less change from current conditions** in temperature and precipitation **in eastern areas** of their sub-regions (i.e., Cariboo Mountains areas from Wells south to Canim Lake area). While precipitation and snowpack levels will decrease, it was felt that this would be less “noticeable” due to the current high levels of precipitation, compared to other regions
- All sub-regions anticipate **more change from current conditions** in temperature and precipitation **in western areas** of their sub-regions (i.e., Nazko area of North Cariboo,

eastern Chilcotin areas of Riske Creek to Tatla Lake, and Meadow Lake, Canoe Creek and Big Bar areas of South Cariboo). Participants described these dry areas as continuing to dry, and that they are the hottest.

- South Cariboo participants anticipate **less change from current conditions** in temperature **in the upper elevations** of their sub-region (i.e., Sheridan and Bridge Lakes), and more change from current conditions in the lower elevation areas (i.e., 108 Mile Lake, Lac la Hache areas).
- South Cariboo and Central Cariboo and Chilcotin participants anticipate **continued drying of surface water, especially in the drier western ecosystems**. These drying trends are anticipated to impact groundwater as well.

Chapter 4 – Impacts and vulnerabilities of a changing climate – general

The impacts and vulnerabilities of a changing climate affect humans and the economy, as well as the environment through the functioning of the ecosystem and impacts on fish and wildlife. The focus of this strategy is on local government services, roles and responsibilities, and not natural resource management.

The following is a summary of impacts that was generated at the March 2009 *Adapting to Climate Change in the Cariboo-Chilcotin Workshop*, hosted by Fraser Basin Council and the CRD, that shows the broad range of impacts across diverse topic areas:

- *Impacts on local government services and infrastructure* – increased road maintenance costs, increased impact on road infrastructure, impacts on water supply and quality, more demand on hydro for air conditioning in summer – more GHGs, less demand for heating in winter – less GHGs, and increased stress on storm sewers, hydroelectric energy supply would be threatened as a result of glaciers melting, due to lack of recharge of reservoirs
- *Impacts on tax base of local governments* – reduction in timber available for harvest will ultimately curtail forest industry and the taxes they pay, and reduced taxes may result in local governments having to make choices about what are essential services to provide, and which ones to eliminate
- *Impacts on human health and communities* – migration of insects and associated diseases with adverse human health effects (e.g. fleas, killer bees, West Nile virus, Lyme disease), increase in heat stroke and heat exhaustion amongst susceptible populations (e.g., elderly, infants), decreased water quality as quantity decreases, social unrest if there are severe water or food shortages.
- *Impacts on food and agriculture* – positive and negative impacts, more diversity of agricultural crops, irrigation restrictions yet higher demand for irrigation, invasive species
- *Impacts on local industries* – uncertainty affects all sectors, reduction in timber supply, less frozen ground for forestry operations, bioenergy potential, tourism impacts of shorter winters and possibly longer summers
- *Impacts on emergency planning* – forest fires, interface fires, more extreme weather events such as wind, flooding, freezing rain/ice storms and drought
- *Impacts on natural environment* – biodiversity, fish and wildlife and their habitats, ecosystem shifts, forest fires, less carbon sequestration, hydrological changes

SECTION 2 – Local Government Services

Chapter 5 – Local government services and relevancy to adaptation

The following local government services were agreed to as **most highly relevant** to climate change adaptation in the November-December 2010 sub-regional workshops (see chapter 6 for impact or vulnerability due to a changing climate, which explains the rationale why the service was chosen as relevant to adaptation). Less relevant local government services that are of low or moderate relevance to climate change adaptation are included in Appendix 1.

Current service – municipalities and CRD	
Planning	Storm water
Airport	Protective/emergency services
Snow clearing	Police
Roads/streets	Parks, recreation
Invasive Plant Management	Solid waste management – wood waste only
Economic Development	Communications
Water	Health Services
Sewer	

Of particular relevancy to climate change adaptation is water and availability for domestic purposes and human consumption. Water is provided by a local government for approximately 38% of the population of the Cariboo (24 870 people of a total population of 65 471). The majority of Cariboo Regional District residents are serviced by individual wells, and less than 1% are serviced by water user communities, improvement districts or water utilities. Water quantity and quality is particularly vulnerable to a changing climate, especially when reliant on a surface source. Table 4 describes the types of water systems within the Cariboo Regional District, the populations that depend on them, and the vulnerability to a changing climate:

Table 4. Water systems in the Cariboo-Chilcotin.

Jurisdiction or legislative authority	System Name	Water source	Population served (approximate)	Capacity	Vulnerability of water system to a changing climate*
City of Quesnel	-	Groundwater, wells	9746		Low
District of Wells	-	Groundwater, deep well	278	1500	Low
City of Williams Lake	-	Groundwater, wells	11002		Low
District of 100 Mile	-	Bridge Creek	1955	4100	Moderate
Cariboo Regional District	Lac la Hache	Groundwater, wells	400 people, 183 parcels of land	Could accommodate 1600 additional users; sewer constraints	Low
	Forest Grove	Groundwater, wells	227 people, 107 parcels of land	At or near capacity	Low
	Canim Lake	Groundwater, wells	85 people, 81 parcels of land	At or near capacity	Low
	Horse Lake	Groundwater, wells	250 people, 174 parcels of land	At or near capacity	Low
	108 Mile Lake	Groundwater, wells	2620 people, 1412 parcels of land	At or near capacity	Low
	Alexis Creek	Groundwater, wells	140 people, 69 parcels of land	Could accommodate 774 additional users; sewer constraints	Low
	Russet Bluff	Groundwater, wells	197 people, 106 parcels of land	At or near capacity	Low
Water User Communities (MOE)	South Lakeside	Surface water	7 users	Unknown	High
	Fraser River	Surface water	2 users	Unknown	High
Improvement Districts (Ministry of Community Services)	Independent Water Works, N of Quesnel	Well	14 parcels of land	Unknown	Moderate
	Lexington, E of Williams Lake	Williams Lake surface	29 parcels of land	Unknown	Moderate
	Wolfe, S of Quesnel	Groundwater, well	15 parcels of land	Unknown	Moderate
Water Utilities (Water Comptroller through Water Utility Act or Utilities Commission Act)	Cinderella Ski Village Ltd., near Quesnel	Surface water, Cinderella Cr.	5 parcels of land	Unknown	High
	Gateway Water Service, E of 100 Mile	Groundwater, well	27 parcels of land	Unknown	Moderate
	Granberg, near Williams Lake	Surface water, Bond Lake	22 parcels of land	Unknown	High
	Saunders Ent., near 100 Mile	Ground water, well	146 parcels of land	Unknown	Moderate
	Benjamin Water & Utility, near Quesnel	Groundwater, well	31 parcels of land	Unknown	Moderate
	Strata Plan KAS2490, Watch Lake	Groundwater, well	27 parcels of land	Unknown	Moderate
None – individuals on wells	Various – wells, lake intakes, etc.	Mostly groundwater, wells	38 473 (remainder of CRD population)	Unknown	Variable

