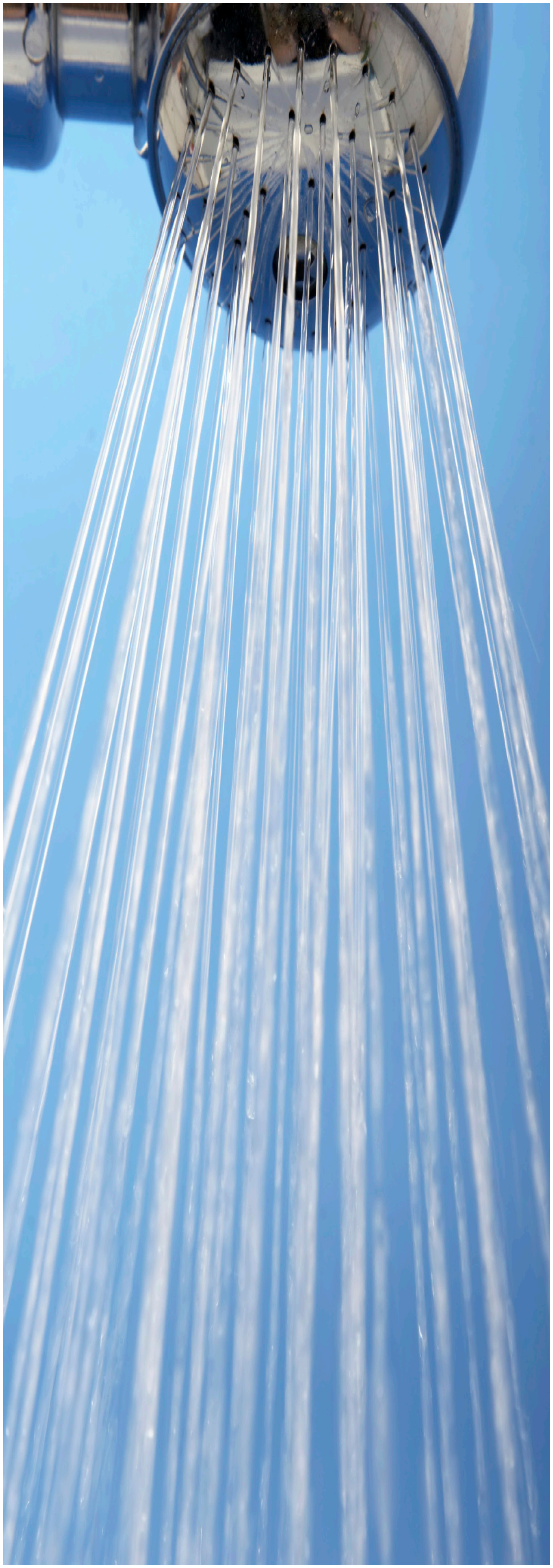

Water Conservation Planning Guide

For British Columbia's Communities

POLIS Toolkit Series 1.0

March 2009

POLIS Project on Ecological Governance
watersustainabilityproject

Water Conservation Planning Guide
For British Columbia's Communities
By Jennifer Wong and Susanne Porter-Bopp with Oliver M Brandes

The POLIS Project on Ecological Governance
March 2009

POLIS Project on Ecological Governance

The POLIS Project on Ecological Governance is a transdisciplinary centre for research and action established in 2000 by the Eco-Research Chair at the University of Victoria, British Columbia. Our mission is to cultivate ecological governance through innovative research, policy analysis and legal reform, as well as through education and community action. The **Water Sustainability Project (WSP)** at POLIS is focused on reorienting Canadian water management from a supply development approach toward stewardship and managing demand as priorities for communities and decision makers. The POLIS Project has established itself as a leader in water conservation and the Soft Path and combines cutting-edge research with on-the-ground action to conserve water for ecosystem health and prosperous communities.

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This guidebook is the first edition of a living document that is intended to evolve and expand with community and practitioner feedback. For suggestions about improving this document, please contact Susanne Porter-Bopp at the POLIS Project on Ecological Governance at water@polisproject.org

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Table of Contents

Water Conservation Planning Guide

For British Columbia's Communities

Purpose

This guide can help communities develop and implement comprehensive integrated water conservation plans. The guide is a tool to meet the Provincial commitment to water sustainability, as outlined in Box 1.0 on page 3.

The guide mirrors the layout of a typical water conservation plan. Following the guide's step-by-step approach can assist communities in meeting the required conservation criteria of the Ministry of Community and Rural Development's Infrastructure Grant Programs.

Scope

Although the guide can be a useful resource for any community, it is designed specifically for smaller to mid-size communities because they typically do not have the capacity of larger communities.

Guide Structure

The guide has two sections:

1. Water Conservation Planning Workbook (Workbook)

2. Water Conservation Planning Handbook (Handbook)

Water Conservation Planning Workbook:
The Workbook identifies seven key steps (chapters) to the development of a water conservation plan. Each step has a series of "TO DO" CHECKLISTS addressing key components of a water conservation plan. The Workbook is intentionally brief to allow users to quickly scan the planning stages and data requirements for each step.

Water Conservation Planning Handbook:
The Handbook provides greater detail on the seven steps, as well as offering in-depth lists of additional resources relevant to a particular step.

How To Use This Guide

Step 1: Scan the Workbook and check off "TO DO" components already completed. Use the **"NOTES"** box beside the "TO DO" CHECKLISTS for jotting down ideas as you scan the Workbook.

Step 2: Compile a separate list of the "TO DO" components required for plan completion.

Step 3: Prioritize actions required to complete the plan.

Step 4: Create an action plan identifying the resources and time required to complete each step. This will help gain support for the development and implementation of the plan.

Considerations When Developing a Water Conservation Plan

Water conservation planning is an iterative and dynamic process. Start small, expanding your plan as more information becomes available. Depending on the scope and complexity of your system, your water conservation plan could be just a few pages or a long and comprehensive document. In some cases it will not be practical or even necessary to complete every checklist in this guide.

Regardless of the size and complexity of your plan, use a holistic approach by taking a "watershed-eye-view". This means using the catchment basin and its watersheds as the geographical basis for decision making. A good water conservation plan integrates all aspects of water and does not solely focus on quantity issues. Consider the linkages between drinking water, wastewater, rainwater and the impacts on energy use. The plan also needs to account for social, cultural and ecological considerations.

The Future of Water Infrastructure Planning in British Columbia

British Columbia is committed to a long-term approach to integrated water demand management. Now, and increasingly in the future, a comprehensive water conservation plan will be a requisite for provincial and federal infrastructure funding. A comprehensive approach to water demand management not only makes economic sense in terms of deferred costs for infrastructure expansion, it can also generate additional ecological benefits such as reduced greenhouse gas emissions from decreased energy consumption and sewage treatment.

Water sustainability does not just happen. To be effective, urban water management must integrate demand management measures into comprehensive, long-term strategies. This means thinking about water infrastructure as something more than pipes, pumps and reservoirs. This “new” infrastructure includes green infrastructure, innovative conservation-oriented physical components, low impact development (LID)/water sensitive urban design (WSUD) and conservation programs that complement existing community water systems. In building capacity for future leaders to implement this new way of thinking, this guidebook represents the future of water management and infrastructure planning in British Columbia.

Box 1.0 *Living Water Smart:* British Columbia’s Water Plan at a Glance

- By 2020, overall water use in British Columbia will be 33% more efficient
- By 2020, 50% of new municipal water needs will be acquired through conservation
- Adapting to climate change and reducing our impact on the environment will be a condition for receiving provincial infrastructure funding
- By 2012, government will require all large water users to measure and report their water use
- By 2010, the Green Building Code will require water-conserving plumbing fixtures such as low flush toilets
- By 2010, government will mandate purple pipes in new construction for water collection and re-use
- By 2012, government will regulate groundwater use in priority areas and large groundwater withdrawals
- Government will fund household evaluations of water, energy and transportation use
- By 2012, water laws will improve the protection of ecological values, provide for more community involvement, and provide incentives to be water efficient
- Government will require more efficient water use in the agriculture sector
- In partnership with industry, government will develop a water efficiency labelling system for water consuming products
- Government will look at new ways to help water conservation technology succeed

Source: Ministry of Environment (2008) *Living Water Smart: British Columbia’s Water Plan*. Available at: www.livingwatersmart.ca

Water Conservation Planning Workbook

Step 1: Introduction

The introduction to your water conservation plan explains why water and water conservation are important to your community and provides the rationale and the methodology used to develop the plan. The introduction also summarizes key elements of the plan and identifies significant linkages to other plans, goals and policies, such as community land use planning and provincial strategies like *Living Water Smart*.

"TO DO" CHECKLIST:

A) Define Community Values *[Section 1.1 & 1.2]*

- ☐ State why water and water conservation are important to your community.
- ☐ Conduct a public visioning exercise to identify community values and depict what the community will look like in 20-50 years.
  - o Use the backcasting approach, a method in which future desired conditions are envisioned and steps are defined to attain those conditions.

B) State Purpose of Plan

- ☐ State why the plan is being developed. E.g. "The purpose of this plan is to develop and implement a long term strategy addressing water quality and quantity issues to protect both public and environmental health."

C) Provide Rationale

- ☐ State why it is important to conserve water. E.g. limited supply, deferring capital costs, ecological health, etc.

D) Define Scope of Plan

- ☐ Define the geographical and other boundaries of the plan, as well as the different sectors in your community that the plan will include.
- ☐ Include the interactions from source to tap to receiving environment.

NOTES:

- ☐ Link the community's built water system with the watershed's hydrology.

D) Outline Planning Process *[Section 1.3]*

- ☐ State how the water conservation plan fits into your community's planning framework.
  - o How does it relate to the Official Community Plan and Regional Growth Strategy?
  - o How does it relate to other plans such as asset management, solid/liquid waste, stormwater and watershed plans?

- ☐ List potential sources of information for the development of the water conservation plan. E.g. reports, studies, bylaws, etc.

- ☐ Describe the methodology you will apply to the development and implementation of the water conservation plan.
  - o Identify all assumptions underlying the methodology.

- ☐ Identify what resources are available to ensure success.

E) Implementation/Action Team *[Section 1.4]*

- ☐ Identify who should be on your Action Team (e.g. municipal staff, scientists, community and environmental groups and water system users)
  - o An Action Team, while not necessary in all cases, can help develop and implement the plan.

F) Political Support *[Section 1.5]*

- ☐ Gain Council and/or Board directive and support for this initiative to ensure appropriate resources will be made available to develop the plan.
  - o Endorsement of the completed plan will help with implementation.

G) Public & Business Sector Support

- ☐ Engage all stakeholders impacted by the plan. Stakeholder engagement will help with the successful implementation of the plan and ensure goals are met.

NOTES:

Step 2: Compile a Community Water System Profile

A Community Water System Profile is an overview of the entire community water system and is the foundation that supports long range planning. The profile identifies all infrastructure related to drinking water, from source to wastewater receiving environment, accounting for all uses. The system profile also identifies social, cultural and ecological needs. It is recognized that a basic water conservation plan may not be able to include detailed ecological information in the first version of the plan. Start with information that is readily available, building upon it as new information becomes available.

"TO DO" CHECKLIST:

A) Community Portrait *[Section 2.2, 2.5]*

Characterize your community and its region.

- ☐ Identify the current population, disaggregated by age where possible.
  - o Note permanent and seasonal populations.
- ☐ Describe the different sectors of water system users (e.g. residential, industrial, commercial, institutional and agricultural).
  - o Does your community have a dominant sector? E.g. is it primarily forestry-based, agriculture-based, tourism-based, residential, other?
- ☐ Identify social/cultural factors affecting your watershed. E.g. do any First Nations in your community rely on the water source for cultural activities?
  - o Identify recreational and/or other social attributes that may impact supply.
- ☐ Identify any governance issues applicable to your watershed or water system.
  - o Are you sharing your water source with other communities/users?

NOTES:

B) Watershed Portrait *[Sections 2.3, 2.4]*

Characterize your watershed in an ecological context.

- ☐ Identify the catchment area with the locations and types of land and water forms.
    - o Consider using a map and overlaying locations of water system components. See example in Appendix A.
- ☐ Characterize hydrological conditions.
    - o Identify annual precipitation (average, high, low), including spring freshet.
    - o Describe groundwater and reservoir recharge rates and time periods.
    - o Identify ecological needs, such as fish flows, and important ecosystem functions.

C) Infrastructure Portrait *[Section 2.3, 2.5, 2.6]*

Compile data on water system infrastructure. For each component provide:

1. A description
2. The length and/or capacity
3. The age and condition

- ☐ Source(s) of supply. E.g. reservoirs, lakes, rivers, aquifers, intakes, wells, pumps.
- ☐ Water treatment used.
- ☐ Distribution system, including balancing storage reservoirs.
- ☐ Connections.
- ☐ Sewer collection system (if applicable).
- ☐ Sewage treatment used (if applicable).
    - o Include effluent receiving environment.
- ☐ Rain/stormwater.
    - o Is rain/stormwater intentionally or unintentionally combined with sewage?

NOTES:

D) Water Use *[Sections 2.8, 2.9]*

Compile data on total system water use by using the tables in Appendix B.

It is best to re-create the tables in Appendix B in MS Excel©. This will allow greater manipulation of the data when completing Step 3, Forecasting Demand.

If the MCD Water Conservation Calculator (MCD WCC) is available, enter your data into the calculator and then export the data into MS Excel© for use in your plan. The MCD WCC can then perform many of the next steps, such as forecasting demand and determining what the best demand management measures are for your community.

Step 3: Forecasting Demand

This step helps users to get a sense of their potential water future. Demand projections provide a baseline that helps determine what intensity of change is needed to ensure a healthy water future.

Forecasting future water demand does not indicate how much new infrastructure must be built, but instead allows a community to understand its possible water future if it chooses to stay on the current course without changing behaviours.

A common tool to use for generating forecasts is MS Excel©, however, when the MCD WCC is fully operational, it would be the preferred tool. The MCD WCC can automatically generate statistical and graphical representations of demand forecasts. The tool also illustrates the difference between the "business-as-usual" approach and a water conservation approach.

"TO DO" CHECKLIST:

A) Water Demand Forecasts *[Sections 3.1, 3.2]*

- ☐ Extrapolate current demands over the next 5, 10, 20 and 50 years. Use the data collected during Step 2 to complete the tables found in Appendix C. Two examples of how to estimate future demands are outlined in the Handbook in the sections referenced above.

