Nicola Water Use Management Plan

Draft Report

Prepared on behalf of the:
Citizens of the Nicola Watershed

Prepared by:
Nicola WUMP Multi-Stakeholder Committee

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Our Vision

... a sustainable supply of quality water that ensures a balance of social, economic, traditional and ecological values.

Our Mission

... to guide the sustainable use of the water resources of the Nicola watershed in order to support the social, economic and ecological well being of our communities in perpetuity.

In the fall of 2004, the residents of the Nicola Watershed endorsed the development of a water use management plan to address issues related to water, fish flows and the Nicola dam. To guide the planning process, the residents agreed to the above vision and mission statement

Acknowledgements

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BC Federation of Fly Fishers

British Columbia Ministry of Environment

City of Merritt

Fisheries and Oceans Canada

Fraser Basin Council

Highland Valley Copper

Ministry of Agriculture and Lands, Integrated Land Management Bureau

Nicola Stock Breeders Association

Pacific Salmon Foundation – Fraser Salmon and Watershed Program – Living Rivers

Real Estate Foundation of British Columbia

Spences Bridge Steelhead Advocate Association

Steelhead Society of BC

Thompson Nicola Regional District

Watershed Watch Salmon Society

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Acronyms

ALR	Agriculture Land Reserve
BC	British Columbia
BMP	Best Management Practice
COM	City of Merritt
DFO	Fisheries and Oceans Canada
EFP	Canada – BC Environmental Farm Plan[1]
EMA	BC *Environmental Management Act*
FN	First Nation
GW	Groundwater
GWPR	BC Ground Water Protection Regulation (under the *Water Act*)
IFN / IFR	Instream Flow Needs / Requirements
IHA	Interior Health Authority
INAC	Indian and Northern Affairs Canada
ISWP	Integrated Source Water Program (for the City of Merritt)
IIABC	Irrigation Industry Association of British Columbia
LWS	BC's *Living Water Smart Plan (http://www.livingwatersmart.ca)*
MAL	Ministry of Agriculture and Lands
MLA	Member of BC Legislative Assembly
MO	Ministerial Order
MOE	Ministry of Environment
MSC	NWUMP Multi-Stakeholder Committee
NMP	Nutrient Management Plan
NTA	Nicola Tribal Association
NWAC	Nicola Water Advisory Council
NWCRT	Nicola Watershed Community Round Table
NWUMP	Nicola Water Use Management Plan
OCP	Official Community Plan
PSF	Pacific Salmon Foundation
QWD	Qualified Well Driller
SC	NWUMP Steering Committee (formerly known as the Planning Team)
SW	Surface Water
TNRD	Thompson Nicola Regional District
WL	Water License
WMP	Water Management Plan (under Part 4 of the *Water Act*)
WSC	Water Survey of Canada
WUMP	Water Use Management Plan

[1] A partnership between Agriculture and Agri-Food Canada, the BC Ministry of Agriculture and Lands and the BC Agriculture Council (for more information see http://www.bcac.bc.ca/efp_programs.htm).

Executive Summary

Without water there is no life. The quantity, accessibility and quality of water have a direct bearing on the health, well-being, prosperity and sustainability of a region's human, animal, and plant populations. As the number of people who call the Nicola watershed home continues to grow, and as the local economy expands to meet the needs of that growing population, there will be increased pressures on the available water resources. Increased competition for this vital natural resource will lead to conflict between various users if equitable 'rules of the game' are not developed. To avoid conflicts and to address existing and emerging water issues, residents of the Nicola watershed and others are developing a water use management plan.

On October 14-15 of 2004 the Nicola Watershed Community Round Table held a workshop in Merritt entitled *Charting Our Water Future*. The catalyst for the workshop was a series of events[2] associated with the drought of 2003. The workshop brought together a large and varied group of people who were interested in proactively addressing the ongoing water management issues that the region was experiencing. Following the workshop an inaugural meeting of what is now known as the Nicola WUMP was held.

A four-phased planning process was adopted. Phase 2 of the process involved the development of a draft WUMP – ***this draft report therefore signals the end of Phase 2.*** Phase 3 will entail a broader review and feedback by the public, First Nations and government agencies as the plan gets finalized. Phase 4 consists of implementing the plan and adapting it as new information is collected and assessed.

The main purpose of the plan is to, *"ensure that the future water supply will be divided equitably among all water users balancing the community's social, economic, traditional and ecological values".* In other words, the plan is meant to address critical water issues that have occurred or which are likely to occur in the immediate future. Some of the general issues instrumental in driving the development of a WUMP include:

- Insufficient water for both irrigation and fish (instream flow needs) during summer and early fall low flows;
- New zoning and land development pressures, in certain areas, have led to greater water demand and placed greater risk of insufficient water supplies being available to meet existing water uses.
- Inadequate groundwater controls or regulations, in place, which further threaten base flows in streams. Without some regulation, there is a loophole for persons wanting access to surface water (e.g. pending water license applications), as they could simply drill wells into

[2] The 2003 drought led to a heightened awareness about the consequences of low flows on fish populations and the potential impacts on water license holders (with fish clauses) who might be instructed to reduce their water use during critical periods. An announcement in March 2004 via a news release and subsequent front page article in the Vancouver Sun, also drew attention to the Nicola River as the most endangered river in British Columbia. The outlook for 2004 looked as though it could be another drought year in the Nicola watershed with potentially more years of low flows to come. The impact of these low flow periods on the agricultural sector, in particular, led to the Nicola Stockbreeders' Association initiating a process of strategic water management planning. A series of meetings were also called and chaired by then MLA, Dave Chutter, in May of 2004, to address a long outstanding issue - the Nicola dam - and to discuss a broader drought strategy.

the underlying aquifers without consideration of the resulting surface water effects[3] or potential interference effects on adjacent wells.

- In times of drought, surface water license holders can be asked to abide by regulatory requests for voluntary curtailments of water use or restricted water provisions can be imposed if fish clauses are associated with their licensed rights. These periods can impose significant economic hardships on the agricultural sector and threaten the livelihoods of farmers and ranchers.
- Poor water quality from land use practices has been raised as a major concern. It should be noted, however, that during the development of the WUMP, it became apparent that there was insufficient baseline data to evaluate policy instruments that would reduce the risk of contamination.

The planning process was structured around two main committees: the Steering Committee (SC, formerly the Planning Team) and the Multi-Stakeholder Committee (MSC). The SC provided organizational and technical support in between MSC meetings; the MSC was responsible for decision making during the plan's development. In addition, a number of sub-committees were formed to aid the MSC. The Nicola Watershed Community Round Table provided administrative and support services throughout the process.

During the WUMP planning process 26 objectives were agreed to which served as the foundation for the recommended policy instruments discussed in Section 6. In addition, a series of *Guiding Principles* were agreed to for 'how' the recommendations should be further developed and implemented. In all, ten *Guiding Principles* were agreed to, as follows:

1. *Recognize and promote the value of water, as it is a precious and limited resource.*
2. *Recognize the interconnection between surface and ground water throughout the watershed.*
3. *Recognize that water quantity and quality are required for healthy ecosystems and safe drinking water throughout the watershed.*
4. *Recognize and commit to integrated land and water use planning.*
5. *Recognize that water allocation and other management decisions need to be made in an open, transparent, and equitable way.*
6. *Promote and prioritize water efficiency through conservation and water storage.*
7. *Use the best available information to adaptively manage the WUMP.*
8. *Avoid costly and unsustainable conflicts tomorrow with timely and proactive investment today.*
9. *Recognize that everyone is affected and has a shared responsibility in water management: Active participation and information sharing are necessary in order to lead to more effective water management decisions.*
10. *Recognize and celebrate the achievements of the WUMP.*

[3] There is a regulation for new wells if their capacity exceeds 75 litres per second, which triggers an environmental assessment. There are very few examples of environmental assessments for new wells in the province.

WUMP Information Gathering

During the development of the draft WUMP, the MSC was actively collecting and sorting through relevant documents, thus expanding the information base to make wiser water management decisions now and into the future. Over $340,000 was spent on studies to address critical data gaps (see Section 4 for an annotated bibliography of the research that was drawn upon). A few highlights from the research are:

- Climate change is having a significant effect on the precipitation patterns and hydrology in the Nicola Watershed leading to dryer and more prolonged periods of low flows through the late summer and winter in some years. This trend will likely continue into the future.
- Groundwater discharge to surface water is the primary source of stream base flow. Any groundwater extractions and off-stream use (e.g. consumptive) in the Nicola Watershed will reduce downstream flows.
- Based on a water budget analysis of instream flow requirements for fish and water needed for off-stream use (e.g. irrigation), the Nicola Watershed as a whole has a net surplus of water on most years in terms of how much water is available (supply and storage) versus how much is needed to meet existing water demand. However, there is a timing and distribution challenge between when water is needed and when it is available. During typical drought periods (1 in 10 year event) every sub-basin in the Nicola Watershed has a water deficit through the summer and fall (July to October) and therefore there is insufficient water to meet irrigation and instream flow requirements even when dam storage is factored in. Despite the fact that over the next 10 years there may be slightly more water available as a result of the effects from the Mountain Pine Beetle infestation, this gain will be more than offset by rising demand. Therefore, the consistent and general trend will be an increasing water deficit (in drought years) over the next 40 years as there will be less water supply and greater water use unless action is taken.
- If a sub basin is at a water deficit, all upstream sub basins should also be considered to be at a deficit because of the critical contribution from those upstream sources.
- In order to properly assess potential changes at (or in the operation of) Nicola Dam, there are some critical data gaps which must be addressed first (e.g. potential impacts to the resident burbot population associated with fluctuating water levels).

WUMP and Nicola Dam

For more than 20 years, the completion of the Nicola Lake dam has been a contentious issue that despite numerous attempts to resolve, remains outstanding. The dam and its operations are seen as perhaps the most immediate and effective opportunity to address a number of long standing water availability issues in the watershed, if more storage or a shifting of flow releases from the dam were possible at certain times of the year. As a component to the WUMP, the MSC undertook a preliminary options assessment to explore potential changes at the dam (Section 5.3). The outcome from that assessment (Appendix B) led to a recommendation for a more detailed trade-off assessment to be undertaken once critical data gaps had been addressed. Some observations and highlights from the preliminary options assessment included:

- Everyone agreed that changes to Alternative 1 (which represented current Nicola Lake rule curves and minimum flow release requirements) should be explored in greater detail, as consensus on a preferred option at the dam seemed achievable across the multiple interests of the community.

- It was felt that changes at the dam could result in significant benefits – *increased irrigated land along the lake and downstream and improved fishery flows at key times.* Moreover, if some small physical works projects were undertaken[4], the benefits could be considerably more. While operations at the dam over the past few years have begun to make some of these operational changes, the MSC supported further work to evaluate the potential of these changes (see *Recommendations #20 and #21* in Section 6).
- There are key data gaps[5] which should be addressed in order to inform a more detailed options assessment and provide a higher degree of confidence when assessing impacts of current operations as compared to any proposed changes. In particular, a study to determine whether or not there are likely impacts on burbot was previously identified as one of the most important unresolved issues to address[6]. The MSC strongly endorsed a number of environmental studies to address these information gaps (*Recommendation #33*).

WUMP Recommendations

The identification, screening and ultimate selection of recommended policy instruments for the draft WUMP was a multi-step process carried out by both the SC and MSC.

The package of 37 policy instruments presented in this draft plan were endorsed and recommended by consensus by the MSC. They were grouped into five main categories: water quantity, water quality, environment, learning, and management. The focus of the policy instruments was related to ***water quantity***: to conserve and better ensure the adequacy and availability of water supplies both in terms of **demand management** and ***increased storage potential*** [7]**.** There were a couple of reasons for this: water shortages were fairly well understood at the initiation of the WUMP; there was a high level of awareness in the community about water shortage conflicts; given recent climate change effects and land development pressures the competition for and potential for conflicts around water availability was expected to increase; and any decrease in water use would have a corresponding benefit to all other water interests including the environment.

Costs for the recommended policy instruments were crudely estimated. The purpose of approximating costs was to provide a relative comparison between the instruments. Total costs to implement the WUMP – *averaged over the first ten years* – works out to about $600,000/year in 2009 dollars using a 5% discount rate. On a per capita basis for the residents living in the Nicola Watershed, total costs work out to about $20 per person per year assuming a 50-50 cost sharing arrangement between the province and the residents of the region to implement the plan (Note. This assumes no contributions from businesses who would also benefit from the plan).

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[4] For example, limited dredging, consideration of groundwater pumps below the dam to augment river flows, pump intake modifications along the lake, etc.

[5] Burbot, kokanee, and rainbow trout spawning and rearing habitat impacts, tributary migration issues, wildlife impacts associated with staging and nesting areas, fish passage issues, pump intake issues associated with lower lake levels, water quality issues associated with lower lake levels, water level effects associated with Upper Nicola Band's infrastructure facilities, and potential aquifer effects associated with a new groundwater pump to augment river flows at certain periods.

[6] Urban Systems. March 2006. *The Completion of the Nicola Lake Dam Project: Technical Feasibility Study.*

[7] A number of storage related recommendations are associated with the WUMP, including: #9 – unused portions of WLs; #19, #20, & #21 – related to Nicola dam; #22 – all dams; #23 – potential new dams; #24 – use of cisterns; and #33 – storage sites and groundwater storage study.

Actual costs will be largely dependent on how implementation occurs within the lead agencies, cost sharing arrangements between the federal, provincial and local governments, grant application success for some of the eligible instruments, to what degree some of the instruments are carried out under the LWS strategy, the governance model that ultimately gets established, and to what degree community residents and businesses are willing to pay for more effective water management and more secure water rights that they will benefit from.

It is hard to demonstrate the value of the WUMP in terms of a cost benefit analysis because many of the social and environmental benefits are hidden or are hard to monetize. Having said this, the adoption of the WUMP is anticipated to have a number of significant benefits, for example:

- Avoided legal costs associated with water disputes and environmental appeals;
- Improved supply of irrigation water during critical periods (i.e. lessening the risk of fish clauses being triggered for some water licensees) and potentially allowing for more irrigated lands;
- Improved water conditions to meet instream flow requirements for fish and wildlife;
- Improved water supply to support local economic development and growth;
- Reduced contamination risks to aquifers and fish bearing streams;
- Improved education and public awareness to better conserve and protect water supplies;
- Increased social benefits associated with water based recreation, fishing and wildlife viewing opportunities;
- Increased flexibility and knowledge to adapt to changing climatic conditions in the watershed; and
- Improved baseline data and information to assess the effectiveness of policy instruments for better water management in the future.

The sequencing for when the recommended policy instruments should be started was influenced by taking a staged approach. For the most part, lower cost instruments that were associated with a high potential of public support were proposed earlier. Other potentially more costly or controversial instruments were more dependent on the results from the proposed monitoring and study program. Accordingly, the implementation of the instruments associated with larger trade-offs was delayed until better information was available and could be assessed during the WUMP review (i.e. year 5). It is noted that many of the policy instruments have been logically tied to other policy instruments.

Table 1 summarizes the package of recommended policy instruments which comprise this draft plan; includes a recommended schedule for when the instruments should be started; and provides a relative cost comparison for the implementing agencies.

Monitoring, learning and adapting to new information is a core and guiding principle for the Nicola WUMP. Effective water management needs to adapt to new conditions, changing values and better information. The WUMP is considered a living plan which needs to be periodically reviewed and updated. Based on the proposed monitoring and research activities identified in this draft plan, it is recommended that a full review take place within 5 years of the WUMP being implemented.

WUMP Next Steps

The completion of this draft WUMP report triggers Phase 3 of the planning process, which entails a broader review and feedback by the public, First Nations, and government agencies towards the plan's finalization.

Table 1 - Summary of WUMP Recommendations

Objective	*Location*	*#*	*Recommended Policy Instrument*	*Targeted at*	*Implemented thru*	*Begin in Year*	*Approx Costs*[8] *Low < ~$25K /yr Med < ~$70K /yr High > ~$70K /yr*
General	Nicola Watershed	**1**	• ***Initiate and implement a Water Management Plan for the Nicola Watershed under Part 4 of the Water Act***	All Sectors	MOE	**1**	**Depends**
Water Quantity	All Areas	**2**	• ***Enhance public education and outreach program***	All Sectors	COM / TNRD Prov / Fed / FNs	**3**	**Med**
	All Areas	**3**	• ***Initiate a staged conservation initiative, which may include installing and reading flow meters on all connections and reporting usage on an annual basis***	All Sectors	COM / TNRD Prov / Fed / FNs	**3**	**High**
	All Areas	**4**	• ***Mandate drilling authorizations for new water supply wells***	Well Owners / Drillers	MOE / DFO (fish impacts) / Possibly INAC	**3 - 5**	**Med**
	All Areas	**5**	• ***Work towards the implementation of a water licensing system for all new water supply wells***	All Well Owners	MOE	**10**	**Low**
	All Areas	**6**	• ***Support condition of no new permanent water licenses unless backed by storage***	WL Applicants	MOE	**0**	**Nil**
	All Areas	**7**	• ***Harmonize surface water allocations/licenses with groundwater use/demand/licenses***	WL Holders	MOE	**5**	**Med**
	All Areas	**8**	• ***Ensure that all provincial and federal infrastructure grants are contingent on water metering***	Local Gov'ts / Agriculture	MCS (BC) / Fed (Ag Canada)	**3**	**Nil**
	All Areas	**9**	• ***Seek opportunities to renegotiate and hold in reserve unused portions of water licenses***	WL Holders	MOE	**5**	**Low**
	All Areas	**10**	• ***Update land use plans to be consistent with WUMP goals and objectives***	New Developments	TNRD / COM / MOFR / FNs / etc.	**5**	**Nil**
	All Areas	**11**	• ***Implement a new by-law for facilitating grey water systems and any needed regulatory changes***	New Developments / Major Renos	TNRD / COM / Prov / IHA	**4**	**Nil**
	All Areas	**12**	• ***Recommend new by-laws and development permit requirements to better conserve water supplies***	New Developments / major renos & retrofits	TNRD / COM	**4**	**Low**
	All Areas	**13**	• ***Implement a graduated summertime sprinkling restriction system***	Non-Agriculture	COM / TNRD Prov / Fed / FNs	**3**	**Low**
	All Areas	**14**	• ***Implement a rebate program encouraging water conservation***	All Sectors	COM / TNRD	**5**	**Low**
	All Areas	**15**	• ***Develop an integrated drought management plan***	All Sectors	MOE / NWAC / COM / TNRD	**1**	**Low**
	All Areas	**16**	• ***Develop a program to identify and cap free flowing artesian wells***	Well Owners	MOE	**4**	**Low**

[8] Costs are approximate at this point and are only intended to give a general sense of the relative costs of the proposed policy instruments. The cost categories (high, medium and low) are arbitrary and were set to show differences between the policy instruments. Annual costs are averaged over a 10 year period and depend on the year the policy instrument begins. The costs include upfront and ongoing costs to the implementing agency. Costs are in 2009 dollars with no discount rate being applied.