*Relative and subjective to other systems

Chapter 6 – Recommendations to address impacts/vulnerabilities of a changing climate to local government services

The following are the impacts or vulnerabilities of a changing climate to local government services that were heard at previous workshops in March 2009 and November-December 2010. Strategies are from the April 2011 workshop, and are a collection of input from across the region – they may be specific to one or more community and not apply everywhere.

Current service – municipalities and CRD	Impact or vulnerability due to a changing climate	Recommendation
Planning	<ul style="list-style-type: none"> ▪ Increased importance of planning to identify areas appropriate for development, to identify areas such as flood plains and unstable areas, and to assess water resource availability prior to settlement or development of new areas ▪ Increased reliance to coordinate local government services to adapt to long-term climate projections ▪ Increased risk of erosion to agricultural land reserve (ALR) lands with increased spring freshet 	<ol style="list-style-type: none"> 1. Update floodplain mapping and bylaws 2. Enhance airshed management planning capacity and linkages to health outcomes 3. Coordinate IPP zoning and land use planning 4. Plan land use to address new industries and growth potential, including small scale agriculture and recognition of micro-climates 5. Inventory and review ALR lands for agricultural suitability, remove marginal land, and increase protection from changing climate 6. Orient subdivisions to maximize solar power potential, include in OCP zoning 7. Densification for compact development 8. Potable water planning for future development 9. Consider draw-down rates for surrounding aquifer 10. Utilize development planning in consideration of interface forest fire risks
Airport	<ul style="list-style-type: none"> ▪ Decrease in number of commercial flights being able to land due to increased number of fog days in fall-winter ▪ Decreased life span of runway infrastructure from increased freeze-thaw cycles, and increased amount of salt and de-icers 	<ol style="list-style-type: none"> 11. Install infrastructure improvements at airport to enable landing of flights that don't rely solely on visual landings only (i.e., GPS?) 12. Increase budget flexibility for snow removal 13. Assess demand for air travel as costs increase, and therefore assess airport viability and alternatives such as bus, rail 14. Integrate planning and delivery of emergency services such as medivac and forest fire aerial attack with local government airport functions

Current service – municipalities and CRD	Impact or vulnerability due to a changing climate	Recommendation
Snow clearing	<ul style="list-style-type: none"> ▪ Increased variability in snowfall from year to year will create budgeting difficulties ▪ Warmer winters with less snow, and increased frequency of rain/freezing rain/mixed precipitation events will require more salt/de-icers and traction material being applied 	<ol style="list-style-type: none"> 15. Enhance budget flexibility for snow clearing 16. Reduce public expectations for snow clearing 17. Limit urban sprawl and amount of snow clearing needed, by considering this at subdivision development phase 18. Increase versatility of equipment for other uses (e.g., garbage trucks with plows, or plows that sweep in spring, brush in summer) 19. Investigate alternative models of snow clearing, such as European methods
Roads/streets	<ul style="list-style-type: none"> ▪ Decreased life span of roads and sidewalks, (e.g., increased frost heaving, potholes, and degradation of concrete) from increased freeze-thaw cycles, and increased amount of salt and de-icers used. ▪ Increased need for dust control during drought or winter inversions 	<ol style="list-style-type: none"> 20. Investigate paving technology options and pilot project outcomes to increase longevity of road surfaces 21. Reduce expectations for paved surfaces 22. Investigate different methods of surfacing for storm water management 23. Increased quality of gravel with less dust 24. More effective dust control – remove fine material from winter abrasive traction control material in-town, but not out of town 25. Recycle winter abrasive traction control material that is cleaned up in spring
Invasive Plant Management	<ul style="list-style-type: none"> ▪ Increased demands for invasive plant management services due to increased spread of invasive species 	<ol style="list-style-type: none"> 26. Tarp agricultural products such as hay during transportation 27. Improve public education around garden invasive plants 28. Track invasive plants in gravel movement 29. Seeding of disturbed areas promptly
Economic Development	<ul style="list-style-type: none"> ▪ Increased need for economic development to capitalize in the positive aspects of a changing climate (e.g., agricultural opportunities due to longer growing seasons, agricultural composting business opportunities, recreation-related opportunities with shorter winters, bioenergy, etc.) ▪ Changes to tourism opportunities with shorter winters, longer summers 	<ol style="list-style-type: none"> 30. Assess immediate economic development opportunities within the context of future climate scenarios 31. Continue to investigate shared energy projects such as district energy heating between CRD, institutions, municipalities 32. Assess water availability in light of promoting agricultural economic development opportunities 33. Investigate non-trade incubators and alternative economic development drivers

