A New Path to Water Sustainability for the Town of Oliver, BC

A Soft Path for Water Case Study

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A Soft Path for Water Case Study

SECTION I – Introduction

Fresh water is vital to Canada's long-term prosperity. Yet despite its critical importance, water in this country is undervalued and often perceived (and managed) as if it were a virtually limitless resource. In water-stressed areas such as British Columbia's semi-arid Okanagan Basin, this "myth of abundance" remains firmly entrenched even though the region's drinking water supplies are under stress, conflicts among water users are increasingly common, aquatic ecosystem health and fisheries are in decline, and economic opportunities are threatened (Brandes and Kriwoken, 2006: 90).

The traditional, supply-oriented, approach to water management in the Okanagan Basin is strained by rapid population growth, pollution, increasing demands by residents for sustainable approaches, and the uncertainty of a changing climate. Changes in the region's economic priorities are another significant factor. Emerging regional economic reliance on tourism and a shift from lower value agriculture to more specialized organics, fruit crops and wineries, focus attention on water security and emphasize the need for a new approach to water management in the Basin.

During this period of rapid change many water supply systems in the Okanagan may not be able to meet future projected demands based on their current supply capacity (Cohen et al. 2004a: 2). Traditional water management approaches, based on bigger dams, deeper wells, and complex treatment plants, may simply not be ecologically sustainable in the long term. Fortunately, a new paradigm of water management is emerging—an approach focused primarily on water conservation and efficiency, with the potential to ensure long-term sustainability and social and economic prosperity. It is called the "soft path" for water.

Case study purpose and overview

This case study is a "real world" application of the soft path concept for the Town of Oliver in the Okanagan Basin, British Columbia. The research is part of a national soft path study initiative led by David Brooks at Friends of the Earth Canada that set out to develop, test and refine methodological approaches and tools for water soft path planning.[1] Through three studies in the Province of Ontario, the Annapolis Valley watershed in Nova Scotia, and the urban sector generally, this initiative applies the soft path concept at multiple scales and contexts to explore its potential for developing a more sustainable approach to water management in Canada.

The case study is divided into four sections. Following the introduction in Section I is an overview of the soft path approach in the context of various water management approaches (Section II). To ground the study in a practical application, Section III provides some of the context specific to the Okanagan Basin. This includes a discussion of the Basin's geography and hydrology, water and the local economy, climate change impacts and some aspects of the regional institutional framework for water management. More specific details about water use, infrastructure and current water management efforts in the Town of Oliver are also provided in this section. This discussion is not exhaustive; it merely provides a general idea of the character of the place and points to some emerging issues and challenges as background for the soft path scenarios and analysis.

Section IV begins a more detailed soft path discussion, outlining the potential of water conservation, and developing three different soft path scenarios. Each of the scenarios—Business as Usual, Enhanced Efficiency and Conservation Commitment —are summarized in tables of water use and savings potential. The Business as Usual scenario describes future water use for the Town of Oliver under current management practices. The Enhanced Efficiency scenario applies some common demand management techniques to the Business as Usual model to demonstrate potential water savings. The Conservation Commitment scenario goes even further. This is the preferred scenario, which integrates efficiency and conservation measures, and illustrates what a commitment to "no new water until 2050" would entail for the Town of Oliver.

The final section provides a brief summary, recommendations and next steps for the community to begin developing a sustainable approach to water management.

Why the Town of Oliver, BC?

The Okanagan Basin is becoming an important focus in British Columbia, and indeed across Canada, concerning water issues and the impacts of climate change. This is demonstrated through a number of local and regional initiatives, such as the selection of the Town of Oliver by Smart Growth BC for a Smart Growth on the Ground project; BCWWA Water

[1] For more information on this national study see www.waterdsm.org and www.foecanada.org.

Sustainability Committee's initiative Convening for Action in the South Okanagan; an ongoing UBC climate change study; existing regional land use planning processes; and efforts by BC's Ministry of Community Services to link water infrastructure grants to promote conservation. Focus on the Okanagan Basin led to the selection of the Town of Oliver as an applied urban sector case study for the national water soft path study led by Friends of the Earth Canada.

SECTION II – Soft Path for Water

The soft path and a spectrum of water management approaches

A holistic water conservation approach in a community or urban context—sometimes referred to as a “soft path” approach—depends on existing supply-side infrastructure, but shifts the focus from continuing to increase supply to controlling demand for water and changing current practices and institutions dealing with water management.

Progressing from a supply-side focus further along the spectrum of water management approaches requires an initial focus on water efficiency. But achieving true water sustainability means moving beyond efficiency toward a soft path approach. This requires a long-term commitment and new measures that influence the nature of water demands. Developing and instilling a water ethic, for example, can be achieved through education and social marketing or changing current approaches to urban development. Instead of continued urban sprawl, water sensitive urban design can be used to build water conservation right into planning. Examples include not only innovative green building technologies such as green roofs and rainwater harvesting systems for toilet flushing and laundry, but also smaller, more compact communities that rely on native drought resistant greenery to reduce outdoor irrigation.

Supply-side management

Supply-side management is one approach to water management. Grounded in the philosophy that water is not a limiting factor to growth, supply-side management views the only real constraints to development as the technological and financial resources needed to build infrastructure to harness, store and deliver water. With this approach, future growth is simply modeled on extrapolations from past activities and existing consumption patterns, setting in motion engineering and water management plans to increase capacity to meet anticipated future needs.

The technological impacts and underlying ecological assumptions of conventional supply-side water planning are increasingly at odds with a transition to a sustainable society. Plans to construct more and bigger dams, pipelines and groundwater pumping capacity are carried out based on the belief that demand is insensitive to policy and behavioural change—and with little or no regard for local eco-hydrological limits.

Demand-side management

A demand-side approach increases the flexibility of urban water management by building demand reduction into planning and decision making. It expands the perspective of management beyond the large, centralized engineering projects typical of the supply-side approach to include economic, socio-political and physical measures that change some behavior and emphasize increased water-use efficiency. Demand-side management specifically seeks to use existing capital more efficiently, and to investigate opportunities to lower water demand before considering additional infrastructure. Demand-side approaches focus first on efficiency and cost-benefit analysis and then may evolve to address institutional and longer-term water use considerations.

Often, reducing water demand is a cheaper alternative to supply options as it can usually be implemented more quickly and with less environmental damage. Many options are available to reduce water use and achieve water sustainability. Drip irrigation, low-flow faucets, toilets and appliances can all improve water efficiency. These measures are, however, just the beginning of the water-saving story, and the first step toward a true soft path for water.

The soft path for water

For the most part, contemporary urban water efficiency efforts are viewed as ad hoc measures aimed at buying time until new supplies can be secured and developed. The soft path differs fundamentally from these efforts in its focus on services.

Soft path planning directs planners to look beyond programs aimed at simply using water in more efficient ways. Instead it encourages a different approach to meet the underlying human needs for services, such as sanitation and irrigation to maintain pleasing landscapes. It promotes using alternative and more ecologically sustainable water sources such as rainwater harvesting and water reuse and recycling.

The soft path tackles broad questions—asking not only how to use water more efficiently, but, in some cases, why use water at all? This shifts the objective of water management from expanding and maintaining water supply infrastructure to providing water-related services, such as new forms of sanitation, drought-resistant landscapes, rain-fed ways to grow certain crops, or even influencing what crops are grown in the first place.

Box 1: Soft path core principles

- Treat water as a service rather than an end in itself – Consider alternative ways to deliver services that commonly use water—air-based cooling, rain-fed agriculture, waterless sanitation, low-flow fixtures—that maximize water productivity.
- Make ecological sustainability a fundamental criterion - Recognize ecosystems as legitimate users of fresh water; work within local eco-hydrological limits by setting limits for water withdrawals and standards for water returned to nature.
- Match the quality of water delivered to that needed by the end-use – Design policies to match the quality of water supplied to the quality required by cascading water systems, ensuring that wastewater from one use becomes input for another use—from a washing machine to a garden, or from a cooling system to other industrial uses.
- Plan from the future back to the present – Use the soft path planning technique of "backcasting" to define a sustainable future scenario, then work backward to identify policies and programs that will connect the future to the present. This requires open, democratic and participatory planning that engages the entire community and ensures that a broad public good is served.

The soft path as a planning approach

Planners rarely claim to be able to predict the future in detail. Rather, their focus is usually on developing and assessing scenarios of possible futures and creating conditions that make them probable. The goal of planning is to better understand possibilities for our future and the implications of decisions taken in the present.

Water soft paths specifically employ this scenario-based approach to planning. The process involves developing hypothetical scenarios that determine water use under different "packages" of technologies and practices. In addition to providing direction for management, developing scenarios can also be an effective way to enhance community dialogue and engagement around water sustainability.

Backcasting

As Figure 1 illustrates, soft path planning moves away from the forecasting approach typical of contemporary water management—the Business as Usual and Enhanced Efficiency scenarios. Instead, it employs "backcasting"—a planning approach that first establishes a vision of a desired (and sustainable) future and then works backward to find paths that connect that desired future to the present—the Conservation Commitment scenario.

