Appendix M - Briefing sheets

1. Introduction
2. Overview
3. Agriculture and food security
4. Water supply and demand
5. Water data
6. Watersheds

KASLO/RDCK AREA D PARTNERSHIP

Climate Change Adaptation & You

What is climate change adaptation?

Adapting to climate change refers to actions by individuals and organizations to avoid or take advantage of current and future climate changes and impacts.

Adaptation is about being prepared, being resilient and being ready as we can be for a future climate that is different from what we have seen in the past.

Examples of climate change impact and how it could affect Kaslo/Area D

Water Supplies - Lower stream flows in summer.
Q: What will lower flows mean for drinking water and how would we adapt to that?

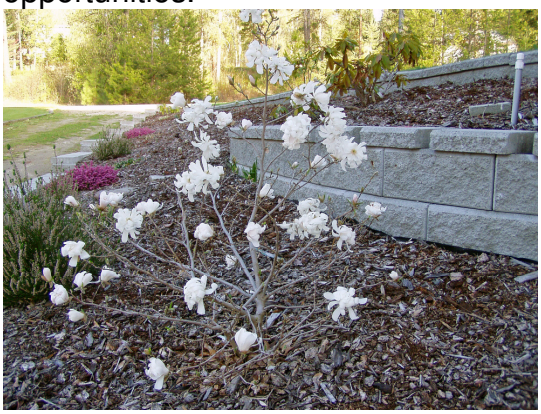
Ground transportation - Mud slides and floods could wash out bridges & roads.
Q: How could we prepare for that now & avoid washouts?

Agriculture - Higher temperatures alter irrigation needs
Q: What crops might be suitable in new growing season?

Learn more!
www.rdck.bc.ca/adaptation
Join the discussion group: send an email to
climateadaptation_kaslo_aread-subscribe@lists.groundwire.org
leave the subject line blank.
Contact: areadadaptation@columbiawireless.ca,
Project Coordinator 250 358 2721

What is Kaslo/Area D climate change adaptation project all about?

Our climate change adaptation project will help us see where we are likely to be most vulnerable (or at risk) to the local impacts of climate change, and if there are new opportunities. When we know that, we can decide what actions we can take to reduce risks and capture opportunities.



How will we decide what adaptation actions we might take?

* Increasing our understanding about climate change and expected local impacts
* Identifying priorities;
* Assessing vulnerability, risk & opportunities
* Developing adaptation strategies and actions
* Implementing & monitoring
* Engaging with local communities & businesses

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This project is part of Columbia Basin Trust's
Communities Adapting to Climate Change Initiative

www.cbt.org/climatechange

Contact: Coordinator, Tim Sander areadadaptation@columbiawireless.ca (250) 358 2721

PROJECT OVERVIEW

Our climate change adaptation project will help us see where we are likely to be most vulnerable to the local impacts of climate change, and what opportunities might exist. When we know that, a strategy can be developed that will help us reduce vulnerabilities and capture opportunities..

Who is doing something?
The Village of Kaslo, RDCK/Area D and a Steering Committee of local people are working with scientists and technical experts to look at the changing climate and what this may mean for the area. We are one of the project communities for the Columbia Basin Trust's Communities Adapting to Climate Change Initiative.

What is being done?
Information is being collected for action recommendations, due to be agreed to in the summer of 2010. Future actions and monitoring will be central to the project.

What are the priorities?
The Steering Committee decided to concentrate on examining the impacts, vulnerabilities and opportunities for water availability and agriculture/food security.

Who is this for?
This will be used by the Regional District and Village Council to help local households, community groups and businesses prepare for and adapt to changing climate.

What is the timescale for this project?

