CITY OF MERRITT

Water Conservation Strategy

FINAL REPORT

0521.0148.01 / May 2003

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May 16, 2003 File: 0521.0148.01

City of Merritt
PO Box 189
2185 Voght Street
MERRITT, BC V1K 1B8

Attention: Jennifer Bridarolli, Administrator

RE: WATER CONSERVATION STRATEGY - DRAFT REPORT

We are pleased to forward you the final report for the Water Conservation Strategy for endorsement by City Council on May 27, 2003. This strategy has been prepared to provide recommendations for water conservation planning and direction for future water conservation programs as they relate specifically to Merritt.

As suggested by Peter Bailey, Senior Engineer with the Ministry of Community, Aboriginal and Women's Services, we have based the strategy on the *United States Environmental Protection Agency (USEPA) Water Conservation Guidelines*. These guidelines have been incorporated where appropriate and supplemented by Urban Systems' historical knowledge about Merritt's water system and water conservation programs. As such, this plan provides valuable suggestions and recommendations to build on Merritt's water conservation programs which have existed since the early 1990s.

We understand that completion of this project prior to the end of May 2003 is necessary in order to qualify for Local Government Grant Program (LGGP) #P012005. We look forward to working with Council and staff to implement the strategy and to continue water conservation efforts in the community.

Yours truly,

URBAN SYSTEMS LTD.

Thérèse Gieselman, MUP
Community Planner

/tag

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1.0 INTRODUCTION

The purpose of the Water Conservation Strategy is to set out a long-term plan for future water conservation efforts within the City of Merritt. The Strategy provides a "how-to" guide which illustrates the importance of establishing clear direction so that water conservation efforts are coordinated and comprehensive rather than ad hoc exercises that are sporadic and infrequent.

The City of Merritt first introduced a water conservation program in the early 1990s with the introduction of an education program in the form of flyers, advertising and information panels. Over time, the City's water conservation efforts evolved to include enforcement through water sprinkling restrictions. Generally, the City's program has targeted outside water use, and has experienced reasonable success in reducing peak water demands during the summer months.

The impetus behind this strategy comes as a result of the City's desire to reduce overall water demands and continue to build on past successes of water conservation programming. In reviewing this strategy with the Ministry of Community Aboriginal and Women's Services, Ministry representatives suggested the strategy be based upon the *United States Environmental Protection Agency (USEPA) Water Conservation Guidelines.* These guidelines have been utilized where appropriate and supplemented by research and Urban Systems' knowledge with respect to the City's water system and past water conservation efforts.

This report is to serve as a guiding document for the City of Merritt to ensure future implementation of water conservation programming is defined with specific goals and objectives.

The following outlines the format of this report:

- **Introduction** – presents an overview of the purpose of the report;
- **Why is Water Conservation Important** – provides the context for the report and benefits to implementing water conservation programs;
- **Overview of Merritt's Water System** – presents an analysis of water use and costs to provide water in Merritt as well as a summary of water conservation efforts and results to date;
- **Moving Towards Merritt's Water Conservation Strategy** – provides an approach to implementing the strategy and suggests goals and guiding principles;

- **Water Conservation Measures** – provides a summary of water conservation measures, illustrates how these currently apply in Merritt and offers recommendations for the future;
- **Conclusion** – provides a summary of the strategy.

2.0 WHY IS WATER CONSERVATION IMPORTANT?

2.1 Introduction

Water conservation is important from a variety of perspectives. The first is that humans have a moral responsibility to act as stewards of natural resources. Because of our reliance on water, we must ensure prudent used of this resource. In the case of Merritt, there are several unknowns surrounding the City's aquifer which provides the City's only source of water. The capacity and longevity of the aquifer has not been determined, so reducing unnecessary use of this resource is very important.

The second perspective relates directly to future infrastructure requirements that will be necessary to upgrade Merritt's existing water and sewage treatment systems in order to meet increasing demands of residents. As water use increases, demands on the water supply system and outflow to the sewage treatment plant also increase. If demands continue to proceed unchecked, the need for these improvements will occur sooner rather than later. This will inevitably translate into additional utility costs for water consumers within the next few years. With additional water conservation measures in place, not only will demand be alleviated, but also the need for water supply and sewage system upgrades and associated capital improvements. Ultimately, this will also reduce operation costs for the both the water and sewer systems.

2.2 Benefits to Implementing a Water Conservation Program

The key benefits to implementing a water conservation program include:

- Environmental
- Social
- Economic

2.2.1 Environmental Benefits

The promotion of a conservation program increases understanding about the environment and creates an awareness of the importance of wastage and its impact on the environment. This encourages the community to become more active in the area of conservation, primarily through the reduction of waste, which can be translated to other areas of the community. In the case of

Merritt, this translates into the protection of the aquifer and reduce flows to the sewage treatment plant, as well as excessive use of energy resources necessary for pumping water to name a few.

2.2.2 Social Benefits

Water conservation creates an awareness of usage, so it directly involves the community in making decisions about their resources and the costs to purvey services related to water (i.e. water system and sewage treatment plant). By informing the public about the resource and how it is delivered to individual homes and businesses, citizens are empowered to understand the implications of their individual actions and how they can protect a valuable resource. In addition, water conservation allows the City of Merritt to maintain a higher quality of life by ensuring there is always sufficient water available for health and safety measures.

2.2.3 Economic Benefits

The on-going implementation of a water conservation program will defer the need to expand existing infrastructure to cope with increasing water demands and usage. This includes the addition of new facilities, such as additional pump stations, transmission lines, distribution lines and reservoirs, which are all required to meet peak demands. This also applies to wastewater treatment facilities. A reduction in water usage and disposal will result in a reduction of operating costs for wastewater treatment.