Current service – municipalities and CRD	Impact or vulnerability due to a changing climate	Recommendation
Water	<ul style="list-style-type: none"> ▪ Decreased water supply in late summer as a result of earlier spring freshet – affecting surface water and also groundwater, with spatial and temporal variations ▪ Cumulative effects of upstream activities and changes in hydrology will be exacerbated, and continue to affect downstream municipal water quantity and quality (i.e., Bridge Creek watershed, San Jose watershed). ▪ Increased understanding of local interaction between surface water and groundwater systems is needed ▪ Decreased water quality when water quantity is decreased, due to concentration of contaminants ▪ Increase in treatment costs to supply water when quality has decreased 	<ol style="list-style-type: none"> 34. Increase understanding of groundwater – surface water interactions, starting with critical areas 35. Undertake watershed planning to influence activities upstream of municipal water intakes 36. Promote xeriscaping, alternative water harvest such as rain barrels, watering restrictions 37. Investigate greywater processing options 38. Continue to promote water conservation in municipal areas
Sewer	<ul style="list-style-type: none"> ▪ In general, limited to no impacts are anticipated as sewers are generally buried deep underground. ▪ In some cases, depth of sewer systems and proximity to natural features may cause concern 	<ol style="list-style-type: none"> 39. Infrastructure redevelopment needs to identify sewer system weaknesses 40. Assess the need for sewer in areas currently without sewer, such as Mountview, Deka Lake and others to minimize groundwater contamination risks in dense neighbourhoods
Storm water	<ul style="list-style-type: none"> ▪ Increase in spring freshet volume will strain capacity of storm water systems causing local flooding, and potentially damage the infrastructure ▪ Decreased life span of storm water systems from increased amount of salt and de-icers used on roads 	<ol style="list-style-type: none"> 41. Assess capacity of storm water systems, their life span and replacement plans 42. Infrastructure redevelopment needs to identify storm water system weaknesses 43. Assess alternative storm water systems such as ditches, rather than pavement/concrete 44. Assess open-grid paving and other permeable surfaces to reduce runoff and need for storm water systems
Protective/emergency services (fire protection, search and rescue, 911 telephone)	<ul style="list-style-type: none"> ▪ Increased demand on emergency management services and related social services as a result of increased frequency and intensity of forest fires, spring floods, landslides in unstable areas and avalanches ▪ Increased training demands to increase emergency response capacity in local government or volunteers 	<ol style="list-style-type: none"> 45. Increase human resources capacity to provide emergency/protective services and communications at key times of the year (i.e., spring freshet, forest fire season) 46. More training for non-trade human resources (i.e., pull jobs temporarily for people to serve during emergencies) 47. Implement more frequent response exercises

Current service – municipalities and CRD	Impact or vulnerability due to a changing climate	Recommendation
Police	<ul style="list-style-type: none"> ▪ Increased demand for police in rural areas during forest fires, spring floods and emergency events to enforce evacuations and provide communication and safety to residents 	48. Explore community policing options with provincial resources
Parks	<ul style="list-style-type: none"> ▪ Increased management needed due to pressures from invasive plants, flooding and impacts on park infrastructure ▪ Increased management needed due to longer recreation season and increased use and demand of parks 	49. Evaluate what parks are at risk, and explore alternative uses (i.e., gardens) and xeriscaping options 50. Assess impacts of ecosystem shifts on important or rare natural ecosystems, similar to what City of Prince George has done 51. Capitalize on natural parks for carbon credits
Solid waste management	<ul style="list-style-type: none"> ▪ Increased demand for management of woody debris as a result of interface fire treatments, and invasive plant management 	52. Assess future need for wood waste options only, not all solid waste
Communications	<ul style="list-style-type: none"> ▪ Increased demand on communication services as a result of increased frequency and intensity of forest fires, spring floods 	53. Continue to ensure capacity and protocols are in place for emergency communications 54. Investigate potential communications disruptions due to forest fire and other hazards/extreme weather events, and investigate alternatives 55. Investigate looping communications systems/infrastructure
Health Services	<ul style="list-style-type: none"> ▪ Increased frequency and intensity of respiratory issues due to poor air quality during forest fires or prolonged drought/dusty conditions in summer or during winter inversions ▪ Increased summer temperature will lead to increased incidence of heat stroke ▪ Introduction of new diseases such as West Nile virus 	<ul style="list-style-type: none"> ▪ No recommendations created.

SECTION 3 – Regional Development Strategy

Chapter 7 – Regional development strategy and relevancy to adaptation

There are a minimum of 14 matters that must be considered in a regional growth strategy, according to section 849 of the *Local Government Act*. While the regional development strategy will be different than a regional growth strategy, it was deemed a good starting point. The following regional development strategy matters to consider were agreed to as **most highly relevant** to climate change adaptation in the November-December 2010 sub-regional workshops (see chapter 8 for opportunity to address a changing climate, which explains the rationale why the matter was chosen as relevant to adaptation). Less relevant regional development strategy matters to consider that are of low or moderate relevance to climate change adaptation are included in Appendix 1. Note that the numbers are not concurrent and that all of these matters overlap and are connected.

Matter for RDS to consider
1. avoiding urban sprawl and ensuring that development takes place where adequate facilities exist
2. settlement patterns that minimize the use of automobiles and encourage walking, bicycling and public transit
3. the efficient movement of goods and people while making effective use of transportation and utility corridors
4. protecting environmentally sensitive areas
5. maintaining the integrity of a secure and productive resource base , including agricultural and forest reserves
6. economic development that supports the unique character of communities
7. reducing and preventing air, land and water pollution ;
9. adequate inventories of suitable land and resources for future settlement
10. protecting the quality and quantity of ground water and surface water
11. settlement patterns that minimize the risks associated with natural hazards ;
13. planning for energy supply and promoting efficient use, conservation and alternative forms of energy
14. good stewardship of land, sites and structures with cultural heritage value

The following additional matters were suggested to be considered in the RDS.