Objective	*Location*	*#*	*Recommended Policy Instrument*	*Targeted at*	*Implemented thru*	*Begin in Year*	*Approx Costs*[8] *Low < ~$25K /yr Med < ~$70K /yr High > ~$70K /yr*
Water Quantity	All Areas	**17**	• ***Encourage more efficient irrigation systems***	Agriculture	Ministry of Agriculture / MOE	**3**	**Low**
	All Areas	**18**	• ***Support LWS's requirement for mandatory purple pipes in new construction by 2010***	New Developments	MOE / IHA	**0**	**Nil**
	Nicola Dam	**19**	• ***Initiate periodic and planned communication meetings between WUMP Advisory Council, stakeholders, and MOE dam operators***	All sectors	MOE / NWAC	**1**	**Low**
	Nicola Dam	**20**	• ***Undertake a detailed options assessment to find a preferred management solution***	All sectors	MOE / DFO / NWAC	**3 (ASAP)**	**Med**
	Nicola Dam	**21**	• ***Initiate an aquatic ecosystem study associated with lake level changes in Nicola Lake (and downstream)***	All sectors	MOE / DFO / NWAC	**1**	**Low**
	All Dams	**22**	• ***Recommend a review of the operations for Mamit Lake and all other existing small dams***	All sectors	MOE / NWAC	**5**	**Low**
	All Areas	**23**	• ***Revisit and identify potential new storage dams given water deficit***	Crown Land / Private Land	MOE / NWAC / Property Owners	**4**	**Low**
	All Areas	**24**	• ***Explore potential program to encourage use of cisterns to store rain water***	All sectors	MOE / COM / TNRD / IHA	**3**	**Low**
Water Quality	All Areas	**25**	• ***Encourage farms to undertake nutrient management plans (NMP)***	Feedlots / Winter Feed Grounds / Dairy Farms	Ag Canada / Province	**3**	**Low**
	All Areas	**26**	• ***Encourage agriculture, mining, and other industries to adopt best management practices around water use and conservation***	Agriculture	BC Ag Council / MEMPR / MOFR	**4**	**Low**
Environment	All Areas	**27**	• ***Support ongoing enhancement initiatives***	All sectors	DFO / MOE / FNs / COM / TNRD / NWAC	**1**	**Nil**
	Nicola Dam	**28**	• ***Develop a Fish - Water Management Tool***	All sectors	DFO / MOE / NWAC	**6**	**High**
	Priority Areas	**29**	• ***Develop suitable riparian setback requirements for new water supply wells in priority areas***	Well Owners / Drillers	MOE ➔ Drilling Authorizations	**4**	**Low**
	All Areas	**30**	• ***Ensure that Instream Flow Needs are taken into account within any harmonized surface and groundwater licensing system***	WL Applicants / Holders	MOE / DFO	**7**	**Low**
Learning	All areas	**31**	• ***Prepare bi-annual report on the state of water in the valley and the effectiveness of the WUMP***	Everyone	MOE / NWAC	**3**	**Med**
	All Areas	**32**	• ***Develop a monitoring program to better determine baseline conditions for water quantity and quality trends including climate change adaptation***	Everyone	MOE / EC (WSC) / NWAC	**3**	**High**
	All Areas	**33**	• ***Undertake specific studies*** *A. Contaminant Inventory* *B. Nicola Lake Aquatic Impact Study* *C. Complete Preliminary Instream Flow Needs* *D. Detailed IFN Assessment in Priority Areas* *E. Groundwater Storage Study* *F. Detailed Water Budget* ***G.** Storage Sites Assessment*	Everyone	MOE / DFO / Env Canada (WSC) / IHA / NWAC	**1 - 5**	**High** (combined)

Objective	*Location*	*#*	*Recommended Policy Instrument*	*Targeted at*	*Implemented thru*	*Begin in Year*	*Approx Costs*[8] *Low < ~$25K /yr Med < ~$70K /yr High > ~$70K /yr*
Management	All Areas	**34**	• ***Establish a community driven governance system to inform water management systems***	FNs & Stakeholders & Regulators	MOE / NWUMP	**1**	**Med**
	All Areas	**35**	• ***Create secure and stable funding sources to support water management activities***	Grants / regulators / water users	NWAC	**1**	**Med**
	All Areas	**36**	• ***Support a compliance and enforcement system for monitoring activities associated with the delivery of the WUMP***	Regulators	MOE / Local Governments / Regulators	**3**	**Nil**
	All Areas	**37**	• ***Review the WUMP at a 5 yr review (or before) as required***	All Sectors	MOE	**5**	**Low**

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1 Overview and WUMP Context

1.1 Overview

The Nicola Watershed has been undergoing rapid changes over the past twenty years and this has led to increasing pressures on the availability and timing of water supplies to meet the needs of the region's people and environment. While the watershed has historically experienced short and longer term periods of low river flows (and droughts); these periods of increased competition for water will likely become worse in the future as a result of climate change, the pine beetle infestation, and the region's burgeoning population. A water balance study[9] concluded that there is insufficient water supply in any of the Nicola sub basins to meet current and future needs in times of drought and this situation will get worse over time. Another assessment[10] highlighted the significant effects[11] that climate change is already having in the Nicola Watershed. If these trends continue, there will be intensifying competition and conflicts over the remaining water supplies. For example,

- In times of drought, like 2003, there typically isn't enough water to satisfy both agricultural and instream flow requirements for fish. This has led to regulatory requests for restricted water use and voluntary curtailments of water use by farmers and ranchers. If drought events become more frequent or severe, the effectiveness of these voluntary measures will be further tested.
- There is growing tension with how water is managed for agriculture and recreation. Those who use the lakes located throughout the watershed for recreation are increasingly vocal if the lake levels are kept high or drop too low. In recent years, both the north and south side of Nicola Lake have been sub-divided and developed. Any changes to the lake's level causes discontent from either these new residents and/or long established ones who then request action to address the issue. As there is more and more recreational property developed around lakes and along rivers and streams, the conflicts are predicted to increase.
- Another potential conflict area involves competition for scarce water supplies between new land developments and existing surface water license holders. Nicola WUMP recently completed a surface and groundwater supply and interaction study[12] which concluded that any "groundwater abstraction in the Nicola watershed will reduce downstream flows". With many new developments being planned (e.g. a new resort in Merritt and the proposed all season resort planned for the headwaters of the Coldwater River which flows into the Nicola River), there is increasing concern over the eroding value (water availability) for downstream water licensees. The Coldwater Indian Band Reserve, which is located on both sides of the Coldwater River, is already seeing water levels in their wells dropping and that is even

[9] Water Management Consultants. October 2008. *Nicola Watershed Water Balance Study*.
[10] Solander Ecological Research. October 2006. Assessment associated with *Nicola River Watershed - Water Use Management Plan - Instream Flow Needs for Fish*.
[11] Over the last 18 years the timing of the freshet (spring snow melt) occurs on average about 3 weeks earlier than it used to; low flow periods in the late summer and fall time now extend for about one week longer; and typical low fall and winter flows are lower than they used to be.
[12] Water Management Consultants. March 2008. *Surface and Groundwater Supply and Interaction Study – Phase 1 and 2*.

before any new resorts are built. There is anecdotal evidence that other landowners between the Reserve and Merritt have also seen their wells dry up and have had to drill new wells. The cumulative impact of new well construction on surface flows has not been calculated but the surface water license holders see their water licenses as not having much value if, when they need it, water is just not there.

Given the scarcity of water during some periods and the potential for conflicts among water interests, the Province of BC has repeatedly identified the Nicola Watershed as a high priority planning area for innovative water management planning.

1.2 WUMP Overview

In the fall of 2004, the Nicola Watershed Community Round Table held a workshop in Merritt entitled *Charting Our Water Future* (October 14-15, 2004). This workshop came about as a result of a number of events[13] and developments over the previous ten months that provided a catalyst for a large group of people from different backgrounds and sectors, but with a vested interest in the management of water, to begin a dialogue about a water use management plan for the Nicola watershed. The workshop concluded with a strong endorsement for a water use management plan for the Nicola Watershed.

On November 15, 2004 the inaugural meeting of what would become known as the Nicola WUMP multi-stakeholder committee (MSC) was held. From the beginning, community representatives and local stakeholders took the lead role to facilitate the planning process with ongoing support from local, provincial and federal government agencies who participated. The main purpose of the plan was to, *"ensure that the future water supply will be divided equitably among all water users balancing the community's social, economic, traditional and ecological values".* The planning process was primarily structured around two main committees: the MSC and Steering Committee (SC - formerly known as the Planning Team). The MSC was responsible for decision making during the plan's development and the SC provided organizational and technical support at times in between MSC meetings. In addition, a number of sub-committees were formed to aid the MSC and the Nicola Watershed Community Round Table provided administrative and support services throughout the process.

A four-phased planning process was adopted. Phase 1 was focused on process related matters, agreeing to planning objectives, and developing mission and vision statements. Phase 2 involved the development of a draft WUMP including information gathering and activities around the plan's synthesis. ***This draft report therefore signals the end of Phase 2.***

[13] The 2003 drought led to a heightened awareness about the consequences of low flows on fish populations and the potential impacts on water license holders (with fish clauses) who might be instructed to reduce their water use during critical periods. An announcement in March 2004 via a news release and subsequent front page article in the Vancouver Sun, also drew attention to the Nicola River as the most endangered river in British Columbia. The outlook for 2004 looked as though it could be another drought year in the Nicola watershed with potentially more years of low flows to come. The impact of these low flow periods on the agricultural sector, in particular, led to the Nicola Stockbreeders' Association initiating a process of strategic water management planning. A series of meetings were also called and chaired by then MLA, Dave Chutter, in May of 2004, to address a long outstanding issue - the Nicola dam - and to discuss a broader drought strategy.

Phase 3 will entail a broader review and feedback by the public, First Nations and government agencies as the plan gets finalized. Phase 4 will consist of implementing the plan and ongoing review and amendments.

1.3 Government Support

Ever since the idea of a community-driven water use management plan was conceived back in 2004, there has been continued support from elected officials and government agencies through their involvement in the planning process and their ongoing financial assistance and grants. This has led to active participation of key regulatory agencies on both the MSC and SC and a series of endorsements and commitments throughout the planning process. A highlight of some of the government support and encouragement is provided in the following summary table.

Date	Government Agency	Support
May 7, 2004	Meeting chaired by Dave Chutter, MLA Attendees included Ministry of Water, Land and Air Protection (MWLAP), Ministry of Agriculture, Food and Fisheries (MAFF), Ministry of Water, Land and Air Protection (MWLAP), Fisheries and Oceans Canada (DFO), City of Merritt (COM)	*Commitment to a water use planning process made verbally by MWLAP (Al Martin), MAFF, DFO.* *The MWLAP agreed to contribute $10,000 towards a workshop with a facilitator and a final report.*
June 10, 2004	Meeting chaired by Dave Chutter, MLA Attendees included MWLAP, Land and Water BC, City of Merritt	*David Laird (City of Merritt) offered a staff person to provide communication and help organize workshop as well as a venue.* *Rich Chapple (Pacific Salmon Foundation) indicated he had a memorandum of understanding signed with the Ministry of Water, Land and Air Protection for how $50,000 could be spent on a watershed management strategy.*
October 8, 2004	Meeting chaired by Dave Chutter, MLA Attendees included MWLAP, MAFF, Ministry of Sustainable Resource Management (MSRM), Land and Water BC, DFO, TNRD and City of Merritt	*Land and Water BC and Ministry of Sustainable Resource Management representatives state that they support having local people develop a water use management plan. Ministry of Agriculture representative encouraged the development of a plan that was equitable to both fish and agriculture interests and that he would like to see that the different interest groups work together – a coordinated community approach.*
October 14-15, 2004	***Charting Our Water Future Workshop*** Attendees included MWLAP, MAFF, MSRM, Land and Water BC, DFO, Ministry of Forests (MoF), TNRD and COM	*Agreement to meet again to establish the basis for proceeding with the preparation of a water use management plan to develop solutions to immediate issues;* *1. that a long term planning process should not overshadow or prevent the solution of key issues which require immediate attention; and* *2. that work on the study looking at the feasibility of completing the Nicola Dam should proceed.*
January 18, 2005	Excerpt from Letter from John van Dongen, Minister of Agriculture, Food and Fisheries	*".. The Ministry is highly supportive of this initiative and is looking forward to working with your committees, particularly those relating to agricultural issues. … Ministry staff are prepared to assist with*

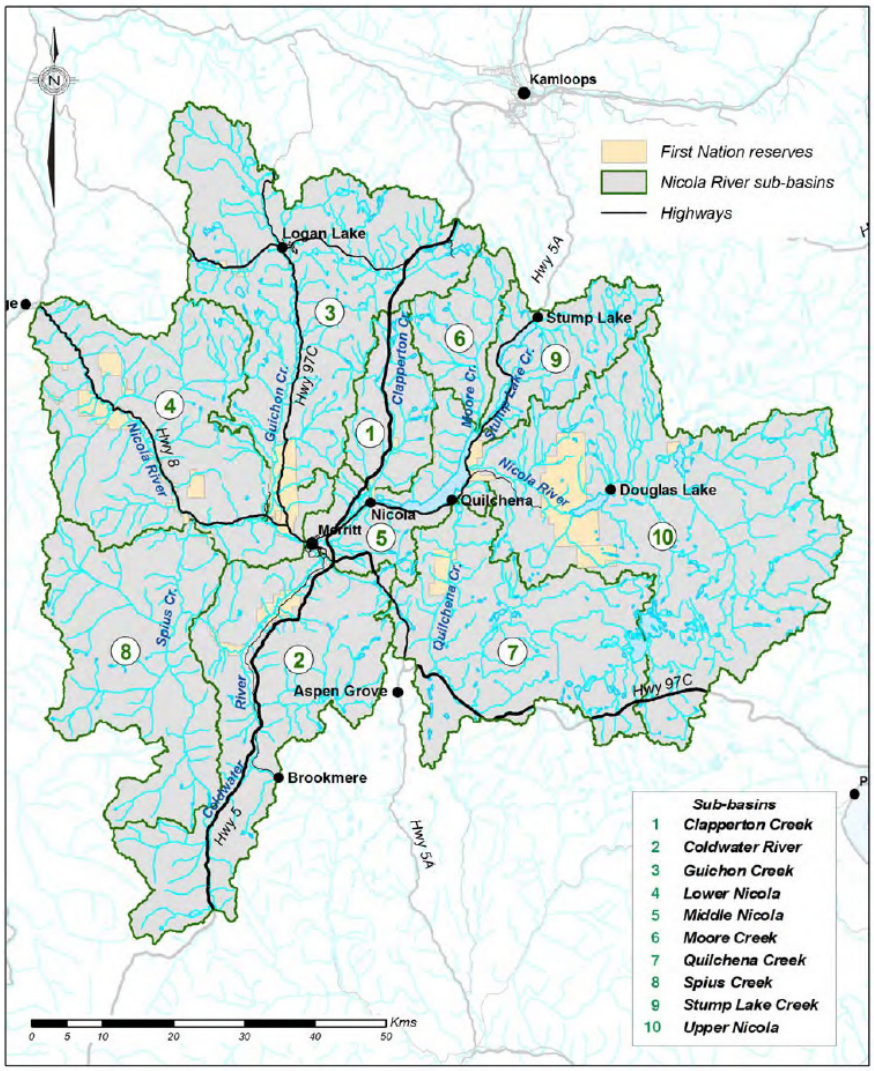
Date	Government Agency	Support
		studies and/or education sessions relating to improving water use efficiencies in agriculture, and to assist as appropriate with funding applications and other related initiatives."
January 27, 2005	Excerpt from Letter from George Abbott, Ministry of Sustainable Resource Management	*" As the Minister of Sustainable Resource Management, I would like to offer my support for this resource planning initiative, and will commit up to $10,000 .. to assist with the development of a water management plan for the Nicola River."*
March 7, 2006	Excerpt from Letter from Barry Penner, Minister of Environment	*" The ministry will consider your request for further financial assistance to the Nicola WUMP through the Living Rivers Fund. … By copy of this letter to Mr. Martin, I ask that he consider your request for funding and continued staff participation in your process."*
May 10, 2006	Meeting with Al Martin, Ministry of Environment, Alan Kenney, Pacific Salmon Foundation	*Al Martin states "we (Ministry) are supporting Nicola WUMP." Later in the meeting he states that the "Ministry is committed to see this planning process through".*
January 8, 2007	Excerpt from Letter from Nancy Wilkin, Assistant Deputy Minister, Ministry of Environment	*" This is an important initiative given the significant and complex water issues in the valley. … We encourage you to continue to work closely with PSF as well as other funding agencies and partners to ensure that your priority projects receive the required funding."*
July 31, 2008	Excerpt from Letter from Barry Penner, Minister of Environment	*"The Nicola watershed is experiencing water challenges that will likely become more acute in the future… our government has committed to support communities to do watershed management planning in priority areas. While I can't be specific at this time about what the nature of that support would be, I can inform you that the Nicola basin has been identified as one watershed where innovative solutions for water management merit further consideration, as resources allow."*

1.4 Nicola Watershed and Climate Change

The Nicola River basin covers an area of approximately 7,280 square kilometres in the South Central Interior of British Columbia. It includes pine and fir tree-covered rolling hills with numerous small lakes; the Cascade Mountains along the south west side of the watershed; and extensive grasslands in the areas between the four large lakes (Nicola, Stump, Douglas and Chapperon) in the drier eastern highlands.

The Nicola River is a tributary of the Thompson River that in turn flows into the Fraser River. The Nicola River stretches for approximately 193 kilometres from its source on the plateau west of Okanagan Lake to where it joins the Thompson River at Spences Bridge. The basin can be divided by its major tributaries and this breaks the area down into 10 watersheds (or sub-basins) as shown in Figure 1.

Figure 1 Nicola Basin and Sub Basins



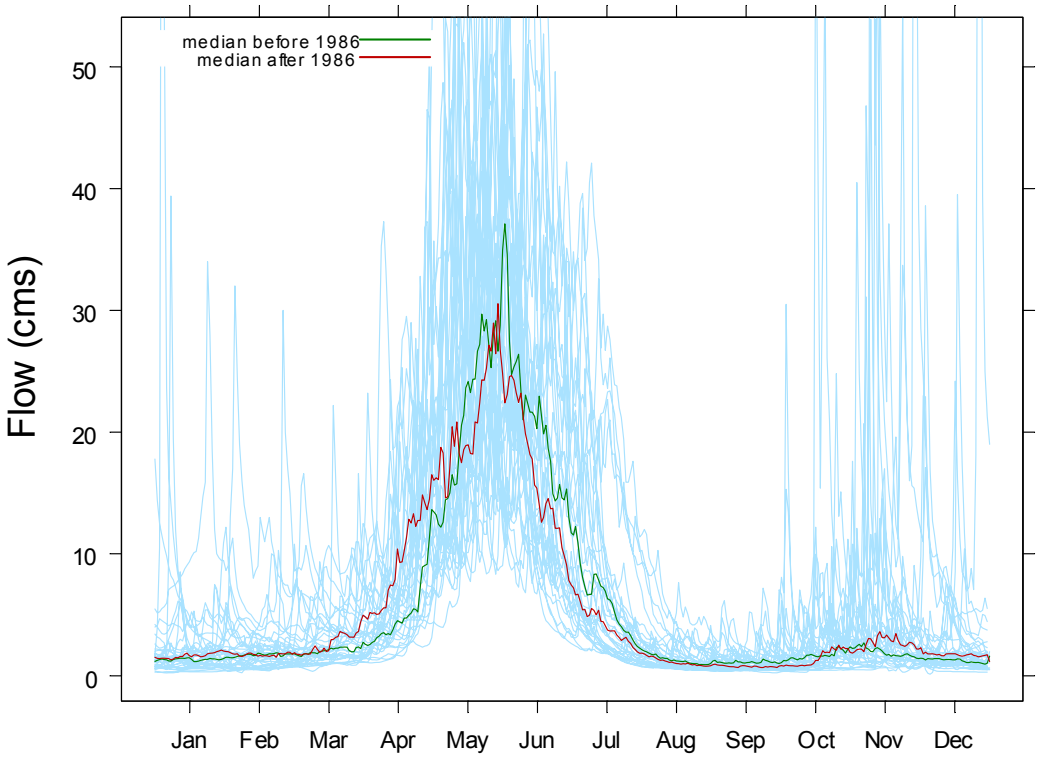
Source: Summit Environmental Consultants[14]

The climate in the area is extremely arid and, in the summers, very hot. Given its altitude it is generally colder in winter than the surrounding basins. The basin also receives less precipitation than adjacent areas as it finds itself in a rain shadow. The basin is also associated with three major valley surficial aquifers which provide base flows for rivers.

The hydrology in the Nicola Valley follows a consistent pattern although the drainages forming in the North Cascades have more rainfall events. Most of the annual precipitation (snowmelt) leaves the watershed during the 4 month freshet period (mid-March to Mid-July) and there are occasional high inflow rain events which typically occur sporadically in spring, through the late fall and early winter. Figure 2 shows a hydrograph for the Coldwater River which highlights these points.

[14] Summit Environmental Consultants. June 2007. *Nicola Watershed Present and Future Water Demand Study*.

Figure 2 Hydrograph of the Coldwater River at Brookmere (1965-2003)



Source: Solander Ecological Research[15].

This representative hydrograph of the Coldwater River also demonstrates the significant impacts of climate change over the past 20 years throughout the Nicola Watershed where freshet flows begin about 20 days earlier (red versus green median lines) than they used to prior to 1986 and end about 7 days earlier. Moreover, the duration of low flow periods in the fall and winter have increased and more significantly those flows have decreased. As climate change effects continue, it will no doubt lead to increased water scarcity and competition between water users on a more frequent basis.