3.0 OVERVIEW OF MERRITT'S WATER SYSTEM

Currently, Merritt's water system serves 94% of City residents within a service area of approximately 10 km^2. The water system in Merritt is subject to some unique characteristics which are important to consider in preparing the City's water conservation strategy. These are summarized below and described in more detail in subsequent sections.

- Merritt's water comes from one source. This source is an unconfined aquifer which supplies the City's entire water system; and
- Major portions of Merritt's water system are subjected to significantly higher water pressure than most municipalities.

3.1 Merritt's Water Source

Merritt draws its water exclusively from an underground aquifer which is located directly below the City. The BC Ministry of Environment Aquifer Classification system categorizes the Merritt Aquifer as type "IA", identifying it as one of the most highly developed and vulnerable aquifers in the province. Less than 5% of aquifers identified in BC currently have this rating[1].

The sustainability of the aquifer is unknown; therefore, conserving the amount of water extracted from the aquifer will help reduce the chances of depletion especially during hot, dry seasons when aquifer recharge rates may be lower. Since 1993, the total average-annual pumping rate has ranged from 83.9 to 109 L/s. Currently, the city extracts about 100 L/s (1,333 Igpm) (average annual withdrawal) from the aquifer via five production wells (Collettville, Fairly Park, May Street and Voght Park #1 and #2). It has been suggested that the City will required about 120 L/s by the year 2010 if current water extraction rates continue.[2] Due to these factors, drawdown of the aquifer may result if groundwater extraction rates continue to increase. Reducing demand will decrease the chances of depleting this resource.

3.2 Merritt's Unique Water Pressure

Due to the existing configuration of the City's water system, water pressures in the City of Merritt are higher than traditionally found in most municipalities. Average pressures in the lower areas

[1] EBA Engineering Consultants Ltd. *City of Merritt Aquifer Protection Plan,.* December 2002.
[2] Ibid.

of the City are 760-830 kPa (110-120 psi) which are considerably higher than other municipalities where pressure levels of 480-620 kPa (70-90 psi) are the norm. This increased water pressure has a direct effect on water usage. For example, a leaky toilet in Merritt will steadily drain more water than a toilet in other municipalities. This water flows directly into the sewage treatment plant, introducing unnecessary additional flows and volumes for treatment and disposal. In addition, Merritt's pumps, which extract water from the underground aquifer via wells, use a considerable amount of energy due to the high pressures. As use increases the amount of energy used to extract water also increases.

These unique characteristics highlight the need for ongoing water conservation measures to be encouraged and implemented throughout the year and especially during high demand periods.

3.3 Water Utility Pricing Structure

3.3.1 Residential Users

Generally, Merritt's water charges for residential users are based upon flat rates. However, some users are individually metered such as strata corporations. In these cases, the users are billed through the strata corporation. Other than this exception, each dwelling unit is charged $9.70 per month. In 1998, Merritt passed a waterworks bylaw requiring all new residential dwellings to install meters. Approximately 2% of households have water meters installed, but the City does not read these meters.

3.3.2 Commercial and Industrial Users

Commercial and industrial users are largely charged on a flat rate basis. However, 33% of commercial and industrial users are currently metered, and several of these users could be classified as "major users" because of the amount of water they consume.

3.3.3 Major Users

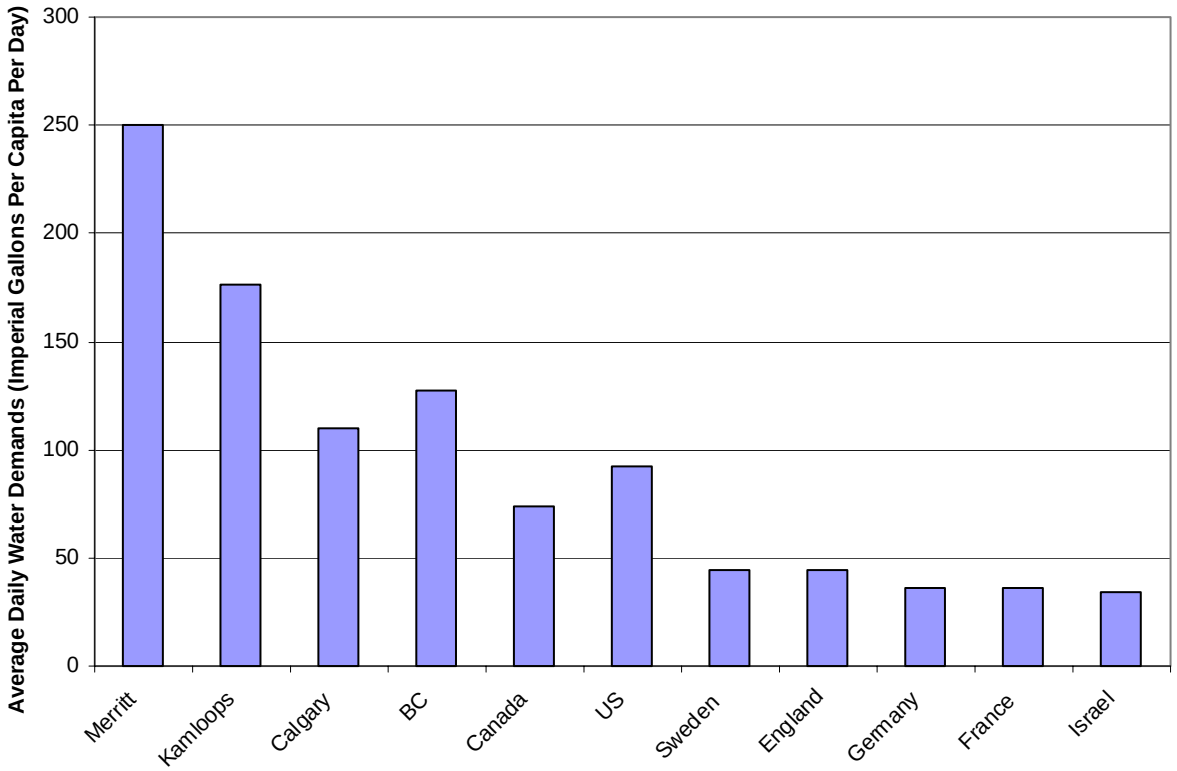
Water use by a relatively small number of "major users" can significantly affect total water consumption. The effect of these major users is important not only because of the water they consume, but also because of their profile within the community. These users can lead by example. The City itself may be counted in this group, with City water use having perhaps an even higher visibility factor than other users.