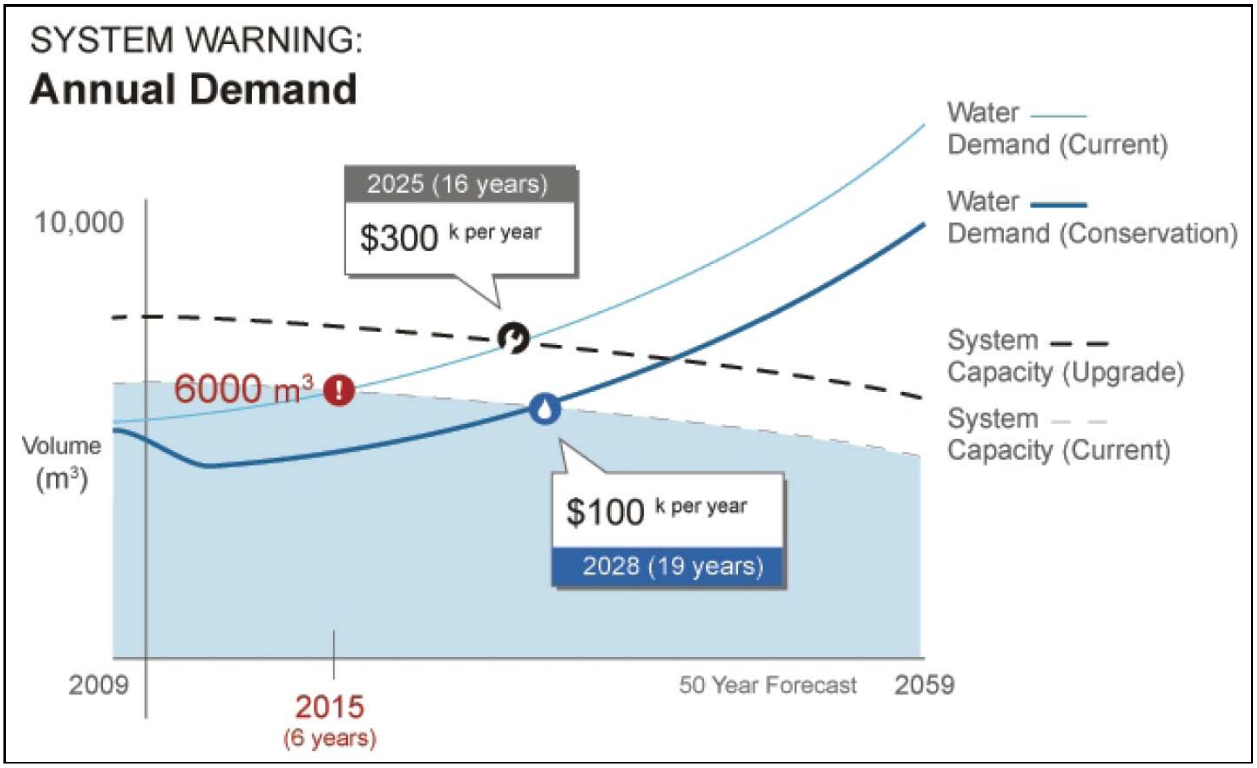
- ☐ Describe how changing demographics and trends might affect your projections.
  - Can your current water source(s) meet your potential "business-as-usual" future demand needs?

- ☐ Describe the possible impacts that climate change could have on your community.
  - How could it affect the watershed and hydrology of the region? E.g. increased severity of extreme weather events - droughts, floods, storms.
  - How will these potential effects impact the current and future population?
    - Based on the potential impacts to water supply and built and natural infrastructure, does continued growth make sense?

NOTES:

The following graph is an example of a “50-Year Annual Demand Forecast” generated by the MCD WCC. One could also use MS Excel© to generate similar graphs if the MCD WCC is unavailable.

ANNUAL DEMAND 50 YEAR FORECAST
(Example graph generated from MCD WCC)



Town X system capacity will be unable to continue to support water demand in 2015 (red exclamation point icon).

Infrastructure upgrades (wrench icon) will extend system capacity for *16 years* at a cost of **$300K per year.**

Water conservation measures (water drop icon) will extend system capacity for *19 years* at a cost of **$100K per year.**

SAVINGS: Water conservation costs **$200K less per year** and extends capacity by *3 years*.

Step 4: Setting targets for a Sustainable Community Water Future

This step identifies water use reduction targets for the present and future. These targets are linked to the vision developed from the values, purpose, scope and rationale outlined in Step 1. The targets can be both qualitative and quantitative.

"TO DO" CHECKLIST:

A) Creating the Future *[Sections 4.1, 4.2]*

- ☐ Set water use reduction targets for the community as a whole.
  - o Consider adopting the provincial *Living Water Smart* goals list in Box 1.1 on page 6.
  - o Set targets over time for the short, medium and long term (<1 year to >50 years).

- ☐ Set specific targets for each sector.
  - o Residential
  - o Industrial
  - o Commercial
  - o Institutional
  - o Agricultural

- ☐ Identify the impacts of water use reduction targets on the wastewater system.
  - o How will reduced water consumption affect wastewater management. E.g. treatment process, capacity, useful life?

NOTES:

Step 5: Reviewing Demand Management Measures and Tools

Step 5 introduces users to the different tools and measures that will help them to accomplish their water conservation goals. This step focuses on researching different demand management options. The selection of specific measures and methodology is introduced in Step 6.

"TO DO" CHECKLIST:

A) Water Conservation & Demand Management [Section 5.1]

☐ Review your community's previous and current conservation programs (if any).
   - Evaluate and assess what was and wasn't successful and why.

☐ Review literature and case studies on water conservation tools and measures. See Table 5.1 on page 63 for an overview of the different categories of measures.
   - The MCD WCC can generate statistical and graphical comparisons of numerous demand management measures.

☐ Research what other communities of the same size and demographic have done.
   - Are they in the process of developing a water conservation plan or program?
   - Is there an opportunity to collaborate?
   - What lessons can be drawn from their failures and successes?

NOTES:

Step 6: Selecting Conservation Measures

This step enables users to understand the options available for evaluating current and proposed water conservation measures. Potential measures are evaluated according to selection criteria established by the user. The chosen measures are then combined into portfolios or comprehensive demand management strategies.

"TO DO" CHECKLIST:

Evaluate EACH demand management measure chosen in Step 5.

A) Analyzing & Evaluating Measures *[Section 6.1, 6.2, 6.3]*

- ☐ Evaluate measures and create a shortlist.
  - o Consider using a matrix like the one below. Note that the user defines the selection criteria and the weighting.

Conservation Measure Selection Matrix

Measure	Overall Score	Targets High Use	Reliability - Actual Reductions	Ease of Implementation	Political / Social Acceptance	Initial Cost	O&M Costs	O&M Capacity
Score / Weighting	100	20	15	10	15	15	15	10
Toilet Replacement	80	17	14	5	12	8	14	10
Conventional Education	65	8	2	8	13	14	12	8
Social Marketing	73	12	10	7	12	13	12	7

- ☐ Bundle selected measures into a conservation portfolio that prioritizes and targets different community water objectives.

- ☐ Explain whether or not the measures you have selected optimize effectiveness and efficiency.
  - o What current and future services could be provided with different or lower-quality (i.e. non-drinking quality) water? E.g. toilet flushing and irrigation.
  - o What current and future service could be provided while requiring little, if any water? E.g. waterless urinals and composting toilets, xeriscaped landscapes.

Step 7: Implementing for Success

This final step provides users with a roadmap for getting their conservation plan off the ground. An effective water conservation plan requires a detailed and thoughtful implementation strategy. An effective implementation strategy includes a realistic timeline and budget, and identifies specific staff or programs that will implement each aspect of the conservation plan.

"TO DO" CHECKLIST:

To complete this section present the following key information for each element of the plan. A possible table format that summarizes the items below is provided in Appendix D

A) Implementation *[Section 7.1, 7.2]*

- ☐ Describe each conservation initiative in detail.
  - Identify any barriers, such as bylaws or legislation that could be changed to make conservation initiatives more effective.
- ☐ Identify the cost of each initiative.
  - Estimate initial and ongoing costs.
- ☐ Identify staffing roles & responsibilities.
  - Specifically outline the individual or position that will take the lead role in implementing each initiative.
  - Redesign job descriptions so that staff are not burdened with water conservation duties being done off the side of their desks. Create new positions if necessary.
- ☐ Outline the scope of each initiative.
  - Describe the extent to which each initiative will be implemented. E.g. what percentage of the distribution system will it target?
  - Should a pilot program be run first?
- ☐ Define the implementation timeline for each initiative.
  - Outline short and long term milestones.

NOTES:

- [ ] Identify options for partnerships and collaboration.
    - Are there opportunities to share delivery or programming costs?
    - Team up with other municipal departments to implement demand management measures.
    - Look to neighbouring municipalities and your regional district for partnerships.
    - Coordination and cohesion of action are crucial since many stakeholders share common interests and/or are in the same watershed and uncoordinated actions could be counterproductive.

- [ ] Set and record ongoing targets for water savings.
    - Estimate the percentage of water saved per year. For example: “This initiative will save 15% of peak day demand by 2010.”

- [ ] Set and record ongoing targets for wastewater savings.
    - Estimate the percentage of wastewater saved per year. For example: “This initiative will save 25% of annual average day demand by 2018.”

- [ ] Set triggers for program evaluation and modification.
    - Peak day and peak hours should be recorded and analyzed to determine whether changes need to be made to the conservation program.

NOTES:

Appendix A

Community Portrait

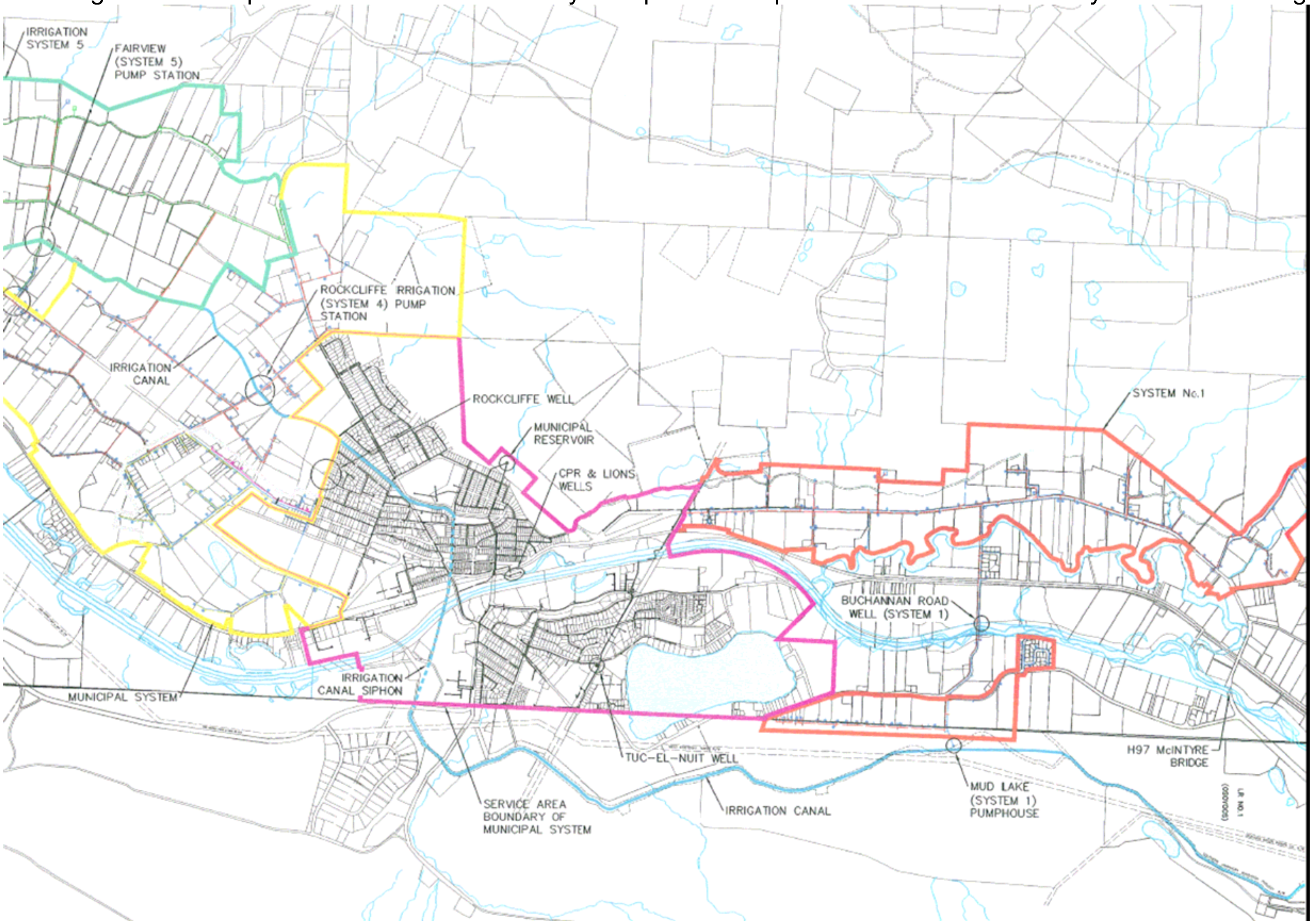
Unconventional (green) infrastructure *[Sections 2.3, 2.4]*
Green infrastructure includes both natural and engineered systems where natural refers to forests, creeks, wetlands and other waterways; and engineered refers to human-designed structures to mimic or reduce impact on ecological systems such as constructed treatment wetlands.

Conventional (grey) infrastructure *[Sections 2.3, 2.6, 2.7]*
Grey infrastructure refers to the built components (pipes, pumps, reservoirs, etc.) of the water supply, distribution, treatment and redistribution systems.

Compile data on the hydrology, character and climate of the watershed(s).
Identify the catchment area – locations/types of land and water forms.

- Consider using an airphoto or satellite image to show the land forms in the community and the nature of the watershed(s). With this image one could then note basic watershed and sub-watershed areas.
- An example of a simple tool to use would be Google Maps© with the satellite function – this provides a view of the terrain and allows the identification of points of interest. One can use the print screen key and paste the map into the MS Paint© program and edit it there.
- An example of a more advanced tool would be Google Earth© or a Geographic Information System (GIS) that has the capability to provide a higher level of detail and accuracy. Many regional districts have employed iMap© to create a useful mapping tool.
- The idea is to connect the unconventional (green) and conventional (grey) infrastructure layers by comparing them in hardcopy or overlaying them electronically. Through this process one can begin to see how the built water system fits or does not fit into the hydrology of the area.

The image below is a portion of the overall water system plan developed for the Town of Oliver by TRUE Consulting.



Sample Water System Map (extracted from Town of Oliver Water Conservation Plan 2007)

Appendix B

Compile data on the total system water use using the following tables.