1.5 Nicola Lake and Dam Completion

Nicola Lake is the largest body of water in the basin and comprises an area of about 2500 hectares. In the 1980s a new concrete dam was built to provide more storage for agricultural irrigation projects and fishery flows during low flow periods of the year. However, because of challenges with excavating a high spot at the outlet of the lake, the full storage benefit was never realized (the completed project would have allowed for the lake to have been drawn down by an additional 0.6m and increased the storage capacity by about 45% if sufficient run-off is available to fill the lake). As a result, in times of drought, there has been increasing risk of water shortages for irrigation and insufficient base flows to maintain the ecological integrity of aquatic habitats. Accordingly, no new water licenses have been issued in recent years.

[15] Solander Ecological Research. October 2006. *Nicola River Watershed - Water Use Management Plan - Instream Flow Needs for Fish*.

Minimum flow releases at the dam are governed by a number of rule curves; these curves serve a number of purposes. The two primary ones are meeting water demand and mitigating higher inflow events (i.e. downstream flooding).

- Water demand is primarily from (1) irrigation use from April to the end of September, and (2) meeting the fish flow requirements[16] from July to April. To better meet this demand, operators aim to have the lake full by the end of June each year (although this is dependent on how much water flows into the lake from melting snow). The minimum monthly dam releases are mostly based on meeting these water requirements.
- The capacity to mitigate flooding events at the dam is limited, since it was never designed for flood protection. It has a relatively small amount of storage potential relative to the freshet flows that enter the lake in many years. Operators (MOE) try to ensure that the lake is at its minimum operating level towards the end of March just before the freshet begins; while at the same time trying to ensure that they capture enough water to fill the lake every year to meet the water requirements for irrigation and fish through the summer, fall and winter periods. It is a delicate balancing act and every month operators must revise their forecasts and adjust the flow releases in order to avoid running out of water.

Uncertainty is a complicating factor in the operation of the dam, as operators must contend with unpredictable weather patterns and varying snow pack levels on any given year. This uncertainty has implications in the day to day operation of the dam and the operator's ability to meet the rule curve requirements at all times.

At the *Charting Our Water Future* workshop one of the main issues that arose was the completion of the Nicola Lake dam. The workshop participants recommended that a study be launched to investigate whether the community should proceed with dam completion or follow an alternative path of shelving the idea once and for all. A study, completed in 2006 by the Nicola Stockbreeders' Association[17], looked at the engineering options for completing the dredging. Since the completion of the report, there has been very little movement on the issue. There continues to be a certain degree of conflict between those who see dredging the channel as a solution to some of the water shortage issues and others who have serious concerns about the long-term potential ecological/environmental costs of that solution. One of the chief concerns is whether a change in dam operations (and reservoir levels) will have any adverse impact on resident burbot populations. This is one of a number of key data gaps to address in order to properly assess any proposed changes at the dam.

1.6 Water Management Plans under Part 4 of the *Water Act*

In 2004, the provincial government enabled Part 4 of the *Water Act* to allow for the development of *water management plans*, which once approved may be made legally enforceable. *Water management plans* (WMPs) are typically done at the request of a local government or region and are intended to assist communities in relation to conflicts between users, risks to water quality or conflicts between water users and in-stream requirements. They have been identified

[16] Based on the instream flow requirements identified in Kosakoski and Hamilton (1982), *Water Requirements for the Fisheries Resource of the Nicola River of BC.*

[17] Urban Systems Ltd. March 2006. *Nicola Stock Breeders Association – The Completion of the Nicola Lake Dam Project: Technical Feasibility Study.*

as arguably the most effective regulatory tools in the province for developing a comprehensive and integrated approach to managing water resources – *taking into account competing sectors, overlapping jurisdictions, multiple pieces of legislation, and the interactions between groundwater and surface water.*

In a letter dated 26 April 2008 to Barry Penner (Minister of Environment), the MSC formally requested that a *water management plan* be developed for the Nicola watershed under Part 4 of the *Water Act*. This decision was reached by the MSC at a meeting held on 6 March 2008. At the meeting, the MSC came to the conclusion that a *water management plan* (under the Act) was the only effective way to address many of the water problems facing the residents in the basin and which could be used to proactively avoid future conflicts among the competing water uses. The MSC was therefore hopeful that a *water management plan* could be ordered and dovetail into the ongoing Nicola WUMP work.

It should be noted that the City of Merritt is also pursuing a *water management plan* under their recently initiated Integrated Source Water Program (ISWP). Their proposed planning area, however, was mostly confined to their municipal boundaries (although consideration is also being given to a larger planning area consisting of the deep aquifer that extends beyond their municipal boundaries). A meeting was held in June 2008 between representatives of Water Stewardship Division (MOE), COM, and the WUMP SC to explore what a joint *water management plan* would entail. The province provided direction that they would likely only consider a single combined *water management plan* rather than two separate ones for the area. At the meeting, there was interest in collaborating on a joint planning process, although there were a number of details which would need to be worked out[18].

In a letter dated 31 July 2008, Barry Penner responded to the MSC's request for a *water management plan* for the Nicola basin. While there were no specific commitments in the letter, he did mention support for community watershed management plans in priority areas like the Nicola basin. Since that time, no further progress has been achieved towards the initiation of a WMP.

At the July 2008 MSC meeting, the MSC confirmed that they would continue to pursue a WMP for the Nicola basin, but they would not wait to complete the draft WUMP as their funding for this work was to run out in early 2009.

1.7 BC's Living Water Smart Plan

In June 2008, the government unveiled a new water strategy for the province entitled, *"Living Water Smart: British Columbia's Water Plan".* It lays out a vision and steps needed to better protect water resources and sustainably manage them. The plan targets over 40 policy measures (or actions) including *"planning, regulatory changes, education, and incentives like economic instruments and rewards. The plan commits to new actions and builds on existing efforts to protect and keep B.C.'s water healthy and secure"*. For more details refer to http://www.livingwatersmart.ca/docs/livingwatersmart_book.pdf.

[18] How and what role would TNRD have in the planning process, how would the joint initiative be funded, how would First Nations be consulted in the plan's development were a few of the outstanding issues.

The SC and MSC reviewed and used the *Living Water Smart Plan* and its actions as a guide in the development of their recommended policy instruments (Section 6. WUMP Recommendations).

1.8 City of Merritt's Integrated Source Water Program

The COM is currently engaged in an Integrated Source Water Program (ISWP) with the goal of ensuring a clean and reliable water supply for the town as it continues to grow and to identify any potential conflicts between water users. Part of the ISWP is assessing alternative water supply options given the vulnerability of the COM's current drinking water which is sourced from a shallow unconfined aquifer. This assessment process is being completed proactively and is not in response to an immediate degradation in the quantity or quality of the water supply. As already mentioned, a component of the ISWP is the establishment of a WMP (Section 1.6) which would likely cover an area that is greater than the City proper in order to take into account the shallow and deep aquifers that extend beyond the City's boundaries.

2 Description of the Planning Process

2.1 Overview

For the past four years, a community-driven planning process has been underway to come up with a draft water use management plan for the Nicola watershed. The planning process is broken down into four phases, as follows:

Phase 1 – Plan Initiation – this phase included process administrative items, confirming issues and planning objectives, development of a vision and mission, a communications strategy, and identification of key data gaps. For a detailed overview of this phase refer to the document entitled, "*Report on Phase 1 of the Process Leading to a Nicola Water Use Management Plan"* (dated September 2005) and available on-line at: http://www.nicolawump.ca/reports.htm

Phase 2 – Plan Development – this phase consists of three main parts: information gathering, options assessment and plan synthesis. For a detailed overview of the progress made up to July 2007 in this phase refer to the document entitled, *"Nicola WUMP: Phase 2 Plan Development – Interim Report"* also available on-line at the above address. Compass Resource Management was hired in early 2008 to assist in the plan synthesis component of this phase. The conclusion of this phase will consist of a draft WUMP that will be used to engage broader input in Phase 3.

Phase 3 – Plan Evaluation and Approval – this phase will seek broad input and feedback from the public, First Nations, and government agencies to improve upon the draft plan. Once the draft WUMP gets finalized, regulatory support and approval will be sought.

Phase 4 – Plan Implementation – this phase is concerned with implementing, monitoring and revising the plan as new information is collected.

2.2 Public Involvement and WUMP Committees

The Nicola WUMP is a community driven process that is structured around a number of committees to work through the phases of the planning process. The MSC is the decision body and includes all participants. The SC provides administrative and technical support to the MSC between their meetings. A number of sub committees support the MSC with specific tasks.

The Nicola Watershed Community Round Table provides administrative support to the process and serves as the main contact.

For a summary of who participated during the Nicola WUMP planning process, refer to Appendix A.

2.2.1 Multi-Stakeholder Committee

As the decision-making body with respect to the recommendations that will be included in the WUMP document, the MSC plays a key role. This role was formulated early in Phase 1 of the planning process and was revisited and confirmed in the spring of 2007. The main functions of

this committee whose membership includes all levels of government, First Nations, interest groups and individuals, are as follows:

- to review, adopt by consensus and if agreed to, implement recommendations of subcommittees and the SC;
- to provide direction to the SC and subcommittees;
- to receive the reports on studies and projects, assess them and either adopt the reports as submitted/presented or adopt them conditionally;
- to assess the suitability of the planning process to address the needs and confirm the desire of the members of the MSC to engage in the process;
- to refine and/or expand the issues identified by the SC; and
- to work through trade-off analyses and decide on what will be in the Plan document.

The MSC has met over 30 times since the start of the process. The MSC mailing list consists of over 125 people who follow the MSC's progress or attend their meetings.

2.2.2 Steering Committee

The Steering Committee (formerly known as the Planning Team) met over fifty times since the start of the process. The SC's main function is to support the MSC and their activities include:

- to support and plan for MSC and any public meetings;
- to coordinate information flow from consultants and sub committees;
- to liaise with the Nicola Watershed Community Round Table;
- to provide progress reports to the MSC, public, government and funders;
- to fundraise and deal with media requests and information requests from the public;
- to help manage contracts of consultants; and
- to provide technical support in reviewing and making recommendations, as required.

2.2.3 Sub Committees

A number of sub committees were struck and tasked with specific deliverables during the planning process. The life of any sub committee depended on their specific tasks. The following sub committees supported the process:

- Mission Statement
- Water Conservation
- Communication
- Current Community issues
- Socio-economic and environmental goals
- Water Technical

- Supply Study
- Governance
- Storage Sites Study
- Demand Study
- Guichon Project
- Government – Technical Support Advisory Group

2.2.4 Website and Public Meetings

A Nicola WUMP website was developed to serve as a central database for project related activities and was regularly updated throughout the planning process. The site included MSC meeting minutes, reports and WUMP related materials, process updates, and a calendar of events for anyone wanting to follow or participate in the plan's development.

Public meetings were held in January, May and November 2005. The first two provided an opportunity to hear guest speakers, learn about groundwater, hear updates on progress and develop terms of reference for the sub-committees that were formed. The last meeting was a presentation outlining the engineering options and costs for adding to the storage capability of Nicola Lake and completing the Nicola dam project as originally designed.

An additional public meeting was held on May 16, 2006 on the topic of groundwater. The guest speaker was Thierry Carriou (BC Groundwater Consulting Services Ltd.), a hydrogeologist who has done extensive work on groundwater in and around Merritt. His presentation included an introduction to groundwater, watershed-scale summary of groundwater resources, review of aquifer and well distribution by sub-basin, surface water and groundwater interaction, and conclusions.

2.2.5 Local Government Involvement

The City of Merritt has been participating in the planning process from the outset. The City has a councilor represent their interests on the MSC and has sent letters of support for the WUMP. The City also provides funding annually in addition to in-kind support (use of their facilities to hold meetings, photocopying and postage).

Participation from the Regional District has been more sporadic. In Phase 1 of the process, there was regular participation from staff and a director on the MSC as well as a director who participated on the SC for the first two years.

2.3 First Nations Involvement

First Nations were involved at the *Charting Our Water Future* workshop and the Chairperson of the Nicola Tribal Association was among the community leaders who supported proceeding with the development of a water use management plan.

At the beginning of the planning process, representatives of the WUMP met with a number of the First Nations[19] to explain the process and seek their preferred level of involvement as the plan was developed. First Nation communities generally wanted to be kept informed at key points such as after a draft WUMP had been prepared. In addition, a couple of MSC meetings were held at the Upper Nicola Indian Band offices and the Coldwater Indian Band offices; at those meetings band members were invited to attend and participate.

Representatives of the Nicola Tribal Association (NTA) Fisheries Program have been active members on the Steering Committee (and previous Planning Team). The purpose of that involvement has been (1) to provide in-depth technical knowledge related to fish and fish habitat resources in the watershed; (2) to share knowledge about some First Nations issues associated with water management; and (3) to serve as a liaison and report periodically to the NTA and First Nation communities on progress of the WUMP.

2.4 The Droplet

A newsletter called “The Droplet” was developed to provide regular updates to the general public. 13 newsletters have been published to date with articles on MSC development, report findings, announcements of future events and other information that may be of interest. The Droplet can be downloaded off the website at:

http://www.nicolawump.ca/droplet.htm

[19] Shackan First Nation, Nooaitch Indian Band, Lower Nicola Indian Band, and Upper Nicola Indian Band.

3 Issues and Objectives

3.1 Issues to be Addressed in the WUMP

One of the main purposes of the WUMP is to avoid conflicts by proactively addressing issues that are – or that are likely – to occur in the immediate future. During the planning process a lot of effort went into identifying specific water concerns that community members wanted to see addressed through a WUMP. Some of the general issues which have been instrumental in driving the development of a WUMP include:

- *Insufficient water* for both irrigation and fish (instream flow needs) during low summer and early fall flows;
- *New zoning and land development pressures*, in certain areas, which lead to more water use (demand) and place more risk of inadequate water supplies being available to meet existing water uses (e.g. downstream water license holders or instream flow requirements for fish).
- *Inadequate groundwater controls* or regulations in place which may further threaten base flows in streams. In essence, this was identified as a loophole for anyone wanting or waiting for access to surface water (e.g. pending water license applications), as they could simply drill wells into the underlying aquifers without consideration of the resulting surface water effects[20] or potential interference effects on adjacent wells.
- In times of drought, surface water license holders can be asked to abide by regulatory requests for voluntary curtailments of water use or restricted water provisions can be imposed if fish clauses are associated with their licensed rights. These periods can impose significant economic hardships on the agricultural sector and *threaten the livelihoods of farmers and ranchers*.
- *Poor water quality* from land use practices was raised as a major concern. However, it was recognized that there was insufficient baseline data available to meaningfully evaluate policy instruments that would reduce the risk of contamination during the development of the Nicole WUMP. Accordingly, the WUMP is focused on water quantity issues and information gathering in the future to better address water quality issues (see Section 6.2.4).

The remainder of this section summarizes all the water-related issues that were identified during the development of the draft WUMP. The issues have been organized under a series of categories, as follows:

[20] No restrictions on well drilling unless the capacity of the new well is greater than 75 litres per second, which triggers an environmental assessment. There are very few examples of environmental assessments for new wells in the province.

Category	Issue

Water Quantity	• Security of supply for water license holders
	• Inadequate/insufficient stream flow for fish
	• Cumulative decrease in surface water supply
	  ○ Climate change
	  ○ Global warming
	  ○ Drought, low river flows
	  ○ Impact on forage production
	• Groundwater
	  ○ Unregulated new well construction
	  ○ Impact of wells on groundwater supply
	  ○ Lack of knowledge about surface and groundwater interaction

Water Quality	• Concern: maintain high standard • Effect of water temperature on fish • Activities in the riparian zone • Leaching from landfills
Increase in Population & Economic Activity	• Impact of development on water resources • Concern: will there be adequate water to sustain existing and projected uses? • Lack of knowledge in government about the impact of development • Lack of integrated planning • Impact of increasing the storage capacity of certain lakes, i.e. Nicola Lake and the unfinished Nicola dam
Wildlife	• Water requirements to maintain wildlife values
Forestry	• Mountain pine beetle and the impact of logging • Impact of natural mortality in pine forest on water resource
Lack of Knowledge & Understanding	Lack of information and understanding related to: • The water resource • Uses (residential/golf and resorts/ranching, etc.) • Regulatory processes • Monitoring • Best practices • How to provide input

3.2 Nicola Dam Issues

As the largest regulated water body in the Nicola valley, the dam at Nicola Lake is central to water management in the greater region as it affords potential opportunities to address issues around the lake and further downstream. During the development of the WUMP, a preliminary options assessment was carried out to see to what degree community members could agree upon changes at the dam (see Section 5.3 for more details). During preparations for the community meeting to discuss options at the dam, a number of issues were identified that could be affected by changes at the dam. The following table summarizes these issues.

Category	Location	Area	Issue
Environment	***Nicola Lake***	Aquatic	• Low reservoir levels in mid August which restrict tributary access for resident and anadromous species (rainbow, kokanee, chinook, coho)
			• Burbot rearing habitat along parts of the rocky shoreline in the summer
			• Potential changes to current littoral productivity
			• Burbot spawning habitat associated with decreasing water levels (Feb to Mar)
			• Reservoir levels can influence resident prey species populations (such as chub, shiner, squawfish), which can in turn affect food availability for predator species (such as burbot, bull trout and possibly rainbow trout).
			• Low reservoir levels may limit fish passage at dam
		Wildlife	• Low reservoir levels (by dam outlet) in May affect the staging area for pelicans, Canadian Geese, Swans, etc.
			• Nesting habitat for ducks may be affected by higher or more fluctuating reservoir levels
			• Concern about the increase in population of mule deer
			• Impacts to riparian vegetation from erosion caused by waves from wakeboard boats
	Nicola River *(below dam)*	Fish	• Low flows in April which serve as a potential migration barrier for Steelhead entering the lower Nicola River from the Thompson River – need for freshet pulse
			• Low summertime and fall flows for all species
			• Migration barriers at mainstem and tributaries because of low flows through fall - need for pulses of water
			• Attraction flows (mainstem) for chinook migration (Aug / early Sept) - need sufficient cold water
			• Low rearing flows fall/winter

Category	Location	Area	Issue
	Nicola River *(below dam)*		• Egg incubation flows / dewatering in the fall and winter
		Fish	• High water temperatures (Jul to mid Sep) lethal to fish / lack of riparian shade (BT, Rb, CHK, ST, CO, PK)[21]
			• Attraction flows from dam gate make it difficult for chinook to use fishway (August)
			• Fish passage concerns at the dam during the winter (what species, when and what challenges do they face)
			• Reduced groundwater flows getting into the mainstem of the river and its effects on spring chinook
		Stream Health	• Need periodic high flows (= 25 cms) during freshet to provide ecological benefits
			• The length of time that high flows occur during the freshet has increased as the dam has attenuated peak flows over a longer period. Moreover there appears to be extended erosion and turbidity during these periods, which may have adverse effects on aquatic productivity downstream.
Economic	***Nicola Lake & River***	Agriculture	• Amount of water available for irrigation / new water licenses on hold
			• Security of access during times of drought
			• High water levels affecting alfalfa production
		Dam Costs	• Capital costs and ongoing maintenance costs associated with dam modifications and ancillary structures (intakes, boat ramps)
		Tourism	• Tourism impacts to local economy
Social	***Nicola Lake***	Misc	• High lake water levels impacts – septic fields, boat dock clearance, some property owners, etc.
		Recreation	• Recreation impacts o Amount of suitable beach areas o Boat ramp access o Operation of boat docks
		Visual	• Aesthetic impacts of exposed mudflats

[21] Burbot (BT); rainbow (Rb); chinook (CHK); steelhead (ST); coho (CO); and pink salmon (PK).

Category	Location	Area	Issue
	Nicola River *(below dam)*	Flooding	• Downstream flooding impacts o Property damage (structures, erosion of land, intake structures, etc.) o A comment from a stakeholder that they felt water levels in the river are dropping as a result of scouring; and this in turn is having an effect on intake structures
		Recreation	• Recreation impacts o Floating activities o Wildlife viewing o Quality of fishing

3.3 WUMP Objectives

From the beginning of the process starting with the "Charting Our Future Workshop"[22], a number of objectives were identified to address the water management issues and problems that were known or anticipated. During the WUMP planning process these objectives were reviewed and revised from time to time. The current suite of objectives have been agreed to by the MSC and have been summarized in the following table. These objectives serve as the foundation for the recommended policy instruments discussed in Section 6.