Major users have many uses in common, but there may also be significant differences in what the water is actually used for. Therefore, it is necessary to understand and work with each major user (individually or perhaps as groups of similar users) to develop and implement conservation initiatives that address the individual needs of each user.

3.4 How Much Water Does Merritt Use?

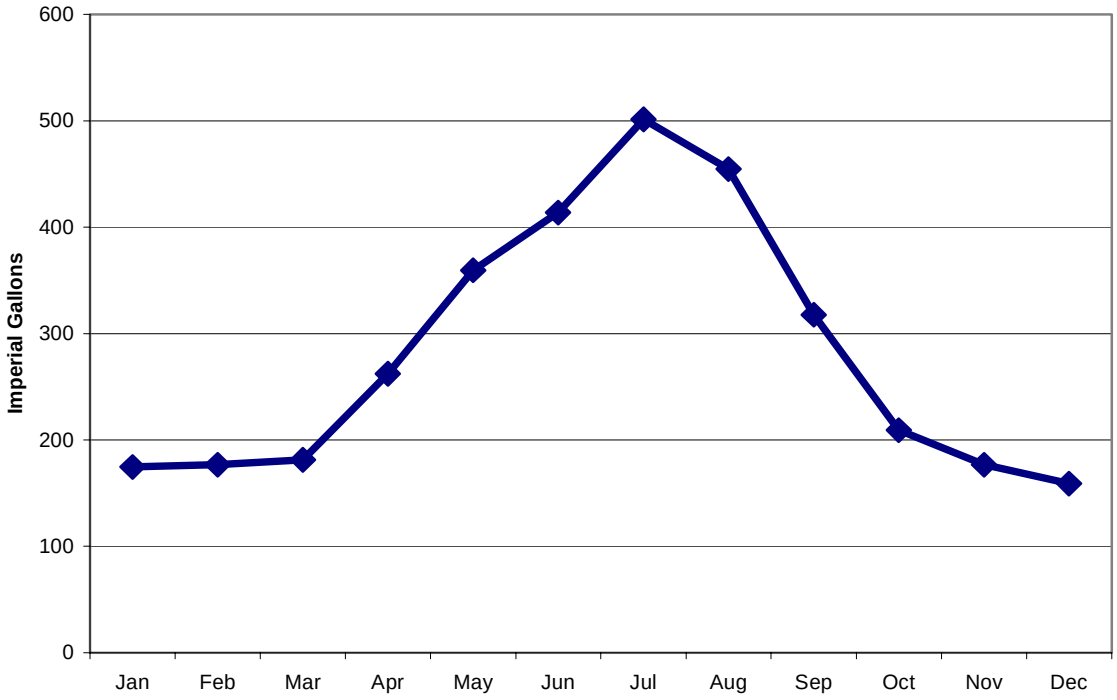
Typically, Merritt residents use a large amount of water, and this is especially true during the summer months when water demands increase due to the semi-arid climate and the ensuing hot, dry weather. When compared to other areas, Merritt residents use a large amount of water. The following figure compares average water use in the City of Merritt to Kamloops (which has a similar climate), Calgary, BC, Canada and other parts of the world.

Figure 1: Average Water Demands in Merritt and Elsewhere



Water use in Merritt is not consistent throughout the year. Peak water demands during the summer period are directly related to a range of summer outdoor uses including lawn and garden irrigation as well as car and driveway washing. These uses place considerably more demand on the water utility than is the case during the rest of the year. This is a significant point because utility system components must be sized according to peak demands. The profile of seasonal water use in Merritt is shown below.

Figure 2: City of Merritt - Average Daily Water Use (Gallons) Per Person 1987 - 2002

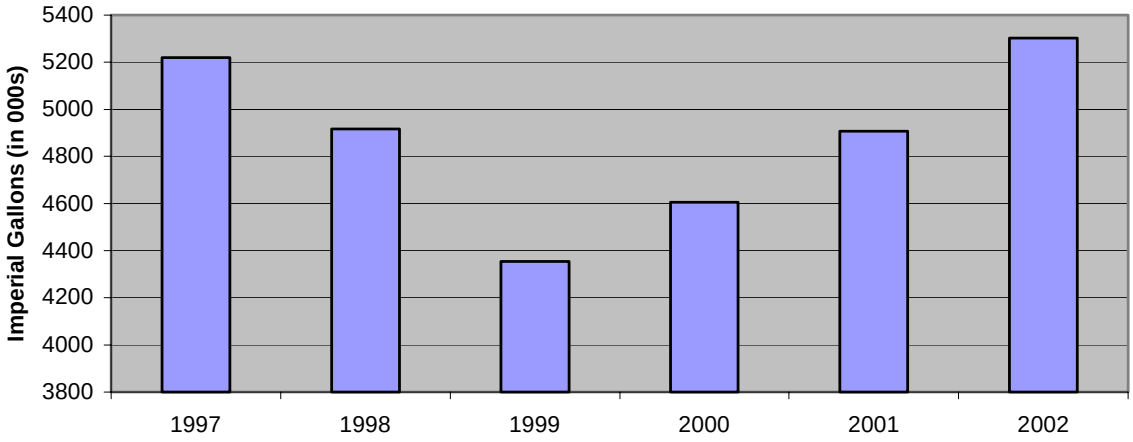


For each of the years presented, highest day use occurred between mid-July to early August at approximately 500 imperial gallons per day, per person. Daily water use during the winter months generally ranged from 160 to 200 imperial gallons per person. This is a 210% increase in water use when compared to average daily water use during the winter months.