Essential Water System Data

TOTAL Service Population	
Annual Water Supply Capacity	
Maximum Daily Supply Capacity	
Peak Hour System Capacity	

Annual Water Demand

Annual Water Demand		**M3 per year**	**Metered Volume m3**	**Non-metered Volume m3**	**% of total**
Residential (single family)	Indoor				
	Outdoor				
Agricultural					
Commercial					
Industrial					
Institutional					
Non-revenue e.g. leaks, fire protection					
TOTAL Annual Demand					100%

Daily Water Demand

Daily Water Demands	**Volume (m3/day)**	**% of maximum daily supply capacity**
Average Daily Demand (ADD)		
Maximum Daily Demand (MDD)		
Peak Hour Demand (PHD)	*m3/hour*	

Monthly Demand Data		**24 Hour Demand Data (day with greatest peak hour)**			
Month	*Demand (m3)*	*Hour*	*Demand (m3)*	*Hour*	*Demand (m3)*
January					
February					
March					
April					
May					
June					
July					
August					
September					
October					
November					
December					
Average					

Detailed Service Connection Data

Service Connections	# of Connections	% of all Connections	Annual demand per connection m3/year	# of connections metered	# of connections not metered	% of connections metered per sector
Residential (single family)						
Agricultural						
Commercial						
Industrial						
Institutional						
Other						
TOTAL Connections						

Appendix C

Annual Water Demand Forecast

Total Annual System Demand m3	**Current Year**	**5 Years**	**10 years**	**20 years**	**50 years**
Population Served					
Annual Water Demand					
Annual Supply Capacity					
Difference Between Annual Supply Capacity & Annual Water Demand (i)					

(i) If the difference is negative, this means the system will experience shortages due to lack of supply; if positive, then a surplus exists,

Daily Water Demand Forecast

Daily Water Demand m3	**Current Year**	**5 Years**	**10 years**	**20 years**	**50 years**
Average Day Demand (ADD)					
Maximum Day Demand (MDD)					
Peak Hour Demand **m3/hour**					

Appendix D

Example of a Short-Term Implementation Timeline

Category of Measure	Water Conservation Measure	Affected Water Use	Water Saving Target	Staffing	Cost	Recommended Implementation	2009	2010	2011
Bylaw	Lawn Watering Bylaw	Outdoor max day Use	20%	1 in-house staff	$25/hour staff pay	2008, ongoing	X	X	X
Education	Home audits, xeriscape workshops	Indoor and outdoor	20%	- 2 in-house staff -Graphics company two week contract - 2 students	$5000	2009, ongoing	X	X	X
Rebate Program	Efficient toilets and fixtures	Indoor	20%	-1 in-house staff	$200000	2011, ongoing			X
Update Implementation Plan	Total Use					Ongoing			

Water Conservation Planning Handbook

Detailed Table of Contents

List of Figures and Tables

Step 1: Introducing Your Plan

"*A new relationship between people and water needs to be established to ensure that there will be reliable water supplies available for human use, thriving ecosystems and a healthy economy…both now and in the future.*" **Cowichan Basin Water Management Plan, 2007**

Step Summary

This step will explain why water and water conservation is important to your community and outlines the values and methodology driving the water conservation planning approach. Users should aim to adopt a "watershed-eye-view" and look at the big picture in order to provide direction and focus for the rest of the planning process. From this step users can develop a vision of a holistic community water future that is linked to land use planning and development, and integrated resource recovery. This vision is then able to inform the development of a healthy and healthful community. A good introduction also summarizes the key elements of the plan.

1.1 Why is Water Important to Your Community?

British Columbians are among the highest water users in the world. The average British Columbian uses more than two times the amount of water the average European uses in a day. Despite the apparent abundance of water in BC, our water supply is not as plentiful as we would like to think: nearly one quarter of our surface water sources have already reached or are nearing their capacity to reliably supply water for increasing extractive uses (MOE 1999). A changing climate, increasing urbanization and growing communities will only further stress existing water sources.

Water conservation plans are now a mandatory requirement for local governments applying to the Province for capital grant funds for drinking water and wastewater infrastructure. In the future, all communities accessing provincial infrastructure funds will be required to actively conserve water. In comparison, in 2004 only 34 percent of British Columbian utilities were implementing water conservation initiatives with 54 percent considering water conservation in the future (BCWWA 2004: 3). A number of British Columbian communities have come a long way with leading programs, including the Capital Regional District, Campbell River, Cowichan Valley Regional District, Dawson Creek, Kelowna, Regional District of Nanaimo, Oliver, Sunshine Coast Regional District, and Vernon.

Box 1.1 Planning It Right: Moving Beyond Efficiency with the Soft Path

The "Soft Path" is a comprehensive management and planning approach that takes its name from the energy soft path pioneered in the 1970s.
The water Soft Path approach:

- *Treats water as an ecological service rather than an end in itself;*
- *Makes ecological sustainability a fundamental criterion;*
- *Matches the quality of water delivered to that needed by the end-use;*
- *Begins not by forecasting water needs into the future; instead starts with a vision of what kind of water future is wanted for the community.*

Source: Brandes & Brooks (2007) *The Soft Path in a Nutshell (Revised)* for details. Available for download at www.poliswaterproject.org

A ***strong*** conservation plan is characterized by:

- At least a 20 to 50 year timeframe.
- A comprehensive and thoughtful rationale for water conservation.
- An integrated approach to water conservation linking with other plans, such as wastewater, land use, asset management and other planning.
- An effective implementation strategy.

An ***excellent*** conservation plan goes further to include provisions that:

- Place ecological health at its core.
- Are tailored to a community's watershed context and consider the community's impact on the watershed.
- Blend innovative legal tools such as water restriction and land use planning bylaws with practical measures such as rebate and metering programs.
- Make managing demand a part of daily business, rather than a stop-gap measure designed to merely buy time needed to increase supply.
- Build in measures that are geared toward rainwater capture, wastewater reclamation, reuse and recycling to better match water quality to end uses.
- Implement outreach and education programs that go beyond information dissemination to engage and inspire citizens to permanently change behaviour.
- Use a "triple bottom line" approach to valuing water.

1.2 Visioning the Community's Water Future

Vision-based planning entails developing narrative descriptions of possible futures or situations. Articulate one or two ambitious yet realistic broad community visions that are based within ecological limits. Ambitious conservation programs tend to be controversial. In many cases, water conservation plans have been more successful because the public was consulted during the planning phase to help determine an acceptable balance between demand management, resource development, and ecosystem health.

One of the best ways to cultivate widespread support for your water conservation plan is to involve the public in aspects of the planning process, particularly in the goal setting described in this step. The planning committee involved in the 2007 Cowichan Basin Water Management Plan engaged in an extensive community consultation and visioning process that spanned 28 months. The plan has not yet been fully implemented, but it sets out a series of ambitious goals including 100% metering and attaching water conservation terms to existing licenses by 2015 (CVRD 2007: 34; 37). See Box 1.2 for ideas on establishing a process to establish a sustainable community water vision.

Box 1.2 Visioning Through Scenario Building

"Scenarios can explore outcomes that are unlikely or incongruent with current decisions and policies. Sometimes scenarios are purely descriptive and are designed to study outcomes that had not previously been considered…

A 'scenario analysis' approach can help resource managers and interested stakeholders better understand the inherent uncertainties about future management and, in turn, help uncover more innovative and successful management strategies for adapting to possible futures…ultimately, the point—and power—of scenarios is not to develop a precise view or prediction of the future. It is to enable us to look at the present in a new and different way, and to find new possibilities and choices we might have previously overlooked or ignored."

Source: Gleick (2005) *California Water 2030*.

1.3 Developing Your Planning Process

This guide lays out one approach to water conservation planning. You may wish to modify the approach presented to better suit your community's population size, environmental challenges, demographics, principal industries and planning history. Regardless of individual community modifications and variations, it is important to justify the logic used in your water conservation plan.

Consider integrating water conservation considerations into all your plans, not just your Official Community Plan (OCP). Embedding water conservation initiatives into an OCP increases both the likelihood of successful implementation and the chance of getting critical players to come to the table. A clear regional perspective is also necessary to coordinate planning and development, and manage growth. It is vital to take into account water recharge rates and other ecosystem constraints. See Box 1.3 for some of the benefits of water conservation planning.

Important General Considerations:

- Does your community have unique needs (size, budget, primary industries) that will require modification of the steps and strategies presented in this guide?
- To what extent will you involve the public in the development of your plan?
- What implementation timeline is most appropriate? For example, is urgent action needed to minimize ecological damage or ensure water delivery?

1.4 Getting Started: Establishing a Comprehensive Action Team

Regardless of the size, political structure and culture of your community, a critical first step to successful water conservation planning is putting together an action team that will inform and direct the planning process. Aim to build this team with sufficient capacity, knowledge and experience to design and implement a comprehensive and integrated program. The team should include municipal staff, scientific experts, community and environmental groups and water system users.

Community water conservation planning extends beyond household water saving to include the industrial, commercial, institutional and agricultural sectors and should be integrated with broader regional growth strategies, land use and transportation planning, watershed management plans, and other relevant community plans. Consider recruiting city planners, parks, transportation and water utility staff to sit on the Action Team to ensure fully integrated planning.

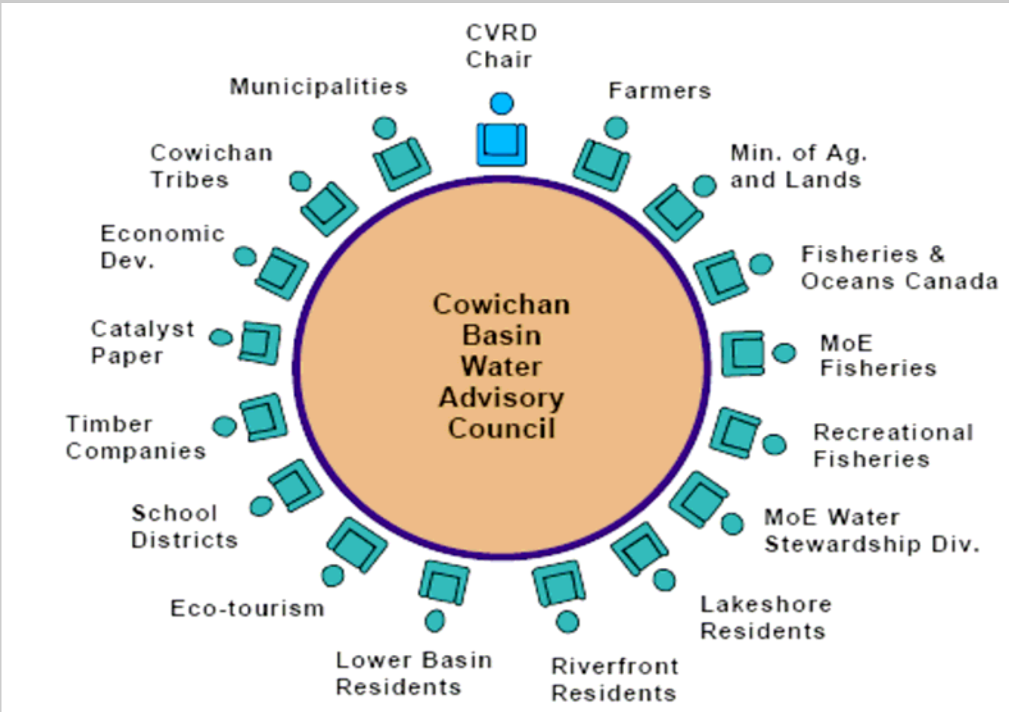
The Cowichan Valley Regional District's Cowichan Basin Water Advisory Council (see Figure 1.1) and the Capital Regional District's Water Advisory Council are both examples of representative task forces comprised of scientists, ratepayers, community and environmental groups, industry, and government that work to facilitate integrated water planning and promote innovative solutions.

Box 1.3 The Bottom Line: Water Conservation Brings Tangible Benefits to Communities
Direct benefits from comprehensive demand management programs include: • Maximize the service from existing infrastructure; • Minimize the need for new infrastructure thereby reducing capital costs and associated operating costs over the long term; • Increase resource use efficiency, particularly of water and energy; • Maintain or increase the affordability and accessibility of services to residents and businesses by reducing waste and pollution; • Reduce degradation of water sources, and improve air quality, climate stability, biodiversity, and natural spaces such as forests, wetlands, and meadows; • Achieve broader community goals for maintaining a high quality of life. Source: Adapted from FCM (2001) *InfraGuide*. See also Box 2.2 Holistic Valuation

1.5 Political Support and Council/Board Endorsement

Council or Board endorsement may be an eligibility or conditional requirement for senior government funding. A directive from the Council or Board to develop the conservation plan will help secure an appropriate budget and allocation of resources to support plan design and implementation. A directive from local politicians demonstrates that water conservation planning is a priority and will be implemented within a set timeline.

Figure 1.1 Membership of the Cowichan Valley Regional District's Basin Water Advisory Council.



The schematic above shows the broad steering committee that directed the CVRD's 28-month planning process.

Source: CVRD (2007) *Cowichan Basin Water Management Plan.*

Step 1 Additional Resources

Water Conservation Planning Manuals:
These publications are helpful resources to reference throughout the planning process. They are relevant to all subsequent chapters of this guidebook.

Brandes, O., & Brooks, D. (2007). *The Soft Path in a Nutshell (Revised).* Victoria BC: The POLIS Project on Ecological Governance, University of Victoria with Friends of the Earth Canada.

Canadian Mortgage and Housing Corporation (Forthcoming). *Guide for the Development of Municipal Water Efficiency Plans in Canada*. Veritec Consulting Ltd.

Federation of Canadian Municipalities. *InfraGuide.* Available at: www.sustainablecommunities.fcm.ca/Infraguide/

Friends of the Earth Canada and the Federation of Community Municipalities. (Forthcoming). *Developing Water Soft Paths in Canadian Municipalities: A Guidebook.*

Ontario Water Works Association. (1999). Water Efficiency: A Guidebook for Small & Medium-sized Municipalities in Canada.

US Environmental Protection Agency. (1998). *Water Conservation Plan Guidelines.* Available at: *http://epa.gov/watersense/pubs/guide.htm*

United Nations. (2003). *Guide to Preparing Urban Water Efficiency Plans*. New York: UN.

Vickers, A. (2002). *Handbook of Water Use and Conservation*. USA: Waterplow Press.

White, S. (1998). *Wise Water Management: a Demand Management Manual for Water Utilities.* Sydney: NSW Department of Land and Water Conservation.

Planning Documents and Case Studies:

Brandes, O., Maas, T., Mjolsness A., & Reynolds, E. (2007). *New Path to Water Sustainability for the Town of Oliver, BC - Soft Path Case Study*. POLIS Project on Ecological Governance, University of Victoria.

California Department of Water Resources. *Examples of Complete Urban Water Management Plans.* Available at: http://www.owue.water.ca.gov/urbanplan/uwmp/uwmp.cfm

Furlong, K., C. Cook & K. Bakker (2008). *Good Governance for Water Conservation: A Primer*. Vancouver, BC: UBC Program on Water Governance & Infrastructure Canada.

Gardner, J. & Furlong, K. (2008). *Workshop Report: Sustainable Water Infrastructure Management in Canada* Workshop held May 5th, 2008 at the Peter Wall Institute, UBC. Vancouver, BC: Program on Water Governance and Infrastructure Canada.

Ontario Ministry of Environment. (June 2005). *Oak Ridges Moraine Conservation Plan Technical Paper #11: Water Conservation Plans*. Available at https://ospace.scholarsportal.info/bitstream/1873/2725/1/254444.pdf

Pacific Institute website: http://www.pacinst.org/

Step 2: Community Water System Profile

"Having a solid understanding of existing system operation provides the starting point for analysis."
Town of Gibsons Water Supply Strategic Plan, 2005

Step Summary

The Community Water System Profile allows users to create an overview of the entire community water system. The physical components of water utilities should be considered in the context of the ecological elements of the watershed. It is recognized that a basic water conservation plan will not necessarily be able to include detailed ecological information and approaches in the first iteration of the plan.