Category	Issue Area	WUMP Objectives
Water Quantity	Water Supply	In recognition that water supply is finite, the WUMP will foster and promote activities to ensure an adequate supply of water for current and future needs.
	Growth within the Basin	The WUMP will include policies, guidelines and recommendations to ensure that the negative impacts on water supply from new developments are minimized on existing water users.
	Lack of Information for Decision-making	a. The WUMP will facilitate/encourage/support/foster the collection and use of sound data and up to date information to ensure the best water planning decisions by all authorities.
		b. The WUMP will include recommendations for a crisis strategy (water shortage situations).
	Water Allocation – Water Distribution	The WUMP will ensure that all perspectives in reference to water quantity needs of off-stream and in-stream (fish-flow) water users are incorporated in its final recommendations.

[22] Held in October 2004. See workshop summary at http://www.nicolawump.ca/reports.htm

Category	Issue Area	WUMP Objectives
	Degradation of Riparian Resource	a. The WUMP will foster/encourage/promote a better understanding of the causes of the degradation of the aquatic/riparian resource.
		b. The WUMP will consider/maintain and improve the aquatic/riparian resource.
	Water Storage	a. The WUMP will improve understanding about surface and groundwater supply and the interaction between surface and groundwater.
		b. The WUMP will improve understanding of and knowledge about opportunities and implications for storing water above ground.
		c. The WUMP will improve understanding of and knowledge about opportunities for and implications of storing water below ground.
Water Quality	Human and Environmental Health	Maintain or improve water quality in the basin when and where possible.
	Limited Supply of Quality Water	Assure water quality is appropriate for its use.
	Aquatic Life	Maintain water temperatures that are adequate for aquatic life.
	Development in the Basin	Ensure new developments' impacts on water quality are thoroughly evaluated and can be accommodated within the basin.
	Contamination	Minimize groundwater contamination and assess risks of contamination in the Nicola Basin.
Information Needs	Access to Existing Data	Develop and maintain access to the best current information about legislation, regulation, policies, by-laws, best management practices and guidelines regarding water in the Nicola Basin.
	Information Gaps	Utilize traditional ecological knowledge.
	Lack of Monitoring	Secure funding for monitoring/collecting additional data required for decision-making.
	Education	Improve public awareness of the relationship between healthy natural systems and maintaining a clear, abundant supply of water.
Institutional Capacity	Authority	Develop a governance model for the Nicola Basin water authority.
	Sustainability	Secure funding for the Nicola Basin water authority.
Natural and Ecological Processes	Habitat Capacity for Fisheries	a. Maintain and restore natural ecological function.
		b. Recognize the Nicola Basin Watershed as a holistic ecosystem.
Human Activities	Development and Economic Growth	Promote and encourage economic development that makes responsible use of water.

Category	Issue Area	WUMP Objectives
	Quality of Life	Ensure sufficient quantity and quality of water to support a high quality of life for the people of the Nicola Basin.
	Cultural / Heritage	Encourage the conservation of lands, structures, and artifacts that have cultural heritage value.

3.4 Guiding Principles for a WUMP

In addition to the agreed to objectives for 'what' a WUMP is trying to achieve, a series of *Guiding Principles* were agreed to for 'how' the agreed to WUMP Recommendations (Section 6) should be further developed and implemented. In all, 10 Guiding Principles were agreed to as follows:

1. ***Recognize and promote the value of water, as it is a precious and limited resource.***
2. ***Recognize the interconnection between surface and ground water throughout the watershed.***
3. ***Recognize that water quantity and quality are required for healthy ecosystems and safe drinking water throughout the watershed.***
4. ***Recognize and commit to integrated land and water use planning.***
5. ***Recognize that water allocation and other management decisions need to be made in an open, transparent, and equitable way.***
6. ***Promote and prioritize water efficiency through conservation and water storage.***
7. ***Use the best available information to adaptively manage the WUMP.***
8. ***Avoid costly and unsustainable conflicts tomorrow with timely and proactive investment today.***
9. ***Recognize that everyone is affected and has a shared responsibility in water management and that active participation and information sharing are necessary in order to lead to more effective water management decisions.***
10. ***Recognize and celebrate the achievements of the WUMP.***

4 Information Gathering

4.1 Collected Information and WUMP Studies

During the development of the draft WUMP, the MSC has been actively collecting and sorting through relevant documents, and expanding the information base to make wiser water management decisions now and into the future. The following table provides an annotated bibliography of studies and reports which have been commissioned, created or used by the WUMP MSC in their discussions and deliberations.

Study Name	Author(s)	Date	Annotation
Nicola Watershed Water Budget Analysis	Water Management Consultants	Oct 8, 2008	The objectives of the water budget analysis were to calculate the water budget in relation to water supply and water use for the Nicola watershed and its sub-basins; to comment on water surplus or shortages for each sub-basin and, where applicable, within each sub-basin; and to recommend geographic areas for further study and monitoring. The main body of the report is 44 pages long. The report has four appendices. The second, third and fourth appendices are tables of numbers which show the calculations for the water budget final figures for each of the sub-basins.
Surface and Groundwater Supply and Interaction Study – Phase 1 and 2	Water Management Consultants	Mar 31, 2008	The study was carried out by Water Management Consultants Ltd. (Richmond, BC). The objectives of the water supply study were: to determine current water supply (surface and groundwater) and seasonal patterns of supply for the entire watershed; to forecast water supply and seasonal patterns stemming from climate change; and to identify where and to what degree surface and groundwater, including aquifers, interact in order to understand more fully the implications of water extraction. The final report on Phase 1 and 2 of the water supply study describes the surficial geology and the types of aquifers found within the watershed, discusses groundwater and surface water interaction, estimates the water supply for each of the ten sub-basins of the Nicola watershed and projects future water supply. ***The major conclusion from the study was that any groundwater abstraction in the Nicola watershed will reduce downstream flows.***
Additional Storage Sites Study – Phase 1	K.G. Gizikoff	Jul 2007	The report provides information on identified water storage sites in the Nicola watershed. The goals of Phase 1 of the Additional Storage Sites Study were: a) to build a listing of sites with potential storage for water along the Nicola River and its tributaries; b) to develop criteria for identifying sites suitable for further study; c) to calculate the relative amount of water that could be stored a these sites. In addition to the report, a number of maps were produced showing swamps, topography and slope ranges, biogeoclimatic and moisture zones, land tenure and rural parcels, pine stands, agricultural land reserve, critical ungulate winter range and water catchment areas in each of the ten sub-basins of the Nicola watershed.

Study Name	Author(s)	Date	Annotation
Phase 2 – Plan Development – Interim Report	Nicola Watershed Community Round Table	Oct 2007	The report is a compilation of the work done on the Nicola Water Use Management Plan between July 2005 and July 2007. The main body of the report summarizes the accomplishments and completed projects in this period and provides an update on the works in progress. The report is intended only as a reference document. Appendix A consists of the first 11 issues of the droplet.
Nicola Watershed Present and Future Water Demand Study	Summit Environmental Consultants	Jun 2007	The above report summarizes the findings of a study carried out by Summit Environmental Consultants in the latter half of 2006. The goal of the study was to determine as accurately as possible current and future demand for water in the Nicola watershed. The principle objectives of the study were to: a) quantify current (2006) water demand by sub-basin and sector on an annual, monthly and weekly basis (August and September); b) compare water demands with licensed quantities in the watershed in order to identify potential water licensing issues; c) evaluate irrigation efficiency in the watershed; d) develop future projections of water demand by sector and sub-basin taking into account three different growth and climate change scenarios. The scope of the study excluded the demand for water by the fisheries resource and that required for maintaining or enhancing existing ecological systems. Actual water use data was not readily available. Therefore, the report provides only estimates of water demand and water use. Future projections of water demand using three different scenarios are provided for 2020 and 2050. The Multi-Stakeholder Committee of Nicola WUMP reviewed the study findings and had a number of comments related to the study findings and the information contained in the final report. In order to address these, the decision was made to prepare an addendum to the report. The Present and Future Water Demand Study and the final report met the terms of reference that were developed for the project. The intention of the addendum is not to question the validity of the study findings but to add clarity, highlight a number of statements made in the report, and provide context in order to minimize misinterpretation of the data and comments that are found in the final report. It is recommended that the addendum be read in conjunction with the report.
Governance - Part 1: Preliminary Assessment of Governance Options	Water Management Consultants	Mar 2007	The report was prepared by WMI Water Management Consultants International Inc. (Kamloops). The report summarizes the results of a look at water governance models around the world and outlines why a water management governance structure is necessary to meet water stewardship requirements. The report also summarizes the main discussion points from a meeting on February 21, 2007 in which members of the Multi-Stakeholder Committee of Nicola WUMP took part. The report concludes with a suggested way forward regarding institutional development. There are five appendices after the ten-page body of the report.

Study Name	Author(s)	Date	Annotation
Review of Groundwater-Salmon Interactions in British Columbia	Tanis Douglas	Nov 2006	The review summarizes information on surface and groundwater links, the importance of groundwater to salmon, and current policies on groundwater use and important gaps in the current groundwater policy in British Columbia. The author reviewed 67 reports and papers about surface and groundwater interaction related to fish habitat; behavioural thermoregulation and redd site selection; artificial groundwater recharge and groundwater use in fish restoration; management and use of surface and groundwater with respect to fish; and groundwater fish management needs.
Nicola River Watershed - Water Use Management Plan - Instream Flow Needs for Fish	Solander Ecological Research	Oct 2006	The report summarizes some of the existing information on instream fish flows in the Nicola watershed and provides recommendations for further work with respect to understanding and resolving fish-flow issues. The main body of the report ends with these recommendations: 1) produce defensible time series of naturalized flows for the Nicola River and its tributaries; 2) conduct a quantitative analysis of water use and its effects on fish habitat; 3) establish instream flow targets for fisheries, based on empirical and overview methods, including temperature modeling; 4) conduct trade-off analyses in the WUMP using a third party experienced decision analyst and facilitator; 5) develop tools to manage the water resources in the face of conflicting needs, including development of rules under different flow scenarios such as wet and dry years; 6) incorporate climate change projections into water management decisions; 7) avoid further water allocation for out-of-stream uses.
A Study of Governance Models	Allison Guichon	Sep 2006	The report summarizes information about nine organizations that manage aspects of water. They are the Oldman Watershed Council, Mackenzie Valley Land and Water Board, Mount Werner Water Board, Manitoba Conservation Districts, La Salle Redboine Conservation District, Turtle Mountain Conservation District, Okanagan-Basin Water Board, Bow River Irrigation District and Bonaparte Water Users Group. The report describes these entities in terms of their legal status; the selection, composition, term and qualifications of the board of directors; mandate and limits of authority; types of decisions made and how decision are made; reporting requirements; sources of income; user fee structure; staffing and budget line items.
Nicola Stock Breeders Association – The Completion of the Nicola Lake Dam Project: Technical Feasibility Study	Urban Systems	Mar 2006	The report provides a history of the building of the current dam, explains why it was not completed, and discusses and evaluates the engineering options for completing the Nicola Dam. The purpose of the study, which was carried out by Urban Systems Ltd., was to conduct an objective assessment of the feasibility of dam completion. Technical engineering factors, impacts and technical financial/economic analysis were the criteria selected to determine feasibility. The report also outlines a way forward, the benefits from dam completion and the social, environmental financial and economic considerations that will have to be weighed in deciding whether or not to move forward with

Study Name	Author(s)	Date	Annotation
			implementing the recommended engineering option.
Report on Phase 1 of the Process Leading to a Nicola Water Use Management Plan	Nicola Watershed Community Round Table	Sep 2005	The report summarizes the activities that took place between November 15, 2004 and June 30, 2005 of the WUMP process. The report provides a brief background as to how the planning process came about, includes the terms of reference for the planning process and its structure. It summarizes the work of five committees and sets out next steps for Phase 2 - plan development.
Nicola River Basin Management Strategy – Phase 1: Scoping Study	Urban Systems (Jeremy Cooke)	Jan 2005	The report summarizes the findings of a study commissioned by the Nicola Stockbreeders Association. The report describes the natural processes at work in the Nicola watershed, the ecological process and the human activities. It discusses in general terms water use, water availability and the water balance. The report identifies some of the issues around water, provides an assessment of those issues and sets out some first steps for developing future local water management strategies.
Charting Our Water Future, Overview of Workshop Results	Urban Systems	Dec 2004	The report summarizes the discussions that took place around water issues, vision and goals for the future of the Nicola basin, knowledge gaps and next steps. The report includes a list of all the workshop participants, the names of the presenters and the titles of their presentations.
Conflicts Between People and Fish for Water	Pacific Fisheries Resource Conservation Council	Sep 2004	This study was commissioned by the Pacific Fisheries Resource Conservation Council. The report's authors are Dr. Marvin Roseneau and Mark Angelo. The report looks at water flows and water extraction in two BC rivers, the Nicola and the Englishmen. The report discusses the impact of water extraction on fish and how government has responded to increasing demands for new water license applications. The report recommends several ways for government agencies and the public to protect and restore fish flows.
Forum on Water – Water: Is There Enough for Everybody?	Nicola Watershed Community Round Table	Feb 2004	This is a summary report on a public forum that was held in Merritt on February 21, 2004. The report includes the list of participants, speakers and presenters and their presentations, and a summary of the question and answer period that followed.
Analysis of Agricultural Water Supply Issues – National Summary	Agriculture and Agri-Food Canada	May 2003	This report was prepared by Agriculture and Agri-Food Canada. The report summarizes the agricultural and water supply issues and constraints throughout the country and in each region. The information in the report came from consultations that were undertaken in order to provide guidelines for the development of the National Water Supply Expansion Program.
Water Conservation Strategy – City of Merritt	Urban Systems	May 2003	This strategy was prepared by Urban Systems for the City of Merritt. The report is divided into six chapters: introduction, why is water conservation important, overview of Merritt's water system, moving towards Merritt's water conservation strategy, water conservation measures and conclusion and recommendations. The report includes tables and charts showing average water demand in Merritt and elsewhere, highest daily water use, average daily water use per person, water and wastewater system expenditures, and city spending on water conservation.
Coldwater River Watershed Recovery Plan	LGL Limited	Nov 2001	The recovery plan was prepared by LGL Limited. The plan identifies and sets priorities for activities required to achieve the recovery goals for the Coldwater watershed and its fish stocks. The report includes a stock and watershed profile, and

Study Name	Author(s)	Date	Annotation
			information about the stock and freshwater habitat condition. It discusses the biological, and socio-economic factors influencing recovery, and presents recovery objectives, targets, strategies and options.
Low Altitude Thermal Imaging of the Coldwater River	Henderson Environmental Consulting	Jul 2001	The study was carried out by Henderson Environmental Consulting for Tolko Industries Ltd. The study was exploratory in nature and had the following objectives: a) to test the accuracy of aerial versus ground measured stream temperature; and b) to explore the utility of other features of aerial photographic technology to complement the existing Tolko stream-temperature monitoring project in the Coldwater River.
The Water Quality of the Tributaries of Nicola Lake	D.W. Holmes	May 1998	The study examined water quality in Chapperon Creek, Upper Nicola River, Spahomin Creek, Moore Creek, Quilchena Creek, Wasley Creek and the Nicola River at the outlet of Nicola Lake. The report's author, D. W. Holmes, concluded that Nicola Lake "obviously acts as a 'sink' retaining phosphorous in the sediments and that total nitrogen exiting the lake was always in the form of organic indicating the source was probably algae cells".
Nicola Basin Strategic Plan – Summary Document	MOE	Jul 1983	The Nicola Basin Environment Strategic Plan was the first example of this type of planning for the Ministry of Environment. The report is divided into four chapters: an introduction; management strategies for water and anadromous fisheries, water quality, resident sport fisheries and wildlife; response to the strategic plan; conclusions; and a recommended management strategy.
Nicola Basin Strategic Plan – Technical Document	MOE	May 1983	This document provides a summary of the information and analyses that support the Summary of the Nicola Basin Strategic Plan. It contains an integrated information base of the Nicola basin at the strategic level. The report contains numerous tables of data and figures.
Engineering Feasibility Study on Rebuilding Outlet of Nicola Lake	L.A. Bergman	May 1983	The report summarizes the results of further work (a preliminary assessment was done in 1981) to assess the benefits to agriculture and fish of a new dam to replace the existing dam at the western outlet of Nicola Lake. The report includes a preliminary design for the new dam with cost estimates; and data on storage, licensed uses, water supply, water levels, value of the fishery resource, etc.
Water Requirements for the Fisheries Resource of the Nicola River of BC	G.T. Kosakoski and Roy E. Hamilton	Sep 1982	The report examines the hydrology of the Nicola River system and analyses low flows. Data on the fisheries resource is summarized including, distribution, timing, and escapements of salmon stocks. Information on the economic value of the fisheries resource is provided. Spawning and rearing habitat was studied and the results are discussed in the report. Nearly half of the report is comprised of appendices containing data, figures and graphs to support the conclusions. Recommendations are made regarding regulation of storage on Nicola Lake for the benefit of the fisheries resource.
Chemical and Biological Characteristics of the Nicola/ Coldwater Watershed (incl Nicola Lake)	D.W. Holmes	1979	The report summarizes the findings of a one-year intensive study on water quality of the Nicola-Coldwater watershed. This study took place in 1979. The objectives of the study were: a) to determine the basic water quality of the Nicola River; b) to determine the effect of the Merritt sewage treatment plant on the Coldwater and Nicola Rivers prior to plant operating in late 1979; and c) to determine the basic limnology of Nicola Lake.

4.2 Key Findings from the WUMP Studies

A number of key study findings are highlighted here:

- Climate change is having a very significant effect on the precipitation patterns and hydrology in the Nicola Watershed leading to dryer and more prolonged periods of low flows through the summer and winter in some years. This trend will likely continue into the future.
- Total annual water use in the watershed was estimated at 74 million cubic metres (in 2006). The agricultural sector accounts for approximately 80% of this water use. Conservatively, water demand is projected to be 5% greater in 2020 and 14% more by 2050 than today. If climate change and rapid population growth are factored in, the demand for water will be 42% more by 2020 and 124% more by 2050 than today. Efficiencies in irrigation water use are increasing and a limited amount of flood irrigation is being practiced.
- Groundwater discharge to surface water is the primary source of stream base flow. Any groundwater extractions and off-stream use in the Nicola Watershed will reduce downstream flows. Approximately 30% of all water use was estimated to come from groundwater (2006). Groundwater extraction from surficial aquifers will have a local effect on stream flows. Groundwater extraction from confined aquifers will have a more widespread effect on stream flows.
- Based on a water budget analysis of instream flow requirements for fish and water needed for off-stream use (e.g. irrigation), the Nicola Watershed has a net surplus of water in most years in terms of how much water is available (supply and storage) versus how much is needed to meet existing water demand. However, there is a timing and distribution challenge between when water is needed and when it is available. During typical drought periods (1 in 10 year event) every sub-basin in the Nicola Watershed has a water deficit through the summer and fall (July to Oct) and therefore there is insufficient water to meet irrigation and instream flow requirements even when dam storage is factored in. Despite the fact that over the next 10 years there may be slightly more water available as a result of the effects from the Mountain Pine Beetle infestation, the consistent and general trend will be an increasing water deficit (in drought years) over the next 40 years as there will be less water supply and greater water use unless action is taken.
- If a sub basin is at a water deficit, all upstream sub basins should also be considered to be at a deficit because of the critical contribution from upstream.
- In order to properly assess potential changes at (or in the operation of) Nicola Dam, there are some critical data gaps which must be addressed first (e.g. impacts of resident burbot population associated with fluctuating water levels).

5 Options Assessment

5.1 Overview

The identification, screening and ultimate selection of policy instruments included in this draft report was a multi-step process carried out by both the SC and MSC committees. In addition, a structured preliminary options assessment was carried out for potential changes at Nicola Dam.