The following figure illustrates the highest daily water use in Merritt. As indicated below, the amount of water consumed by Merritt residents in a single day increased to 5.3 million imperial gallons in 2002. This is a significant increase in the highest daily use as recorded over the past

four years. These daily figures occurred on very hot, dry days during the summer months, and illustrate a considerable increase in water use. Generally, the average daily use during the winter months ranges from less than 1.0 to 1.3 million imperial gallons. When comparing lowest and highest use averages, the increase in water use increased 430% during 2002.

Figure 3: City of Merritt - Highest Daily Water Use



3.5 The Costs of Water in Merritt

The expenditures incurred by the City of Merritt on average over the past six (6) years to provide water and waste water services to its customers are as follows:

Table 1: Water and Wastewater System Expenditures

System	Average annual expenditures*
Water System	$278,080
Wastewater System	$485,152
Total Expenditures	**$763,232**
Average cost per capita**	$101.10

* Average for 1997 to 2002 inclusive.

** BC Stats estimated population is 7,549 for 2001

3.6 Water Conservation in Merritt

Since 1993, the City has undertaken water conservation efforts including public education and promotion of water conservation. Water conservation programs in Merritt appeared to be effective since average daily water use per person significantly decreased after an awareness program was introduced in 1993 (see figures 4 and 5). However, this does not take into consideration other factors that may influence water demand including annual variations in temperature and precipitation.

In 1998, the City enacted a bylaw that restricts outdoor water use with the intent to reduce peak summer water demands. To date, enforcement of the bylaw has been limited to providing information to violators rather than imposing fines. It is unknown what the rate of compliance is among users.

3.7 Water Conservation Public Awareness Programs

In 1993, 1998, 1999 and 2000, the City hired a water conservation coordinator for the summer months. The program included: educational programs in elementary schools, bike patrol, advertising, media coverage, and promotions. These programs were highly visible within the community and the widespread exposure of the program put the message of outdoor water conservation in the minds of the public. The intent of these programs was designed to reduce peak demand during the summer months.

In order for water conservation awareness to be successful, it is important to keep the messages out in front of the public on an on-going basis with additional emphasis on reducing overall water consumption. This is effective in terms of:

- reducing flows to the sewage treatment plant;
- reducing costs to pump and store water;
- preserving the City's aquifer and main source of water, and;
- maximizing the useful service life of an existing water and sewer infrastructure.

3.8 Water Conservation Regulations and Bylaws

The City has taken steps to introduce regulations in the interests of reducing water demand. These include regulating outdoor water which is aimed at reducing peak demands in the summer, and the installation of water saving features and fixtures aimed at reducing overall demand.

In 1998, Council adopted a policy statement which included the implementation of watering restrictions for outdoor watering activities. For example, based on civic address, even addresses water on even calendar days, odd addresses water on odd calendar days. This applies between June 1st until August 30th and irrigation is only permitted between 6:00 am to 10:00 am and 6:00 pm to 10:00 pm for basic sprinklers. For properties with irrigation systems, sprinkling is permitted midnight to 7:00 am. Even addresses can sprinkle on Monday, Wednesday and Friday and odd street addresses can sprinkle on Tuesday, Thursday and Saturday.

The City also requires the installation of water conserving fixtures in all new construction. The City's Waterworks Bylaw No. 1640 specifies the following:

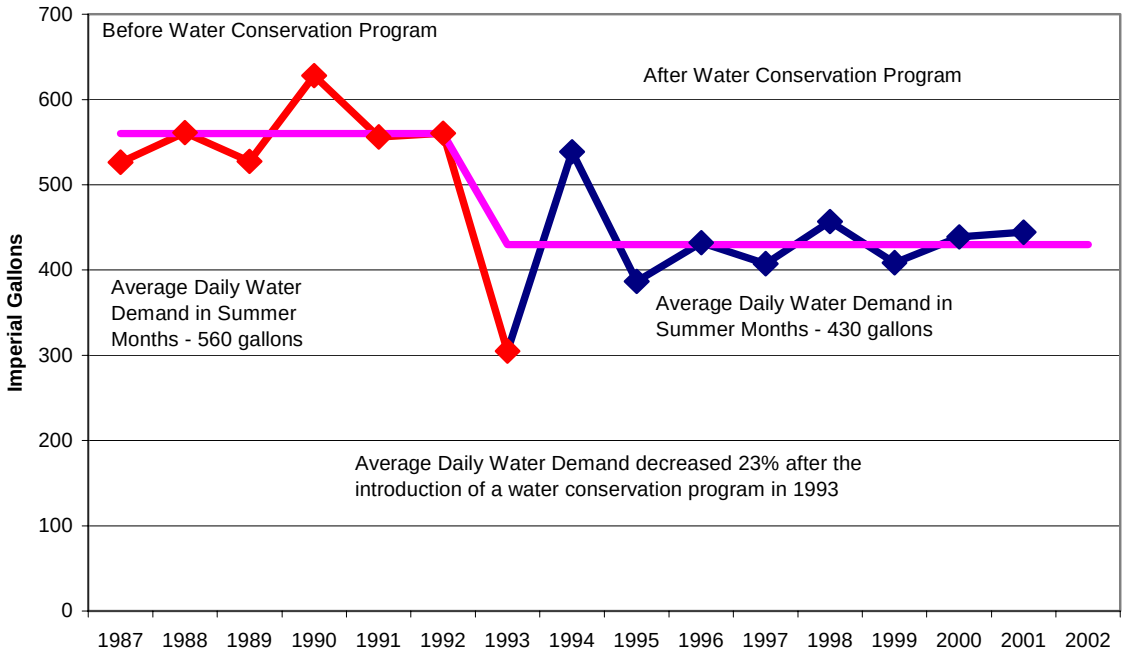
- all toilets installed in newly constructed buildings must be equal to or less than 6 litres per flush and urinals must have a direct flush valve;
- provision should be made on all new services and all existing non-residential buildings for the installation of water meter readout equipment; and,
- water dependent cooling systems are not permitted in commercial, industrial, institutional or residential applications.