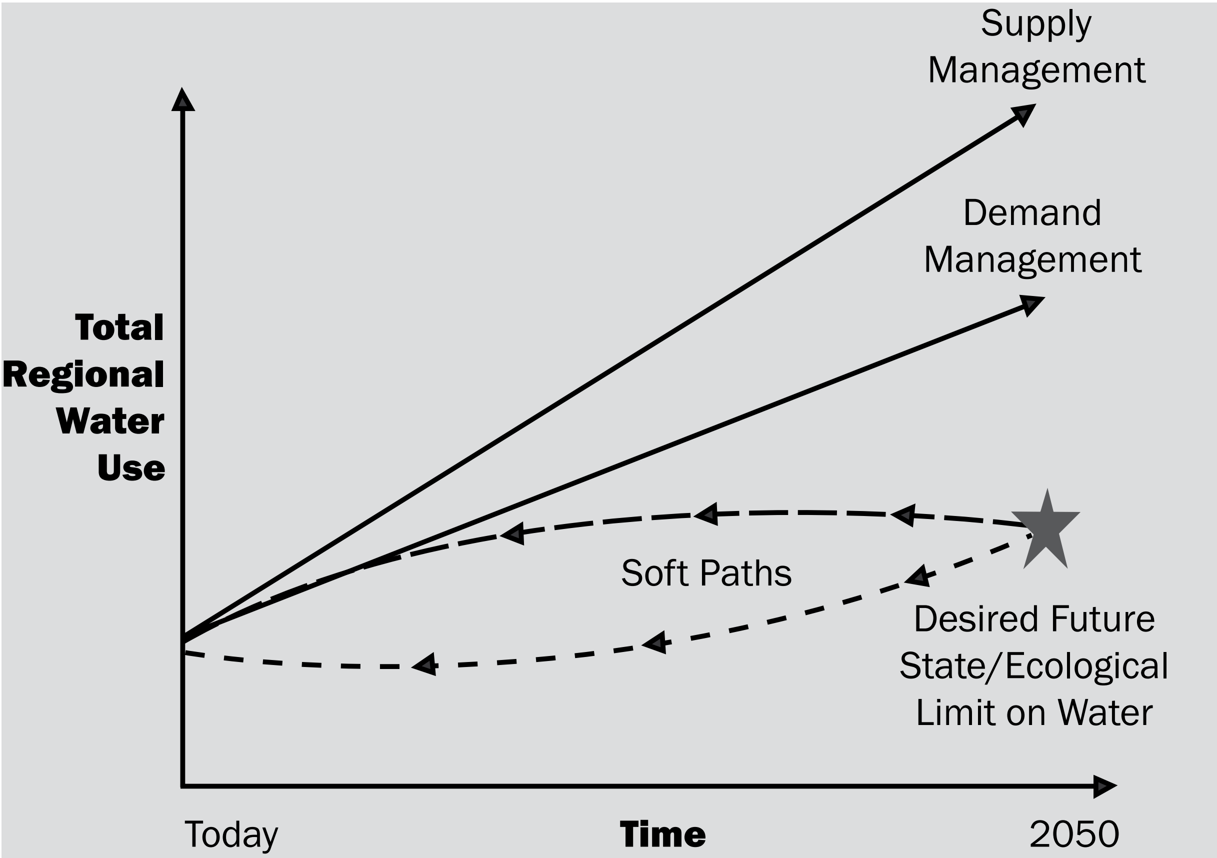
Backcasting is one of many methods used to study the future. Others include trend analysis, cost-benefit analysis, visioning and modeling. Each is well established and supported by extensive literature, and each serves a different function. As a modern method for studying the future, backcasting focuses on how a specific desirable future can be created, not on what futures are likely to occur.

For water planning, the backcasting process projects 20 to 50 years into the future to establish desired sustainable future conditions that reflect ecologically and socially acceptable limits on withdrawals.[2] The process then turns to developing feasible paths to meet long-term social and economic needs for water-related services. For urban centres, a vision of "no new water" until 2050 (or some other projected future date) is a simple proxy, and a good starting point. Setting such a limit establishes the water-related context within which an urban centre must function. A more detailed desired future condition is developed through extensive public engagement.

At the core of the soft path approach are structural changes that embed conservation, complemented by technologies and practices to increase efficiency. Thus, developing soft paths to a sustainable future requires the integration of policies and programs that change behavior (conservation) and promote greater water productivity (efficiency) to the extent that urban centres can reduce or eliminate the need for infrastructure expansion. This changes the form of future water infrastructure, changes the way communities are designed, and changes the institutions that govern water management.

2. Based on a conception of humans as part of—not separate from—ecosystems means that basic human needs for water (i.e. for drinking, cooking and sanitation) are included in this limit.

Figure 1: Soft path water planning conceptual diagram



This diagram illustrates a number of possible scenarios for water management based on a spectrum of water management that runs from supply- to demand-side management, and finally to soft paths. The top line illustrates a Business as Usual scenario base on supply-side management. The second line, Enhanced Efficiency, reflects conditions under a demand-management approach, which employs a standard suite of efficiency-oriented measures.[3] The Conservation Commitment scenario illustrates the backcasting approach, starting from a desired water future (i.e. the star) and working backward as indicated by the arrows flowing back to the present.

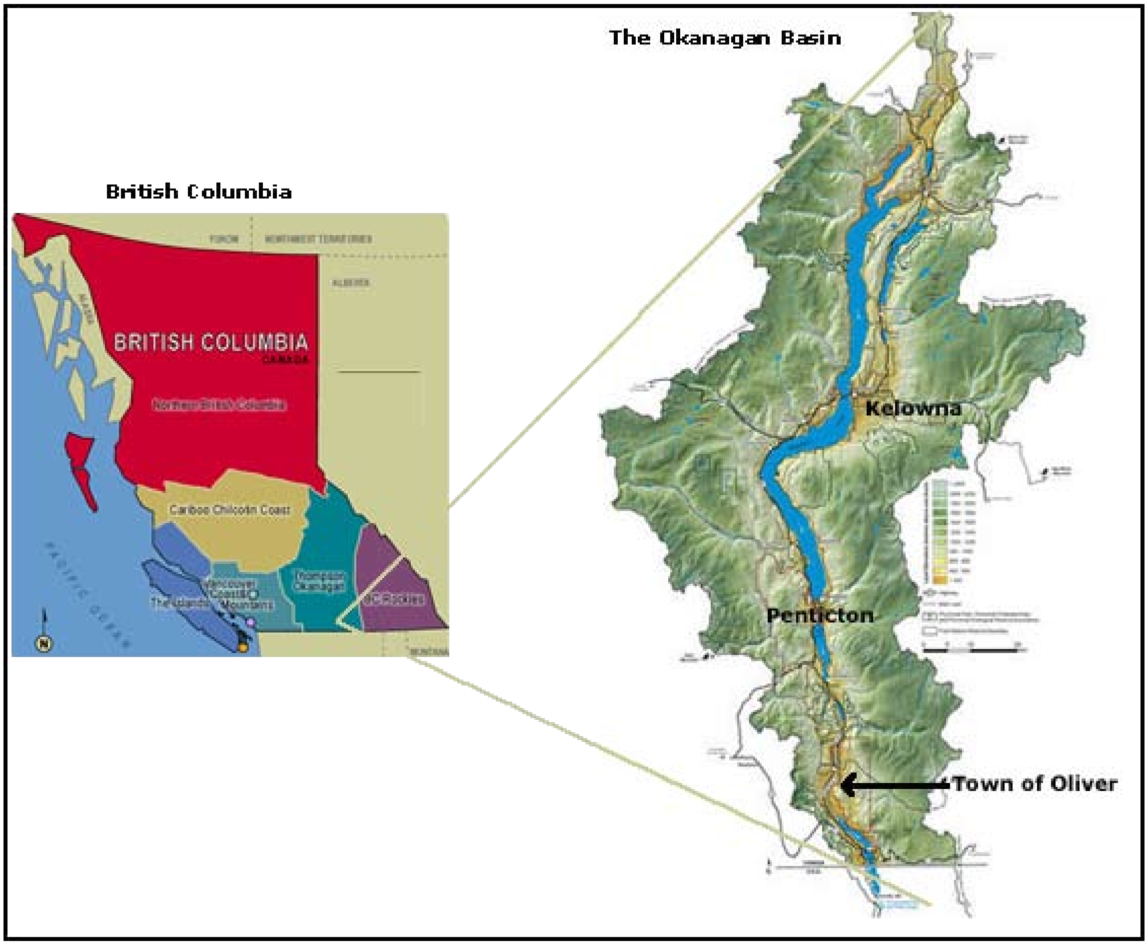
3. Demand management includes commonly available technologies or practices that are already widely employed and do not require significant education or structural changes (e.g. 6L toilets, low-flow faucets and shower heads). The soft path integrates efficiency and conservation measures and includes cutting edge technologies and approaches that require significant changes to behaviour and widespread adoption of advanced technologies and practices (e.g. composting toilets, waterless sanitation, Xeriscaping, widespread reuse recycling).

The Okanagan Basin

Geography and hydrology

Located in the rain shadow of British Columbia's Coast Mountain Range, the Okanagan valley bottom receives an annual average of 2000 hours of sunshine but only 300 mm of precipitation (Mason et al., 2005: 2). Mean annual precipitation increases with elevation, however, and sub-alpine areas receive at least 700 mm precipitation. About 50 reservoirs located at high elevations throughout the basin are predominantly responsible for meeting the valley's agricultural and municipal water demands (Taylor & Barton, 2004a: 25).

Figure 2: British Columbia and the Okanagan Basin



As the Okanagan Basin is a watershed dominated by snowmelt, replenishment of its reservoirs is heavily dependent upon spring runoff (Taylor & Barton, 2005: 90). Annual accumulation and recession of the mountains' snowpack is the most important factor influencing availability of water in the Basin—in terms of both timing and volume (Barton et al., 2004: 66).

Mountain streams flow into the Okanagan River, which is dammed in several places to form the valley's main lakes—the largest of which is Okanagan Lake, with a surface area of approximately 350 square kilometres. These waters drain southward to Osoyoos eventually flowing into the Columbia River in Washington State, USA.

Water and the economy

It has been suggested that the economy of the Okanagan is already limited by water availability and quality (Okanagan Partnership, n.d.: 5), since agriculture and tourism—the economic mainstays of the region—both rely upon an adequate supply of water resources (Taylor & Barton, 2004a: 25). Agriculture alone accounts for 75% of the Okanagan's consumptive water use (Neilsen et al., 2005: 110).