5.2 Process to Select Recommended Policy Instruments

The selection of recommended policy instruments consisted of the following steps:

#	Activity	Who	When
1	• Brainstormed ideas for policy instruments • Discussed preliminary policy instrument ideas	MSC	March 2008
2	• Reviewed preliminary ideas generated at March MSC meeting	SC	April
3	• Reviewed Province's Living Water Smart Plan and associated actions	SC & MSC	July
4	• Reviewed other community water management plans for potential policy instruments o Township of Langley Water Management Plan – *2nd Version Draft Report (May 2008)* o Cowichan Valley Water Management Plan (March 2007)	Compass	August
5	• Screened policy instruments against NWUMP objectives • Reviewed preliminary policy instruments against province's Living Water Smart Plan actions • Brainstormed additional ideas for policy instruments	SC	September
6	• Assessed and screened[23] preliminary policy instruments	SC	October
7	• Reviewed, evaluated and suggested new policy instruments	MSC	October
8	• Revised the preliminary policy instruments based on MSC feedback	SC	November

[23] Based on costs, effectiveness and public acceptability.

5.3 Preliminary Nicola Dam Options Assessment

In Phase 2 of the planning process the MSC confirmed that they wanted to undertake an options assessment to see to what degree there could be community support towards recommended changes at Nicola Dam. The options assessment was to consider potential changes in operations at the dam and potential new capital improvements which could increase the available storage of the facilities. A multi-attribute evaluation was carried out culminating in two values-based trade-off exercises undertaken by the MSC at their July 10th, 2008 meeting. The main impetus for the options assessment was to scope out how much community support there was to complete the dam as it was originally envisioned or whether there were alternative ideas that would better meet the communities' multiple and competing interests. The dam and its operations were seen as perhaps the most immediate and effective opportunity to address a number of long standing water availability issues, if more storage or a shifting of flow releases from the dam were possible at certain times of the year.

Leading up to the July 10th meeting a lot of preliminary work was done to try and estimate the impacts of various dam options, including:

- A literature review of the available and relevant materials related to Nicola Dam operations and its completion;
- A review of Environment Canada's historical inflow data and lake levels;
- Discussions with Water Management Consultants on Nicola Lake inflows and water demand estimates simulated during their recently completed study, "Nicola Watershed Water Budget Analysis, Draft version dated June 6, 2008";
- Discussions with the Steering Committee and its members;
- Telephone surveys with knowledgeable experts and dam operators to assess the possible issues and impacts associated with changes at the dam;
- Development of a simple water balance tool for Nicola Dam to be able to compare between different dam options. The tool provided flow estimates of dam releases and corresponding water levels for Nicola Lake (based on 17 years of inflow data: 1989 to 2006);
- A technical workshop was also held on June 17th in Merritt with fisheries experts (from DFO, MOE, Nicola Tribal Association, and Solander Ecological Research), the current and past dam operators (MOE), and knowledgeable locals. The workshop participants (1) identified and assessed the potential environmental issues and impacts, (2) developed some rough performance measures, (3) developed some representative options, and (4) estimated the impacts across the options according to the performance measures.
- At the June 18th MSC meeting the Committee reviewed and added to the potential issues that might be associated with changes at Nicola Dam. In addition, the Committee reviewed the tentative suite of options, which were to be used for the upcoming assessment; and
- Additional telephone surveys were carried out with local residents on the potential impacts of any changes at the dam.

The options assessment consisted of 5 options involving operational and/or infrastructure changes at or near the dam. These options were assessed using 14 performance measures. Table 2 summarizes the options and their relative performance against one another.

Table 2 - Consequence Table for Preliminary Dam Options

Area	Objective	Performance Measure	What is Better	Dam Options				
				1a	1b	2	3	4
				Current Dam (Status Quo) *Existing Min Flows*	Current Dam *Modified Min Flows*	Dredge Channel *Modified Min Flows*	Incre Dam Ht = 0.40m *Modified Min Flows*	GW Pump @ dam (Q=0.5cms) *Modified Min Flows*
				28,500 AF	28,500 AF	41,600 AF	38,500 AF	28,500 AF
Enviro	**Fish - Lake**	• Aquatic Health Index (Scale 1- worst; 5 – best)	More	**4**	**4**	**1**	**3**	**5**
	Fish - Lake	• Burbot spawning success						
	Wildlife - Lake	• Staging Area (Apr-May)						
	Fish - River	• Avg # days/yr dam outflows < **1.7 cms** (*betw Jul-Nov*) **– *Relative to Option 1A***	Less	**-**	**-1**	**+1**	**+2**	**-19**
		• Avg # days/yr dam outflows < **1.2 cms** (*betw Dec-Apr*) **– *Relative to Option 1A***	Less	**-**	**0**	**0**	**0**	**0**
		• Freshet Fish Pulse Index (Apr-Jun) - (Scale 1- worst; 5 – best)	More	**1**	**3**	**5**	**3**	**1**
		• Water Temperature Index (1-no change; 2-better)	More	**1** *(No Change)*	**1** *(No Change)*	**2** *(Better)*	**2** *(Better)*	**2** *(Better)*
		• Stream Health - # of yrs (out of 18) dam releases = or > 25cms	More	**7**	**7**	**4**	**6**	**7**
Econ	**Costs**	• Capital Costs ($)	Less	**$0**	**$0**	**$1,300,000**	**$200,000**	**$1,500,000**
		• Ongoing maintenance ($/yr) – ***Relative to Option 1A***	Less	**-**	**$0**	**+$50,000**	**$0**	**+$20,000**
		• Other ?	Less					
Social	**Agriculture**	• Area of Irrigation Land (Acres)	More	**4,900**	**4,900**	**9,800**	**9,800**	**4,900**
	Drought resistance	• Addn Water Storage during 1:15 yr drought (AcreFt) – ***Relative to Option 1A***	More	**-**	**+700**	**+5,200**	**+2,100**	**+3,300**
	Downstream Flooding	• Flood mitigation potential for a 1:5 yr flood (scale 1 – worst; 5-best)	More	**3**	**3**	**5**	**4**	**3**
	High Lake Levels	• Avg # days/yr lake levels are above 625.8m – ***Relative to Option 1A***	Less	**-**	**-4**	**-16**	**+17**	**+4**
	Recreation – Beach Avail.	• Avg # days/yr water levels are above 625.5m (from Jul 15 to Sep 15) – ***Rel to 1A***	Less	**-**	**0**	**-4**	**+12**	**+3**
	Aesthetic – Low lake levels	• Avg # days/yr lake levels are below 624.5m (March to April) – ***relative to Option 1A***	Less	**-**	**1**	**10**	**-2**	**-14**

Note. The cells to assess potential burbot and wildlife impacts were left blank to highlight them as critical data gaps to be filled, as they might be instrumental in assessing the performance of different dam options.

The MSC undertook two values-based exercises[24] to highlight which options were best serving their interests and which performance measures were most influencing their preferences. The resulting facilitated discussion from these exercises highlighted the following:

- Everyone agreed that changes to Alternative 1 (which represented current Nicola Lake rule curves and minimum flow release requirements) should be explored in greater detail, as consensus on a preferred option at the dam seemed achievable across the multiple interests of the community.
- It was felt that changes at the dam could result in significant benefits – *increased irrigated land along the lake and downstream and improved fishery flows at key times.* Moreover, if

[24] A direct ranking exercise and a swing weighting exercise.

some small physical works projects were undertaken[25], the benefits could be considerably more. While operations at the dam over the past few years have begun to make some of these operational changes, the MSC supported further work to evaluate the potential of these changes (see *Recommendation #20 and #21* in Section 6).

- There are key data gaps[26] which should be addressed in order to inform a more detailed options assessment and therefore provide a higher degree of confidence when assessing impacts of current operations as compared to any proposed changes.
- Both the MSC and SC agreed that there would be value in carrying out a more detailed options assessment to explore some hybrid options towards reaching community consensus on a preferred option at the dam.

For a more detailed summary of the preliminary options assessment refer to Appendix B.

[25] For example, limited dredging, consideration of groundwater pumps below the dam to augment river flows, pump intake modifications along the lake, etc.

[26] Burbot, kokanee, and rainbow trout spawning and rearing habitat impacts, tributary migration issues, wildlife impacts associated with staging and nesting areas, fish passage issues, pump intake issues associated with lower lake levels, water quality issues associated with lower lake levels, water level effects associated with Upper Nicola Band's infrastructure facilities, and potential aquifer effects associated with a new groundwater pump to augment river flows at certain periods.

6 WUMP Recommendations

6.1 Overview

As described in Section 5, the recommended policy instruments which make up the WUMP were identified through a multi-step evaluation process. The package of policy instruments presented here have been endorsed and recommended by consensus by the MSC for the draft Nicola WUMP.

6.2 Recommended Policy Instruments

A total of 37 policy instruments were recommended for the draft Nicola WUMP. The instruments were grouped according to the following five WUMP objective areas, as follows:

- Water quantity
- Water quality
- Environment
- Learning
- Management

It is noted, however, that many of the instruments could have been placed under more than one of these objective areas.

6.2.1 Water Quantity

As mentioned previously, the focus for the Nicola WUMP is on water quantity and ensuring the adequacy and availability of water supplies (both in terms of water demand and increased storage). There are a couple of reasons for this: water shortages were fairly well understood at the initiation of the WUMP; there is a high level of awareness in the community about water shortage conflicts; given recent climate change effects and land development pressures the competition for and potential for conflicts around water security is expected to increase; and it is felt that water quantity needs to be addressed upfront.

Recommendations

#1 Initiate and implement a Water Management Plan for the Nicola Watershed under Part 4 of the Water Act

Early in the plan synthesis for the WUMP, the MSC recognized that the best way to implement many of the needed policy instruments towards sustainable water management was through a Water Management Plan (WMP) under the *Water Act*. A WMP provides arguably the most effective tool for communities and local governments to play a more active role in the stewardship of the resource. A WMP provides a forum and the legislative tools to manage water on an integrated basis across overlapping jurisdictions. While the MSC has made formal attempts to initiate a WMP, it has not been successful at this time. A WMP would be a critical element to enable the adoption – and implementation – of many of the recommended policy instruments contained within this

WUMP. A WMP would be applied across all sectors of water supply and demand *(residential, commercial, institutional, industrial, and agricultural).*

#2 Enhance public education and outreach program

There are public awareness initiatives already in existence, but there is a need for a more comprehensive and coordinated effort across the region. A scaled up program would raise awareness about water issues, ground and surface water interactions, fishery and environmental requirements, conservation measures, best land use management practices, etc. The program is also expected to include:

- Implementing a drought awareness plan;
- Promoting grey water systems;
- Supporting water conservation rebate programs;
- Raising awareness about the WUMP (bi-annual reports and WUMP studies); and
- Encouraging best management practices in the agricultural, mining, and industrial sectors.

#3 Initiate a staged conservation initiative, which may include installing and reading flow meters on all connections and reporting usage on an annual basis

Knowing how much water is being used, by whom, and when is core to the WUMP. Effective management cannot occur without this information and yet it was recognized that this information comes at a potentially high relative cost. The MSC therefore recommended a staged and adaptive approach towards understanding water use that was tied to ongoing monitoring. The staged approach would consist of the following sequential steps:

Step 1 Information Gathering

- Collect and assess flow meter data already available from the City of Merritt
- Undertake a study to estimate actual water use/demand, audit large users and update the water supply model (under studies in *Recommendation #33F*)

Step 2 Limited Water Meters on New Water Connections

- Support universal water meters on all municipal water supply system connections and community well systems
- Mandate flow meters on all new water supply wells with annual reporting
- Mandate flow meters on all new water license applications with annual reporting

Step 3 Water Meters on Existing Water Connections

If monitoring is showing that water availability is decreasing and conflicts between water users are increasing then:

- Initiate a pilot project to install water meters on all existing water supply wells and water license intake structures with annual reporting

Based on the results from the pilot project and if monitoring continues to show declines in the greater area in water availability and conflicts between water users persist, then:

- Lead the development of a *made in Nicola* conservation initiative to promote and plan for water shortages with large water users and water purveyors
- Mandate water meters on all existing water supply wells and licensed surface water intakes

These steps are linked with both *Recommendations #4 and #5* and the proposed monitoring and study program described in *Recommendations #32 and #33*. They are also associated with the province's Living Water Smart plan which will require measuring and reporting water use of large users by 2012 and regulating groundwater use in priority areas.

#4 Mandate drilling authorizations for new water supply wells

Currently, there are not many regulatory controls to manage groundwater use in the province. With few exceptions[27], anyone can drill and extract as much groundwater as they would like with little regard to adjacent streams or neighbouring wells. In areas of high priority and vulnerable aquifers this was to be dealt with through the establishment of water management planning areas under Part 4 of the *Water Act (see Recommendation #1)*. Until a water licensing regime can be established (*Recommendation #5*), drilling authorizations would provide some level of protection to minimize well interference and flow impacts on adjacent waterways through the use of setbacks and flow restrictions. Drilling authorizations could be associated with:

- Setbacks for well interference and riparian requirements
- Environmental assessments for new wells in close proximity to fish bearing streams
- Flow restrictions for the size of new wells according to property area

This recommendation is linked with the LWS which states that government will regulate groundwater in priority areas for large users by 2012.

#5 Work towards the implementation of a water licensing system for all new water supply wells

As more and more people move into the region; as more and more wells are drilled and water license applications approved; as climate change continues to potentially shift the availability of water resources; and as the inter-dependency between groundwater and surface water becomes more evident, it is only a matter of time before a comprehensive water licensing system will be required involving groundwater. A licensing system will secure the rights of water users and provide the controls needed to allocate water on a more sustainable basis.

[27] An environmental assessment gets triggered for new wells with a capacity greater than 75 litres per second (1200 US gpm). The next phase of the GWPRs are supposed to provide guidance on setback distances.

This recommendation is also connected with the LWS which will implement time bound water licenses in the future for new licenses.

It was also recommended that a review of the licensing system should consider the option of granting additional downstream water rights given some of the unallocated storage at Nicola dam (i.e. beyond DFO's licensed rights). This recommendation is linked with *Recommendations #6 and #7*.

#6 Support condition of no new permanent water licenses unless backed by storage

Currently there is a practice in place which does not allow new permanent water licenses to be issued unless they are backed by storage, as many areas in the watershed are already fully allocated. This recommendation supports this practice and also supports the consideration of allowing short-term freshet licenses where it makes sense.

#7 Harmonize surface water allocations/licenses with groundwater use/demand/licenses

Groundwater and surface water are hydrologically linked. Any water that is extracted from an aquifer will ultimately result in a decrease in river flows downstream by a corresponding amount[28]. The water that is available to meet the needs of the basin is therefore a combination of water stored in the groundwater reserves and the water that is stored or flowing on the surface. To effectively manage the water resources an integrated approach is needed for considering both groundwater and surface water.

#8 Ensure that all provincial and federal infrastructure grants are contingent on water metering

This recommendation was identified from the Cowichan Basin WMP and is linked with *Recommendation #3.* It was felt that any grant application involving water or waste water infrastructure requests by local governments should be tied to better water use data.

#9 Seek opportunities to renegotiate and hold in reserve unused portions of water licenses

There is allocated water that is currently not being productively used. This unused water could provide benefits. The idea is to identify opportunities and then negotiate with water license holders for the temporary use of their water rights. The unused water portions of the water licenses would then serve as a potential "water bank" for other uses within the watershed. It should be noted that there are successful examples of this in the Nicola region. This recommendation would also explore the benefits of an incentive program to encourage water users (e.g. license holders) to invest in more efficient water use.

#10 Update land use plans to be consistent with WUMP goals and objectives

Water availability, water use and water quality are associated with land use planning and practices. To meet the objectives set out in this draft WUMP there is a need to review related land use plans as they get updated. Related land use plans would include:

[28] Water Management Consultants. March 2008. *Surface and Groundwater Supply and Interaction Study – Phase 1 and 2*.

- Official Community Plans (OCPs), Neighbourhood Plans and Integrated Growth Plans
- Non-OCP and non-ALR plans (e.g. forestry stewardship plans / sustainable forest management plan, liquid waste management plans, Indian Reserve plans, etc.)

Issues to be considered when these plans get updated would include:

- New subdivisions (development areas) that would be dependent on groundwater in areas already experiencing localized water shortage issues;
- New subdivisions (development areas) over important groundwater recharge areas unless pre-development infiltration targets were agreed to;
- New developments or higher risk zoning over vulnerable aquifers susceptible to contamination;
- New developments in areas of sensitive aquatic environments; and
- Other zoning or by-law changes that would further the WUMP goals.

#11 *Implement a new by-law for facilitating grey water systems and any needed regulatory changes*

Currently there are regulatory impediments which make it difficult to build grey water systems. A coordinated effort is required between local governments and regulatory agencies (MOE and IHA) to facilitate the adoption of grey water systems and this should ultimately be built into by-law requirements for new building permits. It is noted that new legislation in 2010 will make it more difficult to dump grey water into or near water courses (under the *EMA*). It is also noted that this recommendation is closely tied with *Recommendation #18.*

#12 *Recommend new by-laws and development permit requirements to better conserve water supplies*

Given the scarcity of water during certain periods, local governments need to demonstrate leadership to save and better preserve the available water supplies. It is recommended that local governments look to some of the positive water conservation by-laws that are underway in other parts of the province related to:

- Low flow fixtures, appliances, and ultra low flow toilets, associated with new developments and major renovations or retrofits involving building permits;
- Soil by-law requiring new developments to preserve and redistribute topsoil on green field sites (ideally this would include a minimum of 0.3m of top soil for lawns or gardens);
- Xeriscaping by-law requiring drought resistant and/or indigenous plants in landscaped areas;
- Infiltration by-law requiring new developments and subdivisions to meet the pre-development infiltration rate of precipitation seeping into aquifers;
- Potable water by-law requiring new developments and subdivisions to prove that a sustainable supply of potable water already exists before a development permit is issued;

- Green development policy that would fastrack green development permit applications and therefore provide incentives for water conservation; and
- Other related bylaws identified in the Green Bylaws Toolkit (see http://www.greenbylaws.ca/)

It was noted that government buildings could be the first to adopt these new water conservation measures. It was also suggested that golf courses needed to be targeted for better water conservation.

It should also be noted that the LWS will require fifty percent of new municipal water needs to be met through conservation by 2020, require better water conserving plumbing fixtures, and will encourage green developments waiting on environmental approvals.

#13 Implement a graduated summertime sprinkling restriction system

While there are summertime sprinkling restrictions for people on the municipal water systems, no such restrictions apply for people watering their lawns or gardens off municipal water. This recommendation would be applied through raising public awareness (*Recommendation #2*) and through the implementation of sprinkling restrictions that treats everyone fairly. This recommendation does not apply to agricultural lands which are irrigated.

#14 Implement a rebate program encouraging water conservation

This recommendation recognizes that a lot more can be done to encourage people to adopt water conserving ways. While there are some rebate programs underway in the region, it is recommended that more funds are made available to promote and scale up these initiatives. Options for potential additional rebates could include outdoor watering kits, a rain barrel program, more efficient sprinklers with timers, soil moisture tensiometers, etc.

#15 Develop an integrated drought management plan

Part of the motivation for initiating a WUMP was to develop a comprehensive drought management plan, but because of timing and resource constraints this never occurred during this phase of the draft WUMP. It was recognized, however, that a drought management plan is a critical piece for water management in the region. It was also noted that while there are individual drought management plans in areas, there is no overarching integrated plan which ties them all together.

#16 Develop a program to identify and cap free flowing artesian wells

Although all artesian wells are required to have control devices (well caps) on them according to the Groundwater Protection Regulations (GWPR), there is very little monitoring and enforcement which has been carried out to date. Given this, and the knowledge that there are many free flowing artesian wells which may be draining groundwater levels, the MSC supported a program to help identify and better ensure compliance with the regulation.

#17 *Encourage more efficient irrigation systems*

Agricultural accounts for approximately 80% of all water used in the Nicola watershed (Summit Environmental[29]). It follows that small improvements with more efficient irrigation systems, would yield potentially significant water savings. Two areas in particular that offer opportunities are:

- Certified irrigation plans, which better ensure that irrigation systems are designed to optimize water use and minimize the potential for over watering crops.
- Soil moisture tensiometers provide an additional means for farmers to assess their irrigation schedules. The MSC recommended the promotion of these devices and supported a rebate program to further encourage their use.

It was noted that more efficient irrigation systems may be eligible for grants and partial subsidies through Environmental Farm Plans. This recommendation was also related to the LWS, which will require more efficient water use in agriculture. This recommendation is also tied with *Recommendation #9* that supports the review of an incentive program to encourage water users (e.g. license holders) to invest in more efficient water use.