2.1 Where to Find Data

- "Must have" data elements in this chapter are <u>underlined</u>.
- Data elements that are useful but not crucial are in plain text.
- Data collected in this step will be used to make demand projections in Step 3 or can be entered into the MCD Water Conservation Calculator. If possible, include a map that shows the spatial layout of all components of your water system underlain by the geography of the area.

The majority of the data needed for this section should be available from:

- Drinking water and wastewater plant operators or managers
- Metering and billing records
- Water master plans and other community documents
- Other municipal departments such as planning and engineering

Developing a Water System Profile	
WHO	Water utility operators, managers and other waterworks staff. Smaller communities may wish to hire consultants.
WHAT	Gather and assess relevant information about ecological systems, water source, supply, distribution, treatment, and redistribution systems, water users and end uses of water. This is the foundation upon which you will build your conservation program.
HOW	Collect data from water metres, water utility records, billings records and municipal planning documents. Reports from neighbouring municipalities and provincial and federal studies such as those from the Ministry of Environment, the Department of Fisheries and Oceans and Environment Canada may also be of use.

If the data required for the calculations outlined in this guide are not available, be sure to include an explanation of any alternative terms and calculations used in your community. Where possible, data should be averaged over a span of five to ten years to ensure an accurate community water system profile. Data should include dry and wet maximums such as the wettest year on record and the lowest levels of water sources during the third year of a three-year drought. Consultants or other experts may be contracted to obtain and analyze more technical data.

2.2 Community Portrait

Provide a brief overview of the characteristics of your community. This will include such information as the population (permanent & seasonal), and a general description of the urban and/or rural environs. In addition, briefly describe the residential, industrial, commercial, institutional, and agricultural aspects of the community. For example is the community primarily agrarian or forestry-based, what types of industries and commercial enterprises are currently operating and/or have operated historically? If agricultural, what types of crops are grown and/or livestock raised?

What Social, Cultural, and Governance Factors Affect Your Watershed?
Comprehensive integrated water conservation planning requires thinking beyond the physical components of the water system and taking into account the broader context of the watershed. Consider the following:

- Are you sharing your water sources with other communities?
- Are there community environmental stewardship groups active in the community and what type of projects are they conducting?
- Does water consumption impact recreational uses?
- What is your community's minimum required fire flow?

2.3 Community Water System Profile

The following subsections outline the components that will comprise the profile for the total water system cycle from source to tap to receiving waters and back to source. The profile also includes both human-built and natural infrastructure.

2.3.1 Water Source(s) and Supply

Give an overview and inventory of your community's water source(s) and supply. Consider significant environmental, social and economic variables that affect the integrity of your water sources now and in the future. Communities may also wish to complete a water supply master plan.

Assess important factors affecting sources of supply:
Does your community have direct or exclusive control over its water supply? Are there multiple sources? Does it purchase bulk water from another purveyor such as a Regional District, or does your community sell water to other purveyors, and if so, at what cost? Who owns or controls the watershed?

Box 2.1 Inextricably Linked: Water Quality and Quantity

Although at first glance it may appear that most of the actions and strategies promoted in this guidebook focus on water quantity, water quantity and quality are inextricably linked. The first step to improving water quality is reducing the amount of wastewater generated and maintaining adequate volumes of water in streams (NRCAN 2004:40).

Surface water quality deterioration can result from low reservoir water levels (CRD 2001). Increases in temperature can encourage organic growth and algal blooms. In coastal areas, increased groundwater extraction can lead to saltwater intrusion in aquifers (BC WLP 2002). Lowering water levels in aquifers can also encourage oxidation of aquifer walls and leach contaminants into the water.

Other factors to consider include:

- ***Water quality*** – summarize water quality reports for source waters including: BOD, TSS, NH4-N, NO3-N, turbidity, toxicity, temperature and other important considerations. Are there activities occurring in the watershed that could affect the quality and quantity of surface/groundwater source and supply? E.g. development, logging, mining, or agriculture.
- ***Water quantity*** – summarize what kinds of quantity challenges affect your source and supply. Obtain existing water quantity data including total annual flow and historical flow trends; note any established "low water" level flow data and periods of multiple year droughts.

- ***Ecological Health*** –summarize existing studies on each water source noting any evidence of stressed ecology (as indicated through Environmental Assessments, environmental non-government organization or other third party reports, Ministry studies, or feedback from community groups).

- ***Infrastructure capacity*** – identify the capacity limits of your infrastructure by taking an inventory of treatment plants, reservoir balances and storages, diameter of trunk mains and well screen condition.

- ***Climate change*** **–** identify any studies that predict the effects of climate change on water sources in your region. Is the watershed particularly vulnerable to changes in precipitation, reduced recharge salt-water intrusion, rising sea levels or pine beetle or other invasive species infestation?

2.3.2 Surface Water

In many cases the total volume allocated under a license is not actually available because of ecosystem requirements or competing licenses held within the watershed.

Assess and describe the available surface water capacity, including:

- Location of source water in relation to community
- Location of intake(s)
- Water license allotment, including annual allowable volume extracted in relation to total availability
- Service area
- Current annual supply capacity, including maximum and minimum flows and volume capacity. For example: highest and lowest lake level per year and maximum and minimum river flow volume.

2.3.3 Groundwater

Assess well yield rate(s) and water quality, including a groundwater capacity assessment. Review the community's groundwater (aquifer) protection plan (if none exists the community may wish to develop one). Increased regulation of groundwater in British Columbia in the near future will significantly impact how groundwater is managed.

Assess and describe available groundwater capacity, including:

- Location
- Service area
- Existing rated capacity/well yield rate(s)
- Current annual average water production, such as peak day and maximum month water production
- Is there a reduced yield rate at certain times of year?

2.3.4 Other Sources of Water

Take into account and quantify any reclaimed water, recycled water and rainwater sources your community is currently using. Including:

- Annual and summer rainfall data
- Users and uses that could benefit from non-potable water use

Fixing leaks is potentially another fairly significant source of "new water" in that it is recovering lost water and making it available again.

2.4 Ensuring Ecosystem Health in Your Watershed

How does your community's water consumption impact the ecosystem health of your watershed? The American Bureau of Land Management has published a guidebook to help communities assess stream health. The step-by-step guide provides sufficient detail so that the average person can walk along a steam and complete a page-long twenty-question checklist that produces a general assessment of stream health. [BC-based Aqua-Tex Scientific Consulting Ltd. has developed a detailed proper functioning conditions framework and has also done excellent work on stream health assessment and restoration through its Revenue Streams project in the CRD (see Box 2.2).]

In your watershed:

- Are there sensitive ecosystems?
- Can fish habitat be affected by stream flow or temperature variations?
- Do industrial practices impact water quality?

Box 2.2 Holistic Valuation
Nature's Revenue Streams (NRS) is a 3-year public-private pilot project led by Aqua-Tex Scientific Consulting Ltd. based in Saanich, BC that links stormwater infrastructure to the restoration of stream and watershed function. The project uses techniques that mimic the ability of natural systems to store water and treat pollutants, to show that developments can be built for less money, with more stable and cost-effective drainage systems, while also creating attractive green spaces, restoring water flows, rebuilding habitat and saving significant municipal infrastructure costs. Valuation is typically thought of from a "single perspective," for example that of the municipality. However, the NRS project shows that there are multiple beneficiaries of the single investment. This goes beyond the "Triple Bottom Line" approach which evaluates a single perspective by three or more accounts; instead, there is a clear need to consider a "holistic valuation" that values "three-dimensional accounting". Source: Corps, C. (2007) Vancouver Valuation Accord Case Study. Available at: http://www.vancouveraccord.org/pdf/vva_case_study_1.pdf

2.5 Distribution and Treatment Systems

Provide an overview of the water distribution system(s). Including:

- Kilometres of potable and wastewater lines in the system
- Total number of connections
- Level of water treatment, including technologies used
- Descriptions of each reservoir, water tower or other balancing storage tanks
- Rated capacity
- Pressure zones
- Potential or expected known leaks as percentage (see *IWA Water Balance* in Table 2.1)
- Any twin systems or purple pipe systems that deliver both potable and non-potable water.

2.6 Wastewater Treatment and Infrastructure

Water conservation can reduce the need for wastewater infrastructure expansion. Typically about 70 percent of water supplied to residences is returned as wastewater (CMHC, Forthcoming). This ratio will change with the use of water reclamation and reuse technologies. Therefore it is important to understand your wastewater system as it is a potential future source of water for certain specific applications such as irrigation and indoor use in toilets and laundry.

Describe your wastewater system, including:

- Wastewater treatment facilities (do they operate under a permit or the Municipal Sewerage Regulation with an approved Liquid Waste Management Plan?)
- Is stormwater combined with wastewater?
- Wastewater rates and pricing structure
- Type of treatment used (e.g. primary, secondary and tertiary treatments, ultra violet treatment, nitrification and/or anaerobic digestion, etc.)
- Rated flow and load
- Current volume of average annual and daily discharge
- Service area
- Outfall point, including name of receiving body of water and location/type of land application

2.7 Community Water Use

Conduct a profiling of water users and end uses of water within the community to identify where water conservation initiatives should be directed. Note that detecting and repairing leaks can be an extremely valuable initiative as the recovery of the lost water becomes a source of “new water”.

2.7.1 Peak Day Demand (PDD)

Peak day demand (PDD) is one of the most important factors driving infrastructure expansion. **Peaking factors (PDD divided by Average Day Demand)** are often 150 percent or more than **average day demands** and are usually the result of lawn watering in the summer. Identify both the peaking factor used in the design of the community water system along with the historical (actual) peaking factor. PDD is found by looking at metering data or water production data for the largest volume of use in one day. If possible identify peak hourly use. Be aware that some events such as large fires or closure of high water users will impact Average Day Demand (ADD) and PDD but do not indicate any behavioural changes. Compile and compare **maximum month use and/or average summer use against winter use**. This analysis presents a complete picture of the increase in water use during summer months and may be more consistent year to year than peak day demand.

For Peak Day Demand compile:

- Peak day demand
- Maximum month demand
- Summer demand
- Peaking factors (design & historical)

2.7.2 Average Day Demand (ADD)

System input volume is the total annual volume of water input into the supply system and is typically estimated using total water production measured at the well-head, water treatment plant or reservoir. Average Day Demand (ADD) is calculated by taking the total annual water production and dividing it by the number of days in a year. This information can be collected from metered flows of water treatment plant(s), wells, reservoirs, etc. Ideally, use data from the past consecutive five years. However, if growth has been minor, the water produced over the last few years can be averaged assuming weather patterns and water use have been typical (AWWA 2006a:40). Gross per capita demand is then determined by dividing ADD by the residential population.

Technical Box: Calculating Average Day Demand
Average Day Demand = Total Annual Water Production / 365 days To Estimate Unmetered Water Use: ***Average Day Demand = Pump Rate x Run Time x Efficiency of Pump**** **Efficiency of pump decreases annually*

For Average Day Demand compile:

- Total Annual Water Production
- Current Population
- Gross per capita demand

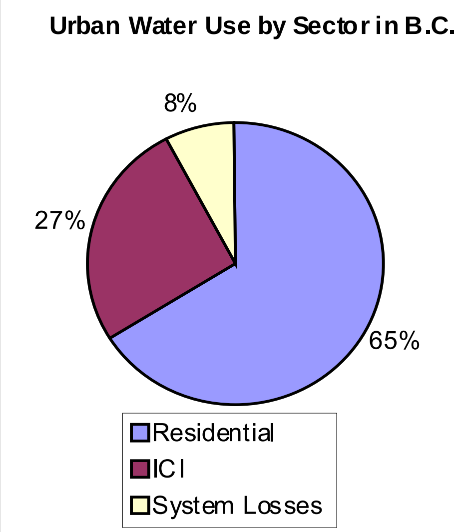
2.7.3 Sectoral Water Use

Gross (total) per capita demand in Canada is typically further broken down into residential (net) and industrial commercial institutional (ICI) sectors (See Municipal Water and Wastewater Survey at www.ec.gc.ca). Establish the annual water use, per capita demand, and the percentage of total water production for each sector.

Water use for each sector can often be obtained through billing data; however, if the community is not fully metered, the averages for Canada shown in Figure 2.1 can be used as a first estimate.

Compile for each sector:
- Sectoral current average annual water demand
- Sector percent of total water production
- Per capita water demand

Figure 2.1 Average Water Use by Sector in British Columbia



Municipal Population	Residential %	ICI %	System Losses %
Under 1000	71.5	22.2	6.3
1000 to 2000	70	24	6
2000 to 5000	67.2	26.8	6
5000 to 50 000	61.1	28.4	10.4
50 000 to 500 000	58.2	30.2	11.6
More than 500 000	52.2	32.1	15.7

Source: Municipal Water and Waste Survey (2004). Available at: www.ec.gc.ca/water/mwws/

2.7.4 Residential Water Use

Residential water use can be further disaggregated into single-family and multi-family (if billing data identifies these sub-categories) and further into **Indoor** and **Outdoor uses**. Outdoor water use is strongly weather and climate dependent, and therefore can vary significantly from year to year. Average per capita indoor water use, however, is much more stable and will typically be dependent on the number of persons per household (Griffin & Morgan 2008) and age of the home (RMSI 2008). Indoor water use can be determined by examining residential average monthly water use data, and averaging the per capita demands for the winter, or base demands, months. The ratio of average per capita *indoor residential* water use to average *total residential* per capita water use provides the percentage of indoor, and conversely outdoor, residential use on an annual basis.

Further disaggregate indoor end uses of water if data are available (toilets, showers, laundry, etc.). If data on indoor end uses of water are not available, typical values can be obtained from the Municipal Water and Waste Survey (MWWS 2004) or the AWWA Water

End Use Study (Mayer *et al*. 1999). Similarly, but often more challenging, typical outdoor end uses should be identified for the community, and quantified if possible.