Additional matters for RDS to consider
15. tax base and revenue sources due to changing economies and resource sector.
16. intergovernmental efficiency of service delivery
17. addressing natural hazards affecting existing settlements

Chapter 8 – Recommendations to address a changing climate in regional development strategy

The following are the opportunities and challenges to address a changing climate in the regional development strategy, including the additional matters 15, 16 and 17. Note that the numbers are not concurrent and that all of these matters overlap and are connected. Recommendations are from the April 2011 workshop, and are a collection of input from across the region – they may be specific to one or more community and not apply everywhere.

Matter for RDS to consider	Opportunity to address a changing climate	Recommendation
1. avoiding urban sprawl	<ul style="list-style-type: none"> ▪ Limit urban growth to areas where existing services are already in place (i.e., water, sewer, streetlights, roads) to minimize costs of development ▪ Implement SmartGrowth for rural areas 	56. Plan collaboratively between different jurisdictions on long-term issues that are common 57. Determine what the limits to growth are, and how to balance economy and our resource and environmental capacity or limits to growth 58. Provide development incentives to densify in certain areas 59. In addition to zoning and tools currently available, shift subdivision control and jurisdiction to regional districts from MOTI 60. Require proof of water capacity before development of an area
2. settlement patterns	<ul style="list-style-type: none"> ▪ Densification of downtown areas to reduce reliance on automobiles ▪ Establishment of bike trails for commuting 	61. Plan for an aging population/community 62. Require existing infrastructure and services to be in place before settlement proceeds in a regional district 63. Establish maximum lot size, and diversity of lot sizes within a settlement area (i.e., Calgary) 64. Install escape routes in subdivisions for emergency evacuation
3. the efficient movement of goods and people	<ul style="list-style-type: none"> ▪ Minimize road and other infrastructure development and maintenance costs by utilizing existing transportation corridors 	65. Encourage local production of goods and reduce need for movement of goods 66. Encourage better rail utilization 67. Encourage compact development and mixed use (e.g., shopping available in neighbourhoods, don't separate them) 68. Encourage more efficient methods of transportation, multiple use of existing roads, and better use of existing systems as opposed to creating new systems 69. Investigate options for more frequent stops between major centres on regional bus routes 70. Encourage private sector options in under-served areas (i.e., Quesnel to Barkerville), and multi-purpose trips (i.e., grocery delivery, mail/courier)

Matter for RDS to consider	Opportunity to address a changing climate	Recommendation
4. protecting environmentally sensitive areas	<ul style="list-style-type: none"> ▪ Restoration of degraded ecosystems, in particular those that impact water 	71. Reduce pesticide and herbicide use through bylaws 72. Educate the public about lakeshore management 73. Identify critical ecosystems, protect from development and pollution 74. Enhance enforcement of current bylaws 75. Consider enhanced policies to ensure riparian integrity 76. Implement protected areas strategy recommendations of CCLUP
5. maintaining a secure and productive resource base	<ul style="list-style-type: none"> ▪ Agricultural and forest specific issues ▪ Policies and bylaws, direct involvement through management of community forests and other tenures 	77. Conduct detailed inventory assessments of agricultural land reserves (ALR), and protect the most productive 78. Enable bylaws or policies to promote local agriculture and food security, including education of the public 79. Reduce barriers to local food production 80. Encourage return to productivity of marginal forest and marginal agricultural lands to forest cover 81. Promote fire resistant tree species near communities
6. economic development	<ul style="list-style-type: none"> ▪ Identify how to support existing economic sectors such as forestry, ranching, mining and tourism in the future climate scenarios ▪ Identify new and emerging economic sectors that are appropriate will fit with the future climate scenarios in the sub-regions ▪ Agricultural diversification and processing opportunities ▪ Composting opportunities as a result of increased woody debris, invasive plants, or other ▪ Trail development ▪ Cultural heritage development 	82. Determine what new economic sectors are appropriate for the future climate scenarios 83. Implement CCBAC strategies 84. Change the sustained growth mentality 85. Celebrate small community 86. Selective economic development to ensure compatibility with environmental objectives and minimization of pollution
7. reducing and preventing air, land and water pollution ;	<ul style="list-style-type: none"> ▪ Airshed management planning, scrubbers on emissions ▪ Small scale settlement and development planning 	87. Assess opportunities for corridors for through-traffic to ensure efficient movement of vehicles, and minimization of air pollution in communities