It is unclear how much public knowledge or enforcement there is of these requirements.

3.9 Effectiveness of Past Water Conservation Programs

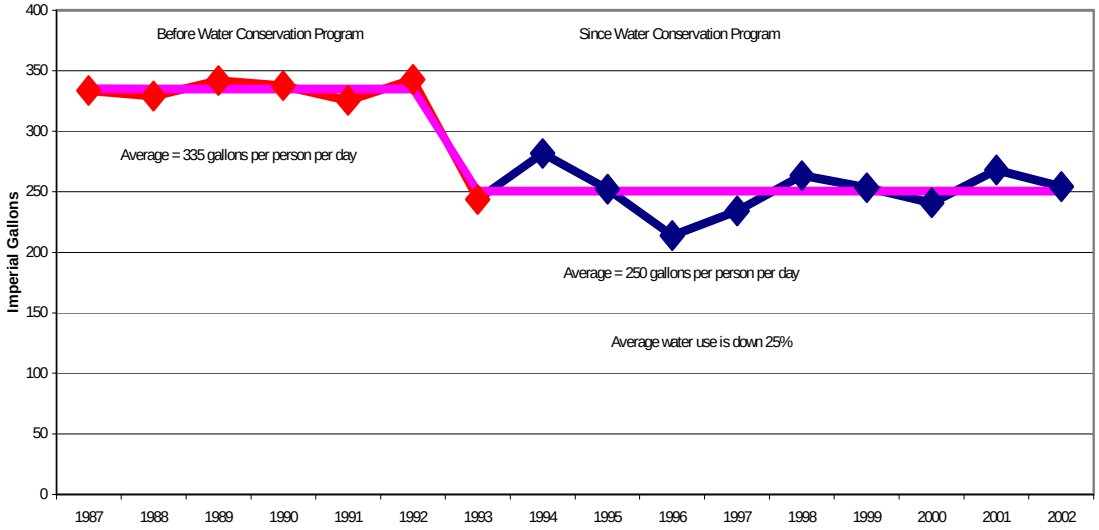
Since the promotion of water conservation awareness began in Merritt in 1993, residents appear to be using water more efficiently. During the past decade, these efforts appear to have achieved positive results. As shown in the figure below, peak demands during the summer months of July and August have reduced by 23%. Average daily demands during the summer months have decreased from 560 gallons per person to 430 gallons per person.

Figure 4: City of Merritt - Average Daily Water Use Per Person
Summer Months (July and August)



Although Merritt's water conservation initiatives have focused on outdoor water conservation measures, data supplied by the City further indicates that water use throughout the year has also decreased over the past decade. Figure 5 below indicates that daily water use throughout the year has decreased by 25%. Average daily demand has reduced from 335 gallons per person per day to 250 gallons per person per day.

Figure 5: City of Merritt - Average Daily Water Use Per Person (January to December)



Overall, reductions in water demand seem to be directly related to the introduction of an education program. It is safe to assume that these initiatives appear to have created a heightened awareness about water conservation. As will be discussed, these efforts could be expanded by changing the focus of current water conservation measures to further reduce overall water demand.

3.10 Future Water Conservation Programs

To date, water conservation programs in Merritt have occurred sporadically since the early 1990s. In years when water conservation programs have been in place, programming focused on reducing outside water use through education programs and sprinkling regulations. These programs have occurred independently of each other without a comprehensive plan in place to guide intended results. As shown in Figures 4 and 5, these programs have been reasonably successful, but now is the time to move to the next level in water conservation planning.

Water conservation in Merritt is an important consideration from several perspectives as outlined in this section. In order to ensure water conservation becomes increasingly effective, it will be essential that the City proceed with a long-term strategy that is more thoughtful and comprehensive which will provide long term continuity and direction. In addition, to be successful, the strategy needs to be quantifiable and engage the public in a meaningful way.

4.0 MOVING TOWARDS MERRITT'S WATER CONSERVATION STRATEGY

4.1 Purpose

The purpose of this section is to present ways in which the City can move towards developing a strategy that will ensure the success of future water conservation efforts in Merritt. By taking action, the City will be on its way towards designing and implementing a long-term water conservation strategy that will build on the successes of water conservation efforts to date. Merritt is well positioned to take even greater leaps in conserving water within the community, but this will require a program that is sustained each and every year with clearly defined guiding principles and goals.

4.2 Approach to the Strategy

The strategy provides direction for on-going efforts with respect to water conservation in Merritt. As such, the strategy is aimed at long range planning with the intent to evaluate water conservation programming, learn from successes and failures and analyze applicable data on an on going basis. The following discussion suggests ways in which the City can begin to move in that direction by undertaking activities within the following approach areas:

- Administrative approach;
- Coordinated approach;
- Comprehensive approach; and,
- Quantifiable approach.