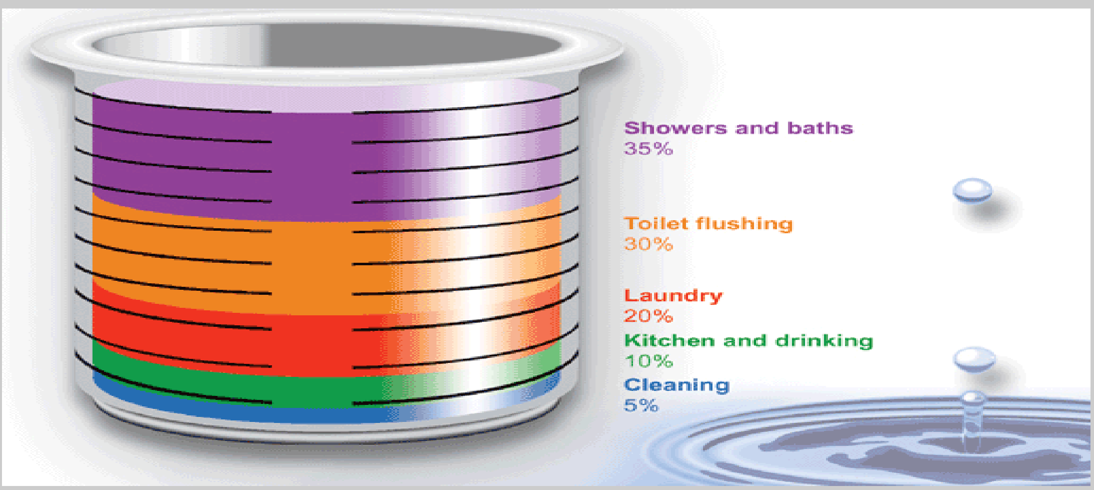
For Residential Water Use, compile:

- Indoor & outdoor residential per capita water demand (LCD)
- Peak demands (peak season/peak day/peak hour)
- Indoor and outdoor end uses

2.7.5 Industrial, Commercial and Institutional (ICI) Water Use

While indoor residential water end use is generally comparable across Canada, ICI water use is specific to each community. In addition, the water use, base demand and peak demands of each sector – industrial, commercial and institutional – should be identified through methods similar to those described for the residential sector. Once again, analysis of peak seasonal use versus base use can enable an estimate of indoor vs. outdoor water demands. Given the diversity of the ICI sector, some communities have found identifying the largest water users to be an effective way of focusing water efficiency programming efforts.

Figure 2.2 Average breakdown of residential end-use



Source: Environment Canada Freshwater Website www.ec.gc.ca/water/

For ICI Use describe:

- ICI users with largest annual water demand (typically universities, food processing, manufacturing, etc.)
- Current average annual water demand for each sub-sector
- Base annual water demand (determined by examining monthly use patterns)
- Peak demands (peak season/peak day/peak hour)
- Rated/permitted total supply

2.7.6 Agricultural Water Use

Water for agricultural use in Canada is largely supplied through private wells, retention ponds or irrigation districts. It is important to consider agricultural practices even if they are not on a community's water system as they often draw from the same aquifer or surface water source. Where possible, obtain the annual amount of water withdrawn by agriculture each year by looking at water licenses.

For Agricultural Use describe:

- <u>Current average annual water demand</u>
- Base annual water demand (determined by examining monthly use patterns)
- Peak demands (peak season/peak day/peak hour)
- <u>Primary crops or livestock grown</u>

2.8 Water Losses and Non-Revenue Water

Non-revenue water is the difference between system input volume (gross water production) and the sum-total of all billed water consumption. It is useful to examine non-revenue water as a portion may be accounted for by water losses in the form of system leaks (refer to Table 2.1).

Conducting an IWA water balance is a useful exercise to assess non-revenue water and its components as noted in Table 2.1. Further details can be obtained in Lambert (2003), but note that an expert practitioner may be required to conduct this analysis.

Table 2.1 IWA Water Balance Accounting

<table>
<tr><td rowspan="8">System Input Volume (corrected for known errors)</td><td rowspan="4">Authorised consumption</td><td rowspan="2">Billed Authorised Consumption</td><td>Billed Metered Consumption (including water exported)</td><td rowspan="2">Revenue Water</td></tr>
<tr><td>Billed Unmetered Consumption</td></tr>
<tr><td rowspan="2">Unbilled Authorised Consumption</td><td>Unbilled Metered Consumption</td><td rowspan="6">Non-Revenue Water (NRW)</td></tr>
<tr><td>Unbilled Unmetered Consumption</td></tr>
<tr><td rowspan="4">Water losses</td><td rowspan="2">Apparent Losses</td><td>Unauthorised Consumption</td></tr>
<tr><td>Customer Metering Inaccuracies</td></tr>
<tr><td rowspan="2">Real Losses</td><td>Leakage on Transmission and/or Distribution Mains</td></tr>
<tr><td>Leakage and Overflows at Utility's Storage Tanks</td></tr>
</table>

Source: Lambert (2003) *Assessing Non-Revenue Water and Its Components*.

Step 2 Additional Resources

AWWA. (2006). M36 *Water Audits and Leak Detection.* Denver: AWWA.

Mayer, P.W., & DeOreo, W.B. (1999). *Residential End Uses of Water***.** American Water Works Association Research Foundation. Denver: Colorado.

Online Tools for Assessing Water Systems and Use:

AWWA Free System Water Audit Software:
Available at: http://www.awwa.org/files/science/WaterLoss/WaterAudit.xls

BASINS (Better Assessment Science Integrating point and Non-point Sources) is a multi-purpose environmental analysis system that integrates a geographical information system (GIS), US (and some Canadian) watershed data, and environmental assessment and modeling tools into one. Available for download at: www.epa.gov/waterscience/basins/

Step 3: Forecasting Demand

"Trend is not destiny."
Lewis Mumford

Step Summary

Forecasting future water demand does not indicate how much new infrastructure must be built, but instead allows planners to get a sense of their community's water future if it chooses to stay on its current course without changing demand. Demand projections provide a baseline that helps determine what intensity of change is needed for a sustainable water future.

Developing a Demand Forecast	
WHO	Water utilities and engineering departments and other community staff in consultation with DSM planning action team and ICI representatives.
WHAT	Project future water use by population and by user group.
HOW	Calculations and models based on projections of historical water consumption patterns extrapolated into the future

3.1 Two Basic Methods of Estimating Future Water Demand

This section presents two simple methods of projecting water demand: 1) forecasting by population[1] and 2) forecasting by user groups. A series of high, medium and low forecasts should be made at 10, 15, 20, 30 and 50-year intervals. No single method of forecasting will satisfy the varied needs of all water utilities.

For example, when a forecast of average annual demand is the primary requirement, a simple per capita approach might be sufficient. When major new capacity must be added in different locations within the utility's total service area, an analysis of disaggregated demand by area and customer class will more accurately quantify the size and character of facilities required (AWWA 2007:41).

The MCD Water Conservation Calculator can assist with basic projections. Note that additional factors such as those outlined in Table 3.1 can affect future water demand. If your community has the capacity to do so, consider incorporating some of the additional variables presented in Table 3.1 when making demand projections.

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[1] Increasingly, leaders in water conservation have started to decouple growth and consumption. For example, the CRD has been able to increase population but curb total annual water use (CRD 2008). And in the RDN, water consumption decreased by 8 percent between 2005 and 2008 while population increased (RDN 2008).

Technical Box: Per Capita Water Demand Forecasting

This method is most appropriate for smaller communities that do not have detailed information on end uses in their water system. The per capita method assumes that water consumption is directly linked to population growth. Although this link is not always present, this method is useful for communities that have not yet decoupled population and total water consumption because it provides a picture of what water demand will look like if no water saving behaviours are introduced.

Future water use = (current gross per capita water use) x future population x 365

3.2 Climate Change and Your Watershed

Adapting to climate change and reducing human impact on the environment will be a condition of BC Provincial infrastructure funding. While it is difficult to predict exactly how communities will be affected by climate change, there are publications available with helpful information. For example, Chapter 8 of NRCAN's 2008 study Adaptation: Canada in a Changing Climate provides useful information about possible impacts on British Columbia and cites water demand management as one of the most important techniques for adaptation (see Case Study Box 3.1).

Case Study Box 3.1 Water and Adapting to Climate Change in British Columbia

"Water resources are one of the highest-priority issues with respect to climate change impacts and adaptation in Canada" ***NRCAN, 2008****.*

Climate change is already affecting British Columbia. Over the past 100 years sea surface temperatures have increased by 0.9ºC to 1.8ºC along the BC coast and average annual temperatures warmed by 0.6ºC on the coast, 1.1ºC in the interior, and by 1.7ºC in northern BC. Two large BC glaciers have retreated by more than a kilometre each, and sea levels have risen by 4 to 12 centimetres along the BC coast (Indicators 2002: 4).

Climate change will likely result in decreased summer flows, warmer summer water temperatures and higher winter flows (NRCAN 2008: 38). In many regions, decreases in flow volumes and water levels are expected to create or exacerbate water supply problems during the summer months. Overall, the most vulnerable regions will be those already under water stress, such as the Okanagan Valley, where demand is already approaching available supply.

Climate impacts on British Columbia's water include:

- Saltwater intrusion due to a rise in sea level and increased water demand
- Water-borne health effects from increased floods
- Increased water turbidity from increased landslides and surface erosion
- Increased risk of drought
- Potential rupture of water infrastructure in the north as a result of permafrost degradation

Source: NRCAN (2004)

Box 3.2 Pine Beetle and Water Management in BC

Throughout the 1990s rising temperatures dramatically increased the spread of pine beetle. Beetle-killed forests will increasingly affect water resources for people and wildlife dependent on aquatic ecosystems by causing changes in water flows, stream temperatures, sedimentation and flooding (BC MOE 2007).

Pine beetle-killed forests may severely impact water quality in BC through:

- increased surface erosion and water channel destabilization
- increased landslide activity
- increased occurrences of wildfires in watersheds

Source: BC MFR Web www.gov.bc.ca/for/

3.3 What Next?

Steps 1 through 3 have provided the necessary framework to develop a comprehensive community water use profile and forecast future demands. This knowledge provides a solid foundation for establishing a community water future (Step 4) and quantifying and understanding the impacts of potential water conservation measures (Steps 5 and 6).

Demand projections should not dictate water management strategies. Instead they should inform realistic goal setting and serve as benchmarks of what a water future could look like if conservation is not pursued. Steps 4, 5, and 6 will assist in developing a conservation strategy that will support a sustainable community water future.

Technical Box: Water Demand Forecasting by User Group

This method accounts for different growth rates in residential population, industry and commercial businesses. This method is a more accurate method than per capita water demand forecasting because it estimates growth of each sector within the community and is best used when a reliable breakdown of user groups is available.

Future water use = (annual sectoral water use) x (growth in sector)

Table 3.1 Factors Affecting Demand Forecasting

Variable	How Does Variable Affect Demand Projection?	Where to Collect Data?	Why is it important?	Leading Examples and Additional Considerations
Community Growth Strategies and Visions	Coordinates land use and ecological constraints and provides direction for when and how growth and development will occur	Municipal or Regional District Planning Department	Will inform demographics and population estimates	Okotoks, Alberta designed its growth plan around the water supply limits of its supply source, Sheep River. Okotoks has a population cap set at 30,000, which is the carrying capacity of water and wastewater facilities. If your community has not yet done so, it may wish to develop such a growth strategy
Industrial and Economic Growth	Large industrial users of water affect overall consumption. Particularly water intensive uses include: food processing plants, irrigated parkland, golf courses, aggregate operations, fish packing plants, or water parks	Municipal or Regional District Planning Department	Industrial and economic growth rate is used in most basic water demand equations	Look to trends in business and goals and regulatory measures set in the Official Community Plan
Seasonal Populations	Increases in summer populations can play a considerable role in increasing peak day and peak hour demands	Municipal or Regional District Planning Department	Places more load on infrastructure at the time of greatest stress and could lead to premature infrastructure replacement or expansion	Be aware that current recreational homes may become permanent residences in the future
Income	IWA studies show a correlation between higher income and higher water use. Indicators of high incomes include: fewer residents per household and homes with large yards (Butler & Memon 2005:7)	Municipal or Regional District Planning Department	An IWA study found that a single person home used 73 percent more water per capita than a four person home. Projections based on population should be aware that demographics will affect the volume of water used	The Town of Oliver has estimated that its population will double over the next 20 years and that the majority of that growth will be directed into existing communities to optimize infrastructure and to preserve Agricultural Land Reserve zoning. This densification is expected to translate into lower per capita maximum day and average day water demands due to more people living in apartments and fewer people dwelling in single-family lots (Town of Oliver 2007:17)
Age	An IWA study showed that a retired person uses 60 litres more water a day than an average adult. This is attributed to increased toilet flushing (Butler & Memon 2005:7)	Municipal or Regional District Planning Department. Statistics Canada	Projections based on population should consider that demographics will affect the volume of water used	California Study cites age as a factor in projecting demand (Davis 2003)
Social Trends	Can increase or decrease the volume of water used	Municipal or Regional District Planning Department, media, community committees	Can affect the accuracy of projection	The CRD accounts for a growth in the urban agriculture movement in Victoria in its future water needs projections
Climate Change	Increasingly historical rainfall and climate will change, altering capacity and yield of reservoirs and aquifers and use of water	Municipal or Regional District Planning Department. Provincial and Federal studies	One way to account for climate change is to include it as a percentage in reduced water supply. For example when running a projection, instead of basing calculations on the current capacity of your reservoir, calculations might be based on 90 percent of its capacity	Climate change may extend the irrigation season throughout much of BC, both in the spring and fall. With earlier spring freshets, reservoirs fill earlier in the season and with fall rains coming later in the year existing supplies will need to satisfy increasing irrigation demands for longer time periods than previously. Longer growing seasons may also result in dramatic shifts in crop types resulting in higher irrigation demands
Leaks	It is important to consider factors such as aging infrastructure to ensure accurate demand forecasts	Water utility operator, literature on breakdown and wear of infrastructure components	Determine current leakage volume. Project based on estimates for infrastructure age and materials	Look at IWA Water Balance and Infrastructure Leak Index

Step 3 Additional Resources

Billings, B., & Jones, C. (2008). *Forecasting Demand*. Denver: AWWA.

Butler**,** D., and Memon, F. (2005). *Water Demand Management***.** IWA.

Davis, W. (2003). *Water Demand Forecast Methodology for California Water Planning Areas*.
Available at:
http://www.waterplan.water.ca.gov/docs/technical/Water_Demand_Forecast_Methodology.pdf

Griffin, D., & Morgan, D. *A New Water Projection Model Accounts For Water Efficiency*. Water and Waste Department, City of Winnipeg. Available at http://www.cmhc-schl.gc.ca/en/inpr/su/waco/waar/waar_001.cfm

Step 4: Setting Targets for a Community's Water Future

"The best way to predict the future is to invent it."
Alan Kay

Step Summary

This step allows users to apply the vision developed from the values, purpose, scope, and rationale outlined in Step 1 into devising cogent targets for the community's present and future. The objectives set should include tangible qualitative and quantitative targets.

4.1 How do we invent our water future?

Setting goals and future targets is a critical step in planning for water sustainability. Goals provide both direction and focus and benchmarks against which future consumption can be measured.

This step moves beyond simple demand projections to incorporate the diversity of needs and values of the community into the design of the water conservation plan. Analysts and decision makers construct scenarios to better understand the broader consequences of choices and policies on a wide range of plausible future conditions. This is particularly useful when there are great uncertainties about the future or when the stakes are especially high. Water resource management in particular requires a long-term planning approach.

Are You Moving Towards a Sustainable Water Future?

- Do you have water quality issues that are related to quantity?
- Do you have a water supply shortage?
- Does the shortage currently exist or is it projected to occur in the future?
- What are the primary limiting factors on supply? (Possibilities include system leaks, insufficient water licenses, pipeline delivery limitations, and inadequate water supply or treatment plant limitations).