November 2009	Steering committee formed
January 2010	Coordinator appointed
	Presentation to Steering Committee on preliminary climatic data projections
February	Expert visit to investigate potential priority issues and data gathering Steering Committee sets priorities: water availability, agriculture/food security
March	Agriculture/food security discussion for CBT project community reps Steering Committee introduced to impact mapping for the priority topics
April	Public engagement events on climate change impacts
May	Compilation of data, looking ahead
June	Vulnerability and opportunity assessments on priority topics
July	Action recommendations with public outreach Next steps

Steering Committee Members

Andy Shadrack, RDCK Area D Director
Bill Wells, Kaslo & District Community Forest Strategic Planning Team
Bob Dovey, Mirror Lake Water Users Vice-Chair, Area D Area Planning Commission
Greg Lay, Mayor Kaslo Village Council
John Alton, West Kootenay Eco-Society
John Addison, Kaslo Chamber of Commerce
Aimee Watson, Kaslo Food Security Project
Linda Brooks, Meadow Creek
Paul Sneed, Selkirk College
Rae Sawyer, Village of Kaslo
Rhonda Ruston, Shutty Bench Area D Area Planning Commission.
Gail Spitler, Johnsons Landing
Michelle Laurie, CBT Communities Adapting to Climate Change Initiative Coordinator
Ramona Mattix, Development Control Manager, Regional District of Central Kootenay

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The Climate Adaptation and You project is supported by the Columbia Basin Trust. To learn more about Columbia Basin Trust's Communities Adapting to Climate Change Initiative visit www.cbt.org/climatechange.

Agriculture and food security in Kaslo/Area D

(Dylan Hackenbrook, David Springer, Shannon Swayze, Selkirk College 2010, edited by Aimee Watson)

Land allocation

- average North American diet requires 0.524 hectares of productive farm land to be sustained annually (Grow BC 2008) – this is obviously a very rough estimate but is one way of assessing what is need in the way of productive lands for a population
- Kaslo and Area D could be not be "food secure" because 1,362 hectares of land would be required
- 885 hectares of developed or cleared (agricultural) lands in Area D, and 6,630 hectares of forested, undeveloped (non-agriculture land) within the ALR
- under utilization for ALR and farm land, vast majority is forested land
- very little of the ALR is used for commercial farming/food production
- very little information is publicly available on farm production and food export

- Existing Farms in ALR = 49 Ha
- Existing Farms not in ALR = 21 Ha
- Unutilized Farms in ALR = 996 Ha

These numbers for "farm" land in ALR are higher because a different data set (RDCK cadastral and BC Assessment authority) was used than above where on provincial ALR data was used along with analysis of aerial photo imagery. However, in either case, there does not appear to be enough cleared or developed agricultural land in the ALR alone to feed the current population of Kaslo and Area D.

Food crops known to be grown commercially

- carrots, potatoes, leeks, cabbage, parsnip, corn, fava beans, tomatoes eggs
- No meat – nearest abattoir Creston
- Very little commercial grain and fruit produced

Problems faced with food growing:

Land access
Difficult to compete with industrial prices
High Cost of producing organic, high quality veggies
Lack of licensing administrative body for abattoirs
Lack of Storage Facilities

Food security initiatives

Re-launched Kaslo community garden program
Kaslo Food Charter
Food Security and our Official Community Plan
West Kootenay Food Directory
Founding of Community Garden Society of Kaslo
Community Kitchen Feasibility Study
Workshops: Canning, Cooking, Gardening, Seed Saving
Speaker Events: 8
Kaslo's Seedy Saturday
North Kootenay Lake Food Assessment
North Kootenay Lake Local Market Analysis
Director for Kootenay Local Agriculture Society
Director for Canadian Biotech Action Network

Ongoing Programs:

Lawns to Gardens- 3 gardens successfully installed!
Video Publication to showcase and educate about Lawns to Gardens
Community Garden
Demonstration Garden
Food for Families
Bulk Food Club
Food Hub working group
Food Policy working group
Farmer availability lists
Knowledge Pantry
Provincial Food Action E-Brief

Climate Change Adaptation Project & You! Food questionnaire summary
Aimee Watson

10 questionnaires's returned
Of those 10:

- 4 were homesteaders
- 4 commercial farmers (2 selling farmgate, not retail as their product are not deemed "legal")
- 2 were potential farmers or working towards farming

Of the commercial farmers:

- 3 meat producers (beef, rabbit, chicken, goats- none are legal at this moment)
- 1 hay producer
- 1 grain producers
- 2 veggie growers
- 2 dairy (eggs, yoghurt, cheese)
- 4 organic, 0 certified

Not on the surveys, but observed in comments:

- 2 retired farmers
- 1 beekeeper retired due to loss of hives
- 1 retired due to loss of market, regional distributor went out of business

Limits to Farmers

- Land access
- Market potential (global prices continuously undermine true costs and make the ability to sell for profit in the retail market impossible)

<u>Climate Change Summaries</u>
All agreed on the following observations:

- Seasons are different every year
- Longer summers
- Hotter summers
- Less snow
- Less water
- Less mushrooms
- Less glaciers

Analysis of Present/Future Water Supply and Demand Issues
Preliminary Findings
***(*Hans Shreier, Martin Carver, Arelia Werner)**

Question: How will projected climatic changes affect water provision for Kaslo/Area D?
Why do we want to know this? If precipitation and melt patterns alter due to climate change, will demand outstrip supply in years to come under present consumption levels?
Quick answer: Initial findings indicate that water conservation measures need to be seriously considered to avoid costly water shortages.

Water supply findings include:

- Increased monthly maximum temperatures in both late winter and late summer
- Highest increases occur in January-February and September.
- No clear trend in total annual precipitation (rain & snow) from 1950-2006 (same amount but more rain and less snow).
- Marked decrease in precipitation in January and February and increase in March and April.
- Snow accumulation, particularly at lower elevations, has declined between January and March with the largest declines in February.
- The peak flow is occurring earlier in the season.
- July and August rainfall declining since the mid 1970s. This means less base flow as a result of higher temperatures, more evaporation and less rainfall.
- Evidence for increased annual discharge for Kemp Creek
- Increased streamflow between November to April
- Lower streamflow during May-September, particularly in July at a time when the water demand and environmental stress is usually the highest.

Water demand findings include:

- Only 3.5 years of domestic water use data available in Kaslo
- Highest demand usually occurs in the July-August period.
- Average annual consumption (water provided by the treatment plant) per person between 1000-1100 L/person/day (excluding water use for the golf course).
- Golf course consumption highest in May and June (13-18% of the domestic water used)
- Golf course consumption lower in July/August (6% of domestic water used)
- Total residential demand can reach more than 2300 L/person/day during hot summer days in July and August.

Conclusion

There is a need to adapt to changing conditions, eg through water conservation, especially in the short term.

- Further modeling and comparisons are recommended.
- Climate change can be partly verified by trends in the historic climate data and some of the modeled discharge data.
- Earlier peak flow and lower summer low flow are of concern.

Climate Impacts on Local Water Availability and Quality – STATUS REPORT

***Purpose**:* Assess how climate change will impact the availability and quality of year round accessible water.

Resource people involved

CBT Technical Support:

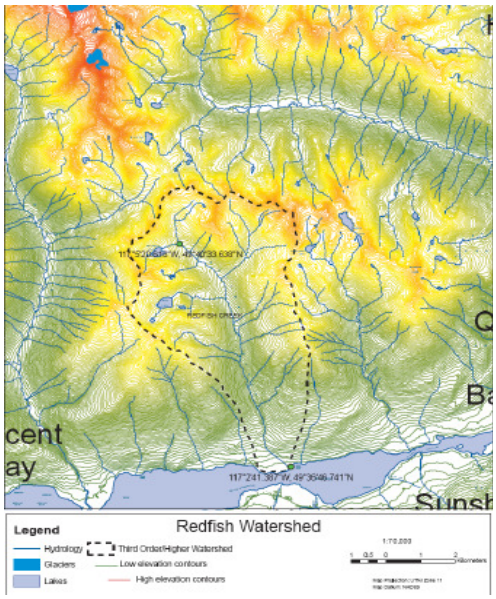
- Arelia Werner, Pacific Climate Impacts Consortium (PCIC)
- Hans Shreier, UBC
- Alan Hamlet, Climate Impacts Group (CIG), University of Washington
- Martin Carver, Hydrologist