The Okanagan's agricultural industry is one of BC's largest horticultural and viticultural industries (Barton et al., 2004: 66). The region is also the largest tree fruit producer in British Columbia, encompassing 88% of the province's tree fruit production area (Westland, 1993: 15). Perennial crops such as wine grapes and tree fruits require timely and sufficient irrigation to assure quality and to protect the grower's investment; if orchards and vineyards lack water too early in the fall, vines or trees can be lost (Neilsen et al., 2004a: 89; Dickenson, 2005: 275).

Annually, more than one million tourists visit the Okanagan region (Wei, 2005: 6). Many of these sun-seeking visitors come for recreational activities such as sport fishing, boating and swimming—all of which require sufficient water quantity and quality in lakes and streams. Okanagan Lake alone supports an annual kokanee and rainbow trout fishery valued at $2 million (Westland, 1993: 7).

Water licensing

In the Okanagan Basin, water management is dominated by the needs of agricultural irrigation. Currently, 78% of all licensed water (consisting of approximately 1,200 licensees) is allocated for irrigation. Approximately 75% of this irrigation water is supplied by headwater diversions and high elevation in-stream storage basins; the remaining 25% is pumped from lakes, streams and groundwater (Neilsen et al., 2004a: 99).

From 2003 to 2005, 71 licences were issued on Okanagan Lake, representing more than 15 million cubic metres of water (Dickenson, 2005: 273.) In 2002, there were approximately 4,130 active water licences listed in the Okanagan Basin, representing an annual allocation of 1.05 billion cubic metres of water, of which 476.8 million cubic metres are allocated for consumptive purposes (Cohen et al., 2004a: 14). Although the volume of this allocated total that is actually used is unknown, in 2002 approximately 300 out of 980 licensed streams had water withdrawal restrictions placed on them. The majority of these streams have been deemed to contain insufficient water to grant further licences (Cohen et al., 2004a: 14-15).

Aquatic habitat management

The Okanagan River system supports one of the most diverse fish communities in British Columbia. More than 20 fish species—including sockeye salmon, kokanee, and rainbow trout—rely on the valley's waters for habitat. Some of these species, such as umatilla dace and yellow perch, are rare or unusual for BC (Westland, 1993: 13). Unfortunately, more than 85% of the valley's wetlands have been filled or drained, 90% of the region's historic stream spawning habitats have been lost, and about half of these remaining streams have insufficient flow regimes to support spawning (Ellis, 2000: 23).

In recent years, however, more attention has been paid to balancing water-related economic development in the Okanagan with the protection of aquatic habitat. In an effort to sustain successful economic development while protecting ecological integrity and residents' quality of life, the three regional districts of the Okanagan have recently funded a strategy to collaborate to achieve "green sustainable economic development" in the valley (Westland, 2003: 2).

Climate change

The Okanagan Basin can be viewed as a "canary in the mine" regarding climate change and water management implications in British Columbia (and perhaps throughout Canada). Climate change models for the Okanagan indicate the likelihood of warmer, wetter winters and hotter, drier summers over the course of this century (Taylor & Barton, 2004b: 53). This projected increase in minimum temperatures will likely significantly reduce the average snowpack, resulting in reduced peak flows during the spring freshet (Barton et al., 2004: 76) as well as decreased summer replenishment for the high-elevation reservoirs. In addition, lake and reservoir managers will be less able to use the winter's snowpack to inform the following summer's water management decisions (Merritt & Alila, 2004: 86).

Under climate change scenarios, it is projected that the Okanagan's existing water infrastructure will be inadequate, even if land use were to stay the same and a 30 to 40% water savings were to be achieved through conservation measures (Neilsen et al., 2005: 117-118). At present, very few water management strategies in the Okanagan have made allowances for the impacts of climate change on water supply and demand (Neale, 2005: 8).

Population growth

The Okanagan's current population is more than 300,000 and is projected to increase to nearly 500,000 by 2020 (Okanagan Partnership, n.d.: 18). With about 18 people per square kilometre of land, the Okanagan Basin is already the most densely populated area of British Columbia outside of the lower Fraser Valley (Hartley, 2005: 298; Mason et al., 2005: 2). The region also has the fastest rate of population growth among the 23 major river basins in Canada (Taylor & Barton, 2004a: 26).

Models of population growth suggest that by 2031, mean annual water use in the Okanagan could reach 486.5 million cubic metres. In this scenario, based on the 1994 estimate of 532 million cubic metres of water available for licensing in the Basin, no meaningful surplus would exist to handle unusually severe droughts, adapt to the anticipated impacts of climate change, or expand agricultural land use (Hartley, 2005: 301-302).

Water conservation in the Basin

Many water utilities in the Okanagan Basin employ demand management techniques in the residential sector. In a 2002 survey, Shepherd (2005) found that while most municipal utilities are using some demand management measures, only a few have well-established programs employing a broad suite of initiatives. Larger municipalities such as Kelowna and Vernon employ a variety of demand management techniques, most commonly education programs, metering, watering restrictions and rebates for fixtures and toilets. The Southeast Kelowna Irrigation District (SEKID) universal agricultural metering pilot project reduced annual allocated water allotments by 27%—a significant regional success story (Pike, 2004). Box 2 provides a list of many successful initiatives in the region.[4]

Box 2: Okanagan Basin demand management initiatives

Black Mountain Irrigation District: Watershed protection, collaboration with other utilities, public education

City of Kelowna: Residential and ICI metering, watering restrictions, demand management planning, water audits, bench-marking, voluntary in-home low-flow fixture programs, leak detection, sector demand study, Green design/SmartGrowth, water supply upgrades, computer upgrades, watershed protection, residential technologies, pilot programs, pricing review, water conservation applied to operations and maintenance, collaboration with other utilities, public education, education for elected officials

Greater Vernon Water: Residential and ICI metering, demand management planning, water reuse, water supply upgrades, computer upgrades, voluntary in-home low-flow fixture program, public education

Lakeview Irrigation District: Watering restrictions, sector demand study, computer upgrades, watershed protection, water conservation applied to operations and maintenance, public education

Rutland Waterworks District: Metering, pricing review, watering restrictions, water supply upgrades, computer upgrades, collaboration with other utilities, drought management planning, demand management planning, water conservation applied to operations and maintenance, public education, education for elected officials

South East Kelowna Irrigation District: Agricultural metering, collaboration with other utilities, sector demand study, water supply upgrades, computer upgrades, watershed protection, pilot programs, pricing review, drought management planning, demand management planning, water conservation applied to operations and maintenance, public education

Westbank Irrigation District: Watering restrictions, water supply upgrades, computer upgrades, pilot programs, Xeriscaping, public education, drought management planning

Adapted from deVries 2004

Water and the future of the Basin

For many Okanagan residents, their sense of place is defined by the landscape of the valley, with its agricultural legacy and traditional communities. Given recent population growth, many valley residents are concerned about the increasing pressure on land use and feel that water could and should be managed better. Residents of the southern Okanagan—the driest part of the valley—have identified the availability and quality of water as their top concern (WSC-BCWWA, 2005: 1).

Some politicians in the Okanagan, however, have been slow to initiate proactive water management initiatives such as water metering. This may be due to the financial expense involved, as well as the possibility of insufficient public support and the associated political fall-out. Nonetheless, planning for future growth must consider water use and management in a more holistic way in order to ensure the economic and ecological health of the Okanagan Basin (Hartley, 2005: 301; Brandes and Kriwoken 2006). The region's current growth trend will be unsustainable unless major changes are made to the management and regulation of the Okanagan's water resources (Jatel, 2005: 368).

The Town of Oliver

Oliver is a small but growing community in British Columbia's southern Okanagan, with 4,400 town residents and 4,500 rural residents. Originally established around a mine, the town has now shifted its economic focus to agriculture—in particular, viticulture. There are 14 vineyards in the Oliver's surrounding area, and the town has recently sought to brand

[4]. For a detailed discussion of these success stories see the 2004 BC Water Conservation Survey at www.waterbucket.ca.

itself as the “Wine Capital of Canada” (McNeill, 2004: 167).

However, the Okanagan Basin’s water supplies—the source relied upon to provide irrigation to Oliver’s agricultural sector—are facing both increasing demand from a growing population and dwindling replenishment resulting from a changing climate (Neale, 2005: 2). Due to the perception of local groundwater security, however, many Oliver residents have fewer immediate concerns about water availability than do residents of other parts of the Okanagan Valley, where water conservation measures are more commonplace (McNeill, 2004: 172; Neale, 2005: 44). Demand-side management (DSM) of water in Oliver has been limited to date, and Oliver’s per-dwelling water use is two to three times higher than that of the nearby cities of Kelowna and Penticton (Neale, 2005: 58, 78, 81).

With a Regional Growth Strategy for the Regional District of Okanagan-Similkameen currently in its first phase, Oliver residents are preparing to make important decisions about their community’s future, including how they want their water resources managed (WSC-BCWWA, 2005: 1). Decisions made today will be crucial to preventing a projected future based on continuing a business-as-usual mindset; by 2069 this status quo approach could lead to at least a doubling of water demand in the Okanagan Basin (Neale, 2005: 2).

Fortunately, many DSM measures are currently available, and these options can likely provide water security to Oliver in a more cost-effective manner than can traditional supply-side measures (Neale, 2005: 23). One good example is the municipal pipe-twinning project currently underway (discussed in more detail below). Furthermore, because of Oliver’s high per-dwelling water use, there is great potential for these DSM strategies to provide the community with valuable flexibility in adapting to potential future water demand increases (Neale, 2005: 81).