#18 *Support LWS's requirement for mandatory purple pipes in new construction by 2010*

Purple pipes are described as,

> *"Household purple pipes are a second set of plumbing that captures rainwater and recycles leftover water from the dishes, washing and showers. This 'extra' water can be used for flushing toilets and watering gardens, this means we can save the best water for drinking and take less from the environment (Living Water Smart 2008)".*

This recommendation wanted to highlight and support the purple pipe program mentioned in the province's LWS plan.

#19 *Initiate periodic and planned communication meetings between WUMP Advisory Council, stakeholders, and MOE dam operators*

While there are currently informal discussions between dam operators and stakeholders when it comes to operations at Nicola Dam, the MSC wanted to develop a more regular forum to discuss and share local information that might be helpful to the dam operators on an ongoing basis.

#20 *Undertake a detailed options assessment to find a preferred management solution*

As discussed in Section 5.3, the MSC undertook a preliminary options assessment for changes at Nicola Dam. The outcome from that assessment led to this recommendation for a more detailed trade-off assessment to be undertaken towards reaching a consensus decision on a preferred community option. This assessment would include a review and recommendations for any needed changes to the operational rule curves.

[29] Summit Environmental Consultants. June 2007. *Nicola Watershed Present and Future Water Demand Study.*

Critical to this assessment is the filling of a number of outstanding data gaps and, in particular, whether any changes at the dam would have an adverse impact on the aquatic health (e.g. resident burbot population in the lake). A number of recommended studies[30] have been strongly endorsed by the MSC to be carried out in support of a detailed options assessment.

It needs to be highlighted that for more than 20 years, the completion of the Nicola Lake dam has been a contentious issue that, despite numerous attempts to resolve it, remains outstanding. At the *Charting Our Water Future* workshop one of the main issues that arose was the completion of the Nicola Lake dam. The workshop participants recommended that a study be launched to investigate whether the community should proceed with dam completion or follow an alternative path of shelving the idea once and for all.

The recommended study was carried out in 2005[31] and consisted of an objective assessment of the feasibility of dam completion for alleviating current river flow problems. An aspect of the study included a review of the potential social and environmental issues that could be affected by the completion of the project. The study concluded that one of the most important unresolved issue that needed to be addressed before dam completion could proceed was the whole question of the burbot fish life cycle and how fluctuations in lake levels would affect this species. Since the 2005 study, a number of other important fish and fish habitat data gaps have been identified.

The absence of fisheries information (burbot, kokanee, rainbow, etc.) limited the Nicola dam options assessment in that a major performance measure was lacking to evaluate alternative dam options. These data gaps were recognized as being crucial to address in order to inform a more detailed options assessment and provide a higher degree of confidence when assessing impacts of current operations as compared to any proposed changes.

The initiation of this recommendation should be as soon as the identified Nicola Lake Aquatic Impact Study (*Recommendation #33B*) is completed. This has been assumed for Year 3 in the implementation schedule for the NWUMP.

#21 Initiate an aquatic ecosystems study associated with lake level changes in Nicola Lake (and downstream)

Critical to undertaking a more detailed options assessment – *which would include consideration of dredging and increased storage potential at Nicola dam* – is a clear understanding of the potential environmental effects in the lake or downstream associated with operational changes at the dam (i.e. changing water levels or flow releases) or any proposed infrastructure modifications. This study is also included in *Recommendation #33B – Nicola Lake Aquatic Impact Study*, but is highlighted here as a separate recommendation because of its importance.

[30] Under Recommendation #33 Studies B, D and E.
[31] Urban Systems. March 2006. *The Completion of the Nicola Lake Dam Project: Technical Feasibility Study.*

#22 Recommend a review of the operations for Mamit Lake and all other existing small dams

Similar to the operations at Nicola Dam, it was felt that there were significant potential benefits associated with operational changes at other dams. The MSC recommends a review of the operations (including rule curves where they exist) for all the dams in the watershed (including Mamit Lake).

#23 Revisit and identify potential new storage dams given water deficit

During the development of the draft WUMP, an additional storage sites study[32] was undertaken which initially identified 345 potential sites. A further examination and assessment of each of these sites narrowed down the number of potential storage sites significantly. In addition, a water balance study showed that during low inflow periods there was a deficit of water to meet the needs for people and fish throughout the region. In light of this new information, the MSC recommended that an assessment take place to identify the best new storage dams based on feasibility, cost, and opportunity. This study is also identified in *Recommendation #33G – Storage Sites Assessment.*

#24 Explore potential program to encourage use of cisterns to store rain water

The use of cisterns to store rain water for household and outdoor use was identified as a potential area that could provide benefits. At this point, the MSC wanted to explore this option in greater detail to assess its potential.

6.2.2 Water Quality

While not the primary focus of the WUMP at this point due to a limited amount of baseline information, two recommended policy instruments were identified to help reduce contamination risks and support good land use practices. In addition, a number of studies were identified to be carried out during the review period of the WUMP, which would help inform future policy instruments focused on land use practices (see *Recommendation #33*). It is noted that the recommended policy instruments described in this section are supportive of the provincial government's commitment to improve the quality and protection of drinking water sources (as described in the LWS plan).

#25 Encourage farms to undertake nutrient management plans (NMP)

Nutrient management plans provide an assessment as to the amount of nutrients (fertilizers, septic systems, manure, etc.) used on agricultural lands and whether an excess of nutrients is posing risks to groundwater or nearby water bodies. The goal for a NMP is for better managing nutrient application on farms. Farmers can apply for subsidies to carryout a NMP and receive funds for nutrient management through EFPs[33].

[32] K.G. Gizikoff. July 2007. *Additional Storage Sites Study – Phase 1.*
[33] A partnership between Agriculture and Agri-Food Canada, the BC Ministry of Agriculture and Lands and the BC Agriculture Council (for more information see http://www.bcac.bc.ca/efp_programs.htm).

#26 Encourage agriculture, mining, and other industries to adopt best management practices around water use and conservation

The MSC wanted to raise awareness and promote best management practices across all industries and commercial sectors associated with lowering the threat of contamination and pollution and furthering the objectives of the WUMP. This recommendation is linked with *Recommendation #2*.

6.2.3 Environment

Environmental objectives for the WUMP are closely related to the recommendations identified for water quantity and quality. Therefore any improvements which conserve water or reduce contamination risks also have a consequent benefit on environmental interests. Having said this, there were a few policy instruments identified which were specific to environmental values.

#27 Support ongoing enhancement initiatives

The MSC wanted to recognize and support past, ongoing and future environmental initiatives being carried out by volunteers, community groups, businesses, and government agencies. This recommendation is linked with *Recommendation #2.*

#28 Develop a Fish - Water Management Tool

ESSA Technologies carried out a technical feasibility and design assessment for an integrated decision support tool for Nicola Basin and dam[34]. This water management tool would be similar to the one developed for the Okanagan Basin and which has been used successfully to optimize fish flow releases from Skaha Lake and balance the other potentially affected social and environmental water interests around the lake systems. The MSC and SC both supported the development of such a tool for the Nicola WUMP.

It was recognized that the Nicola Watershed would benefit from a planning tool that integrates climate, snowpack, stream flow data together with real time fish flow needs. A tool like this would avoid unexpected economic impacts and balance instream and off-stream water requirements in dry years. Data on climate, snow and hydrometric stations already exist throughout the basin (although there are key gaps) but are not integrated to support good water management at the watershed level. The Okanagan Fish Water Management tool optimizes water needs for key fish life stage activities such as spawning with other competing water interests.

#29 Develop suitable riparian setback requirements for new water supply wells in priority areas

Currently there are no setback requirements for where people can drill new wells in relation to fish bearing or sensitive streams. It is expected that the next phase of the GWPRs will provide some guidelines on this, but it is not clear when these new regulations will come into force nor whether they will have the flexibility to adapt to localized conditions which may warrant more stringent requirements. Accordingly, the MSC has recommended the development and implementation of suitable riparian

[34] ESSA Technologies Ltd. March 2008. *Technical feasibility & design options for an integrated decision support tool for water use management in the Nicola Basin: FINAL Report*.

setbacks for new water supply wells. This recommendation is tied to *Recommendation #4*.

#30 Ensure that Instream Flow Needs are taken into account within any harmonized surface and groundwater licensing system

The LWS has stated that new legislation will recognize water flow requirements for ecosystems and species. However this does not necessarily deal with existing legislation nor provide any specifics for how or what role groundwater plays when determining and better ensuring that instream flow needs are provided for. This recommendation therefore emphasizes the importance of an integrated approach to meet fishery requirements in a harmonized water resources management regime. This recommendation is linked with *Recommendations #5 and #7*.

6.2.4 Learning and Raising Awareness

Monitoring, learning and adapting to new information is the essence of an effective WUMP. The following recommendations represent a comprehensive approach to collect needed baseline information, address critical data gaps, and inform decision makers on the effectiveness of the WUMP and in order to plan for climate change adaptation. These recommendations were informed by the studies undertaken in the WUMP described in Section 4.

#31 Prepare bi-annual report on the state of water in the valley and the effectiveness of the WUMP

This would become a living document and a report card for the WUMP. It would tie into the proposed public education and awareness program *(Recommendation #2).*

#32 Develop a monitoring program to better determine baseline conditions for water quantity and quality trends including climate change adaptation

There were a number of important areas requiring better baseline data identified during the WUMP studies. These information gaps were to be addressed through a comprehensive monitoring program. It is noted that the proposed monitoring program is crucial for the delivery and ongoing review of almost all the recommended policy instruments. The monitoring program consists of following components:

- Hydrometric stations, weather stations (include stream flow gauges, groundwater (expanded observation well network), snow level stations)
- Public reporting of local conditions (tie into public education program – *Recommendation #2*)
- Real time water temperature stations needed for the Fish Water Management Tool (*Recommendation #28*)

#33 Undertake specific studies

A number of important data gaps were identified during the course of the WUMP. An initial longer list was reviewed and screened to the short list of proposed studies described below.

The environmental studies identified in the WUMP are considered critical to:

1. Resolve long-standing questions about instream flow requirements in specific sub-basins with complex water demands, different species of fish and other important aquatic life.

2. Clarify the degree to which there is water available to satisfy instream and off-stream water demand. This information is essential to informing drought management planning, demand side management, water licensing system, storage requirements, and climate change adaptation strategies.

3. Build understanding of how annual reductions in water levels in Nicola Lake below natural levels following dredging will affect terrestrial and aquatic life dependent on the lake littoral habitat. This habitat is important to species of interest such as kokanee and burbot. An equal priority is assessing how critical wildlife habitat and life stages may be impacted by dredging and annual deeper drawdowns associated with some of the dam options considered.

The shortlist of recommended studies is summarized as follows:

A. Contaminant inventory (including a nitrate loading study – link with *Recommendation #25 NMPs*)
B. Nicola Lake Aquatic Impact Study – to assess impacts associated with potentially different operating levels (same as *Recommendation #21*)
C. Instream Flow Needs (IFN) on remaining streams not reviewed during the development of the WUMP
D. Detailed IFN assessment in priority areas
E. Groundwater storage study – to review and/or undertake a pilot project to assess the benefits and potential of groundwater storage to augment river flows during periods of drought or critical life stages of fish
F. After 5 years of improved surface water and groundwater monitoring (*Recommendation #32*), undertake a detailed water budget analysis and tie into any water metering data collected (*Recommendation #3*) and licensing (*Recommendation #5*) decisions. This study would include (1) an update of water supply estimates, (2) actual water use/demand assessment, (3) audited large users, and (4) modifying the water supply model[35].
G. Storage sites assessment (as described in *Recommendation #23*)

Refer to Table 3 for more details about the proposed studies, research questions, and illustrative study details.

[35] Developed by Water Management Consultants.

Table 3 - Recommended WUMP Studies

#	Study Name	Study Details	Research Question(s)	Management Decision(s)	Lead Agency	Approx Study Cost
A	**Contaminated Inventory Study**	• Inventory of potential contaminants around critical surface and groundwater features (e.g. municipal well capture zones). • Collect water samples and test for key contaminants from representative areas. • Develop detailed land use practices map. • Develop a model for nitrogen mass loading.	• What sources of potential contaminants are present in key water / groundwater areas? • What land use activities and practices are likely adversely affecting water quality? • What is the extent and distribution of contaminants? • Determine whether excessive nutrients are getting into streams or aquifers. • Determine source of nutrient loading. • What are the most damaging sources (septic vs. manure) of nutrient loadings?	• Develop policies for appropriate land use activities? • Whether and how to limit land use and/or land use practices? • Are additional policies to protect groundwater resources required? • What additional detailed contaminant studies should be undertaken (e.g. details for nitrate loading analysis)? • Perform a detailed nitrate loading assessment in areas at high risk of contamination.	City of Merritt/TNRD and IHA	$100,000
B	**Nicola Lake Aquatic Impact Study**	• Collect baseline data on fish habitat and the entire fish assemblage in Nicola Lake. • Collect baseline creel data for the sport fishery. • Kokanee spawner distribution and enumeration; carrying capacity of the lake for kokanee production. • Identify burbot spawning and rearing habitat. • Estimate juvenile rainbow trout densities in the three streams.	•	• What, if any, aquatic effects would occur through changes at the dam (i.e. lake level operations)? • What is the preferred management solution for Nicola Dam that best balances the multiple interests of the community?	MOE	$300,000

#	Study Name	Study Details	Research Question(s)	Management Decision(s)	Lead Agency	Approx Study Cost
		• Determine minimum flows for fish for the three key spawning streams. • Determine presence of chiselmouth in the lake. • Identify habitat restoration opportunities.				
C	**Instream Flow Needs Assessment** (remaining streams)	• Overview natural and modeled streamflow data, water demand, natural flows vs. regulated systems. • Overview of methods for instream flow recommendations. • Previous analysis of fish-flow issues. • Application of BC Instream flow guidelines and other methods. • Review of existing fish flow recommendations.	• What trends are evident in the streamflow data? • What are the effects of climate change? • Which instream flow methods would best apply? • How frequent are current instream flow requirements met? • Can current IFR's be modified given changing conditions? • Where do more detailed studies need to be undertaken?	• How to manage for trends in streamflow hydrology. Will fish populate, benefit or be impacted by trends? • What measures can be implemented to achieve better in-stream flow conditions? • How should IFR's be included in allocation decisions? (Amend *Water Act*)	DFO / MOE	$150,000
D	**Detailed Instream Flow Needs Assessment** (in priority areas)	• Multiple transect measurements at different discharges, analysis, revised IFR.	• Are there better methods? • How do refined IFR's compare to prior IFR's?	• How to implement refined IFR's. • Monitoring IFR	MOE, DFO, NTA and NGO, consultant support	$150,000
E	**Groundwater Storage Study**	• Detail one or more groundwater storage systems currently in use • Establish start-up and ongoing operating costs of groundwater storage systems	• What are the specifics (equipment, flow, timing, infrastructure required, construction and other costs, etc. of a groundwater storage system? • What is the site or what are the	• Should a pilot project be initiated to address the uncertainty and test the benefits of groundwater storage to augment river flows in times of need (e.g. summertime droughts) • Should the Nicola Dam be	NWUMP Advisory Council	$100,000

#	Study Name	Study Details	Research Question(s)	Management Decision(s)	Lead Agency	Approx Study Cost
		• Determine criteria for site selection and provide rationale • Compare this method to other methods of water storage and water conservation – costs, challenges and benefits	sites where groundwater storage would be most effective? • What is the feasibility and costs of a groundwater storage system? • What is the residual impact of such a system?	completed?		
F	**Detailed Water Budget Analysis**	This study would include: • Updating the 1982 fish flow requirement figures where appropriate (see Study E below) • Recalculating water supply figures using additional information collected on natural flows from new stream gauges. • Model water use and supply using demand management, storage and other water management alternatives as variables • Include information from pilot meter project and the audit of large water users.	• Are the water budget figures in the 2008 study valid? • How do the different water management options (demand management storage, etc.) affect the water budget? • How effective has the WUMP been in changing the demand for water and water use?	• Are more stringent water use control regulations required? • What are the most cost effective strategies for reducing water demand? When and how best would they be implemented? • What water conservation / regulatory measures would provide the greatest benefits?	MOE/DFO/ NWUMP Advisory Council	$250,000
G	**Storage Sites Assessment**	• Assess the shortlist of sites identified in the Gizikoff Study and plot on the watershed map • Calculate new surface water storage potential of each sub-basin. • Establish which sub-basin needs more water storage	• Which, if any, of the shortlisted potential surface water storage sites should and could be developed? • What are the issues around building dams and how should those issues be addressed? • Is surface water storage the most cost-effective answer to	• Should policies and regulations promote the development of surface water storage as the best alternative to meeting projected shortages of water in years to come? • How can the release of stored water be better co-ordinated for maximum benefit (agriculture and	NWUMP Advisory Council	$75,000

#	Study Name	Study Details	Research Question(s)	Management Decision(s)	Lead Agency	Approx Study Cost
		• Determine which of the potential storage sites or a combination of them, if any, could meet the water shortfall. • Apply criteria of water balance and any known factors such as environmental considerations, landowner status, etc. to the sites in the most likely area of the watershed • Establish whether there are any sites that are feasible and cost effective.	water shortages?	fish)?		

6.2.5 Management

This category of recommended policy instruments deals with the management of the WUMP once it is finalized, approved, and implemented.

#34 Establish a community driven governance system to inform water management systems

This recommendation calls for the establishment of a water advisory entity – *to be referred to as the Nicola Water Advisory Council (NWAC).* The Council provides an innovative approach to water management that draws upon (and builds from) the community knowledge and involvement developed during the WUMP and as supported and advocated by the Minister of the Environment (MOE letter dated July 31, 2008).

The purpose and mandate of the Council would be related to the following:

- To support and advocate for the Nicola WUMP and, where applicable, may be involved with implementing portions of the Plan. In its advisory capacity, the Council would provide advice on Plan implementation and on water and land use;
- To support and, where appropriate, help coordinate participation of government agencies, First Nations, and residents of the Nicola watershed, stakeholders and interest groups during the implementation of the Plan;
- To work alone or in partnership with government and others with those recommendations that it has been identified with carrying out. For all other recommendations, its role will be limited to an advisory one. The Council will not have veto power on projects that it does not initiate;
- To collect and serve as a repository for information related to the WUMP. The Council will therefore act as a clearinghouse of information related to water use in the Nicola Watershed; and
- In its advisory capacity, the Council would provide input to government on permitting applications directly or indirectly dealing with water. Therefore, it is expected that the Council would be included on the list of referral agencies during approval process considering new land developments or other developments using water.

At a special meeting held on Feb 20, 2009, the MSC confirmed their support for a NWAC and agreed to a governance structure for the proposed Council. *Appendix C* summarizes the framework for the new structure that was endorsed.

#35 Create secure and stable funding sources to support water management activities

The recommended policy instruments in this draft WUMP require consistent and stable year to year funding. A reliance on annual grant applications is not sustainable and will threaten the delivery of this plan. It is therefore recommended that a secure and stable source of funding is secured for the WUMP.

#36 Support a compliance and enforcement system for monitoring activities associated with the delivery of the WUMP

There is very little monitoring and enforcement that occurs with water resources management in the region. The MSC supports a compliance and enforcement system to monitor WUMP related activities.

#37 Review the WUMP and its effectiveness and make any needed changes at a 5 yr review or before as required.

As mentioned previously, effective water management needs to adapt to new conditions, changing values and better information. The WUMP is considered a living plan which needs to be periodically reviewed and updated. Based on the proposed monitoring and research activities identified in this draft plan, it is recommended that a full review take place within 5 years of the WUMP being implemented.

6.3 WUMP Implementation - Timing & Costs

Implementing a WUMP will be challenging without leadership and support from the lead implementing agencies. The sequencing for when the recommended policy instruments should be started was influenced by taking a staged approach. For the most part, lower cost instruments that were associated with a high potential of public support were proposed earlier. Other potentially more costly or controversial instruments were more dependent on the results from the proposed monitoring and study program. Accordingly, the implementation of the instruments associated with larger trade-offs was delayed until better information was available and could be assessed during the WUMP review (i.e. year 5). It is noted that many of the policy instruments have been logically tied to other policy instruments.

The recommended schedule showing the proposed start date and duration for each of the policy instruments is summarized in Table 4 and Table 5.