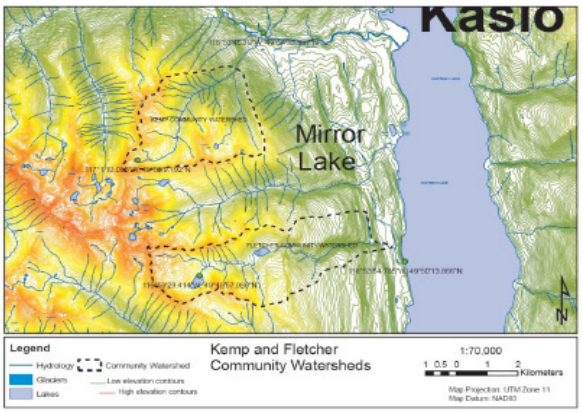
Kaslo/Area D Local Project Support:

- Paul Sneed, Selkirk, GeoSpatial Research Centre
- RDCK planning staff
- Bill Wells

Selected watersheds and data availability

- Redfish Creek (area 26.2 km2) – data for 1932 to 2010
- Kemp Creek (watershed for Village of Kaslo - area 11.9 km2) – data for 1929-1930
- Fletcher Creek – no data





These watersheds are snowmelt dominated, without any glaciers. Modeling work has been done on these watersheds by a hydrologist from PCIC. A model was used that is designed to assess stream flow from snowmelt dominated watersheds. It does not address glacier fed flows, or groundwater and storage.

What we now know about future stream flow with changing climate

- Peak flows are likely to arrive earlier and higher flows could occur over time

- Low flows are likely to start earlier and continue later into the fall, and flows could become lower over time
- Snow fall and snow pack are expected to decline. With less snow, and earlier melting, there will be longer dry periods.

What activities are planned?

- Hydrology and climate-change modelers will forecast:
  - tabulated monthly streamflow change as a percentage of existing flows and
  - apply a reservoir model to assess how inflows to water systems are expected to change in the future.
- RDCK and Martin Carver will acquire necessary reservoir model data, i.e. water licenses and observed data from public works staff and users.
- Selkirk College students will prepare maps to help compare the Redfish watershed to others streams on the western side of Kootenay Lake to discern how representative it is of other systems. Information collected will include:
  - % types of vegetation cover
  - % area lakes
  - % area glaciers
  - % area bare soils/rock
  - Average annual min and max temperature
  - Average annual rain, snow, precipitation
  - Geology
  - Elevation distribution
- Detailed modeling to provide projected snow melt per 100m rise in elevation to give a greater understanding of drainage and storage.
- Compare 6-8 creeks as per above characteristics, water demand data, water license data and potential groundwater sources: eg Laird Creek, Kaslo Creek, Bjerkness Creek, Lofstead Creek, McDonald Creek.

Timeline

March 19 Initial impact mapping of water availability with Steering Committee and technical supports

April 9 (to be confirmed) Public event to describe climate change project and science, impact mapping, description of modeling and expected outcomes

April 15 Maps for approximately 6 creeks with environmental characteristic comparison completed by Selkirk College and RDCK information gathering re: water licenses done

April 30 Observed demand data collected and synthesized by Martin Carver

May 15-30 Arelia Werner to extract available data from CIGs run of the Variable Infiltration Capacity (VIC) model and to compare with observed data, Hans Shreier to import appropriate results into Exel based water supply and demand model.

May Hans Shreier to collate and analyze information

May Project Coordinator to collect, synthesize and create background report on water availability for vulnerability/risk assessment and outreach

June 1/2 or 4 Potential vulnerability/risk assessment on water availability and adaption action listing

June 15 Water availability adaptation actions/strategies prioritized by Steering Committee with public input

Background information

- Nobody takes groundwater in Kaslo; systems are spring or stream fed

Water System (Treatment plant and pumphouse)

History

- Started in 1980's - 15-20 years old
- Village of Kaslo has owned for 3 years. Previous owner of the plant (for past 10 years) kept no records and nothing worked when Kaslo took over.

Watershed

- Draw out of Kemp Creek – and drawing every drop (not a fish bearing stream)
- There are no roads in the watershed
- Kemp Creek terrain is relatively stable
- Forest fire in ¼ of the watershed; trees are still standing.
- There are 3 springs available to get an extra 10% into the system.