Box 3: Summary information on water in Oliver

For sources not listed here, see text below this box

- Municipal water use (litres per capita-day in 2001): 840 (MUD Database, 2001)[5]
- Domestic water use (litres per capita-day in 2001): 706 (MUD Database, 2001)[6]
- Percentage of total municipal water flow used for domestic purposes: 84% (MUD Database, 2001)
- Percentage of Oliver’s total water supply coming from surface water: 78%
- Percentage of Oliver’s total water supply coming from ground water: 22%
- Proportion of surface water used for irrigation during the growing season: 96%
- Number of well sites: 8
- Number of water reservoirs: 6
- Length of buried water pipeline: 100 km
- Length of open irrigation canal: 20 km
- Number of commercial/institutional water customers: 177
- Number of residential water customers: 3,368
- Number of rural domestic connections: 590
- Hectares of cropland under irrigation by Water Works: 1,600

Water use in Oliver

The Town of Oliver collects water use data on a monthly basis (Neale, 2005: 29). In 2001, domestic water use for the Town was approximately 2,641 million litres (ML), or 1.5 ML per dwelling per year (Neale, 2005: 58, 74). In 2003, Oliver residents used an average of 1,664 litres of water per capita per day. In 2004, this figure fell to 1,335 L/c-d; in 2005, the average consumption rate again decreased, to 1,304 L/c-d (Hamilton, 2006: 26).

5. This figure includes domestic, commercial and industrial water use in the municipality.

6. This figure comprises residential water use only, in the municipality.

Approximately 78% of Oliver's total water supply comes from surface water and 22% comes from groundwater (Hamilton, 2006: 28).[7] Water consumption in rural Oliver is approximately eight times the municipal level, due to crop irrigation requirements (Hamilton, 2006: 27); see Table 1.

Table 1: Oliver's average municipal and rural water consumption levels, 2003-2005 (Volumes listed are in units of millions of cubic metres)

Year	2003	2004	2005
Total Annual In-Town Water Consumption	2.64	2.13	2.08
Total Annual Rural Water Consumption	20.08	16.08	16.0

Oliver's annual water use per dwelling is much greater than that of Kelowna (0.7 ML), and Penticton (0.4 ML) (Neale, 2005: 58). Ground-oriented dwellings[8] in Oliver comprise about 86% of town residences, whereas in both Kelowna and Penticton, this proportion is less than 70% (Neale, 2005: 53).[9] This is significant, since ground-oriented dwellings in the Okanagan use about twice the volume of water compared with apartment-style residences (Neale, 2005: 15).[10]

In rural Oliver, data from 2001 show that during the irrigation season, in-house domestic water use (about 65 ML) comprised only 0.5% of total water consumption. Domestic irrigation used about 3.5%, and irrigation of agricultural land in rural Oliver comprised 96% of water use during the growing season (TRUE, 2002).

Future projections

Scenario modeling of anticipated climate change impacts and projections of population growth in Oliver indicate that water use will increase in the future. Under a high population growth scenario, average annual domestic water use in Oliver could triple in magnitude in 50 years (Neale, 2005: 75). Projected water use increases given climate change impacts, under zero-, low- and high-population growth scenarios, are shown in Table 2.

Table 2: Projected increases in average annual domestic water use for Town of Oliver in future decades, given projected climate change effects

Decade	No growth	Low growth	High growth
2020s	3-7%	23-29%	57-64%
2050s	7-17%	62-77%	178-203%

Source: Neale, 2005:75

Town of Oliver Water Works

In 1990, the Town of Oliver Water Works amalgamated with the South Okanagan Lands Irrigation District (Hamilton, 2006: 1). The Water Works now includes eight separate water systems: seven serve the rural residences and agricultural lands, and one system serves municipal residences. The municipal system operates year-round, but the rural systems operate only during the irrigation season, April through October (Hamilton, 2006: 5.) The entire system includes eight well sites, six water reservoirs, more than 100 km of buried pipeline and 20 km of open canal/gravity pipeline (Hamilton, 2006: 7, 13, 14).

The Oliver water system serves 177 commercial/institutional customers and 3,368 residential customers. Of the residential customers, 2,778 are on the municipal system, which supplies town residences with well water throughout the year (Hamilton, 2006: 15). The municipal system is serviced by four groundwater wells and one 300,000 US Gallon reservoir, which provides pressure equalization and reserve water supply for fire protection and power failures (Hamilton, 2006: 4;

7. This includes both irrigation and domestic use.

8. Ground-oriented dwellings include the single-detached house, semi-detached house, apartment in a detached duplex, row house, other single-attached house, and mobile home and other movable dwelling. These types of homes typically have lawns and gardens, which require water for aesthetic and maintenance purposes. In comparison, apartment dwellings generally only require water for indoor use. Source: Neilsen et al., 2004b: 128-129.

9. These figures are based on data from 2001.

10. Apartments may also use less water indoors, due to fewer washing machines per capita.

Town of Oliver, 2006). Minor chlorination is provided at one municipal well to manage manganese bacteria (for aesthetic purposes only) (Town of Oliver, 2006).

Storm water in Oliver is collected in approximately 330 catch basins, approximately 220 of which discharge to drywells. The remaining 110 catch basins discharge to streams and the Okanagan River (Hamilton, 2006: 25).

Oliver's agricultural irrigation system

Seven of Oliver's water systems are dedicated to serving rural customers (approx. 590 domestic connections[11]) and their 1,600+ hectares of irrigated land (TRUE, 2002). Approximately 75% of this irrigated land area receives a pressurized water supply, with the remaining 25% receiving a low-pressure supply (Hamilton, 2006: 15). Four of the rural water systems supply surface/canal water, one pumps directly from the Okanagan River, one pumps well water, and one is a twinned system running both groundwater (domestic use) and canal water (irrigation use) (Hamilton, 2006: 5).

An open-channel irrigation canal—built after World War I and locally called "The Ditch"—has for many years been the lifeline for most of the farms in the Oliver area, bringing in water from the Okanagan River just downstream of Vaseux Lake (Town of Oliver, 2006). Although parts of it have since been converted to pressurized pipelines,[12] The Ditch still provides water to the four main irrigation pumping stations in the rural Oliver area (Town of Oliver, 2006). Surface water for irrigation is transported by gravity to locations downstream, and is pumped to upstream locations (Cohen et al., 2004b: 217). Chlorine is added to this surface water at the pump houses (TRUE, 2002).

The vineyards around Oliver pump well water to their crops, which are located higher up the mountainside than most other agricultural land in order to take advantage of the ideal microclimate for growing grapes (Cohen et al., 2004b: 218; Barton et al., 2004: 55). Unfortunately, high levels of calcium in Oliver's groundwater require frequent changes of water filters to maintain desired quality for irrigation (Cohen et al., 2004b: 218).

Water infrastructure improvements and the pipeline twinning project

Oliver's existing irrigation system is the factor limiting an expansion of the agricultural land base. It has also been reported that pump stations to serve higher elevation areas are currently cost-prohibitive (WSC-BCWWA, 2005: 6). However, within the region, Oliver is in the relatively unique position of having a reliable water supply: Vaseux Creek, Reed Creek, Testalinda Creek and Shuttleworth Creek are all considered to have greater storage capacities than are currently in place (Cohen et al., 2004b: 217).

On the demand side, reclaimed water has recently been introduced as a source for irrigation. In 2003, the Town of Oliver implemented a Reclaimed Water Irrigation System Expansion Project, where some restricted-access public lands are now irrigated with treated effluent discharged from the Town's wastewater treatment plant (TRUE, 2001; TRUE, 2002). These reclaimed water customers include a golf course, a vineyard, a hobby farm, a municipal park, a municipal cemetery, a public works yard and an airport hayfield (Hamilton, 2006: 23).

Upgrades to the rural distribution system began in 2006, with the objective of "twinning" the system by installing a potable water system to run parallel to the existing irrigation (non-treated water) lines. The entire project—estimated to cost $8,886,000—will include three new wells with flow capacities of about 35 L/s, one new reservoir, 41 km of distribution main (with pipe diameters ranging from 50 mm to 250 mm), and water meters at each connection. Major funding for Phase 1 of this project has been provided to the Town by the BC Ministry of Community Services, through a grant under the BC Community Infrastructure Program. A unique feature of the funding arrangement for this project is that access to money for future phases of the twinning project is contingent upon the Town demonstrating a commitment to significant water conservation efforts (BCCWIP, 2005).

All new twinned connections will be metered, with well water (indoor use) being charged at a significantly higher rate than surface water (outdoor irrigation) (Town of Oliver Public Works, 2006: 2).[13] Since 2003, connections to most newly constructed buildings have included water meters. Metering of all existing municipal water services will be undertaken in future phases of the twinning project (Hamilton, 2006: 20).

11. One connection is equivalent to 2.5 people served. Source: TRUE Consulting Group, 2002.

12. More than $5 million have been spent rehabilitating portions of "The Ditch" over the past 12 years, and Public Works crews reline approximately 300 linear metres of canal each year. The open sections of the canal have caused some concern, as they are vulnerable to water contamination from pesticide spray drift, vandalism and animals. Source: Hamilton, 2006: 7, 9, 10.

13. Meters have been installed in all new residential, commercial, industrial and institutional connections. To date, no agricultural water services have been metered. Source: Hamilton, 2006: 21.

Water demand management in Oliver[14]

Other than metering and water reclamation, information is scarce regarding existing DSM strategies being applied in Oliver. Under increasing apparent climate change impacts and with a growing population, conservation and efficiency will become increasingly important for future water security.

DSM options implemented in Oliver would incur much lower costs per litre of water saved compared to cities such as Kelowna and Penticton, since water savings per dwelling unit in Oliver are expected to be much greater (Neale, 2005: 88). Neale (2005: 89) provides initial estimates of costs and savings in Table 3.

Table 3: Estimated costs and potential water savings expected to result from implementing six DSM options over the ten-year period 2010 to 2019 for the Town of Oliver, in a "current preferences, medium population growth" scenario (ML = million litres).