Matter for RDS to consider	Opportunity to address a changing climate	Recommendation
9. suitable land and resources for future settlement	<ul style="list-style-type: none"> ▪ Ensuring future settlement areas are located where the land is suitable (i.e., not ALR) and sufficient water resources exist ▪ Address limits to development given limitations of natural resources 	<p>88. Utilize boundaries of natural systems, when addressing resource management issues (i.e., aquifers, watersheds, airsheds, habitats) and ignore administrative/jurisdictional boundaries</p> <p>89. Review the Agricultural Land Reserve boundary to remove marginal land, allow for increased density of communities, and enhance local food production</p> <p>90. Require earlier proof of water capacity or changing precipitation patterns before development of an area</p> <p>91. Avoid building communities at the upper elevations of watersheds with limited precipitation recharge to water bodies and aquifers (e.g., 108 Mile Lake, Chimney Lake)</p>
10. protecting ground water and surface water	<ul style="list-style-type: none"> ▪ Point-sources of contamination ▪ Storm water management systems ▪ Improvement districts and private water systems ▪ Mapping of aquifers and assessment of groundwater – surface water interactions ▪ Engage communities and residents to take ownership over the protection of aquifers (e.g., Kersley aquifer meeting, June 2011) 	<p>92. Assess feasibility of establishing water and sewer service to at-risk, dense neighbourhoods (i.e., Mountview, 10 Mile Lake, Dekka Lake)</p> <p>93. Assess groundwater supply and refreshment in areas of high demand and growth</p> <p>94. Assess vulnerability of aquifers based on overlying soil texture</p> <p>95. Assess feasibility of alternative water supply and distribution options (i.e., grey/black water recycling, storm sewer runoff collection) for uses where potable water is not required (i.e., irrigation, dust control, certain industrial uses)</p> <p>96. Increased policies and planning around watershed protection</p>
11. minimizing the risks associated with natural hazards;	<ul style="list-style-type: none"> ▪ Assessments of new settlement areas for risks associated with natural hazards (i.e., landslides, erosion, flooding, interface fire) 	<p>97. Implement FireSmart recommendations into zoning and permitting, and other innovative ideas beyond FireSmart</p> <p>98. Geotechnical and flood risk assessments where needed</p>
13. planning for energy supply	<ul style="list-style-type: none"> ▪ Develop shared heating/cooling that recaptures lost energy or is based on renewable sources ▪ Bioenergy potential ▪ Geothermal potential 	<p>99. Complete accurate projections of energy demand for the future climate scenarios (i.e., more air conditioning demand, less heating demand)</p> <p>100. Assess energy supply options, in particular renewable energy sources such as geothermal, or recaptured such as district heating/cooling systems, or turbines in sewer systems as in Lake Country RD/Kelowna</p> <p>101. Local building codes to address future climate scenarios</p> <p>102. Provide a mixture of incentives and requirements regarding energy supply</p>

Matter for RDS to consider	Opportunity to address a changing climate	Recommendation
14. land, sites and structures with cultural heritage value	<ul style="list-style-type: none"> ▪ Protect land, sites and structures from natural hazards ▪ Learn how early pioneers adapted to the climate in the past ▪ Economic development potential 	<p>103. Create MOUs with first nations, where applicable, for co-management of heritage sites</p> <p>104. Assess need for fireguards and flood protection of heritage sites</p>
15. tax base and revenue sources	<ul style="list-style-type: none"> ▪ Stable tax bases and revenue sources are required to replace the anticipated downturn in the forest industry ▪ This strategy could provide the basis for a funding request from federal or provincial government to implement this strategy 	105. Develop a strategic plan to address to evolving tax base and/or explore a new tax structure
16. intergovernmental efficiency of service delivery	<ul style="list-style-type: none"> ▪ Significantly reduced local government revenue sources as a result of a decreased tax base could lead to forced sharing of services, or a reduction in the kinds of services provided 	<p>106. Assess costs and demand of local government services are essential if future revenues are significantly reduced – which services are essential? Which would be eliminated?</p> <p>107. Change our social norms or societal expectations of what is expected from all levels of government (i.e., paved roads everywhere, sidewalk snow removal)</p>
17. addressing natural hazards affecting existing settlements	<ul style="list-style-type: none"> ▪ Long term plans to move existing settlements away from known natural hazard areas based on level of risk (i.e., Green Acres trailer park in Williams Lake, West Quesnel land instability, Cottonwood River and erosion) ▪ Restoration, remediation or mitigation of natural hazards 	108. Identify natural hazards that will be an issue in the future climate scenarios that are a threat to existing settlement areas, and create a plan to address hazards or move the settlements

SECTION 4 – Other opportunities and conclusions

Chapter 9 – Other regional and community plans and processes

The following plans can be used to address climate change adaptation, with examples of how adaptation has been or could be incorporated:

Type of plan or process	Example of how adaptation was/could be incorporated
Emergency plans and services	Ensure adequate resources are in place, or can be accessed when needed
Official Community Plans	Green Lake OCP was based on watershed boundaries, and acknowledged that the lake is a closed system with limited inflow and no outflow
Integrated Community Sustainability Plans	
Economic development plans	
Greenhouse gas management strategies	Planning for compact development
Community Energy and Emissions Plans	Planning for compact development
Subdivision servicing bylaws (regulate infrastructure)	
Operating budgets (for capital, too)	
Water and sewer bylaws, and rate bylaws	
Storm Water Management Plans	Ensure new projects consider future climate change scenarios
Airshed Management Plans	
Forest Fuel Management in Wildland Urban Interface Areas	Forest fuel management has taken place in several areas to reduce the risk and intensity of future forest fires: 108 Mile Ranch greenbelt areas; Williams Lake and surrounding area; District of Wells; Quesnel and surrounding area; Williams Lake Band, Xat'sull and Ulkatcho
Identification of Sensitive Ecosystems	
Agricultural Land Reserve	Identification of what's in, what's out, and removals
Watershed management planning	Assess future land use
Heritage Conservation Plans	Anticipate future threats
Aquifer plans and studies	Kersley aquifer meeting in June 2011 was a preventive meeting to raise awareness of vulnerability of aquifer based on sand/gravel and surrounding agricultural land use
Sustainability checklists for development	

Chapter 10 – Lessons learned for other regional districts in BC

The steps followed in the development of the strategy were as follows:

- *Learn* – what is each community doing around adaptation, how do they want to be involved, what services do they provide, what are the projected climate change scenarios for the region
- *Share* – through multi-jurisdictional workshops, share local knowledge about sub-regional variations to climate change, which services are vulnerable to a changing climate, how can a RDS help local governments adapt to a changing climate
- *Plan* – summarize what was heard and develop the strategy to feed into the RDS and current plans and operations

This case study was the first regional district-wide approach to address adaptation. As such, the following lessons were learned and are offered to other regional districts as they address their own adaptation plans and approaches:

- Utilize credible, science-based projections for future climate scenarios – but don't rely on them too much. They are just projections.
- Engage at the lay-person level – keep it accessible, don't intimidate people with overly complicated and technical jargon, graphs and statistics
- Utilize citizen science – recognize that people like to talk about the weather; ask people to verify the projections, ground-truth with their own observations and experience
- Make it relevant – recognize that local governments have always been adapting, and continue to adapt to a changing climate in their operations and planning. Identify tangible issues that they can relate to. This process is just more comprehensive and looks farther into the future than they are used to doing.
- Clearly define adaptation vs. mitigation, but point out that they are not mutually exclusive
- Recognize that there are different impacts and vulnerabilities in municipalities vs. regional districts, based on different services provided and different geographic scales
- Collaborate with member municipalities of a regional district – it's a good opportunity to work on a tangible project to address issues that cross administrative boundaries (i.e., a Planners' Working Group consisting of the planners of all local governments was convened to act as a steering committee for the project)

Chapter 11 – Conclusions

Adaptation to climate change by local government is already taking place; this was the first time it was named as such, and that a comprehensive strategy has been developed to look at preventive measures, not just reactive ones.