System

- Downflow gravity fed system
- 1 million gallons/day = 4 million liters for 1,300 people
- Total of 200,000 gallon storage capacity for treated water = couple of hours water storage in the spring and a couple of days in winter
- 1.5 million gallons of untreated upriver water storage - possibility to bypass line, link with reservoir and put a boil water advisory in place.
- Treatment level is okay, depends on turbidity levels
- Automatic controls but manual is possible
- Just bought back-up generator and 2nd compressor back up
- Most of maintenance is done internally
- Pumphouse located beside the Kaslo River has rip rap protection

Users

- Commercial in town is on this system as well as the golf course and village parks

Water conservation

- Golf course is using treated water to irrigate greens.
- The Village waters parks.
- In summer, there are some voluntary sprinkler bans

Potential Vulnerabilities

- The system operates at a maximum for a couple of times a year.

- Liner for the reservoir has 20 year life span and Kaslo's is on year 22. Looking for funding. It is cleaned every year, 8 inches of sludge collects. Pumps are run when cleaning the reservoir. Reservoir sludge is going down with settling which is helpful. Would like sensors to detect levels as currently checking only every 2 days. This could reduce need for bigger reservoir.
- The potential of the pumphouse being damaged by flooding (high water and log jams) is a weak spot in the system.
- Landslide between pipe and pump station in 1999.
- Avalanche in 2009, no power for 2-3 days, back up generators for sewage and pump.
- Wash water goes into Kaslo Creek; can be seepage from ground around.
- Need to look at the Infiltration Gallery.
- Trained people - only 1.5 people now with knowledge

Options

- Kaslo River has turbidity issue, silts quickly.
- Concern is Whitewater Creek is 'creeping' and goes into Kaslo River.
- Back up pump in the river is possibility but not easy, due to turbidity issues.
- Discussion of lake treatment plant, perhaps for golf course.
- Other needs: better infiltration gallery on the river. Still need pumping but 200 vertifcal feet.
- Lower part of town is all gravel, upper has some clay, ½ gravel.

Sewage Treatment Plant

- Located on edge of Kootenay Lake.
- Capacity is 1 street in town, commercial, marina and condos; 60 new condos in development, 6-12 new homes this year.
- Most residential is on septic
- Need to do more - would like to add more streets
- Need liquid waste management plan as 1st step
- Has module structure so should be able to add.

Comparison of Kaslo watersheds

Question: Are the 3 Kaslo watersheds Kemp, Fletcher and Bjerkness Creeks similar to Redfish Creek?
Why would this be useful? There are extensive archived readily accessible data sets for Redfish Creek so it would be useful if it was found that the 3 water sheds were similar in water collection and supply ability.
Conclusion: Unfortunately, the statistical and physical analysis results of the watersheds show that the four creeks are different from each other.
Kemp and Redfish have a very similar elevation gradient with the majority of area above 1500m elevation (only 20% of the watershed area is below 1500m). However, the aspect is very different.
In contrast Bjerkness and Fletcher have similar elevation gradients but 20% of the watershed is below 1000m and 40% is below 1500m. This mean these two watersheds are more vulnerable to loss of snow accumulation in the future than Kemp and Redfish.
Slope influences rate and direction of water flow
Aspect influences the rate of snow melt as well as evaporation of water throughout the watershed area.

RECOMMENDATIONS

- set up local weather stations – precipitation, temperature, snowpack
- collect information on stream flow (water availability) and water usage (metering)
- combine data from multiple watersheds and average to make model
- further analysis to consider Redfish data to be used to represent Kaslo watersheds

Measure	Redfish Creek	Kemp Creek	Fletcher Creek	Bjerkness Creek
Watershed code	340-186300	340-215300-16300	340-214600	340-215000
Aspect	S	NE	E	E
Length (km)	8.69	6.46	9.28	10.23
Watershed Area (ha)	2729.1	1271.3	1785.3	2706.6
Min Elevation(m)	532	659	532	548
Max Elevation (m)	2362	2429	2520	2566
Elevation change (m)	1830	1770	2018	1988
Stream magnitude	10	5	2	11
H60 (m)	1700 (H65)	1860	1700	1700
Shape	Teardrop	Teardrop	Elliptical	Elliptical
% lakes	0.75	1.23	0.70	0.84

(Cris Gray, Katie Ward, Melissa MacLeod 2010)