DSM Options	Total Cost (2010-19)	Water Saved (ML)	Cost/ ML Saved
1. Public Education	$225,102	2,839	$79
2. Residential Metering CUC	$1,381,706	5,678	$243
3. Residential Metering IBR	$1,381,706	11,059	$125
4. High Efficiency Plumbing	$4,967,210	3,633	$1,367

Source: Neale, 2005: 89[15]

14. For a more detailed discussion see Cohen et al. 2004d: 217-219 – available at: http://www.ires.ubc.ca/downloads/publications/layout_Okanagan_final.pdf.

15. This table appears as Table 4.12 in the original source.

SECTION IV – Water Conservation and the Soft Path in Oliver

The Okanagan Basin seems to have an abundance of available water. But, the region actually faces severe ecological limits due to the Basin's arid and semi-arid climate. A close look at the region's water situation reveals pressing reasons to conserve and to manage water demand. In the Town of Oliver, for example, aggressive water conservation may be needed to:

- **Plan for the uncertainty of climate change** – Water conservation is a "no regrets" option to mitigate the possible impacts of climate on water future supplies and improve supply reliability;
- **Defer infrastructure capital costs** (both supply and wastewater);
- **Reduce pressure on local aquifers**;
- **Free up water for competing beneficial uses** – Reducing urban water needs makes water available for other uses such as agriculture, power production, aesthetics or sustaining the environment;
- **Reduce wastewater, greenhouse gases, and chemical and energy costs** – Reduces the need for pumping and treatment, which reduces these throughputs;
- **Increase customer benefits** – Enabling individuals to reduce water use means they can lower their water bills (and potentially wastewater and energy costs);
- **Instil a water ethic** – Dedication to conservation and stewardship by individuals and utilities demonstrates a water ethic and a community commitment to sustainability;
- **Protect the environment** – Water removed from the ecosystem for human use affects the entire watershed, including endangered species, riparian habitats and fisheries.

The building blocks for water conservation

A wide variety of measures exist to reduce water use. Demand-side practices include conservation pricing, smart technologies, public education, and regulations that force innovation by promoting efficiency, conservation and recycling. Options range from simple technologies such as drip irrigation and low-flow fixtures and appliances, to alternative sources such as rainwater harvesting and reuse-recycling technologies. Other measures include education, regulation (e.g. watering restrictions, land-use ordinances and mandated best practices) and economic incentives (e.g. full-cost accounting, conservation-based pricing, rebates for conservation technologies, and subsidies for less water-intensive crops). Collectively, these water demand management measures are critical drivers to a comprehensive approach to urban water sustainability. Box 4 provides an initial list of some of the possible measures to reduce water.

Innovative and emerging water conservation opportunities

Beyond the suite of efficient indoor fixtures and appliances and outdoor practices such as using efficient sprinkler systems and rainwater-dependent (or Xeriscaped) landscapes, a few water conservation measures stand out as opportunities to move toward a more holistic approach in the urban context:

- **Social marketing** – Changing behaviour is challenging. Conventional education programs are focused on information dissemination and sometimes lack a thorough understanding of the barriers to behavioural change. Social marketing is an alternative. It differs from conventional approaches because more time and effort is invested at the outset to understand barriers before program design and implementation (McKenzie-Mohr, 2004). Although such an approach is grounded in local action, the cumulative benefits are an important part of a basin-wide transformation.

  Example: The Region of Durham in Ontario has adopted this approach into its outdoor water efficiency program with notable success. The program started in 1997 with the Region employing summer students in a community-based social marketing program to work with homeowners to reduce residential lawn watering. The result was a 32% reduction in peak water demand over a three-year period (Maas, 2003: 16).

- **Conservation-based pricing** – Experience shows that creative thinking about water rates and prices can have a significant impact on water use and efficiency. Specific examples of conservation-oriented water rates include: excess surcharges, drought demand rates, inclining block rates, seasonal rates, and time-of-use rates. These pricing mechanisms can contribute to a water conservation ethic by signaling customers to curtail excessive use. The success of implementing these types of water rates depends on how customers respond to changes in prices and availability of water efficient fixtures and appliances. Both education and incentives (e.g. rebate programs, giveaways) are important complements to this type of initiative. Also, attention to distributional equity for low-income customers and ensuring revenue neutrality are important to creating a fair and effective program.

Example: A well known local example is the SEKID project, mentioned above, which reduced annual allocated water allotments by 27%.

- **Rainwater harvesting and water reuse and recycling** – This may not always be the least-cost alternative, but it does offer the long-term economic benefit of future reliability in addition to environmental benefits that other alternatives may not offer. By using municipal water supplies twice—once for domestic use and again for irrigation—would-be pollutants become valuable fertilizer, rivers and lakes are protected from contamination, irrigated land boosts crop production, and reclaimed water becomes a reliable, local supply. Typical examples include using treated municipal wastewater to irrigate agriculture non-food crops, urban parkland, landscaping, golf courses, some isolated facilities, and experimental housing.

Example: Roughly 3% of wastewater is reused in BC, and reuse is already a component of BC's water conservation strategy.[16] Vernon has recognized for some time that reclamation is not only an innovative approach to dealing with wastewater, but also constitutes an alternative supply approach.

16. In 2001, BC produced the fact sheet "Guide to Irrigation System Design with Reclaimed Water" (BCMAFF, 2001) to provide a reference for the design of irrigation systems in British Columbia, using reclaimed water in accordance with the Municipal Sewage Regulation. In May 2001, the Province published a Code of Practice for the Use of Reclaimed Water (BCMELP, 2001), which serves as a guide for using reclaimed water in BC, and is designed to support the regulatory requirements prescribed in the Municipal Sewage Regulation (Schaeffer et al., 2004).

Box 4: Water conservation measures	
General Categories	**Specific Examples**
Socio-political strategies	Information and education Social marketing Water policy Water use permits Plumbing codes for new structures Appliance standards • Regulations and by-laws: • Watering restrictions • Landscaping ordinances • Turf limitation by-laws • Once-through cooling system bans
Economic strategies	Rebates for more efficient technologies (e.g. toilets, showers, faucets, appliances, drip irrigation) Tax credits for reduced use Full-cost recovery policies High-consumption fines and penalties Pricing structures • Seasonal rates • Increasing block rates • Marginal cost pricing • Daily peak-hour rates • Sewer and waste water charges
Technical strategies	Metering Landscape efficiency Soil moisture sensors Watering timers Cisterns Rain sensors Efficient irrigation systems • Micro and drip irrigation • Soaker hoses Leak detection and repair Water audits Pressure reduction System rehabilitation Efficiency technology • Dual flush toilets • Composting toilets • Low-flow faucets • Efficient appliances (dishwashers/washing machines) Recycling and reuse – ranging from cooling and process water, to grey water for toilets or irrigation, to treating and reclaiming wastewater for reuse

Source: Adapted from Brandes and Ferguson, 2003: 40.

Applying the soft path approach

This section describes the application of the soft path methodology and planning in the Town of Oliver, BC.

The process

To develop scenarios of future water use conditions and establish the context for backcasting, some knowledge of the trajectory of development is needed. This includes understanding population dynamics, economic conditions and ecosystem health. Usually such analysis assumes that population and economic growth are exogenous variables that are not open to modification.

For the case study, our desired future condition is the simplified goal of no new water until 2050. This is based on the understanding that expanding current water takings and constructing the associated infrastructure will damage the local aquatic ecosystem health—and that both can be avoided through conservation and increased water productivity.

The process begins with population projections. Using data from BC Statistics, we estimate the population growth from 2005 to 2050 based on a growth rate of 1.5% per year. Based on this projection, we calculate water use in 2050 for three scenarios—*Business as Usua*l, *Enhanced Efficiency* and *Conservation Commitment*.

For the *Business As Usual* scenario we extrapolate current water use patterns to 2050. To develop the other two scenarios we use the Business As Usual scenario as a baseline and apply different packages of water efficiency measures and practices. Combined with penetration rates for each measure, we arrive at the community's total water use under these new hypothetical conditions.

To carry out this quantitative analysis we developed a "conservation calculator." This tool—built on a Microsoft Excel spreadsheet—follows a number of steps to arrive at total water demand under a given scenario. At a minimum, the calculator requires quantitative information about current and projected population and per capita water demand. Based on these values, it calculates current and projected annual demand.

Both current and projected demand are then disaggregated—first into sectors (i.e. residential, institution & commercial, industrial); then into sub-sectors (i.e. residential is subdivided into indoor and outdoor uses); and finally into end-use (i.e. for residential indoor, toilets, showers, laundry, etc.).[17] Up to three water conservation measures are then applied to the disaggregated elements of the projected demand. A water reduction factor associated with each measure is applied (the details of how these factors are calculated is in the Appendix), along with a penetration rate, to arrive at a reduced demand for each disaggregated element. The reduced demand values are then re-aggregated into sub-sectors, sectors and total demand for the community. These re-aggregated values can then be compared to Business as Usual conditions to determine potential water savings for each of the two water saving scenarios (Additional information on the conservation calculator is included in the Appendix).

As noted previously, the two water saving scenarios integrate a number of measures into "packages." The Enhanced Efficiency scenario uses a basic suite of demand management measures primarily focused on efficiency, including ULF toilets and HETs,[18] high efficiency dishwashers, outdoor water use by-laws, modest Xeriscaping and system leakage audits.