4.2.1 Administrative Approach

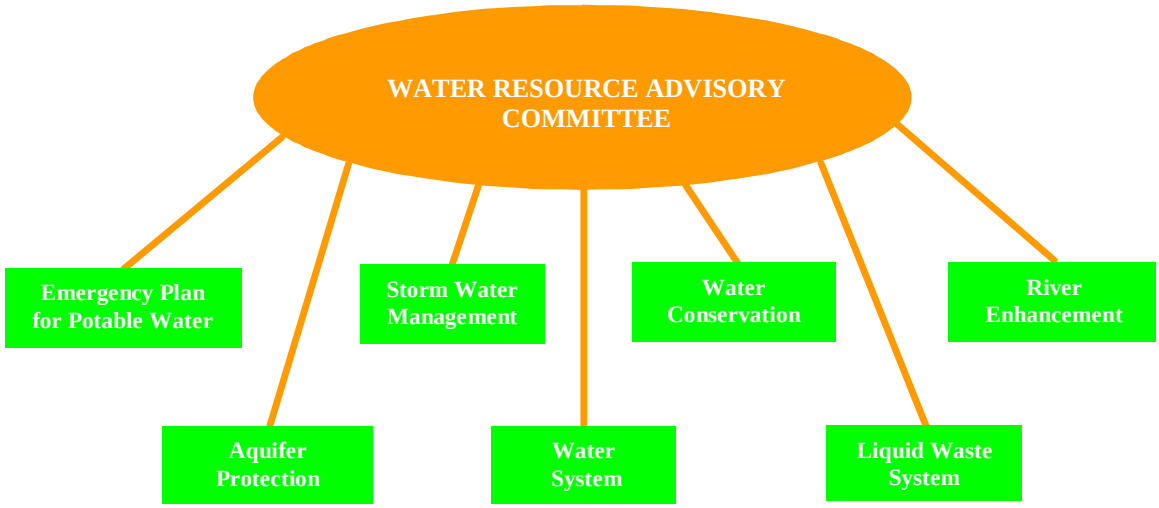
This approach suggests ways in which the strategy should be administered.

- Establish a water resource advisory committee

  The first step in moving the water conservation strategy is to establish an advisory committee. This could be a stand-alone committee or an infrastructure advisory committee which would be armed with a mandate that specifically includes water conservation. This committee would be responsible for moving the water conservation strategy forward, ensuring goals and objectives are met, and providing consistent guidance and leadership

within the community. The committee would also provide valuable linkages to other water related activities in the City. Figure 6 below illustrates potential elements that could be considered by the water resource advisory committee.

Figure 6: Suggested Links for Water Resource Advisory Committee



The City currently has an advisory committee which deals with aquifer protection planning, but the mandate of this existing committee is not directly related to water conservation. Also, the committee is largely made up of City staff and councilors; few representatives of the public are on this committee.

- Engage community involvement

To date, City staff has administered water conservation programming in Merritt without public input. However, in order to ensure community-wide participation, the public must be fully engaged in the planning and implementation stages of water conservation. The traditional top-down approach to water conservation will not take Merritt to the next level in terms of decreasing water demand. This means members of the public who have an interest in water conservation should be part of the committee. This will facilitate buy-in and promotion of the program throughout the City and will promote accountability by the City in terms of implementing the program. In addition, on-going community participation helps maintain and build support for achieving conservation goals and "getting the word out" about the conservation effort. Participants can act as a focus group to explore specific conservation

measures and also to provide linkages to community groups such as residents, businesses, service groups and institutions.

Members of the community who might be interested in water conservation include:

- Residential water consumers
- Commercial water consumers
- Industrial water consumers
- Environmental groups
- First Nations
- Government agencies
- Labour groups
- Business and commerce groups
- Agricultural Users
- Watershed management groups
- Educational institutions

- Commitment by Council

The long-term success of a coordinated water conservation strategy requires on-going support from Council and City staff. Water conservation must be seen to be a priority. This means resources must be committed to the strategy on an on-going basis. One way to ensure this happens is to allocate funds for these efforts within the annual budget. Over the past few years, the City committed, on average, $5,000 towards water conservation in the annual budget. The following table outlines City actual funds used for water conservation related activities on an annual basis.

Table 2: City Spending on Water Conservation (1997 to 2002)

Year	City Spending on Water Conservation
1997	$2,516
1998	$5,095
1999	5,421
2000	$0
2001	$2,569
2002	$468

Source: City of Merritt Ten Year Budget Report, 2003

4.2.2 Coordinated Approach

A well coordinated and organized approached will be necessary to move the initiative forward.

- Establish direction

  Problem solving can be difficult if the purpose of the strategy gets confused or derailed. Details and side issues can often distract decision makers so it is important to lay the groundwork so that as the strategy progresses, the direction is clearly defined.