The following are the key recommendations of this strategy:

1. That the 108 recommendations in chapters 6 and 8 be considered for inclusion in the RDS, or in the development of a policy related to the RDS.
2. Develop a tool, methodology, checklist or process to assess the following:
 - For a proposed “growth” or “development” project or issue a, b, or c (i.e., a housing or infrastructure development, introduction of a new industry), what is the consumption of resource u, v or w (i.e., water, energy, or land), and what is the impact on resource x, y or z (i.e., fish habitat, species at risk, or groundwater supply)? Specifically:
 - What is the projected availability of resource u, v or w currently? In 20 years? In 50 years? In 100 years?
 - What are the competing demands for resource u, v or w?
 - What is the impacts on resource x, y, or z?
 - What protection of resource x, y, or z is needed?

Example: an area of marginal agricultural land within the CRD is identified for development of small lots, and approved to be removed from the Agricultural Land Reserve. This area is in a sub-region of the Cariboo-Chilcotin that has had a noticeable decrease in snowpack in recent decades, significantly warmer winters, and surface water has been drying up. Little is known about the aquifer or groundwater-surface water interactions. There is a salmon-bearing stream that bisects the parcel, and the area which is surrounded by Crown land is suspected habitat of the endangered spadefoot toad. The *Cariboo-Chilcotin Climate Change Adaptation Strategy* projects that this sub-region will continue to warm, precipitation will become increasingly variable. The proposal is to divide what was marginal agricultural land into 50-60 year-round residential lots that range from 1-2 acres in size. This area is outside of existing servicing such as water systems, sewer, streetlighting or other CRD services. The development of the lots are being heavily promoted by the developer to retirees from the lower mainland and Okanagan, and this would bring a significant economic boost to the area not just through the building phase, but with an influx of relatively wealthy new people into the region.

References

- BC Stats. British Columbia Regional District and municipal population estimates. Downloaded 7 July 2011 from <http://www.bcstats.gov.bc.ca/data/pop/pop/estspop.asp#totpop>
- Dawson, R.J., A.T. Werner, T.Q. Murdock. 8 Sept 2008. Preliminary analysis of climate change in the Cariboo-Chilcotin area of British Columbia. Pacific Climate Impacts Consortium. Downloaded 9 September 2008 from <http://pacificclimate.org/sites/default/files/publications/Werner.ClimateChangeCaribooChilcotin.Sep2008.pdf>
- IPCC. 2007. Climate Change 2007: Impacts, Adaptation and Vulnerability. <http://www.ipcc.ch/ipccreports/ar4-wg2.htm>
- Picketts, I., Dyer, D. and Curry, J. 2009. Adapting to climate change in Prince George: an Overview of Adaptation Priorities. Downloaded 26 July 2010 from http://www.resourcesnorth.org/downloads/Dev_Ops_Adapting_Climate_Change_adapt_priorities.pdf
- Swart, R. and Raes, F. 2007. Making integration of adaptation and mitigation work: mainstreaming into sustainable development policies. *Climate Policy* 7(4), 288– 303.

Appendix 1 – Low-moderate relevance to climate change adaptation

The following local government services were agreed to as **lower or moderate relevance** to climate change adaptation in the November-December 2010 sub-regional workshops.

Current service – municipalities and CRD	
Rural refuse	Feasibility study (including rural)
Recycling, composting	Streetlighting
Library	School (Wells)
Community halls	Transit
108 Greenbelt	Animal control
Arts and Culture, museum	Cemetery, crematorium
Heritage	Social development
Building inspection	

The following regional development strategy matters to consider were agreed to as **lower to moderate relevancy** to climate change adaptation in the November-December 2010 sub-regional workshops. Note that the numbers are not concurrent and that all of these matters overlap and are connected.

Matter for RGS/RDS to consider
8. adequate, affordable and appropriate housing ;
12. preserving, creating and linking urban and rural open space including parks and recreation areas

Appendix 2 – Web Resources

www.retooling.ca Retooling for climate change

www.toolkit.bc.ca BC Climate Action Toolkit

www.pacificclimate.org/ Pacific Climate Impacts Consortium

www.plan2adapt.ca Pacific Climate Impacts Consortium – interactive site with information

www.cbt.org/Initiatives/Climate_Change/?Adapting_to_Climate_Change Columbia Basin Trust, Adapting to Climate Change

www.youtube.com/watch?v=ECJtF7CfYcA Columbia Basin Trust animated video on Climate Change Science 101

www.climadapt.com/ A private sector driven environmental network providing innovative climate change adaptation expertise in Canada and internationally

www.adaptation.nrcan.gc.ca/index_e.php Natural Resources Canada Adaptation site

www.pics.uvic.ca/index.php Pacific Institute for Climate Solutions

www.cakex.org/ Climate Adaptation Knowledge and Exchange

<http://www.climate-decisions.org/> University of British Columbia and Carnegie Mellon University

www.c-ciarn.ca/index_e.html Canadian Climate Impacts and Adaptation Research Network

Appendix 3 – Sub-regional workshops summary

Summary of All Workshops as at 20 January 2011 North Cariboo – 17 November 2010 South Cariboo – 1 December 2010 Central Cariboo and Chilcotin – 16 December 2010

Fraser Basin Council is preparing a climate change adaptation strategy for the Cariboo Regional District, to help to create a more effective regional development strategy (RDS) that helps the region plan for the medium-term by incorporating the outputs of long-term climate scenarios. This is one of 22 Regional Adaptation Collaborative (RAC) projects underway in BC, funded by Natural Resources Canada.