The *Conservation Commitment* scenario was developed using the backcasting approach. It starts with the goal of "no new water," which is achieved by offsetting increases in water demand (from growth) through water efficiency and conservation. In order to meet this goal, re-aggregated total demand in the future must be less than or equal to current total water demand. This scenario applies many of the measures more aggressively than under the *Enhanced Efficiency* scenario and includes a number of more innovative technologies, including composting toilets, alternative sources (e.g. rainwater and/or reclaimed water) and behavioural change. Table 4 outlines the measures, water reduction factors and penetration rates used to develop the two water saving scenarios (and Table 6 in the Appendix provides additional detail and the rational for these factors and rates). Figures 3, 4 and 5 illustrate the outputs of the conservation calculator for all three scenarios.

While the calculations performed by the conservation calculator are fairly straightforward, it is important to note that the scenarios are based largely on assumptions and judgments of the analysts. This is in large part due to the nature of studying the future; we must rely on informed judgment to speculate about behavioural changes, technology uptake and technological innovation. This informed judgment approach was used to determine the penetration rates in this analysis, as well as to fill gaps in the literature on water savings (water reduction factors) associated with particular measures.

For this reason, it is important to stress that while the scenarios do reflect leading research on water conservation potential, they are not prescriptions of what the future does or should hold for the Town of Oliver. Nor is our conservation calculator a detailed simulator.[19] Rather, we refer to our analysis as a "back of the envelope" approach.[20] It is intentionally coarse and we recognize that this type of study cannot fully reflect the values, interests and preferences of the community.

17. Due to information limitations, only the residential sector is disaggregated to the level of end-uses.

18. ULF = ultra-low-flow toilets which use 6 lpf; HET = high efficiency toilets, which use at least 20% less water than ULF models. Examples include dual-flush and pressure assist models.

19. More detailed and sophisticated models exist. The Seattle conservation potential assessment (CPA) http://www.seattle.gov/util/About_SPU/Water_System/Reports/Conservation_Potential_Report/index.asp and the Maddaus model http://www.cuwcc.org/uploads/committee/DSS-Model-Demo-3-17-05.pdf and http://www.cuwcc.org/uploads/committee/MaddausWaterSources2004PaperRev4.pdf) are two good examples. Any end-use model will be highly dependent on the reliability of data ("garbage in = garbage out.") In Canada the lack of detailed data is a serious concern and likely will limit any large-scale analysis; however, many of the larger individual communities or municipalities are likely to have accurate and more reliable information.

20. Additional details about this process are in the accompanying document: Brandes, O. M. and T. Maas. 2007. The Urban Soft Path 'Back of the Envelope' Backcasting Framework. The POLIS Project on Ecological Governance at the University of Victoria. Victoria, B.C.

Such contextual refinement can only be achieved by opening the planning process to community scrutiny and detailed community engagement. That said, we believe our analysis can provide sufficient specifics about the potential of a comprehensive approach to water conservation to inform a wider community dialogue. We acknowledge that our analysis is only the start and not the final prescription.

Table 4: Water reduction scenario assumptions

Water Use Sector (Sub- sector)	Water End-Use	Scenarios					
		Enhanced Efficiency			Conservation Commitment		
		Measure	Factor	Penetration rate	Measure	Factor	Penetration rate
Residential (Indoor)	Toilets	6L Dual-flush	.36 .20	90% 10%	Dual-flush Composting or alternative source	.20 0	80% 20%
	Laundry	High-eff Washing Machine	.55	100%	High-eff WM Alternative source	.50 0	50% 50%
	Showers	Low-flow ULF	.58 .48	50% 50%	ULF Behaviour change	.48 .30	50% 50%
	Bath	No change			Changed behaviour	.75	100%
	Faucets	Low-flow	.71	50%	Low-flow	.71	100%
	Dishwashers	High-eff	.71	100%	High-eff Super high-eff	.71 .51	50% 50%
	Leaks	25% leak reduction	.75	100%	50% Aggressive leak reduction	.55	100%
Residential (Outdoor)	Lawn	Appropriate time of day, technology Modest Xeriscaping	.70 .50	50% 10%	Appropriate time of day, technology Modest Xeriscaping	.70 .50	30% 70%
	Garden	No change			No change		
	Other (car washing, outdoor cleaning etc.)	By-law limitations	.90	100%	Aggressive by-law limitations and enforcement	.50	100%
Institutional/ Commercial	Restrooms and kitchens	Mid-eff package: 6L toilets,spray-nozzles, LF faucets, High-eff DWs	.60	100%	High-eff package: dual-flush toilets, spray nozzles; ULF faucets, super high-eff washers	.40	100%
	Outdoor watering	Appropriate time of day, technology Modest Xeriscaping	.70 .50	50% 10%	Modest Xeriscaping Aggressive Xeriscaping and alternative source	.70 0	25% 75%
	Cooling/ heating	Single pass cooling ban	.50	100%	Looping and reuse/recycling	0	100%
Industrial	Details location specific	Technological innovation	.90	100%	Technological innovation	.75	100%
Unaccounted	Including: fire prev. parks & rec leakage	System audits	.90	100%	Aggressive system audits and alternative sources[21] for public lands	.75	100%

21. Rainwater or reclaimed grey water or wastewater

Figure 3: Business as Usual (calculated 27-June-06)

Base year: 2005 – Projected to 2050

Demographics	
Year	Population
2005	4379
2050	8557

input cells

http://www.bcstats.gov.bc.ca/DATA/pop/pop/mun/Mun9605a.asp

DISAGGREGATION						PROJECTION
Total	Sector	Sub-sector	End-use	Demand (LCD)	Demand (m3/yr)	Demand (m3/yr)
Oliver, BC 100%				1304	2,084,229	4,073,027
	Residential 84.0%			1095	1,750,752	3,421,343
		Indoor 50%		548	875,376	1,710,671
			Toilet 30.0%	164	262,613	513,201
			Laundry 20.0%	110	175,075	342,134
			Shower 18.4%	101	161,069	314,764
			Bath 1.8%	10	15,757	30,792
			Faucet 12.8%	70	112,048	218,966
			Dishwasher 1.4%	8	12,255	23,949
			Leaks 13.2%	72	115,550	225,809
			Misc 2.4%	13	21,009	41,056
		Outdoor 50%		548	875,376	1,710,671
			Lawncare 70.0%	383	612,763	1,197,470
			Garden 20.0%	110	175,075	342,134
			Other 10.0%	55	87,538	171,067
	I & C 7.0%			108	**145,896**	337,337
			Restrooms 40.0%	37	58,358	114,045
			Outdoor 22.0%	20	32,097	62,725
			Cooling/Heating 28.0%	26	40,851	79,831
			Other 10.0%	9	14,590	28,511
	Industrial 7.0%			91	**145,896**	285,112
	Unaccounted 2.0%			26	**41,685**	81,461

Figure 4: Enhanced Efficiency (calculated 27-June-06)

Base year: 2005 – Projected to 2050

Demographics	
Year	Population
2005	4379
2050	8557

http://www.bcstats.gov.bc.ca/DATA/pop/pop/mun/Mun9605a.asp

input cells

Notes: Analysis reflects summer water use, not yearly average

DISAGGREGATION						PROJECTION	REAGGREGATION				
Total	Sector	Sub-sector	End-use	Demand (LCD)	Demand (m3/yr)	Demand (m3/yr)	End-use	Sub-sector	Sector	Total	
Oliver, BC 100%				1304	2,084,229	4,073,027				**2,915,074**	**1.40**
	Residential 84.0%			1095	1,750,752	3,421,343			**2,389,979**	**1.37**	
		Indoor 50%		548	875,376	1,710,671		**935,908**	**1.07**		
			Toilet 30.0%	164	262,613	513,201	**176,541**				
			Laundry 20.0%	110	175,075	342,134	**188,174**				
			Shower 18.4%	101	161,069	314,764	**166,825**				
			Bath 1.8%	10	15,757	30,792	**30,792**				
			Faucet 12.8%	70	112,048	218,966	**187,216**				
			Dishwasher 1.4%	8	12,255	23,949	**17,004**				
			Leaks 13.2%	72	115,550	225,809	**169,356**				
			Misc 2.4%	13	21,009	41,056	**0**				
		Outdoor 50%		548	875,376	1,710,671		**1,454,071**			
			Lawncare 70.0%	383	612,763	1,197,470	**957,976**				
			Garden 20.0%	110	175,075	342,134	**342,134**				
			Other 10.0%	55	87,538	171,067	**153,960**				
	I & C 7.0%			91	**145,896**	285,112			**187,033**		
			Restrooms 40.0%	37	58,358	114,045	**68,427**				
			Outdoor 22.0%	20	32,097	62,725	**50,180**				
			Cooling/Heating 28.0%	26	40,851	79,831	**39,916**				
			Other 10.0%	9	14,590	28,511	**28,511**				
									256,601		
	Industrial 7.0%			91	**145,896**	285,112	**256,601**				
									81,461		
	Unaccounted 2.0%			26	**41,685**	81,461					

Figure 5: Conservation Commitment (calculated 27-June-06)

Base year: 2005 – Projected to 2050

Demographics	
Year	Population
2005	4379
2050	8557

input cells

Notes: Analysis reflects summer water use, not yearly average

http://www.bcstats.gov.bc.ca/DATA/pop/pop/mun/Mun9605a.asp

DISAGGREGATION						PROJECTION	REAGGREGATION				
Total	Sector	Sub-sector	End-use	Demand (LCD)	Demand (m3/yr)	Demand (m3/yr)	End-use	Sub-sector	Sector	Total	
Oliver, BC 100%				1304	2,084,229	4,073,027				**2,080,545**	1.00
	Residential 84.0%			1095	1,750,752	3,421,343			**1,703,281**	0.97	
		Indoor 50%		548	875,376	1,710,671		**605,030**	0.69		
			Toilet 30.0%	164	262,613	513,201	**82,112**				
			Laundry 20.0%	110	175,075	342,134	**94,087**				
			Shower 18.4%	101	161,069	314,764	**122,758**				
			Bath 1.8%	10	15,757	30,792	**23,094**				
			Faucet 12.8%	70	112,048	218,966	**155,466**				
			Dishwasher 1.4%	8	12,255	23,949	**14,609**				
			Leaks 13.2%	72	115,550	225,809	**112,904**				
			Misc 2.4%	13	21,009	41,056	**0**				
		Outdoor 50%		548	875,376	1,710,671		**1,098,251**			
			Lawncare 70.0%	383	612,763	1,197,470	**670,583**				
			Garden 20.0%	110	175,075	342,134	**342,134**				
			Other 10.0%	55	87,538	171,067	**85,534**				
	I & C 7.0%			91	**145,896**	285,112			**81,970**		
			Restrooms 40.0%	37	58,358	114,045	**45,618**				
			Outdoor 22.0%	20	32,097	62,725	**7,841**				
			Cooling/Heating 28.0%	26	40,851	79,831	**0**				
			Other 10.0%	9	14,590	28,511	**28,511**				
	Industrial 7.0%			91	**145,896**	285,112	**213,834**		**213,834**		
	Unaccounted 2.0%			26	**41,685**	81,461	**81,461**		**81,461**		

SECTION V – A Path Forward for the Town of Oliver

Each of the scenarios developed in this case study—Business as Usual, Enhanced Efficiency and Conservation Commitment—represents a possible future for the community; and each stem from distinct courses of action and lead to very different consequences. The question then becomes: Which path will the community choose?