- Determine goals and guiding principles

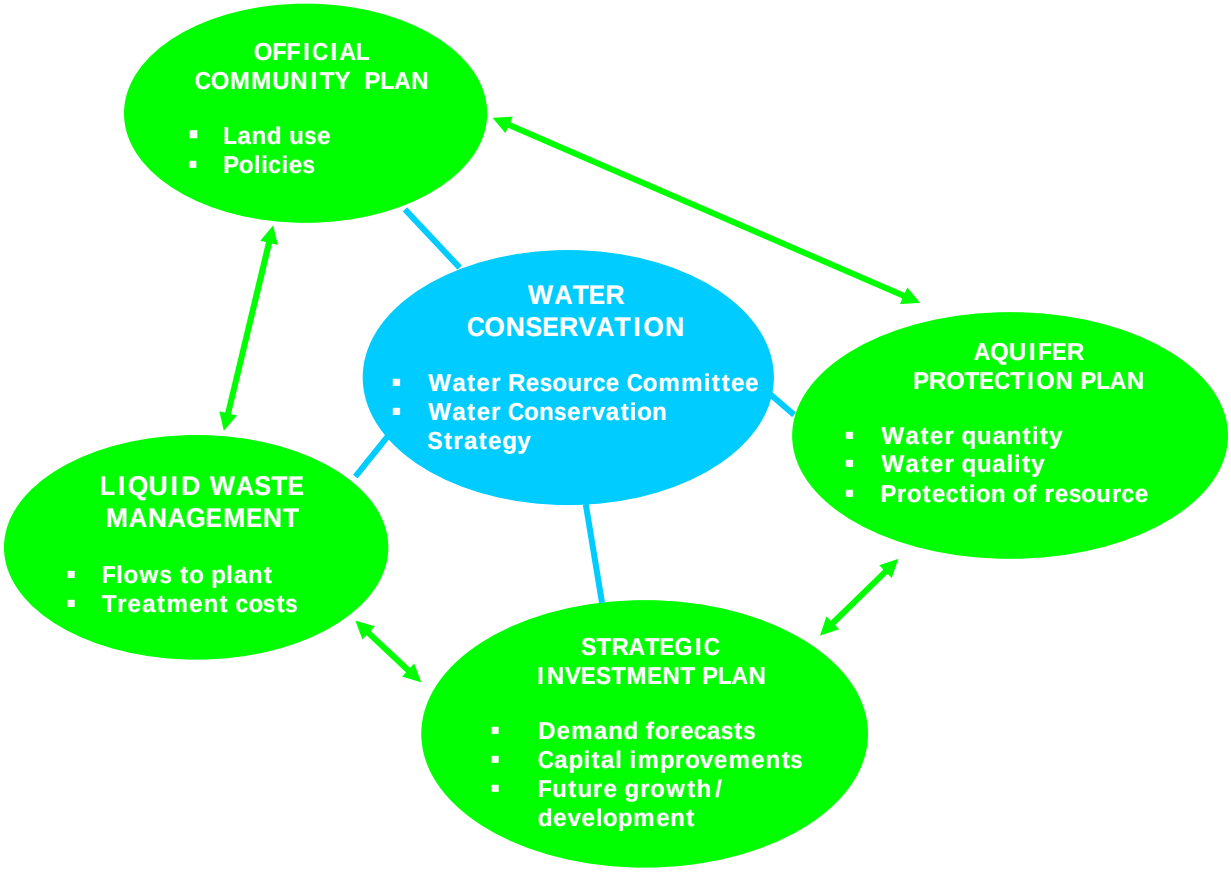
  Implementation of a successful strategy requires a clearly defined framework and criteria to determine priorities. Establishing goals and guiding principles helps to chart a course of action and accomplish objectives. Goals are specific milestones that are used to measure success. Guiding principles act as a filter to ensure specific activities are coordinated and consistent and that the objectives are met.

  Affected members of the community and the water conservation committee must be involved in the development of conservation planning goals and guiding principles and throughout the implementation process.

- Integration with other planning exercises

  Multiple planning exercises occur on an on-going basis which tie directly into water conservation. For example, land use planning exercises such as the City's official community plan and zoning bylaw will have a direct effect on water conservation efforts. In addition, the City has recently embarked upon an aquifer protection plan and a uni-directional flushing program. Plans are also in place to prepare a strategic investment plan which will assess new development, land use and infrastructure requirements. These planning exercises must be integrated in water conservation programming because of the direct implications of each. Figure 7 provides an illustration of potential linkages with other planning initiatives.

Figure 7: Linkages with Other Planning Exercises



4.2.3 Comprehensive Approach

Since water conservation efforts began in Merritt in the early 1990's, the City has achieved some success in decreasing peak demands by largely focusing on reducing short range daily peak flows. However, there is potential to expand this to achieve even greater success in demand management. This could be accomplished by developing a longer term program that is sustained year after year, works towards long range goals and is more clearly defined.

- Long – term commitment

  Water conservation should be a long-term commitment. This means that programming for water conservation becomes a long-term objective which occurs every year without exception. The City should be able to say, with complete certainty, that in ten years Merritt will still be fully engaged in water conservation efforts.

- Continuity

  The water conservation strategy will provide continuity to water conservation programming that builds on previous programs and works toward long-term goals. This will provide greater success and results on a long-term basis rather than short term, ad hoc programming on an annual basis.

  To date, most water conservation efforts have been fairly one-dimensional, focusing on outside single-family residential water use by means of public education. To reach the next level of effectiveness, the program must be broadened to a wider target audience including major commercial and industrial users and such. Other methods must also be considered (i.e. billing information, pricing strategies, etc.) so that the message of water conservation is consistently bolstered by all City policies and activities.

- Evaluation and monitoring

  Program monitoring is an essential component of water conservation efforts because it presents the opportunity for public feedback on the process and evaluation by the committee. This provides the City with additional opportunities to promote the program by soliciting input from the public and offers valuable information for future water conservation efforts. Learning about what worked and what did not work will be critical to the overall success of the program in Merritt in future years. Members of the community who are involved with water conservation programming can offer input on the level of satisfaction with the program and assist in monitoring results and adjusting program implementation.

4.2.4 Quantifiable Approach

Having a comprehensive data bank will provide valuable information for future decision-making. This information can be used to gain a thorough understanding of the factors that affect water conservation and allow the annual programs to be adjusted and targeted for maximum effectiveness.

- Assess the existing system

By taking an inventory of the City's existing resources, the City will be better prepared to assess their present circumstances and design strategies to meet emerging needs. Worksheet 3-1 in Appendix A, as prepared by the USEPA, provides a starting point for gathering this information. The City may wish to modify this as applicable.

- Forecast demand

  Understanding how much water will be used in Merritt in the future is an important consideration in planning for water conservation. This is particularly important in planning for capital improvements or upgrades. As demand decreases or increases, the need for capital expenditures will also decrease or increase. Forecasting future water demands will be undertaken as part of the Strategic Investment Plan in 2003/2004, and the findings of that exercise will be useful in considering the direction and focus of future water conservation efforts. The USEPA provides a worksheet which can assist in preparing these forecasts. A sample of this is supplied in Appendix A, Worksheet 3-2.