The objectives of the workshops were as follows:

- Share projections of climate change impacts in the region, and identify sub-regional vulnerabilities
- Assess impacts on current services and infrastructure
- Seek input on how the regional development strategy should address climate change adaptation
- Encourage adaptation in current operations and plans

Between 9 and 12 local government elected officials and staff attended each of these sub-regional evening workshops. The purpose of this summary is to compare and contrast the sub-regional input received and inform workshop participants of what was discussed in the other sub-regions, as requested by some participants.

Interactive session #1: Overview of past trends and future climate change scenarios

Do these scenarios align with what you're seeing, and would expect in the future? If so, what have you witnessed that supports this. If not, why not?

- All sub-regions agree that the past trends for temperature were too conservative
- All sub-regions agree that winters would be warmer, but summers would not necessarily be hotter – generally consistent with the projections for temperature
- All sub-regions agree that precipitation projections are less reliable than temperature projections – for instance, they anticipate that summers will be wetter
- All sub-regions agree that weather patterns will be more extreme – for instance, while growing degree days are expected to increase, freak frost events will still occur keeping the length of the growing season the same
- North Cariboo participants have observed, and continue to expect in the future, a shift in the seasons with colder springs, warmer falls, and a delayed winter

What do you anticipate for specific sub-regional variations in temperature and precipitation? Why?

- All sub-regions anticipated an increase freeze-thaw cycles and an increase in freezing rain events in winter, throughout the region
- All sub-regions anticipate less change from current conditions in temperature and precipitation in eastern areas of their sub-regions (i.e., Cariboo Mountains areas from Wells south to Canim Lake area). While precipitation and snowpack levels will decrease, it was felt that this would be less “noticeable” due to the current high levels of precipitation, compared to other regions

- All sub-regions anticipate more change from current conditions in temperature and precipitation in the western areas of their sub-regions (i.e., Nazko area of North Cariboo, eastern Chilcotin areas of Riske Creek to Tatla Lake, and Meadow Lake, Canoe Creek and Big Bar areas of South Cariboo). Participants described these dry areas as continuing to dry, and that they are the hottest.
- South Cariboo participants anticipate less change from current conditions in temperature in the upper elevations of their sub-region (i.e., Sheridan and Bridge Lakes), and more change from current conditions in the lower elevation areas (i.e., 108 Mile Lake, Lac la Hache areas).
- South Cariboo and Central Cariboo and Chilcotin participants anticipate continued drying of surface water, especially in the drier western ecosystems. These drying trends are anticipated to impact groundwater as well

Interactive session #2: Current services and connection to adaptation

HIGH relevance for adaptation, aligned on similar rows

Current service - CRD	Current service - municipalities	North Cariboo	Central Cariboo and Chilcotin	South Cariboo
1005 Planning	Planning	Agree	Agree	Agree
1005 Planning 1111-1113 Airport	Airports Snow clearing Roads/streets	Agree with all	Agree with all	Agree with all, note that road maintenance not a CRD service, but it affects them
1010 Invasive Plant Management	Invasive Plant Management	Agree	Agree	Agree
1014, 1017, 1018 Economic Development	Economic Development	Agree	Agree	Agree
1005 Planning	Planning	Agree	Agree	Agree
1880-1889 Water in unincorporated communities 1770-1775 Sewer in unincorporated communities	Water Sewer Storm water	Agree with all	Agree with water and storm water, but not sewer	Agree with all
1319-1385 Protective Services (fire protection, search and rescue, 911 telephone)	Protective services Police	Agree	Agree, but police is not a CRD service, and high applies only to rural areas	Agree
	Health Services	Agree	Agree	Agree

LOW or MODERATE relevance for adaptation, aligned on similar rows

Current service – CRD*	Current service - municipalities	North Cariboo	Central Cariboo and Chilcotin	South Cariboo
1008 Rural Refuse 1009 Solid Waste Management	Solid waste management Recycling, composting	Move solid waste to high relevance, due to increased amounts of woody debris and invasive plants and opportunities for composting in agricultural business development	Move solid waste to high relevance	Agree (with initial ranking)
1546-1670 Recreation (programming and facilities), Library, Community Halls, 108 Greenbelt, Central Cariboo Arts and Culture, Heritage	Recreation (programming, facilities) Parks	Move parks to high relevance, due to increased pressures from invasive plants, flooding and natural hazards, impacts on park infrastructure	Agree (with initial ranking)	Move recreation to high relevance due to similar reasons listed in North Cariboo, and extension of recreation season and budget impacts
	Arts and Culture (museum)	Agree	Agree	Agree
1007, 1015 Building Inspection	Building inspection	Agree	Agree	Agree
1004 Feasibility Study 1019 Rural Feasibility Study		Agree	Agree	Agree
1430-1446 Streetlighting	Streetlighting	Agree	Agree	Agree
Communications	Communications	Agree (with initial ranking)	Move to high relevance, as needed during emergency events	Agree (with initial ranking)
	School	Agree	Agree	Agree
	Transit	Agree	Agree	Agree
	Animal control	Agree	Agree	Agree
	Cemetery, crematorium	Agree	Agree	Agree
	Social development	Agree	Agree	Agree

*Not all CRD services are listed, many are administrative, contributions, grants-for-assistance

What are the impacts of climate change to those services?