Costs for the recommended policy instruments were crudely estimated. The purpose of approximating costs was to provide a relative comparison between the instruments. The thresholds associated with the cost categories (high, medium and low) were arbitrary and were selected to show differences between the policy instruments. Total costs to implement the WUMP – *averaged over the first ten years* – works out to about $600,000/year in 2009 dollars using a 5% discount rate. On a per capita basis for the residents living in the Nicola Watershed, total costs work out to about $20 per person per year assuming a 50-50 cost sharing arrangement between the province and the residents of the region to implement the plan (Note. this assumes no contributions from businesses who would also benefit from the plan).

Actual costs will be largely dependent on how implementation occurs within the lead agencies, cost sharing arrangements between the federal, provincial and local governments, grant application success for some of the eligible instruments, to what degree some of the instruments are carried out under the LWS strategy, the governance model that ultimately gets established, and to what degree community residents and businesses are willing to pay for more effective water management and more secure water rights that they will benefit from.

It is hard to demonstrate the value of the WUMP in terms of a cost benefit analysis because many of the social and environmental benefits are hidden or are hard to monetize. Having said

this, the adoption of the WUMP is anticipated to have a number of significant benefits, for example:

- Avoided legal costs associated with water disputes and environmental appeals;
- Improved supply of irrigation water during critical periods (i.e. lessening the risk of fish clauses being triggered for some water licensees) and potentially allowing for more irrigated lands;
- Improved water conditions to meet instream flow requirements for fish and wildlife;
- Improved water supply to support local economic development and growth;
- Reduced contamination risks to aquifers and fish bearing streams;
- Improved education and public awareness to better conserve and protect water supplies;
- Increased social benefits associated with water based recreation, fishing and wildlife viewing opportunities;
- Increased flexibility and knowledge to adapt to changing climatic conditions in the watershed; and
- Improved baseline data and information to assess the effectiveness of policy instruments for better water management in the future.

For a summary of the recommended policy instruments including the lead agencies, start date, duration, and costs refer to Table 6.

Table 4 - Sequencing the Recommended Policy Instruments

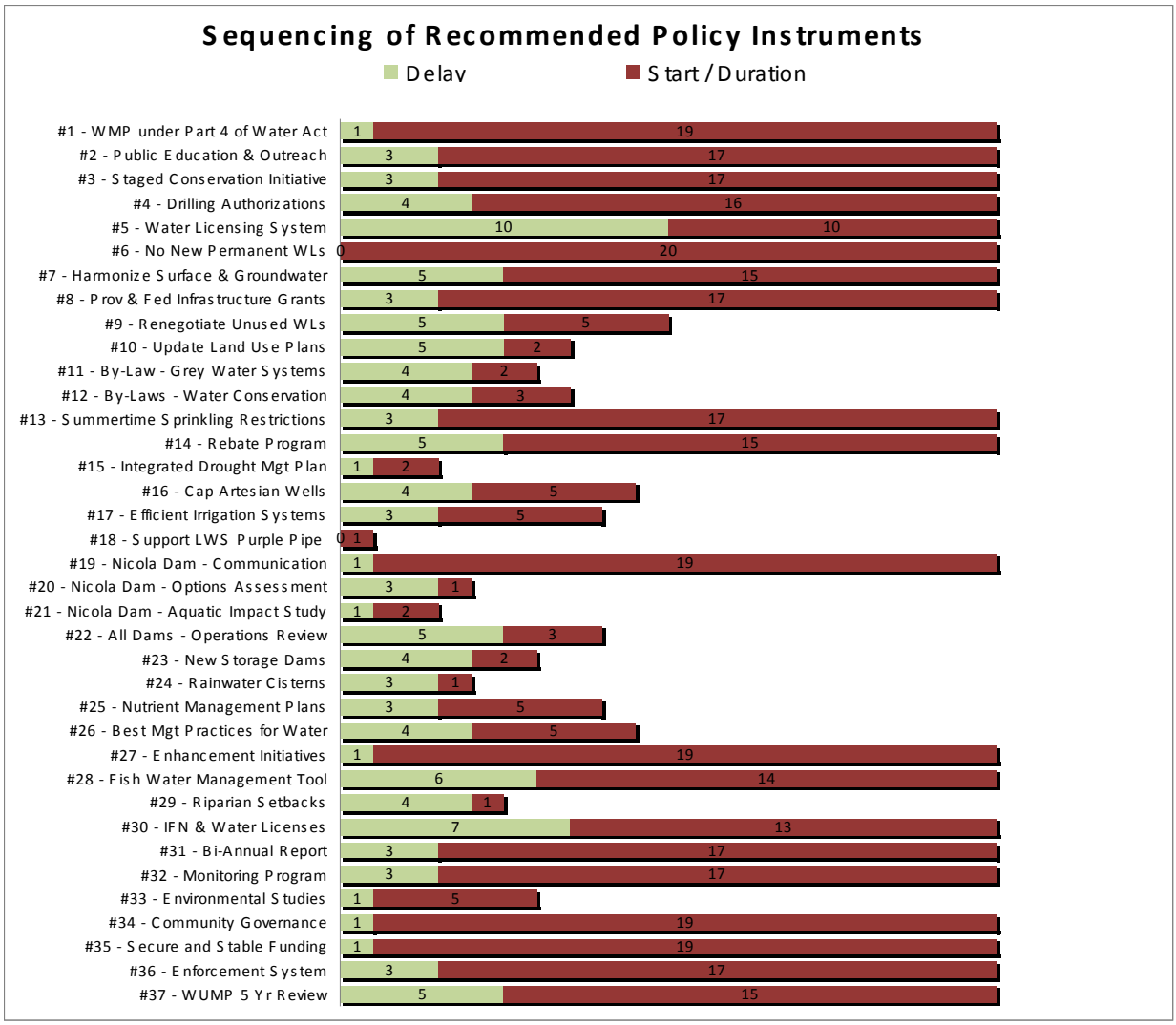
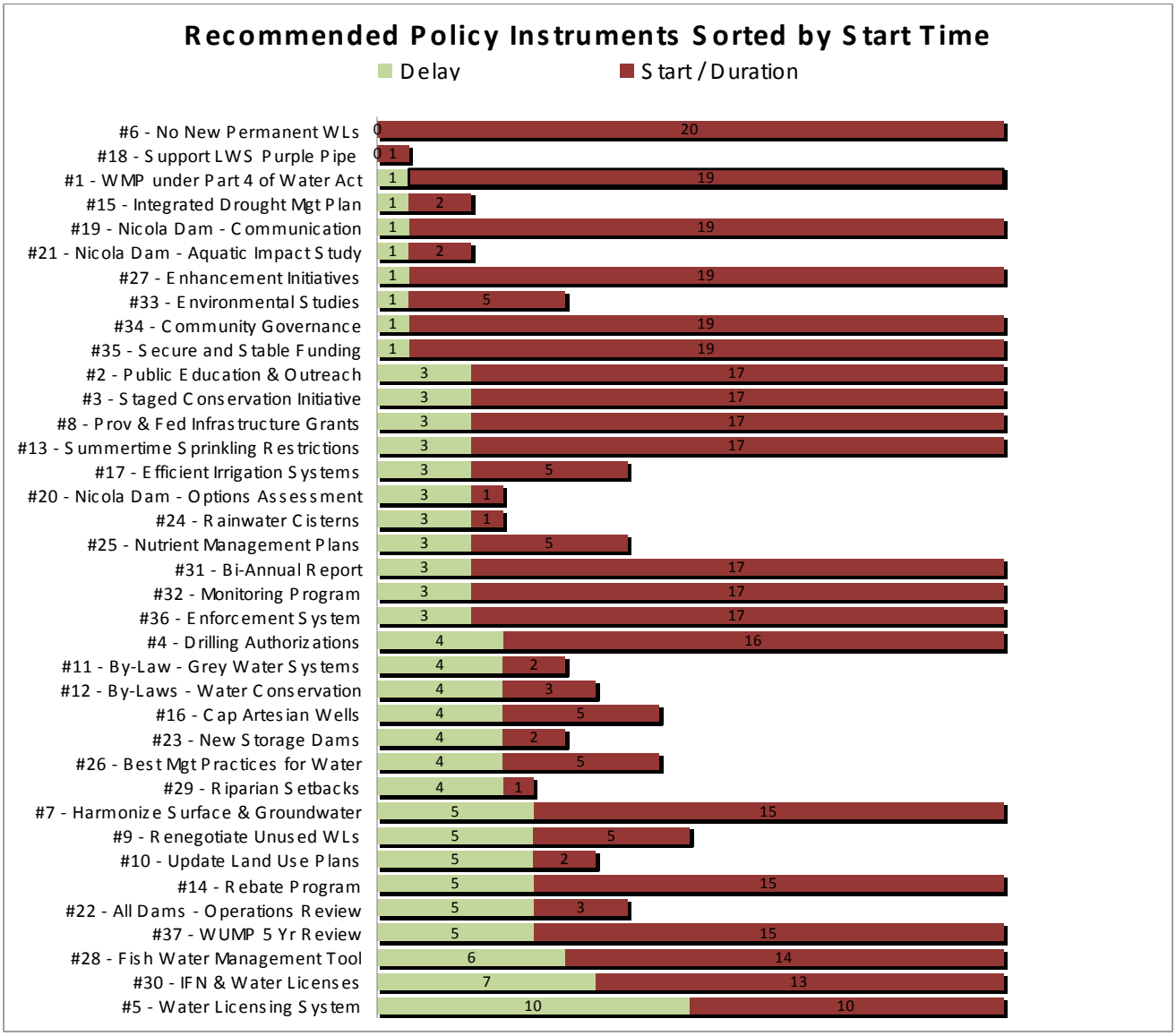


Table 5 - Recommended Policy Instruments Sorted by Start Date



6.4 Summary of Recommended Policy Instruments

Table 6 - Recommended Policy Instrument Summary

Objective	*Area* SW/GW Surface/ Ground Water	*Location*	*#*	*Recommended Policy Instrument*	*Targeted at*	*Implemented thru*	*Begin in Year*	*Approx Costs*[36] *Low < ~$25K /yr Med < ~$70K /yr High > ~$70K /yr*	*Related Policies*
General	**SW GW**	**Nicola Watershed**	**1**	• ***Initiate and implement a Water Management Plan for the Nicola Watershed under Part 4 of the Water Act***	All Sectors	MOE	**1**	**Depends**	
Water Quantity	**SW / GW**	**All Areas**	**2**	• ***Enhance public education and outreach program***	All Sectors	COM / TNRD Prov / Fed / FNs	**3**	**Med**	LWS
	SW / GW	**All Areas**	**3**	• ***Initiate a staged conservation initiative, which may include installing and reading flow meters on all connections and reporting usage on an annual basis***	All Sectors	COM / TNRD Prov / Fed / FNs	**3**	**High**	LWS *Tied to #4, 5, 32, 33*
	GW	**All Areas**	**4**	• ***Mandate drilling authorizations for new water supply wells***	All Well Owners / Drillers	MOE / DFO (fish impacts) / Possibly INAC	**3 - 5**	**Med**	LWS / GWPR *Tied to #1, 5*
	GW	**All Areas**	**5**	• ***Work towards the implementation of a water licensing system for all new water supply wells***	All Well Owners	MOE	**10**	**Low**	LWS
	SW	**All Areas**	**6**	• ***Support condition of no new permanent water licenses unless backed by storage***	WL Applicants	MOE	**0**	**Nil**	
	SW / GW	**All Areas**	**7**	• ***Harmonize surface water allocations/licenses with groundwater use/demand/licenses***	WL Holders	MOE	**5**	**Med**	
	SW / GW	**All Areas**	**8**	• ***Ensure that all provincial and federal infrastructure grants are contingent on water metering***	Local Gov'ts / Agriculture	MCS (BC) / Fed (Ag Canada)	**3**	**Nil**	*Tied to #3*
	SW	**All Areas**	**9**	• ***Seek opportunities to renegotiate and hold in reserve unused portions of water licenses***	WL Holders	MOE	**5**	**Low**	
	SW / GW	**All Areas**	**10**	• ***Update land use plans to be consistent with WUMP goals and objectives***	New Developments	TNRD / COM / MOFR / FNs / etc.	**5**	**Nil**	OCPs
	SW / GW	**All Areas**	**11**	• ***Implement a new by-law for facilitating grey water systems and any needed regulatory changes***	New Developments / Major Renos	TNRD / COM / Prov / IHA	**4**	**Nil**	*EMA Tied to #18*

[36] Costs are approximate at this point and are only intended to give a general sense of the relative costs of the proposed policy instruments. The cost categories (high, medium and low) are arbitrary and were set to show differences between the policy instruments. Annual costs are averaged over a 10 year period and depend on the year the policy instrument begins. The costs include upfront and ongoing costs to the implementing agency. Costs are in 2009 dollars with no discount rate being applied.

Objective	*Area* SW/GW Surface/ Ground Water	*Location*	#	*Recommended Policy Instrument*	*Targeted at*	*Implemented thru*	*Begin in Year*	*Approx Costs*[36] *Low < ~$25K /yr Med < ~$70K /yr High > ~$70K /yr*	*Related Policies*
Water Quantity	**SW / GW**	**All Areas**	**12**	• ***Recommend new by-laws and development permit requirements to better conserve water supplies***	New Developments / major renos & retrofits	TNRD / COM	**4**	**Low**	LWS / Green Bylaws toolkit
	SW / GW	**All Areas**	**13**	• ***Implement a graduated summertime sprinkling restriction system***	Non-Agriculture	COM / TNRD Prov / Fed / FNs	**3**	**Low**	*Tied to #2*
	SW / GW	**All Areas**	**14**	• ***Implement a rebate program encouraging water conservation***	All Sectors	COM / TNRD	**5**	**Low**	
	SW	**All Areas**	**15**	• ***Develop an integrated drought management plan***	All Sectors	MOE / NWAC / COM / TNRD	**1**	**Low**	LWS
	GW	**All Areas**	**16**	• ***Develop a program to identify and cap free flowing artesian wells***	Well owners	MOE	**4**	**Low**	GWPR
	SW / GW	**All Areas**	**17**	• ***Encourage more efficient irrigation systems***	Agriculture	Ministry of Agriculture / MOE	**3**	**Low**	LWS / EFPs / *Tied #9*
	SW / GW	**All Areas**	**18**	• ***Support LWS's requirement for mandatory purple pipes in new construction by 2010***	New Developments	MOE / IHA	**0**	**Nil**	LWS
	SW	**Nicola Dam**	**19**	• ***Initiate periodic and planned communication meetings between WUMP Advisory Council, stakeholders, and MOE dam operators***	All sectors	MOE / NWAC	**1**	**Low**	
	SW	**Nicola Dam**	**20**	• ***Undertake a detailed options assessment to find a preferred management solution***	All sectors	MOE / DFO / NWAC	**3** (ASAP)	**Low**	*Tied to #21*
	SW	**Nicola Dam**	**21**	• ***Initiate an aquatic ecosystem study associated with lake level changes in Nicola Lake (and downstream)***	All sectors	MOE / DFO / NWAC	**1**	**Med**	*Tied to #20 & #33B*
	SW	**All Dams**	**22**	• ***Recommend a review of the operations for Mamit Lake and all other existing small dams***	All sectors	MOE / NWAC	**5**	**Low**	*Tied to #2*
	SW	**All Areas**	**23**	• ***Revisit and identify potential new storage dams given water deficit***	Crown Land / Pvt Land	MOE / NWAC / Property Owners	**4**	**Low**	
	SW	**All Areas**	**24**	• ***Explore potential program to encourage use of cisterns to store rain water***	All sectors	MOE / COM / TNRD / IHA	**3**	**Low**	
Water Quality	**GW**	**All Areas**	**25**	• ***Encourage farms to undertake nutrient management plans (NMP)***	Feedlots / Winter feed grounds / Dairy farms	Ag Canada / Province	**3**	**Low**	EFPs
	SW / GW	**All Areas**	**26**	• ***Encourage agriculture, mining, and other industries to adopt best management practices around water use and conservation***	Agriculture Mining Industry	BC Ag Council	**4**	**Low**	*Tied to #2*
Environment	**SW**	**All Areas**	**27**	• ***Support ongoing enhancement initiatives***	All sectors	DFO / MOE / FNs / COM / TNRD / NWAC	**1**	**Nil**	*Tied to #2*

Objective	*Area* SW/GW Surface/ Ground Water	*Location*	#	*Recommended Policy Instrument*	*Targeted at*	*Implemented thru*	*Begin in Year*	*Approx Costs*[36] *Low < ~$25K /yr Med < ~$70K /yr High > ~$70K /yr*	*Related Policies*
	SW	**Nicola Dam**	**28**	• ***Develop a Fish - Water Management Tool***	All sectors	DFO / MOE / NWAC	**6**	**High**	Similar to Okanagan
Environment	**GW**	**Priority Areas**	**29**	• ***Develop suitable riparian setback requirements for new water supply wells in priority areas***	Well Owners / Drillers	MOE ➔ Drilling Authorizations	**4**	**Low**	*Tied to #4*
	SW / GW	**All Areas**	**30**	• ***Ensure that Instream Flow Needs are taken into account within any harmonized surface and groundwater licensing system***	WL Applicants / Holders	MOE / DFO	**7**	**Low**	LWS *WA Tied to #5 & 7*
Learning	**SW / GW**	**All areas**	**31**	• ***Prepare bi-annual report on the state of water in the valley and the effectiveness of the WUMP***	Everyone	MOE / NWAC	**3**	**Med**	*Tied to #2*
	SW / GW	**All Areas**	**32**	• ***Develop a monitoring program to better determine baseline conditions for water quantity and quality trends including climate change adaptation***	Everyone	MOE / EC (WSC) / NWAC	**3**	**High**	*Tied to all #s*
	SW / GW	**All Areas**	**33**	• ***Undertake specific studies –*** *A. Contaminant Inventory* *B. Nicola Lake Aquatic Impact Study* *C. Complete Preliminary Instream Flow Needs* *D. Detailed IFN Assessment in Priority Areas* *E. Groundwater Storage Study* *F. Detailed Water Budget Analysis* *G. Storage Sites Assessment*	Everyone	MOE / DFO / Env Canada (WSC) / IHA / NWAC	**1 - 5**	**High** (combined)	LWS *DWPA* *Tied to #3, 5, 20, 21, 23, 25, 32*
Management	**SW / GW**	**All Areas**	**34**	• ***Establish a community driven governance system to inform water management systems***	FNs & Stakeholders & Regulators	MOE / NWUMP	**1**	**Med**	LWS / Linked with #2
	SW / GW	**All Areas**	**35**	• ***Create secure and stable funding sources to support water management activities***	Grants / regulators / water users	NWAC	**1**	**Med**	Linked with #34
	SW / GW	**All Areas**	**36**	• ***Support a compliance and enforcement system for monitoring activities associated with the delivery of the WUMP***	Regulators	MOE / Local Governments / Regulators	**3**	**Nil**	
	SW / GW	**All Areas**	**37**	• ***Review the WUMP at a 5 yr review (or before) as required.***	All Sectors	MOE	**5**	**Low**	Linked with #1

Appendices

Appendix A **Participants of the NWUMP Planning Process**

Appendix B **Results from the Nicola Dam Preliminary Options Assessment**

Appendix C **Nicola Water Advisory Council Governance Framework**

Appendix A – Participants of the NWUMP Planning Process

The table below provides a summary of the participants on the MSC, SC, and TAG committees throughout the planning process. It does not include the volunteers and interested people who attended meetings as observers or guest presenters nor summarize who followed the process through receiving meeting materials.