How Will You Get There?

- What level of water use reduction is needed?
- When is the reduction needed?
- Is the need to reduce water use necessitated by government regulations or is it in response to public or environmental concerns?
- What type of users will be most affected by demand management measures?

4.2 Setting Targets for the Community's Water Future

Targets should be expressed both qualitatively and quantitatively (i.e. as total water savings at some point in the future expressed as a percentage of water saved or in terms of benefits realized in terms of deferring physical infrastructure or expansion). Note that the goals you will set in this step will be more general than specific water use targets you will need to set for each of the measures included in your final plan. Rather, the present step allows you to devise high-level goals to achieve the vision of the community's water future.

Box 4.1 Setting Targets for the Community's Water Future
1. Gather a group of stakeholders (in addition to your Action Team) that represents all interests in water for the community. 2. Conduct an exercise to identify possible qualitative and quantitative targets based on the vision for the short, medium, and long term (<1 year to >50 years). 3. Define priorities and ideal outcomes, articulated through a vision from stakeholder input. 4. Develop targets that are specific, measurable, achievable, relevant, and timely. 5. Prioritize targets collectively - try to reach a consensus.

Some Ways to Express Targets for the Vision:
i) Total water savings at some point in the future, expressed as a percentage of total production and/or the quantity of water saved. For example:

> ***Reduce Potable Water Use By 50% by 2030*** *– In order to maintain ecosystem services we will protect our freshwater resources by reducing the quantities of high-quality potable water used for non-potable services and find other sources of water to meet those needs.*
>
> ***No New Water Before 2050*** *– We want our community to thrive without expanding water supply beyond what is currently supplied in 2008. We will only encourage population growth if that growth can be serviced by current water supplies.*

ii) Benefits realized, such as a capital project deferral or avoidance and water made available for environmental purposes. For example:

> ***Defer Replacement of Supply Infrastructure by 50 Years*** *– We will meet all of our new municipal water needs over the next 50 years through water conservation, thus deferring the need to expand infrastructure.*
>
> ***Adequate Water for Aquatic Life and Recreation*** *– In the future we want a level of water quality and quantity that ensures that our rivers and lakes are home to aquatic life and are clean enough for our children to swim in.*

In Steps 5 and 6, you will identify specific measures that will help you map out how to get from where you are now to your desired community water future. For example, the Target 140 initiative in Queensland Australia illustrates how a community vision can be translated into tangible actions (see Case Study Box 4.1).

Case Study Box 4.1 How Low Can You Go? Moving to Target 140 in Queensland, Australia

"The vision for the future includes a well informed, water wise community that understands the balance between water security, quality and cost and is engaged in the planning process as decisions are made."
Queensland Water Commission, 2008

July 2008 marked 52 consecutive weeks of average daily personal water consumption of less than 140 litres for the people in the areas of South East Queensland on Level Six water restrictions. In that time residents had saved 39 billion litres of water and established themselves as world-class water savers. The Queensland Water Commission recorded average daily consumption since late July 2007 at 129 litres per person per day. This year-long average compares with:

- An average of 181 litres per person, per day, in the 12 months before Target 140 began in May 2007;
- An average of 296 litres per person, per day before the drought.

The restrictions were motivated by a series of droughts in the area over the past several years.

Source: South East Queensland Water Commission (2008) *Target 140 Website*: www.target140.com.au/

Step 4 Additional Resources

Brandes, O., & Maas, T. (2007). *Urban Water Soft Path: 'Back of the Envelope' Backcasting Framework*. POLIS Project on Ecological Governance. University of Victoria. Available at: www.poliswatwaterproject.org

Brandes, O., Maas, T., Mjolsness A., & Reynolds, E. (2007). *New Path to Water Sustainability for the Town of Oliver, BC - Soft Path Case Study*. POLIS Project on Ecological Governance, University of Victoria. Available at: www.poliswaterproject.org

Cowichan Valley Regional District. (2007). *Cowichan Basin Water Management Plan*. Available at: www.cvrd.bc.ca/water_cowichan/pdf/CBWMP_29Mar07.pdf

Ontario Ministry of Environment (June 2005). *Oak Ridges Moraine Conservation Plan Technical Paper #10: Water Budgets.* Available at: https://ospace.scholarsportal.info/bitstream/1873/2724/1/254443.pdf

Warwick, C., Bakker, K., Downing, T., & Lonsdale, K. (2003). "Scenarios as a Tool in Water Management: Considerations of Scale and Application" in *Water Resources Perspectives: Evaluation, Management and Policy*. Edited by A.S. Alsharan and W.W. Wood. Elsevier Science: Netherlands. Available at: http://www.geog.ubc.ca/~bakker/PDF/scenarios.pdf

Step 5: Tools and Measures to Reduce Water Use

"With the tools and technologies readily available, enormous water savings are possible in agriculture, industries, and cities."
Sandra Postel (1992), *The Last Oasis*, p.165

Step Summary

This step orients water conservation planners to the different tools and measures that will help accomplish program goals. Planners should consider the appropriateness and feasibility of the tools and measures presented in this chapter; however, overall program selection methodology will be introduced in Step 6. Step 5 provides a preliminary list of potential initiatives and water reducing measures.

5.1 Water Conservation Measures

Conservation measures include both supply side and demand side management techniques for saving water, and range from relatively simple educational tools to advanced water-efficient technologies. Choosing the most effective combination of tools and measures to reduce water use largely depends on current water consumption patterns in the community. For example, providing incentives for homeowners to replace lawns with appropriate drought-tolerant natural cover combined with water restrictions may be most appropriate in communities in which water use tends to peak on dry, summer days.

Tools and Measures to Reduce Water Use	
WHO	Action Team, municipal engineers, industry representatives, senior government
WHAT	Identify and compile a list of potential water reduction tools and measures.
HOW	Look at successful strategies used by other communities and find local solutions that engage the whole community.

Conservation measures can be classified as "hard" or "soft". Hard conservation measures are more rigid and enforceable in their approach to water conservation and include:

- Legal tools and enforcement
- Economic and financial tools
- Operations and management tools

Soft conservation measures typically reflect more negotiation, conciliation, voluntarism and teaching approaches and include:

- Voluntary restrictions
- Educational and outreach programs (targeting residential, commercial/industrial and school audiences)
- Partnership and collaboration initiatives

5.1.1 Legal Tools

Mandatory water use restrictions and municipal bylaws are the two most widely used legal tools. Both the federal and BC provincial governments identify legislation as an effective means of increasing water use efficiency. Other legal tools include regulations, standards and licensing.

Mandatory Water Restrictions

Watering restrictions limit the number of days lawns can be watered and reduce peak day demand so that infrastructure capacity is not reached prematurely. Watering bylaws work though a combination of public education programs and violation fines. Several communities in British Columbia have rotating even/odd address sprinkling restrictions in effect from May through September. Fines can be applied to users that violate mandatory water restrictions. For example, in Penticton violators face from $25 up to $400 in fines for watering outside of watering restrictions. In Calgary, violation fines can run up to $1,000.

Standards, Regulations, and Building and Plumbing Codes

Standards and regulations can be enacted at both the provincial and local level. For example, the BC Water Conservation Plumbing Regulation was amended in 2005 to require the installation of low consumption (6-litre) toilets in specific local government jurisdictions. The District of Chilliwack has a Subdivision Development Control Bylaw that is based on specifications that set out material and construction practices for developers and contractors.

Building and plumbing bylaws that require low flow fixtures can ensure uptake of water efficiency and increase technology market penetration, resulting in innovations and new technologies. As of 2008, British Columbia requires ultra low-flow toilets (6-litre) and other water-saving plumbing fixtures and fittings in new construction and renovations.

5.1.2 Economic and Financial Tools

Economic and financial tools use both “carrots” and “sticks” to penalize overconsumption of water and reward conservation. Economic tools include funding and grant conditions, conservation-based pricing, rate structures, and fines.

Funding and Grant Conditions

Linking funding for development with demand management is a sure-fire way to encourage conservation. Communities can apply innovative “water offset” requirements to building permits, requiring proof that any additional water demand resulting from new development is offset by reducing water use in existing homes (or businesses) with water efficiency measures. Communities can also tie development permit approval to demand management planning that requires all new development and retrofits of existing development use the best available water conservation technologies. Furthermore, this approval should also be tied to the development of mandatory landscaping standards that demonstrate water use reduction, as is done in the City of Kelowna. Provincial and federal infrastructure funding provides another opportunity to promote conservation by giving access to money for projects that consider water conservation measures.

Conservation-Based Pricing and Rate Structures
In British Columbia, as in the rest of Canada, water prices generally fail to account for environmental costs and in most cases, rates do not reflect the full financial costs of providing the service. The problem is not only with the price of water, but also with pricing structures. Research suggests that water demand is sensitive to changes in pricing structures and changes to water prices (Reynaud and Renzetti 2004). A set price or flat rate—common in approximately 40 percent of Canadian communities —is considered to be the least effective pricing structure for reducing demand (Reynaud and Renzetti 2004).

Pricing and rate structures that encourage water efficiency are part of good comprehensive integrated water conservation planning. Water conservation-oriented rate structures such as increasing block/volumetric or seasonal pricing requires water users to pay the full cost of their water. When used in combination with education programs and appropriate billing systems, pricing can provide effective financial incentives and send a message to users about the efficiency of their use. Not only does conservation pricing have the ability to encourage efficient water use, but it has the potential to be more equitable than flat water rate fees when attention is paid to ensuring that the first block (in which water is allocated for basic needs) remains relatively inexpensive.

Metering is essential for the adoption of any volume-based pricing structure. Some analysts report that metering alone, without any changes to pricing, can result in water use reductions of 10 percent to 40 percent (Shrubsole and Tate, 1994). However, without a corresponding shift to volume-based pricing, metering may not sustain this initial level of savings as water use often rebounds to varying degrees after the installation of metres.

Rebate Programs
Technological improvements over the past 20 years have enabled significant water savings without negatively impacting standards of living. There is a natural gradual penetration of water efficient technologies in homes, businesses and farms; however, rebate programs can increase the uptake of these technologies. The CRD operates a successful toilet and washing machine rebate program that has played a strong role in reducing year round average day demand.

Rebate programs are often costly, and so conducting a literature review or talking to other communities that have implemented fixture or toilet rebate programs is recommended. Professional water associations have studies available such as the *Maximum Performance Testing of Popular Toilet Models*, a joint study between the CWWA and AWWA which conducts an impartial evaluation of low flow toilets. Although the average home can save up to 30 percent with off-the-shelf technologies, giveaway initiatives are generally ineffective without a concurrent implementation and installation scheme (Gleick 2005; McKenzie-Mohr 1999: 13).

5.1.3 Operations and Management Tools

Operations and management tools include reducing water losses through water system audits and leak detection programs, water metering programs, water recovery, reclamation, and reuse programs and rainwater harvesting programs.

Water System Audits, Leak Detection and Repair
Leaks result in significant water loss, often due to ageing infrastructure. The quantity of water lost between leaving the source and entering a customer's property is an important indicator of water distribution efficiency. The amount of unaccounted for water can vary greatly from less than 10 percent in new, well-managed systems to more than 50 percent in older systems suffering from poor maintenance (FCM 2007). Environment Canada estimates that an average of 13 percent of municipal water is unaccounted for (EC Web). As leak reduction measures are expensive, spending time on a careful water audit of the distribution system is a prudent step in deferring preventable costs.

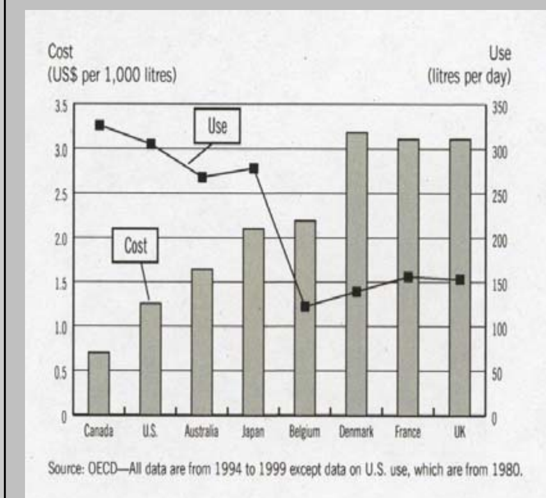
Case Study Box 5.1 Economic Tools in Action: Meters and Conservation-Based Pricing

Meters are a basic water management tool necessary effective water service delivery and water accounting.
Metering is also an important tool to reduce water demand and fosters greater awareness and accountability for water use. Studies have shown that the installation of water meters can reduce consumption by up to 20 percent (UN 2003).

Pricing and rate structures are effective economic tools for reducing water consumption. In Denmark, water consumption decreased from 155 lpd in 1993 to 125 lpd in 2003 following a 54 percent increase of water rates. A similar pattern was observed in the Czech Republic. Both countries now rank among the "low-use" group by OECD standards (OECD 2008). Similar trends have been observed in Canada; Canadians paying flat rates use 70 to 80% more water than those on volume based structures (EC 2008:8).

Pricing is most effective when combined with a conservation rate structure and education. The most common pricing systems are increasing block rate structures where water becomes more expensive with increased usage, and seasonal surcharges, where a higher price is charged for water during dry months (Smith & Wang). The SEKID (South East Kelowna Irrigation District) project near Kelowna in the Okanagan Basin, British Columbia, reduced agricultural water allotments by 27 percent over a five-year period through an increasing-block pricing system (Pike 2005).

Water Use versus Price by Country



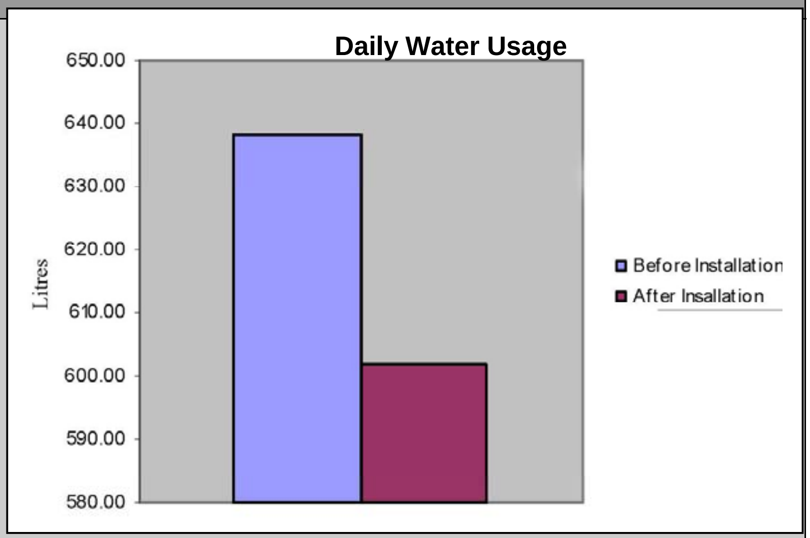
The graph above published in a report by the Auditor General of Canada shows a correlation between full cost pricing and efficient use of water. Canadians are among the highest per capita users of water in the world. Prices in Canada do not reflect the full costs of providing water (OAG 2001: 32).