- All sub-regions anticipate that increased drought will result in an increase in number of forest fires, which will increase demand for many services, especially communications and protective services

- North Cariboo and South Cariboo participants noted an increase in protective services demand as a result of increased risk of landslides in unstable areas, and increased avalanche risk in mountainous areas as a result of variable types of snow
- All sub-regions anticipate an increase the number of poor air quality days due to forest fires and other causes
- All sub-regions anticipate increased risk of interface fires, which may result in increased woody debris at solid waste transfer stations
- All sub-regions, but South Cariboo in particular, noted impacts on water supply for domestic and other consumptive uses
- All sub-regions anticipate increased demands for invasive plant management, but also noted that wildlife species patterns will change that may impact urban areas (e.g., deer, cougars)
- All sub-regions anticipate impacts to, and decreased life span of roads, sidewalks and storm water systems from increased freeze-thaw cycles, increased amount of salt and de-icers used.
- All sub-regions anticipate more budget uncertainty as yearly weather cycles become more variable
- All sub-regions anticipate the increased importance of planning to identify areas appropriate for development, to identify areas such as flood plains and unstable areas, and to assess water resource availability prior to settlement or development, and to coordinate local government services to long-term climate projections
- All sub-regions anticipate increased need for economic development to capitalize in the positive aspects of a changing climate (e.g., agricultural opportunities due to longer growing seasons, recreation-related opportunities with shorter winters, etc.)
- South Cariboo participants anticipate increased demand for health services due to new health issues (e.g., increased incidence of heat stroke, movement of West Nile virus)
- Central Cariboo and Chilcotin participants anticipate a decrease in number of commercial flights being able to land, due to increased foggy weather

What challenges with services are you currently experiencing due to a changing climate?

- All sub-regions clearly identified funding challenges and increased costs for providing services in the future.
- North Cariboo participants elaborated that stability of the tax base is a significant cause of funding challenges – as much of the industrial tax base is resource-related industries such as forestry, the future of that industry will impact local government funding levels.
- All sub-regions listed increased demands of protective services and other staff, notably during the 2010 forest fire season, as a key challenge
- Central Cariboo and Chilcotin participants report that there has been a reduction in the ability of planes to land in winter in recent years, due to an increase in foggy weather
- Central Cariboo and Chilcotin, and South Cariboo participants have experienced water shortages and impacts on water quantity, resulting in an imposition of water restrictions
- South Cariboo participants report increased wear on road and sidewalk infrastructure and increased maintenance costs of salt and de-icing

Interactive session #3: Regional development strategy and connection to adaptation

HIGH relevance for adaptation, aligned on similar rows

Matter for RGS/RDS	North Cariboo	Central Cariboo and Chilcotin	South Cariboo
1. avoiding urban sprawl and ensuring that development takes place where adequate facilities exist	Agree	Agree	Somewhat agree, but isn't this mitigation?
2. settlement patterns that minimize the use of automobiles and encourage walking, bicycling and public transit	Agree	Somewhat agree, but isn't this mitigation?	Agree
3. the efficient movement of goods and people while making effective use of transportation and utility corridors	Agree	Agree	Agree
4. protecting environmentally sensitive areas	Agree	Somewhat agree, isn't this mitigation? If it remains high relevance, move RDS #14 up to high relevance	Agree
5. maintaining the integrity of a secure and productive resource base , including agricultural and forest reserves	Agree, but add mining too	Agree	Agree
6. economic development that supports the unique character of communities	Agree, but highlight partnerships between municipalities	Agree	Agree
9. adequate inventories of suitable land and resources for future settlement	Agree	Agree	Agree
10. protecting the quality and quantity of ground water and surface water	Agree	Agree	Agree
11. settlement patterns that minimize the risks associated with natural hazards ;	Agree	Agree	Agree
13. planning for energy supply and promoting efficient use, conservation and alternative forms of energy	Agree	Agree	Agree

LOW or MODERATE relevance for adaptation, aligned on similar rows

Matter for RGS/RDS	North Cariboo	Central Cariboo and Chilcotin	South Cariboo
7. reducing and preventing air, land and water pollution ;	Move to high relevance due to smoke from forest fires, sedimentation from flooding, etc.	Move to high relevance due to smoke from forest fires, sedimentation from flooding, etc.	Move to high relevance due to smoke from forest fires, sedimentation from flooding, etc.
8. adequate, affordable and appropriate housing ;	Agree	Agree	Agree
12. preserving, creating and linking urban and rural open space including parks and recreation areas	Agree	Agree	Agree
14. good stewardship of land, sites and structures with cultural heritage value	Move to high relevance, these are at risk with forest fires, and could be ec dev opportunity	Agree (with initial ranking) but move up to high relevance if RDS #4 remains at high relevance	Agree (with initial ranking)

What are the opportunities to address climate change adaptation in the regional development strategy?

- Opportunity for CRD and municipalities to work together on shared challenges and long-range planning initiatives
- Economic development opportunities to capitalize on some positive impacts of a changing climate
- Opportunity to address limits to development, given resource limitations (e.g., water in certain areas)

Beyond the 14 matters, are there any others to address?

- Add tax base and revenue sources due to changing economies and resource sector.
- Add duplication of services.
- Specific opportunities for RDS #6 economic development are trail development and cultural heritage
- Natural hazards affecting **existing** settlements i.e. Williams Creek – slides, water back-up/flood sewage lagoons. (RGS matter #11 only addresses future settlement patterns.)

Evaluation and Next Steps

- Merge together the information from all 3 sub-regional workshops and send out to everyone (i.e., this report)
- Form a working group of planners to provide input on the development of the strategy
- April 2011 – region-wide workshop to provide follow up to the sub-regional workshops, and provide feedback on the draft strategy
- 27 May 2011 – presentation of draft strategy to CRD board
- Late August – strategy finalized
- Communications strategy for the Regional Development Strategy to be developed