- *Business as Usual* entails a doubling of water use and extensive supply-side infrastructure expansion. It is also important to note that even with the infrastructure in place, the water required to meet the demands may not necessarily be available given the uncertainties related to climate change and aquifer health.

- *Enhanced Efficiency* demonstrates that opportunities to capitalize on much of the "low hanging fruit" of water conservation exist in this community. Significant water savings are not only possible, but are likely to come about even with a minimal commitment to demand management.

- *Conservation Commitment* emphasizes that sustainable water use is an achievable goal. By committing now to "no new water" the Town of Oliver can develop innovative solutions to that certainly saves water (and might even save money in the long run). Reducing the localized impact on the environment by avoiding the construction of additional infrastructure will have lasting long-term benefits, including healthier and more resilient ecosystems. Ensuring that future water use is reduced on a per capita basis will also reduce operating costs of chemicals for treatment and energy for pumping and distribution. Furthermore, given the uncertainty of climate change impacts on water resources and aquatic systems, reducing current use will also reduce future risks associated with drought and changing water availability.

Getting to success

As mentioned, this is not a detailed analysis, nor does it provide a complete plan of action. Instead this is a coarse survey that illustrates what is possible by integrating various technological and policy measures. This should not be considered an endpoint. On the contrary, it is only the beginning of a dialogue about what kind of future makes sense for the Town of Oliver.

An ongoing dialogue among community members, stakeholders and decision makers will clarify values and preferences and shape the vision of the desired future and guide the community to realizing that future.

Future research must be participatory to be effective. Engaging the community in a planning process that is open to stakeholders input and public scrutiny is critical for moving from theory to action. This report is therefore only the first step towards action for a sustainable water future.

An action plan

A number of potential barriers slow or impede the implementation of water conservation measures. Perhaps most important among these is the general lack of public awareness in the Okanagan about the region's water resource limits and the associated impacts on economic development and ecosystem health. This lack of awareness limits community (and political) commitment to a long-term and comprehensive approach to demand management. With little sense of urgency, inertia maintains the status quo.

The following five action items (and associated recommendations) represent the immediate (and likely most effective) opportunities to begin creating a more sustainable approach to water management in the Town of Oliver, British Columbia.

Action Item #1: Envision a new kind of infrastructure

Recommendation – Hire a full-time demand management coordinator for the town or region.

As the two water savings scenarios illustrate, significant water savings are possible for the Town of Oliver. However, to reap the maximum benefit, a comprehensive program that addresses multiple opportunities and identifies synergies should be instituted. This approach requires specific skills and training and dedicated professionals. The cost of hiring such professionals and creating permanent positions for them may be prohibitive for a small town like Oliver. However, other options are possible, such as job sharing with neighbouring towns, or working with the Province, or the Okanagan Basin Water Board to create a dedicated regional position.

Such capacity building is an element of an expanded view of urban water infrastructure—a view that goes beyond the existing physical infrastructure of pipes, pumps and reservoirs. This new infrastructure includes innovative physical components, water sensitive urban design and conservation programs designed to complement existing water supply networks. It emphasizes decentralized technologies and lasting local programs that inspire behavioural change. Most importantly, this new infrastructure relies heavily on building and maintaining "social infrastructure"—the planning processes, education programs, and financial and human resources needed to liberate the full potential of water efficiency and conservation, and to foster sustainable water use at the community level.

Action Item #2: Build a foundation for success

Recommendation − Provide ongoing education, develop water audit programs, and ensure universal metering and conservation-based pricing as a foundation for success.

The community must see the value and benefits of conserving water before there will be widespread buy-in. Once the community begins to understand the potential of managing demand as a solution to the water challenges faced by the region, resistance to political action and efforts to build an effective, comprehensive conservation program will dissipate.

What gets measured gets managed. Water audits and end-user meters are critical to understanding who is using how much water and for what purposes. They also help tailor and track changes as new initiatives are implemented and create economic incentives to conserve. A pricing system that reflects not only the value of water, but also promotes conservation through a volume-based price structure, will signal to users that water is a precious resource and should be stewarded so that future generations can enjoy the same benefits and quality of life as we do today.

Action Item #3: Turn growth into a catalyst for change

Recommendation − Commit to "no new water" by linking ongoing (and likely inevitable) urban growth to the implementation of cutting-edge technologies and landscaping, and promotion of retrofits and urban re-vitalization with water-centric planning.

The community will face significant growth over the next 50 years. It is critical to engage in effective land-use planning to integrate water issues with the regional growth strategy. Today's land-use decisions will have significant impacts on future water use. A subdivision with green sprawling lawns will use significantly more water for peak summer use than a compact community with townhouses, apartments and locally appropriate lawns and yards.

A significant opportunity for the community is to use the Wine Village concept being emphasized by some stakeholders to capture not only the rural charm of the town while promoting new water savings innovations. A major new development like the Wine Village, which will entail significant development (and re-development), will allow the latest water practices and conservation technologies to be showcased—and sets the standard for all future developments.

Action Item #4: Promote water-efficient fixtures, appliances and best practices

Recommendation − Pass by-laws that require all future housing developments to use the full suite of water conserving fixtures and appliances and outdoor best practices. Initiate a rebate program for retrofitting existing houses funded through new development fees. Show what is possible for outdoor landscaping alternatives by developing highly visible pilot projects and demonstration sites, complemented by financial incentives for residents to switch to more natural landscaping methods.

Our analysis reveals high levels of residential water use; it also demonstrates that significant savings are possible with off-the-shelf technologies and a different view of outdoor use. The five main indoor water uses—toilets, showers, faucets, dishwashers, laundry machines—represent fertile ground for technological upgrades. All new construction projects should be encouraged to employ the cutting edge of each of these options. And innovative "water offset" by-laws should be applied 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).

As in most Canadian communities, outdoor water use is a significant component of the Town of Oliver's high water use. To balance outdoor aesthetics with reasonable use of water, a number of options are available. These range from simple technologies and practices such as time of day watering requirements, drip irrigation and nozzle inhibitors, to Xeriscaping and natural landscaping that rely primarily on drought tolerant plants and natural precipitation. There are also alternative water sources such as rainwater harvesting or grey water reuse. The first step is to educate homeowners on the various possibilities with demonstration sites and pilot projects in highly visible areas, such as community halls, new developments and tourist areas. One way to promote Xeriscaping, for example, would be to establish two plots side by side and Xeriscape one of them. People could see for themselves how the different plots look and could read about the potential water savings on interpretive signage. This could be a school, college or community project to engage the community with guidance and instruction from landscaping companies and municipal staff.

Action Item #5: Continue to seek alternative water sources

Recommendation − Expand current efforts to reuse water to include all public lands and even some larger developments, and ensure all new developments have the infrastructure for rainwater harvesting as part of their basic water supply.

Rainwater harvesting and water reuse and recycling represent important options for dealing with local water challenges. The Town of Oliver already has some experience dealing with reused water through the purple hydrants program and the Pipe Twinning Project. Building on this success could promote new and innovative approaches to water management in the region. For example, the program could easily be expanded to distribute reclaimed water to all public lands and large developments. Rainwater is another important resource to reduce residential demand on municipal infrastructure. Collected at the lot level, rainwater could be used for outdoor irrigation, toilet flushing and even laundry, at the same time reducing the expense of treating and distributing drinking quality water.

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Appendix – Understanding the Water Conservation Calculator

This appendix explains the POLIS water conservation calculator, a Microsoft Excel spreadsheet developed to facilitate the development of the various scenarios presented here. It elaborates on the brief discussion of the tool presented in "The process" and where possible/applicable provides the rationale for assumptions and judgments by analysts.

Input data

The calculator is designed to work with minimal inputs. While detailed data collection for urban water use is improving in Canada, data remain incomplete for the detailed requirements of this analysis (i.e. breakdown of water use to the level of sub-sectors and end uses).

At a minimum, the required data inputs include current population and current water demands—either on a per capita basis (i.e. litres per capita-day – L/c-d) or on a community-wide basis (i.e. cubic metres per year – m3/yr).[22] In some cases, local data on on the sectoral breakdowns of water are available and lead to a more robust or contextualized analysis. In the absence of such data, general values for the region, province or the country as a whole must be used. Data beyond the sector level (i.e. sub-sector, end use) are scarce. To deal with this lack of data we developed a generic breakdown based on values published from a number of sources. This is discussed further in the section below on *Disaggregating demand*.