For example, the Capital Regional District made outdoor water use audits available to priority customers in 1997 after it determined that its own outdoor water use contributed significantly to total and summer water use. And in the District of Chilliwack, supply sources are equipped with meters that track how much water is produced. With each source being metered and read every two months, it is easy to see how much water is lost. The District's yearly amount of unaccounted for water is approximately 10 percent of its production.

Metering Programs
As stated in Box 5.1, an effective water conservation-based pricing system requires a metered system. A reduction in water use after meters have been installed is typically most substantial during the first year following installation. However, if post-metering prices are kept low there is little incentive for users to decrease water use. Metering is most effective when paired with conservation rate structures.

Water Recovery, Reclamation, Reuse and Recycle Programs
More than two thirds of municipal water end uses do not require drinking quality water. Reusing or recycling water for toilets and outdoor irrigation alone results in “double use” of existing water supplies which can result in up to 50 percent in water savings. More significant savings can occur when system-wide reuse programs are implemented. For example, Okotoks uses wastewater biosolids as fertilizer for landscaping and agriculture, and since the 1970’s, Vernon treats all municipal wastewater and uses it to irrigate agricultural areas, golf courses and forestry areas.

Case Study Box 5.2 Effective Implementation: Overcoming Barriers in the SCRD Toilet Replacement Program



In 2001, the Sunshine Coast Regional District (SCRD) realized that if it were able to install low-flow toilets in a large number of residences, it would save more water faster and for less money than building additional infrastructure to support high water demand. The biggest barrier to implementation was liability for property damage or homeowner injury while installing toilets. The SCRD overcame this barrier by contracting Sustainable Solutions International, a distributor of low-flow toilets, which in turn contracted a local company to install the toilets. The contracted company holds its own insurance and provides a 90-day warranty on labour.

The SCRD’s innovative and successful toilet replacement program is in its eight year of sending plumbers into homes to install low flow toilets, high efficiency showerheads and faucet aerators at no cost to the consumer. The program costs were initially estimated at $195,000.The graph above shows water consumption in participating households before and after the retrofit program began.

Source: SCRD (2008) *Interview with Dion Whyte*, *Manager of Sustainable Services.*

Case Study Box 5.3 San Antonio Water System's Recycled Water Reaches 10 Billion Gallon Mark

The San Antonio Water System (SAWS) reached a new milestone in its water recycling efforts in July 2008 by delivering its 10 billionth gallon of recycled water to its customers. The water utility completed its water recycling system in 2001 as the largest of its kind in the United States, built to provide an alternative to Edwards Aquifer water for use in parks, golf courses and other landscaping purposes.

The utility has the ability to treat up to 171 million gallons per day. "Recycled water has really become an economic resource for our community," says SAWS Chief Operating Officer Steve Clouse. "Before, it seemed we had a product no one wanted; now the demand for recycled water just increases each year. It's amazing to see how far we've come in seven short years and 10 billion gallons."

Source: San Antonio Business Journal (2008) *San Antonio Water System's Recycled Water Reaches 10 Billion Gallon Mark*

Rainwater Harvesting Programs

Rainwater harvesting has the potential as a means of both supplementing water supply and mitigating stormwater flows. While its potential as a "new source" of water is increasingly recognized, the widespread uptake of rainwater harvesting has been limited by water quality concerns, a lack of standardized collection technologies and a restrictive regulatory framework. Depending on precipitation distribution and end use statistics, rainwater harvesting programs such as rain barrel rebate programs can be an effective tool to reduce the uses of potable water for household garden irrigation. For example, Delta, BC implemented a successful rain barrel rebate program that resulted in a projected savings of 900,000 litres of water annually.

5.1.4 Voluntary Restrictions

A voluntary restriction is a local measure where residents are asked to voluntarily restrict their use of water during dry spells and peak demand periods. Until recently, the City of Abbotsford relied exclusively on voluntary restrictions to curb water use.

5.1.5 Educational and Outreach Programs

Outreach and education initiatives that inform water users about water conservation programs are a must for any successful program. Even mandatory programs such as watering restrictions are rarely successful without promotion and outreach. The most effective education programs will increase public knowledge about the need for water conservation, the potential benefits of demand management, and how to participate in local action. The main goals of a good education program should include:

- Instilled conservation habits in water users;
- Heightened public awareness of the need to conserve to the point where other measures, such as volume-based pricing and regulation, become acceptable and can be implemented;
- Enhanced public demand for elected officials to address water issues as a policy priority before a crisis is reached;
- Continued awareness through regular public reminders of the need for conservation; and,
- Changed values toward a lasting "water ethic."

To be effective, education programs should be tailored to local needs and involve specific groups, such as homeowner associations, landscapers, contractors, builders, realtors and plumbers. The Massachusetts Water Resources Authority sponsored workshops and provided information at professional trade shows, such as performance details on ultra low-flow toilets. Tours of demonstration projects can be offered to professional and industry groups, allowing for more detailed technical discussions.

Case Study Box 5.4 Innovative Water Conservation in Durham, Ontario: Educational Successes

In 1997 Durham Region ran a pilot program in the town of Ajax aimed at reducing lawn watering. University students used community-based social marketing methods to reduce the amount of water consumed by participants. The students approached residents in pairs when it seemed appropriate.

Students gave the residents a brochure on water efficiency and talked to them about ways to reduce their water consumption. The students emphasized that lawns only need one inch of water a week, including rainfall, to remain healthy. This helped residents realize that much of their watering was unnecessary. This first intervention was followed by five more, with successive visits allowing residents to develop a more trusting relationship with the students. The students visited two hundred homes over a ten-week period.

Where students interacted with residents on average a 26% reduction in watering occurred and peak day water use was halved.

Source: McKenzie-Mohr, D. (2008) *Community Based Social Marketing Web*

5.1.6 Partnership and Collaboration Initiatives

Conventional water planning processes tend to isolate water managers from other important players such as industry, homeowners, facility operators and other local government staff. But the tools of demand management—legal instruments, pricing, small-scale decentralized technologies, and education and all of the other measures and tools described in this chapter —require more interaction with end users than supply-side approaches. This makes demand management a prime candidate for collaboration.

Stakeholder participation in both planning and implementation is critical to a successful demand management program. For example, the Town of Okotoks, which committed the community to living within the carrying capacity of the land and Sheep River by limiting population growth, provides an excellent example of collaborative planning. The Okotoks Town Council emphasized a participatory approach to local governance and generated the Okotoks Sustainability Initiative in close collaboration with the public through surveys and meetings (Personal Communication, May 2008). In British Columbia and Ontario, several communities have partnered with the POLIS Project on Ecological Governance to design and implement long-term integrated local water conservation plans. And the Sunshine Coast Regional District boosted its toilet rebate program by contracting Sustainable Solutions International, a distributor of low-flow toilets, which in turn contracted a local company to install the toilets.

Table 5.1 Summary of Tools and Measures to Reduce Water Use	
"Hard" Measures and Tools	**"Soft" Measures and Tools**
Legal tools o Standards, regulations and building and plumbing codes	**Voluntary Restrictions**
Economic and Financial tools o Funding and granting conditions o Conservation-based pricing and rate structures o Rebate programs	**Education and Outreach Programs** o General communication and information o Personalized communication and contact o Media campaigns
Operations and Management tools o Water System Audits, Leak Detection and Repair o Metering Programs o Water Recovery, Reclamation, Reuse and Recycle Programs o Rainwater Harvesting Programs	**Partnership and Collaboration Initiatives** o Community engagement in planning o Partnering with local businesses, NGOs and other communities

Step 5 Additional Resources

Brandes, O., Mass, T. & Reynolds, E. (2006).*Thinking Beyond Pipes and Pumps: Top 10 Ways Communities Can Save Water and Money*. POLIS Project on Ecological Governance, University of Victoria.

Green Bylaws Toolkit for Conserving Sensitive Ecosystems and Green Infrastructure (2008). Environmental Law Centre at the University of Victoria. Available at www.greenbylaws.ca
McKenzie-Mohr, D. (2006). *Community Based Social Marketing*. Available at: www.cbsm.com

South East Queensland Regional Water Supply Strategy. (2006). *Report 3 – Customer Water Use Efficiency.* Available at: *www.qwc.qld.gov.au/SEQWS+supporting+documents*

Waterbucket Website: www.waterbucket.ca

Step 6: Selecting Water Conservation Measures

"Putting water conservation on equal footing with other water supply options requires quantifying the cost and benefits of conservation methods. In addition to financial benefits, social benefits (ensuring sufficient groundwater supplies for private well users) and environmental benefits (maintaining flows in fish-bearing streams) must be considered. The intrinsic value of a healthy aquifer cannot be overlooked."
Township of Langley Water Demand Management Strategy, 2007

Step Summary

This step enables users to understand the options available for evaluating proposed and implemented water conservation measures. Potential measures are evaluated according to various selection criteria established by the water planning action team, and are then combined and evaluated as portfolios or comprehensive demand management strategies.

6.1 An Initial Screening Process: Evaluating Individual Demand Measures

All water-efficiency initiatives can be characterized as either a *measure* or an *instrument*. To start, assess individual demand measures for suitability in your community using evaluation criteria. Measures and instruments can then be combined into *programs*. Various programs are bundled together to make a water conservation *portfolio*. See Box 6.1 for further details on definitions.

Planners may consider as many selection criteria as appropriate; however, the logic of the criteria should be explained in the conservation plan. The criteria should be comprehensive so that they highlight solutions that allow your community to meet social, economic and ecosystem needs both now and in the future.

Identifying Long-Term Actions	
WHO	Engineers in consultation with action team, water utilities managers, municipal finance staff, industry representatives, and community groups.
WHAT	Select best set of long-term conservation strategies using selection criteria most appropriate for your community.
HOW	1. Screen individual measures 2. Package into portfolios 3. Evaluate portfolios 4. Recommend Actions Incorporate public consultation as much as possible.

Successful conservation programs typically draft a set of criteria that capture social, environmental and economic values with a set of quantitative and qualitative indicators. The best way to select indicators is to consult local experts in your community. Selecting criteria and indicators is a learning experience and it is common for indicators to change and for criteria to be added or dropped as new information is uncovered during the planning process.

In general, criteria for selecting measures should be:

- **Distinctive** - developed to distinguish between one portfolio and another;
- **Measurable** - able to be measured either quantitatively or qualitatively in order to determine if they are being achieved;
- **Non-Redundant** - criteria should not substantially overlap with each other;
- **Understandable** - criteria should be easily explainable;
- **Concise -** criteria should be kept to manageable numbers

Criteria can be ranked on a scale of one to five, where one is the lowest score and five is the highest. Initiatives that can be delivered at a low cost but have a high impact on water demand reduction, expenditure savings or increased revenue should be prioritized. The final overall score allows for a quick and easy comparison between measures (Adapted from UN 2003:35; Campbell River 2004, Waterloo 1998, Santa Fe 2008).

Box 6.1 Important Definitions for Screening Process

Measures involve the use of specific devices or actions that result in reductions in water use. These include indoor and outdoor technologies and efficiency practices along with water capture, reuse, and recycling initiatives.

Instruments are supportive elements that encourage adoption of a technology or a change in habits or practices. These include communication, various regulations and economic incentives.

A *program* is a measure paired with an instrument.

A *portfolio* is a bundle of efficiency programs. Scenarios target one or two specific types of water use implemented using a pre-determined level of effort.

6.1.1 Five Common Criteria Used in Selecting Measures

1. Does this measure target high water users and uses? Each community has a unique water profile that is dependent on climate, varying concentrations of user groups and other factors as outlined in Step 2. Selecting conservation initiatives that impact high water users will have the biggest immediate effect in decreasing water demand. For example, focusing on indoor water reduction initiatives in a community where lawn irrigation accounts for the most consumption makes little sense. Attention should also be paid to whether the initiative affects average day demand or peak day demand.

2. How reliable is this measure?
It is important to consider the reliability of a water conservation measure when quantifying its effectiveness. Historically in the United States, measures that rely on behavioural change tend to result in less consistent water savings than the installation of low flow devices. For example, once a low-flow toilet or washing machine is installed it uses reduced volumes of water over its lifetime, whereas human water use habits are more variable and may change over time. Table 6.1 shows one method of collecting and

comparing reliability information for demand measures. With the onset of climate change and decreased water supply, water conservation will most certainly become a more reliable source than supply-side solutions like reservoirs and infrastructure expansion.

3. Is the technology needed to carry out the measure easily available?
For a measure to be effective, the technology required for its implementation must be readily available and supported by the local industry and businesses. For example, rain shut off devices for residential irrigation systems have only become a feasible option in the past 10 years with advances in technology.

4. Is this measure politically and socially viable?
Acceptance of a demand measure is based on convenience, economics, perceived fairness, culturally accepted practices, aesthetics and environmental values. Acceptance is an important factor because it relates to the potential market penetration of a measure. For example, one could suggest bathing less often as a demand management measure; however, this would be a poor measure because it is socially taboo and therefore politically unpopular.

Measures should also be equitable, so that one category of customers does not benefit while another category of customers pays the costs of a conservation program. This should not be confused with using surcharges to discourage unsustainable behaviour and encourage conservation, which will be discussed further in Step 7.

Box 6.2 Important Information to Include in Evaluation Criteria

Descriptive Title
e.g. Change in Household Water Bill

Definition: ***What the criterion is supposed to measure? e.g.*** Percentage change in the water bill versus the control case.

Indicators Measured: ***What is being measured and how will the information be analyzed? e.g.*** The value of the typical household water bill was estimated for each year over the forecasted period.

Revisions: ***Selection is an iterative process.*** Keep track of revisions to indicators and methodology. A good design will improve and change as the project moves forward.

Source: Adapted from Region of Waterloo (1998) *Water Efficiency Master Plan*

Table 6.1 Confidence Levels in Conservation Water Savings

Measure	Confidence Level	Things to Consider
Toilet Replacement	High	Somewhat non-discretionary water use
System Leakage Reduction	Medium	Largely dependent on condition of current system, though confidence level increases significantly if full ILI study is completed
Outdoor Water Audits	Low	The potential for irrigation reduction is largely dependent on weather patterns in target year, size and type of typical landscape and current irrigation practices

Source: Canadian Mortgage and Housing Corporation (Forthcoming). *Guide for the Development of Municipal Water Efficiency Plans in Canada*

5. Economic Considerations

Most communities must work within a finite budget, making economic considerations an important criterion. A cost-benefit analysis is typically the tool of choice for financial evaluation.

British Columbia is in the process of developing a holistic framework for valuation that will go beyond the narrow economic focus of standard cost-benefit analyses. The Province currently uses the Capital Asset Management Framework and launched the Vancouver Valuation Accord (VVA) in 2007 to develop a standard of holistic valuation protocol and methodology (BC MCS 2008: 122). The VAA will publish a valuation report in 2010. Helpful valuation and methodology is available in the *UK Comprehensive Project Appraisal Guidelines* published in 2007 and the valuation appendix in the BC Ministry of Community and Rural Development's *Integrated Resource Management Report* published in 2008.