Table Notes:

- Prior to April 2007, the Steering Committee (SC) was known as the Planning Team (PT)
- (*) The Water Stewardship staff at the Kamloops office of Ministry of Environment was reorganized in 2007 when Valerie Cameron became its Regional Manager. Shortly thereafter, an email was received from the Regional Manager who advised that due to work load, staff participation in meetings of the Nicola WUMP would be curtailed. Prior to that, several people from MOE came to the MSC meetings.
- TAG – Member of the Technical Advisory Group
- ALT – Alternate on the Steering Committee

SC & PT	MSC *@ Start*	MSC *@ End*	TAG	LAST NAME	FIRST NAME	AFFILIATION / OCCUPATION / BACKGROUND
	X	X		**Anderson**	Jean	Resident
PT & SC	X	X		**Anderson**	John	Rancher
	X			**Anderson**	Kate	Rancher
	X			**Armstrong**	Evelyn	Nicola Lake resident
	X	X		**Armstrong**	George	Nicola Lake resident
	X*	X*	X	**Ball**	Jeptha	Water Resource Hydrologist, Ministry of Environment
			X	**Bennett**	Kevin	Regional Groundwater Engineer, Ministry of Environment
		X	X	**Beeson**	Craig	Section Head, Public Safety and Protection, Ministry of Environment
			X	**Caswell**	Dave	Natural Resources Technician, Lower Nicola Indian Band
ALT SC	X	X	X	**Caverly**	Alan	Ecosystem Biologist, Ministry of Environment
	X			**Chutter**	Dave	Rancher/developer
	X			**Clare**	Derek	Resident
	X			**Cooke**	Jeremy	P. Eng. WMI International
	X	X		**Cooke**	Lou	Rancher and President, Nicola Stock Breeders' Association
PT 04-06	X			**Coutlee**	Dave	First Nations, Nicola Watershed Stewardship and Fisheries Authority
	X*		X	**Edwards**	Mike	Water Technical Officer, Ministry of Environment
	X			**Fischer**	Wally	Resident
	X			**Fisher**	Carol	Recreation instructor & Resident
		X		**Frizzell**	Terry	Resident
			X	**Fuller**	Ted	Flood Hazard Officer, Ministry of Environment
	X			**George**	Cyril	Rod and Gun Club, Resident
PT	X			**Gizikoff**	Katherine	GGEM Consultants Ltd.

SC & PT	MSC *@ Start*	MSC *@ End*	TAG	LAST NAME	FIRST NAME	AFFILIATION / OCCUPATION / BACKGROUND
SC 07-08			X	**Guerin**	Jeff	Fish Biologist, Fisheries and Oceans Canada
PT & SC	X	X		**Guichon-Mailloux**	Judy	Rancher
	X	X		**Hallinan**	Phil	Fraser Basin Council
SC 07	X			**Hamaguchi**	Bob	Highland Valley Copper
	X			**Homoky**	Stephen	Resident
		X		**Huber**	Eugene	Rancher
	X			**Hunter**	Nadia	Councillor, City of Merritt
		X		**Hyslop**	Mark	Resident
	X, 04-07			**Jackson**	Barb	Planner, Thompson-Nicola Regional District
	X	X		**Jeffries**	Liis	Resident, Nicola Lake
SC	X	X		**Joe**	Harold	First Nations
	X			**Jokinen**	William	Resident
SC	X	X		**Kingston**	Laurie	Spences Bridge Steelhead Advocacy Association
		X		**Larsen**	Jens	Rancher
	X			**Laursen**	Cathy	Resident
	X	X		**Lisle**	Robert	Resident
SC	X	X		**Madryga**	Jack	Resident
	X			**Mackay-Smith**	Al	Principal, Resident
	X*	X*	TAG	**McFarlane**	Bruce	Regional Hydrologist, Ministry of Environment
PT & SC	X	X	TAG	**McGregor**	Ian	Section Head, Fish and Wildlife Science, Ministry of Environment
	X			**Methot**	Terry	Developer
SC	X	X		**Murray**	Stewart	Rancher
		X		**Norgaard**	Clara	Resident
	X	X		**O'Hanley**	Elmer	Resident
	X	X		**Olney**	Ed	Resident
	X			**Oram**	Arnie	Spences Bridge Steelhead Advocacy Association
		X	TAG	**Petersen**	Andrew	Regional Resource Specialist, Ministry of Agriculture and Lands
PT 04-06	X	X		**Post**	Joe	Director, Thompson-Nicola Regional District
	X	X		**Reimer**	Elmer	Councillor, City of Merritt
	X			**Rice**	David	Spences Bridge Steelhead Advocacy Association
	X	X		**Robertson**	Laurel	Resident
	X			**Rose**	Mike	Rancher
	X	X		**Rutherford**	Jeanne	Resident
	X			**Sahara**	Butch	First Nations, Rancher
	X			**Sahara**	Gail	Resident
	X	X		**Sanford**	Jill	Resident
	X	X		**Sanford**	Gerry	Resident
	X	X		**Schindler**	Wayne	Rancher
PT & SC	X	X		**Shewchuk**	Katharine	President, Nicola Nordic Ski Club, Resident

SC & PT	MSC *@ Start*	MSC *@ End*	TAG	LAST NAME	FIRST NAME	AFFILIATION / OCCUPATION / BACKGROUND
	X			**Shewchuk**	Murphy	Recreation, Author, Resident
	X			**Sigurdsson**	Eric	Teacher
	X	X	TAG	**Smith**	Ron	Planning Officer, Integrated Land Management Bureau
		X		**St. Pierre**	Christian	Ecosystems Section, Environmental Stewardship Division, Ministry of Environment
	X	X		**Strachan**	Graham	Agrologist, Ministry of Agriculture and Lands
SC	X	X		**Todd**	Neil	Resident, Fisheries Biologist
		X		**Viera**	Erin	Fraser Basin Council
		X		**Wagner**	Leroy	Lower Nicola Water Works
PT & SC	X	X	TAG	**Watts**	Dean	Senior Habitat Biologist, Fisheries and Oceans Canada
	X	X		**Williams**	Matt	Rancher
	X			**Wright**	Paul	Resident

Appendix B – Nicola Dam Preliminary Options Assessment

Overview

As a component of the Nicola WUMP a preliminary options assessment was undertaken to scope out the degree of community support there could be with recommended changes at Nicola Dam. The options assessment was carried out by the MSC at a meeting held on July 10th, 2008.

Performance Measures

A total of 13 performance measures (PMs) were developed to assist the MSC in their evaluation of options. A brief description of the PMs is provided below with more context about their interpretation in order to carryout the options assessment.

Location	Performance Measure (PM)	Unit	What is better?	Description
Lake	**Aquatic Health**	**5 pt scale**	1=worst option 5=best option	This PM provides a relative comparison across the options. Aquatic health in the lake actually represents three separate health indicators: littoral productivity (provides an indication of algae and plant growth used as food for fish and invertebrates), burbot rearing in the summer, and kokanee tributary access in August. This PM was estimated by on expert judgment during the technical workshop that was held on June 17.
Lake	**Burbot Spawning**			This PM is associated with some disagreement between the experts – fisheries regulators believe that burbot spawning success would not be affected by lake levels as they spawn at deeper depths well below the normal operating range (>10m). However, there is traditional knowledge on burbot in the lake which suggests spawning could be affected by lake level operations.
River (below dam)	**Salmon productivity – *Jul to Nov*** (Spawning Flows)	Annual # days dam outflows below < 1.7cms	Less	This PM provides a relative comparison with current dam operations (Option 1A) for meeting Kosakoski and Hamilton (KNH) flow requirements (1982). It is calculated by summing up the number of days that the flow target of 1.7cms (60cfs) is not met on average each year.
River (below dam)	**Salmon productivity – *Dec to Apr*** (Rearing Flows)	Annual # days dam outflows below < 1.2 cms	Less	This PM provides a relative comparison with current dam operations (Option 1A) for meeting KNH flow requirements (1982). It is calculated by summing up the number of days that the flow target of 1.2cms (40cfs) is not met on average each year.
River (below dam)	**Stream Health**	# of years flows reach 25 cms (or more)	More	This PM represents overall stream health as flows of 25cms (or more) are known to provide flushing flows which maintain a stream's natural ecology (these flows are also known as channel maintenance flows). This PM is calculated by counting the number of years (over the 17 dataset) that downstream river flows reach 25cms.

Location	Performance Measure (PM)	Unit	What is better?	Description
River (below dam)	**Water Temperature – *Jul to Aug***	Expert Opinion		The temperature PM was based on an evaluation done during the June 17 technical workshop. It was felt that the higher the dam releases from mid-Jul to mid-Sep, the deeper and cooler the water temperatures would be downstream. *(Note. It is not clear how far downstream any change in temperature effects would be felt until it acclimatizes.)*
River (below dam)	**Drought Resistance**	Additional water available during 1:15 yr drought **(Acre*Ft)**	More	This PM provides an indication of water storage surplus (or deficit) in a 1 in 15 year drought condition after meeting current KNH fish flow and irrigation flow requirements. *(Note that irrigation flow requirements are based on the estimated 4,900 acres of irrigation land that is currently provided by Nicola Dam storage).*
At Dam	**Capital Costs of physical works**	**$**	Less	This PM provides a rough estimate of the costs associated with some of the options that require physical works to be undertaken.
At Dam	**Ongoing Maintenance Costs**	**$/yr**	Less	This PM provides a relative comparison with current operations (Option 1A) for ongoing annual maintenance costs.
River (below dam)	**Downstream Flooding Risk**	**5 pt scale**	1=worst option 5=best option	This PM provides an indication of flood mitigation potential assuming a flood event that occurs once every five years. Typically anything beyond a 1 in 5 year return period will result in downstream flooding regardless of operations – *and whether the dam was completed or not* – because the amount of water flowing into the lake dwarfs the storage capacity behind the dam. This PM was used to estimate the performance of the options during the June 17 technical workshop.
Lake	**High Lake Levels**	Avg # of days lake levels are above 625.83m (Jun-Jul)	Less	This PM provides an indication of the duration that lake levels are above the current maximum operating level of 625.83m. *Note that the maximum dam height is close to 627m and that in 2002 lake levels reached 626.6m on June 1.*
Lake	**Beach Availability**	Avg # of days water levels are above 625.53m (Jul 15 to Sep 15)	Less	This PM provides an indication of suitable lake levels for recreation use in the summer time. In general, when lake levels are 0.3m (1 ft) or more below the maximum operating level (625.83m) there is sufficient beach areas created for recreation.
Lake	**Lake Aesthetics - Winter**	Avg # of days lake levels are below 624.15m (Mar-Apr) **relative to Option 1A**	Less	This PM provides an indication of the degree that the mudflats have significant exposure during the snow free period before the freshet (Mar – Apr) relative to current conditions (Option 1A)

Options

5 options were considered in the assessment involving operational changes (how much water is released from the dam and when) and/or physical works (or infrastructure changes) at or near the dam. The identified options were based on recommendations from past and recent studies.

1. **Current Dam** (and operations) – Status Quo. This option considered minimum flows as they are currently released (Option 1A) and modifying the minimum flows to provide additional fishery benefits (Option 1B).

2. **Dredge Channel** - dredge the high point in the channel by the dam and thereby complete the dam as it was initially envisioned increasing the storage capacity in the lake by about 46%.

3. **Increase Max Operating Level in Lake by 0.4m** – the existing height of the dam allows for the maximum operating levels to be increased with no costs associated with it. In this case, an additional 0.4m would provide approximately 35% more storage capacity.

4. **Groundwater (GW) Pump near the Dam Outlet –** this option involves the drilling of a large capacity well in close proximity to the dam to augment flows in the river during critical periods. The viability of this option depends on characteristics of the underlying aquifer, but conceptually provides an alternatively means to increase the storage potential in the lake as minimum flow releases from the dam could be reduced in proportion to the well's capacity.

Assessing Impacts

Estimating the impacts and performance of the 5 options were done through the development of a flow tool and through professional judgement (which occurred during a technical workshop on June 17th, 2008). The results of these assessments were summarized in a consequence table (see Section 5.3).

Value Rankings

The MSC undertook a direct ranking exercise and a swing weighting exercise which were used to facilitate a discussion on which options were best and which performance measures were most important at driving people's decisions.

A snapshot of the results from the two exercises are presented here. Both summary tables are colour coded to indicate participants most preferred options (in green) and their least preferred options (in red).

Direct Ranking of the Options by Participant

Participant	Option 1A	Option 1B	Option 2	Option 3	Option 4
1	0.23	0.24	0.19	0.22	0.12
2	0.09	0.19	0.24	0.47	0.00
3	0.03	0.03	0.62	0.31	0.01
4	0.19	0.10	0.29	0.38	0.04
5	0.25	0.26	0.08	0.27	0.14
6	0.22	0.22	0.28	0.26	0.01
7	0.28	0.29	0.07	0.22	0.14
8	0.05	0.12	0.36	0.47	0.00
9	0.14	0.14	0.03	0.54	0.16
10	0.22	0.28	0.06	0.43	0.00
11	0.25	0.25	0.31	0.16	0.03
12	0.15	0.15	0.50	0.20	0.00
13	0.19	0.21	0.16	0.26	0.18
14	0.38	0.03	0.51	0.03	0.05
15	0.08	0.33	0.41	0.16	0.02
16	0.21	0.28	0.03	0.34	0.14
17	0.00	0.09	0.45	0.41	0.05
18	0.30	0.40	0.24	0.06	0.00
19	0.19	0.19	0.26	0.32	0.03
20	0.20	0.24	0.12	0.40	0.04
21	0.16	0.25	0.33	0.25	0.02
22	0.22	0.17	0.43	0.13	0.04
23	0.08	0.17	0.41	0.33	0.00

Swing Weighting Ranking of the Options by Participant

Participant	Option 1A	Option 1B	Option 2	Option 3	Option 4
1	0.15	0.18	0.19	0.21	0.28
2	0.19	0.20	0.19	0.24	0.18
3	0.14	0.16	0.28	0.27	0.15
4	0.15	0.18	0.22	0.24	0.22
5	0.16	0.18	0.21	0.22	0.23
6	0.15	0.18	0.21	0.24	0.21
7	0.16	0.19	0.17	0.22	0.26
8	0.16	0.19	0.24	0.20	0.20
9	0.18	0.20	0.18	0.19	0.24
10	0.18	0.20	0.16	0.25	0.21
11	0.12	0.15	0.25	0.23	0.25
12	0.17	0.19	0.22	0.21	0.22
13	0.16	0.18	0.21	0.22	0.24
14	0.21	0.23	0.18	0.18	0.21
15	0.17	0.20	0.20	0.24	0.19
16	0.14	0.17	0.23	0.21	0.25
17	0.10	0.13	0.30	0.27	0.20
18	0.14	0.17	0.20	0.23	0.26
19	0.15	0.17	0.22	0.22	0.23
20	0.16	0.18	0.22	0.23	0.21
21	0.17	0.19	0.22	0.21	0.22
22	0.15	0.18	0.23	0.24	0.20
23	0.13	0.16	0.24	0.24	0.22

The discussions that resulted from these exercises resulted in the following points being highlighted:

- There are key data gaps[37] which should be addressed in order to inform a more detailed options assessment and therefore provide a higher degree of confidence when assessing impacts of current operations as compared to any proposed changes.
- Everyone agreed that changes to Alternative 1 (which represented current Nicola Lake rule curves and minimum flow release requirements) should be explored in greater detail, as consensus on a preferred option seemed achievable across the multiple interests of the community.
- It was felt that changes at the dam could result in significant benefits – *increased irrigated land along the lake and downstream and improved fishery flows at key times.* Moreover, if some small physical works projects were undertaken[38], the benefits could be considerably more. While operations at the dam over the past few years have begun to make some of these operational changes, the MSC supported further work to evaluate the potential of these changes (see *Recommendation #20 and #21* in Section 6).
- Hybrid options which considered more subtle changes to the operational rule curves, slightly higher lake levels (at certain times of the year), and which possibly included some limited dredging in some areas, would likely result in more optimal conditions and a higher degree of community support could be expected.
- Both the MSC and SC agreed that there would be value in carrying out a more detailed options assessment to explore some hybrid options towards reaching community consensus on a preferred option at the dam.

[37] Burbot and kokanee spawning habitat, wildlife impacts associated with staging and nesting areas, pump intake issues associated with lower lake levels, water quality issues with lower levels, water levels and Upper Nicola Band facilities, and groundwater levels if augmented flows with groundwater pumps at critical times.

[38] For example, limited dredging, consideration of groundwater pumps below the dam to augment river flows, pump intake modifications along the lake, etc.

Appendix C – Nicola Water Advisory Council Governance Framework

Introduction

In the course of the planning process to develop a water use management plan, a committee was struck to examine the topic of water governance and how the community could have a greater role in water management. The Governance sub-committee began by reviewing a number of water governance models and with the help of a facilitator, organized a meeting (February 2007) of the Multi-Stakeholder Committee at which the topic was discussed at some length. While no decisions were made at the meeting, one outcome was the preference for some kind of advisory body to be established. Further work on governance was postponed until the fall of 2008. Armed with more information about what the draft Nicola water use management plan would include, the Committee drafted a framework for a local governance model. This was presented to the Multi-Stakeholder Committee for review, comment and adoption.

The following governance framework for the recommended Nicola Water Advisory Council was agreed to at a special MSC meeting held on February 20th, 2009.

Name

The name of the advisory body will be the Nicola Water Advisory Council (NWAC).

Mandate

The NWAC will support, advocate for and where applicable, implement parts of the Nicola Water Use Management Plan. In its advisory capacity, the NWAC shall provide advice on Plan implementation and on water and land use.

The implementation of the Plan will require involvement and participation by all levels of government, First Nations, residents of the Nicola watershed, stakeholders and interest groups.

The NWAC may be responsible for the implementation of some of the Plan's recommendations. In these instances, its role would be that of implementer, either working alone or in partnership with government and others. For all other recommendations, or tasks it may be charged with, its role will be limited to an advisory one. The NWAC will not have veto power on projects that it does not initiate.

The NWAC will also be a repository for data on water use, and land use that involves the use of water. The NWAC will act as a clearinghouse for information about the Nicola watershed water resource.

Finally the NWAC, in its advisory role, will provide input to government on permitting applications directly or indirectly dealing with water. Within the administrative regime for project approvals, there will be provision made for the NWAC to be included on the list of referral agencies for proposed land developments and other developments using water.

The mandate of the NWAC may change over time.

Structure

The NWAC shall be registered as a non-profit society under the Societies Act of British Columbia. The NWAC will consist of members and a Board of Directors. The general membership at an annual general meeting will elect a number of directors. A number of directors will be appointed.

The Board of Directors will consist of officers (chair, recording secretary, treasurer or secretary-treasurer), directors-at-large and ex-officio directors.

The Board of Directors shall consist of five (5) directors elected from the general membership, one (1) director appointed by the City of Merritt, one (1) director appointed by the Thompson Nicola Regional District and directors appointed by the First Nations bands in the Nicola watershed. The number of First Nations directors is not specified at this time.

Ex-officio directors, consisting of representatives from Fisheries and Oceans Canada and one or more provincial ministries (Ministry of Environment, Ministry of Agriculture and Lands, etc.) will not be voting directors. Their role shall be to provide expertise to the NWAC on water issues, water management, legislation, policy, etc.

Membership

Membership in the NWAC will be open only to those individuals residing in the Nicola watershed, to interest groups and organizations whose home address is within the watershed, to the City of Merritt and to the Thompson Nicola Regional District.

Ex-officio directors will not be required to take out a membership in the NWAC.

Principles and Policies

The NWAC shall adopt the following principles: accountability, transparency, respect for the rule of law and equitable (fair) participation. The NWAC will exercise due diligence and document and record all decisions, conclusions and advice proffered concerning all water issues that come before it. Financial sustainability, accessing and using the best available scientific information and shared decision-making will also be principles.

The NWAC shall develop conflict of interest guidelines and procedures in order to address situations where a perceived or actual conflict of interest may arise. Given the composition of the Board and its members' links to other decision-making bodies, such situations are inevitable. One identified situation that will arise from time to time is during the approval process for new developments: a government representative may need to abstain from participating in NWAC's deliberations, if the Committee intends to form a position on the proposed development.

The NWAC's constitution and bylaws will provide for adequate checks and balances to ensure that the principles will be adhered to.

Decision-Making

The Board of Directors will strive to make all decisions by consensus. In situations where positive action needs to be taken and consensus cannot be reached, decisions will require a two-thirds (2/3) majority vote of the Board members present. An example of a situation would be a development project which has a fixed start date and therefore requires a timely response from the NWAC.

Funding

The NWAC's revenues shall come from membership fees and/or taxation processes and/or government grants and/or other grants and other sources.

There are costs associated with water management decisions, both prior to the decision and once the decision has been made. If decisions can be made sooner rather than later, and if those decisions are good decisions, costs may be lower for water users than if the decision were delayed for years. This in turn could have a bearing on the financial viability and long-term sustainability of a business or operation that relies heavily on water. In these situations, there would be a benefit in financially supporting at the watershed level (taxation) a local water authority working in concert with the provincial government and others.