For the case study, sector level data were available from Environment Canada's MUD database where residential water use is reported as 84% of total demand, ICI as 14% and "other" as 2%. To fit the format of the calculator, which divides ICI into Institutional & Commercial and Industrial, it was assumed that the 14% was equally split between the two sectors (i.e. 7% each).

Population projection

The first step in running the calculator tool is to project population figures. In many cases this information may be available from other official sources, including local planning documents or from provincial or federal government statistics. For the case study, statistics were sourced from BC Statistics[23] that estimate the 2005 population for the Town of Oliver at 4,379. This value was then projected forward to 2050, based on a growth rate of 1.5% per annum, to arrive at a future population of 8,557. The growth rate of 1.5% was chosen since it represented the mid point between high and low growth projections.

The calculator contains a worksheet entitled "Pop Projection" that performs the population projection calculation. From this worksheet both current and projected population (in the desired year) must be input into the appropriate cells in the scenario worksheets (in this case, the cells are labeled BAU, EE and CC).

Water use – Current and projected

Current water use is calculated by multiplying the reported L/c-d for the community by the current population and then converting this to m3/yr. Projected population is calculated using the same approach with "current population" replacing "projected population" in the calculation.

Disaggregating demand

Disaggregate demand—current and projected—requires the user to input percentage values for sectors, sub-sectors and end uses. As noted above, ideally these values would be locally sourced. Where this is not possible, proxies such as values from similar communities or regional, provincial or national averages may be used. To deal with the scarcity of sector level data, we compiled values from a number of sources to arrive at generic disaggregated values for end uses. These are presented in Table 5.

22. The calculator is formatted to use L/c-d. If data are reported on a community-wide basis they will need to be converted from m3/yr to L/c-d.

23. See the web site at http://www.bcstats.gov.bc.ca/DATA/pop/pop/mun/Mun9605a.asp

Table 5: Default disaggregation values	
End-use	**% of total demand**
Toilet	30
Laundry	20
Shower	18.4
Bath	1.8
Faucet	12.8
Dishwasher	1.4
Household leaks	13.2
Misc	2.4

Applying the measures

With projected demand disaggregated into its component elements, we then apply up to three measures to them. To calculate the impact of these measures on water demand requires application of the associated water reduction factor and a penetration rate to each of the disaggregated elements.

Water reduction factors are values between 0 and 1.00, representing the water savings associated with a particular measure. For example, we use a water savings factor of 0.36 for 6L toilets, which means that these models use only 36% of the water that is currently required (on average) for the service of human sanitation. A composting toilet, which we assume uses no water at all, has a water savings factor of 0.00.

Recognizing that it is overly simplistic to assume that any given measure will be applied in all instances, we built in penetration percentages ranging in value from 0 to 1.00 that represent the degree of uptake of a particular measure. For example, a penetration rate of 50% for 6L toilets means that half of the toilets in the community have been replaced with this technology. The total of all penetration percentages for a given disaggregated element of demand (e.g. toilet demand) must equal 100%.

By multiplying a disaggregated element of demand by the *water reduction factor* and the penetration percentage, the result represents the *resulting demand* for each measure.

Re-aggregating for comparison

The resulting demand values are then added together to arrive at the new end-use demand for each disaggregated element. These are then further re-aggregated to the level of sub-sectors and sectors. Comparing these re-aggregated values of treated projected demands to current untreated projected demands illustrates the water saving potential for the scenario.

Table 6: Scenario descriptions for the Town of Oliver

Water Use Sector (Sub- sector)	Water End-Use	Enhanced Efficiency			Rationale
		Measure	Factor	Penetration	
Residential (Indoor)	Toilets	6L Dual-flush	.36 .20	90% 10%	All existing 10 to 23L toilets replaced. 6L toilets predominate with minimal penetration of dual flush models. Penetration is the product of natural replacement and typical $50 - $75 rebates.
	Laundry	High-eff Washing Machine	.55	100%	All existing washers replaced with high efficiency models. Penetration is the product of natural replacement and typical $100 - $150 rebates.
	Showers	Low-flow ULF	.58 .48	50% 50%	All existing showerheads replaced. Penetration enhanced through giveaways of low-flow models and small rebates for ULF models.
	Bath	No change			NA
	Faucets	Low-flow	.71	50%	Half of all faucets replaced with low-flow models – remainder stay as is. Penetration enhanced by small rebates and aerator giveaways.
	Dishwashers	High-eff	.71	100%	All existing washers replaced with high efficiency models. Penetration is the product of natural replacement.
	Leaks	25% leak reduction	.75	100%	Current household leakage reduced by 25% through enhanced leak detection and repair. Penetration product of education programs and home auditing.
Residential (Outdoor)	Lawn	Approx time of day, technology Modest Xeriscaping	.70 .50	50% 10%	50% of population adhering to appropriate watering techniques and advanced irrigation technology. Penetration product of by-laws and education.10% of land area converted to Xeriscaping. Penetration product of packages offered by developers, education and support by government.
	Garden	No change			NA
	Other (car washing, outdoor cleaning, etc)	By-law limitations	.90	100%	General reduction of water use for other outdoor uses through by-laws.
Institutional/ Commercial	Restrooms and kitchens	Mid-eff package: 6L toilets,spray-nozzles, LF faucets, High-eff DWs	.60	100%	All institutional and commercial customers enhance efficiency with readily available "off the shelf" technologies and practices.
	Outdoor	Approx time of day, technology Modest Xeriscaping	.70 .50	50% 10%	Half of institutional and commercial lands regulated to time of day watering restrictions and supporting technology.10% of institutional and commercial lands are converted to modest Xeriscaping.
	Cooling/ heating	Single pass cooling ban	.50	100%	All customers move to looped cooling systems.
Industrial	Details location specific	Technological innovation	.90	100%	Industrial customers employ technological improvements, leak detection and repair.
Unaccounted	Including: fire prev. parks & rec leakage	System audits	.90	100%	Leak detection and repair programs created, funded and implemented.

Water Use Sector (Sub- sector)	Water End-Use	Conservation Commitment			Rationale
		Measure	Factor	Penetration	
Residential (Indoor)	Toilets	Dual-flush Composting/ alternative source	.20 0	80% 20%	All existing 10 to 23L toilets replaced. Dual flush toilets predominate with minimal penetration of composting models and flushing with alternative sources (rainwater, grey water).
	Laundry	High-eff WM Alternative source	.55 0	50% 50%	Half of existing washers replaced with high-efficiency models, and half of all households use alternative sources (rainwater) for laundry (these homes could have a high or low-efficiency washer).
	Showers	ULFULF, behav-iour change	.48 .30	50% 50%	All existing showerheads replaced. Penetration enhanced through giveaways of low-flow models and small rebates for ULF models. Further reduction in use in half of all homes comes through behavioral change (shorter shower time).
	Bath	Changed behaviour	.75	100%	All residents reduce volume of water used per bath.
	Faucets	Low-flow	.71	100%	All faucets replaced with low-flow models – remainder stay as is. Penetration enhanced by small rebates and aerator giveaways.
	Dishwashers	High-eff Super high-eff	.71 .51	50% 50%	Half of existing washers replaced with high-efficiency models, half with super high-efficiency models. Penetration is the product of natural replacement.
	Leaks	50% Aggressive leak reduction	.55	100%	Current household leakage reduced by 50% through enhanced leak detection and repair. Penetration product of education programs and home auditing.
Residential (Outdoor)	Lawn	Approx time of day, technology Modest Xeriscaping	.70 .50	30% 70%	30% of population adhering to appropriate watering techniques and advanced irrigation technology. Penetration product of by-laws and education.70% of land area converted to Xeriscaping. Penetration product of packages offered by developers, education and support by government.
	Garden	No change			N/A
	Other (car washing, outdoor clean-ing, etc)	Aggressive by-law limi-tations and enforcement	.50	100%	Significant reduction of water use for other outdoor uses through by-laws.
Instit/ Commercial	Restrooms and kitchens	High-eff package	.40	100%	All institutional and commercial customers take aggres-sive efficiency measures, still using readily available "off the shelf" technologies and practices.
	Outdoor	Modest Xeriscaping Aggressive Xeriscaping and alternative source	.70 0	25% 75%	25% of institutional and commercial lands converted to modest Xeriscaping.75% of institutional and commercial lands converted to aggressive Xeriscaping and most irrigation uses alternative sources (rain and grey water).
	Cooling/ heating	Looping and reuse/recycling	0	100%	This technology is commonly available and is increasingly considered standard practice.
Industrial	Details location specific	Technological innovation	.75	100%	Industrial customers employ technological improve-ments, leak detection and repair.
Unaccounted	Including: fire prev. parks & rec leakage	Aggressive system audits and alternative sources[24] for public lands	.75	100%	Aggressive leak detection and repair programs created, funded and implemented.

24. Rainwater or reclaimed grey water or wastewater.

POLIS Project on Ecological Governance

Created in 2000, the POLIS Project on Ecological Governance is a research-based organization housed at the University of Victoria in British Columbia. Researchers who are also community activists work together at POLIS to dismantle the notion of the environment as merely another sector, and to make ecological thinking and practice a core value in all aspects of society. Among the many research centres investigating and promoting sustainability worldwide, POLIS represents a unique blend of multidisciplinary academic research and community action.

POLIS Project on Ecological Governance University of Victoria **www.polisproject.org**

Water Sustainability Project

Created in January of 2003 at the POLIS Project, the Water Sustainability Project seeks to understand the structure and dynamics of urban water use, and to provide mechanisms to help reorient water management in Canada from supply to demand-side approaches. The WSP team has developed a comprehensive legal and policy framework for urban water management and detailed action plans for federal, provincial and municipal governments. The Project is also investigating the emerging field of watershed governance to test its practical implementation and explore its potential for "developing sustainability" in Canada.

The Water Sustainability Project **www.waterdsm.org**

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