The field of comprehensive cost-benefit analysis has developed significantly in recent years and is frequently used by leaders in water conservation. Increasingly the economic value of healthy environments and communities are recognized in these analyses. Box 6.3 provides one example of "on-the-ground" holistic valuation.

6.2 Creating and Evaluating Water Conservation Portfolios

A portfolio is a bundle of tools and measures. Water conservation portfolios are typically characterized by the level of effort – from "do nothing" to a high level of effort--and the component of demand that is targeted for reduction (for example average day, maximum week or both) (Waterloo 1998).

Rank the portfolios based on the criteria used to evaluate conservation measures. The criteria will continue to be refined as you work with them and consult with community experts. Not all water conservation measures are as efficacious when employed alone; some measures are only effective in concert with others. For example, as mentioned in Step 5, metering is significantly more effective when implemented with volumetric water conservation-oriented rate structures.

The US Environmental Protection Agency's *Water Conservation Plan Guidelines* provides useful information on prioritizing and scheduling measures and portfolios. Group and regroup measures and delivery mechanisms into portfolios and evaluate based on selected criteria. Consult local experts and community groups to help refine portfolios.

6.3 Pulling it All Together –Choosing a Portfolio

Once you have evaluated and ranked your water efficiency portfolio, you are ready for public and political consultation. It is important to gain support for the plan that you seek to implement. Ideally, the evaluation criteria act as decision-making tools, but ultimately public, political and other non-quantifiable interests may be the most important factor in selecting a portfolio.

Include a summary of analysis for each feasible measure and portfolio in your conservation plan so that the logic behind the selection of demand measures is transparent. Information can be organized in a table or written out in paragraph form.

In the final Step you will consider the implementation of your chosen water conservation portfolio.

Box 6.3 Community Experiences: On Selecting a Conservation Portfolio

"The selection of a preferred strategy was not a direct outcome of the scores resulting from the portfolio evaluation process. Rather, the strategy to be implemented was based on decisions by the City's governing body, using the results of the scoring to illustrate the tradeoffs between alternative water supply portfolios in meeting the objectives."

Source: Santa Fe (2008) *Long Range Water Supply Plan*.

Step 6 Additional Resources

Capital Asset Management Framework. Available at: www.fin.gov.bc.ca/tbs/camf.htm

Comprehensive Project Appraisal. Available at: http://www.rics.org/NR/rdonlyres/CAF66321-481C-491C-8EA3-9EBC83D59B9A/0/CPAGISfullreport.pdf

Department of Fisheries and Oceans. (1999). *Corridors of Green and Gold: Impact of Riparian Suburban Greenways on Property Values.* Available at: www.dfo-mpo.gc.ca/Library/241452.pdf

Santa Fe (2008). *Plan Appendix: Detailed Selection Methodology*. Available at: www.santafenm.gov/DocumentView.asp?DID=2828

Vancouver Valuation Accord Website. Available at: www.vancouveraccord.org/

Step 7: Implementing for Success

"The toilet rebate program saves more water faster… [and is] cheaper than cost of building infrastructure to support high water demand."
Sunshine Coast Regional District (SCRD PC 2008).

Step Summary
An effective water conservation plan requires a detailed and thoughtful implementation strategy. This final step provides a road map for getting the conservation portfolio off the ground. An effective implementation strategy includes a realistic timeline and budget, and identifies specific staff or municipal positions that will implement each conservation program.

7.1 Considerations for Successful Implementation

At this stage, it is advisable to pilot conservation programs before the plan is implemented on a large scale.

Budget, staffing, and collaboration are important considerations in plan implementation and are explored in the following sections. As conservation is increasingly recognized as one of the best sources of new water, more municipalities like the City of Dawson Creek are hiring permanent fulltime Water Conservation Coordinators (Personal Communication with Katie Stevenson, August 2008). In smaller municipalities, the water utilities manager or operator will likely be responsible for overseeing and implementing conservation programs. However, it is possible to share staff and resources between communities as is done in the Okanagan basin.

Develop short-term and long-term work plans. Table 7.1 outlines key considerations in developing a work plan. Note that planners can expect a delay between implementation and actual water saving results. It typically takes three or four years for conservation measures to become fully operational and up to ten years for full savings to be realized (AWWA 2006a:7).

Implementing for Success	
WHO	Water utilities operators, finance staff, demand management coordinators, community groups, business, politicians and community leaders.
WHAT	Develop a strategy, timeline and budget for implementing and delivering selected water conservation portfolio.
HOW	Determine who will be responsible for delivery and implementation of each conservation measure, and outline how it will be funded. Make a clear implementation resolution with timelines with political leaders.

Table 7.1 Example of a Short-Term Implementation Timeline

Category of Measure	Water Conservation Measure	Affected Water Use	Water Saving Target	Staffing	Cost	Recommended Implementation	2009	2010	2011
Bylaw	Lawn Watering Bylaw	Outdoor max day Use	20%	1 in-house staff	$25/hour staff pay	2008, ongoing	X	X	X
Education	Home audits, xeriscape workshops	Indoor and outdoor	20%	- 2 in-house staff -Graphics company two week contract - 2 students	$5000	2009, ongoing	X	X	X
Rebate Program	Efficient toilets and fixtures	Indoor	20%	-1 in-house staff	$200000	2011, ongoing			X
Update Implementation Plan	Total Use					Ongoing			

7.1.1 Budgeting and Funding Options for Conservation Programs

Water conservation programs can be funded through a variety of sources, including:

Taxes and levies
In the future, it is likely that community water conservation budgets will represent an increasing proportion of municipal operating budgets. For example, the annual operating budget for the Capital Regional District's Demand Management Program for the 2008 fiscal year was 1.5 million dollars, yet these costs are significantly cheaper than the alternative of higher water use. The CRD Program employs five full- time permanent positions and hires an additional four summer students and one winter co-op student, each of which are paid for through provision of wholesale water to the thirteen surrounding municipalities (CRD PC 2008).

Infrastructure Cost Savings
Toronto estimates that it will save $146 million in infrastructure and upkeep by implementing an integrated water conservation program. These savings will pay for the city's new $75 million water efficiency plan. Not only is conservation the City's cheapest supply option, but not building a treatment plant will save an initial 400,000 tonnes of carbon emissions and 14,000 tonnes for each year after (City of Toronto WEP: 2002).

Conservation-Based Water Use Rates
Water bill surcharges targeting wasteful behaviour can be used to help fund water conservation initiatives. For example Pleasanton, California implemented a $0.05/ccf surcharge on water bills for irrigation accounts to fund a rebate program that subsidizes efficient irrigation technologies such as low volume spray heads and drip irrigation (AWWA 2006a:111).

Private and Outside Sources of Funding, such as Foundations, Partnerships, and Pilot Programs
Edmonton Alberta's water utilities avoided $26 million in capital costs by partnering with Petro Canada, which operates a refinery in the area and paid for the construction of a membrane filtration facility to treat effluent and a 5.5km pipeline in exchange for water charged on a cost-recovery basis. This private-public partnership, the first of its kind in Canada, saved over 2,650,000 m^3 (700,000,000 gallons) of fresh water while significantly reducing the amount of wastewater discharged into Alberta's North Saskatchewan River (Membrane Tech 2008: 10-11).

Increasingly leaders in water service delivery are recognizing conservation as a new kind of infrastructure. As a result municipalities and other levels of government are putting more money towards water conservation programs. This is evident in provincial and federal funding water conservation through initiatives like the BC Ministry of Community and Rural Development's Infrastructure Grant Programs and the Federation of Canadian Municipalities' Green Infrastructure Fund.

7.1.2 Staffing and Program Delivery Options

Programs can be delivered and enforced by municipal staff, contracted to the private sector, or administered in partnership with community groups. In smaller communities where limited staffing may present challenges, the Water Conservation Coordinator position may begin as a part-time position. For example, the Town of Oliver has an employee who works part-time as a planner and part-time as the municipal Water Conservation Coordinator. Water conservation duties have not been added on top of their workload; instead the employee's job has been redefined so that half of their time is allocated to water conservation program delivery (Oliver, PC 2008).

Another option for smaller service areas is sharing a water conservation coordinator between several communities, as is done in the Okanagan basin and by BC Hydro as part of its energy conservation initiative. The Province of Ontario is developing a system that shares water-testing scientists between multiple municipalities, demonstrating that employing one expert across communities is feasible.

7.1.3 Saving Money and Time through Collaboration

Partnering with community groups, businesses and other levels of government is an effective way of pooling expertise and decreasing implementation costs. Community partners can contribute time, money and specialized skills. Community involvement encourages water users to take ownership of their conservation plan and increases the likelihood of people becoming engaged in water conservation initiatives. For example:

- In Kelowna, high school student volunteers rode bikes and reported violators as part of water bylaw enforcement. The high school students would leave information "Door Knockers" on water customer's doors with conservation tips and friendly reminder notes for violators.
- In 2005, the Regional District of Nanaimo ran a competition for kids to name its new water drop mascot. The winning prize was a helicopter ride over the watershed donated by a local company. Because of local business and community involvement, the WaterSmart conservation program received increased media attention, which made it easier to promote and implement other conservation initiatives.
- The CRD worked in partnership with the Province to develop a Water Conservation Plumbing Regulation that required that all new toilets installed in the CRD be 6 litres or less. In September 2008, this initiative became part of the BC Building Code.

7.1.4 Political Support Leads to Success

Utilities operators and/or managers should seek support for design and implementation of the water conservation plan from City Council as this will increase the likelihood of full implementation and at least partial funding for the water conservation portfolio.

7.2 Monitoring and Evaluating Water Conservation Initiatives

Water conservation plans should outline specific indicators to monitor for comparison with baseline data. Once a program is implemented data should be collected periodically. For example, when implementing a water conservation bylaw, volumes of peak day and peak hour flows should be recorded and analyzed to determine whether or not the initiative is working or needs revision.

Program managers can get an early idea of the impact of their programs on water use by tracking water use through a small survey sample of program participants and nonparticipants. This level of data collection is relatively inexpensive and informative and requires only 30 to 50 households in each group (Pekelney 1996: 8). In general, public surveys are a useful tool for monitoring and evaluating conservation programs.

Even the best conservation programs can be improved to incorporate new technologies and innovations and shifting public opinion (for example, increased public acceptance of indoor use of recycled water). Project timelines should also be periodically reviewed to ensure the water utility is not falling behind its conservation goals.

Box 7.1 Triggers for Conservation Program Review or Modification

A conservation plan is a living document and should be monitored and revised to ensure that it remains effective and relevant. Aside from a periodic review that should take place every three to five years, certain triggers will necessitate re-evaluation and quick action, including:

- Unforeseen increases in population;
- Unforeseen variations in climate;
- Program success & program failure.

Source: AWWA. (2006a). *Water Conservation Programs—A Planning Manual.*

Step 7 Additional Resources

Funding:
Federation of Canadian Municipalities Green Municipal Fund.
Available at: www.sustainablecommunities.ca/GMF/

Ministry of Community and Rural Development BC Grants.
Available at: http://www.cd.gov.bc.ca/LGD/infra/infrastructure_grants/index.htm

General Implementation Resources:
Alliance for Water Efficiency Website. Available at: http://www.allianceforwaterefficiency.org/

California Urban Water Council Website. Available at: http://www.cuwcc.org/

Endnote: Summary & Drafting Your Plan

The completion of steps 1 through 7 of the workbook should suffice to generate the substance and structure needed to construct a basic a water conservation plan that is ready for implementation. As a **Final Step**, planners should prepare the Water Conservation Plan by providing a written account and evaluation of the process of working through Steps 1 through 7. The final plan should also include:

- An implementation plan;
- Description and illustration (e.g. graphs, tables) of anticipated effects of conservation measures and tools on water demand and supply capacity, and;
- A plan for monitoring and evaluating effectiveness.

The key steps and considerations described in this guidebook that should be included in your final water conservation plan are summarized below.

Looking to the Future

In most communities, demand management programs are developed on an incremental basis with little regard for long-term planning. The tendency is to start with low-cost and politically acceptable measures such as public information and watering restrictions. This short-term and ad hoc approach is the result of narrow planning time frames—usually 2 to 3 years—aligned with electoral cycles and established to develop political capital by demonstrating concrete results in a short period.

Reaching the full potential of water conservation requires comprehensive and long-term strategic planning, as outlined in this guidebook. As planners that are using this guidebook and this new way of thinking, you represent the future of water management and infrastructure planning in British Columbia.

Key Steps and Considerations for Development and Implementation

Defining Conservation Needs

Step 1 Community Context and Relevant Local Issues

A water conservation plan should start by providing context and framing relevant local issues.

- Why is water & water conservation important to the community?
- How does a water conservation plan fit into the broader planning framework of the community?
- Is there political support for designing and implementing a water conservation plan?

Step 2 Community Water Use Profile

Compiling an overview of the community's water infrastructure and systems allows planners to consider the community's water limits (for example, quantity, quality, or ageing infrastructure) in order to select the best combination of locally appropriate water conservation measures and tools.

- What is the community's supply capacity and water infrastructure capacity?
- Who are the biggest users of water? Can these uses be met by non-potable water?

Step 3 Forecast Demand
Forecasting future water demand allows planners to begin to determine the community's water future by providing a "business as usual" baseline projection that helps determine what intensity of change is needed to achieve a sustainable water future.

- Can the community's current water sources meet future demand needs?
- Should variables used in the demand projection be changed to incorporate future trends?

Step 4 Set Water Conservation Targets
Setting high-level qualitative and quantitative 20- and 50-year water targets for the community provides direction and focus to the rest of the planning process.

- What scenarios define ideal water futures and reflect community values?
- Given current water use, what degree of conservation is needed to reach the community water vision?

Choosing Appropriate Measures and Tools

Step 5 Identify Water Conservation Measures and Tools
A number of tools and measures to reduce water use exist. Planners should ensure they have a good sense of the range of options before selecting specific tools and measures.

- What previous and current water conservation programs in your community have been most successful and why?
- What kinds of water conservation programs are in use in other communities of similar size and demographics?

Step 6 Select Measures and Tools and Assemble a Water Conservation Portfolio
Evaluating tools and measures using locally-determined criteria combined with a cost-benefit analysis allows planners to decide what water conservation strategies will be most effective in the community.

- Do the measures selected optimize effectiveness by taking into consideration what services can be provided by other means than water or by non-potable water?

Step 7 Design an Implementation Plan
Developing a detailed and thoughtful implementation strategy that includes timelines and budgets is a critical final step to getting a conservation plan off the ground.

- Have you considered teaming up with other municipal departments or municipalities in the same watershed to implement demand management programs?

Drafting the Plan

Final Step Prepare Water Conservation Plan
The final water conservation plan should be a written account of the process of working through Steps 1 through 7 and should also include:

- An implementation plan;
- Illustration of anticipated effects of conservation measures and tools on water demand and supply capacity, and;
- A plan for monitoring and evaluating effectiveness.

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