- On-going data capture and analysis

  Reliable and comprehensive data capture must be maintained in order to ensure continual and meaningful analysis with respect to water conservation. Not only does this mean gathering data on an on-going basis, but it also means documenting significant water use events over time to keep track of anomalies that may skew water use data (e.g. boundary expansion to include Collettville, periods when water conservation programs were in place, changes in enforcement of sprinkling restrictions, correlation with weather conditions, etc.). This may mean introducing a long-term monitoring system. In addition, a comprehensive analysis of water use and the resulting effects of the various events will be extremely valuable.

4.3 Establishing Goals and Guiding Principles

The following section provides suggested directions that the City may wish to take in terms of establishing goals and guiding principles for the strategy. However, these suggestions simply provide a starting point. Additional thinking will be required with input from an appropriately appointed committee and the public.

4.3.1 Water Conservation Planning Goals

Goals are specific milestones that will help the City to evaluate progress of water conservation efforts over the long-term. These goals will be measured against the specific tactics and measures employed by the City to achieve results.

Suggested water conservation planning goals include:

- Reduce overall water demand; not just peak demands
- Postpone the need for capital projects
- Avoid new source developments (i.e. new wells, pumps, etc.)
- Educate the public about the value of water in Merritt
- Protect and preserve water resources
- Produce measurable results
- Ensure programming is on-going every year
- Integrate water conservation with other issues
- Evaluate and monitor programs on an on-going basis

As mentioned earlier in this strategy, lowering water demand in Merritt can help to ensure the long-term sustainability of Merritt's aquifer which is the City's source of water. Reducing demand also postpones the construction and operation of additional facilities for water extraction, water and wastewater treatment systems. In the long term, this benefits the City and consumers both monetarily and environmentally.

4.3.2 Water Conservation Guiding Principles

Suggested guiding principles include the following:

1. Be informative

a. Continue to inform the public about the importance of water conservation in the City of Merritt.

b. Ensure public conservation materials are educational and easy to understand for all ages.

2. Reduce overall water consumption levels

a. Promote reductions in overall water use per person on annual and seasonal (summer) basis.

b. Promote reductions with major users.

c. Promote alternate sources of supply.

3. Engage community-wide participation

a. The entire community should feel they are a positive part of the action. Each water user should feel they are a catalyst for reducing demand rather than feeling the program is punitive.

b. The public should be represented on the water committee that will be responsible for preparing and implementing the water conservation strategy.

4. Ensure High Profile and Visibility of Water Conservation program

a. Water conservation should be part of everyday life in Merritt. This can be achieved by ensuring water conservation is constantly "out in front" of the community.

b. Public representation on the water committee will provide a natural link between the decision-making body and water users.

5. Build on successful steps

a. Water conservation is an ongoing, incremental process. Implementing programs that generate momentum and build on past efforts will produce results.

b. Demonstrating appreciation for public support of conservation measures to date will go a long way towards garnering momentum and support for programs.

6. Quantify the effectiveness of the water conservation program on an on-going basis to track peak use and annual use between years of similar climate to gauge results

a. Track how water is used and the quantities of water used.

b. Filling out forms (worksheet supplied by the USEPA are attached in Appendix A, and could form the basis for establishing data capture).

c. Document significant events (i.e. boundary expansion to include Collettville, periods when water conservation programs were in place, changes in enforcement of water restrictions, correlation with weather conditions, etc.).

7. Ensure water conservation measures make efficient use of resources

a. City's institutional memory (i.e. Council, staff, consultants, public, etc.) has considerable knowledge with issues related to water conservation.

b. There must be accountability for financing.

5.0 WATER CONSERVATION MEASURES

As a result of increased water pressure, on-going summer demands, and impending infrastructure upgrade requirements, reducing overall demands on the City's water system throughout the year is increasingly important. This can be employed through a number of alternatives as suggested by the US Environmental Protection Agency (USEPA). The USEPA suggests the following water conservation measures for municipalities with the same population as Merritt (i.e. serves up to 10,000 people). These measures include:

- Universal metering
- Water accounting and loss control
- Costing and pricing strategies
- Information and Education

To date, the City's efforts have focused almost entirely on one aspect of the last measure. Although these are valuable, there are additional measures that could be applied to Merritt. While the USEPA suggests the following tools be implemented in communities that are larger than 10,000, these should be considered in the context of Merritt. These include:

- Water-Use Audits
- Retrofits
- Pressure Management
- Landscape Efficiency
- Replacements and Promotions
- Reuse and Recycling
- Water-Use Regulations
- Integrated Resource Management

Table 3 below outlines potential water conservation measures and assesses the viability of these in the context of the City of Merritt. Information is supplied with respect to each measure as it applies to Merritt and presents the status of the measure as well as comments, options and recommendations. This provides a brief summary of each initiative. However, each initiative is described in greater detail in Appendix B as provided by the USEPA.

Table 3
Potential Water Conservation Measures[3]

Measures	Tools	Applicable to Merritt	Present Status	Comments/Options/Recommendations
Universal Metering	• Source-Water Metering	Yes	All wells metered & read daily	Meter accuracy should be verified periodically
	• Service-Connection Metering	Yes	Commercial/major users read quarterly - new residences installed - not read	Read major users more frequently Voluntary residential reading*
	• Public-Use Water Metering	Yes	No meters in place	High efficiency sprinklers/independent supply may be relevant for Parks*
Water Accounting and Loss Control	• Account for Water	No		Requires universal metering to be effective
	• Repair Known Leaks	Yes	Repair when leaks are observed	Leaks generally not recorded
	• Analysis of Non-Account Water	No		Relevant only if revenue received from metered water
	• System Audit	No		Relevant as input for analysis of non-account water
	• Leak Detection and Repair Strategy	Yes	No leak detection undertaken except on Nicola	GIS not available, could start with historic material/location analysis*
	• Automated Sensors/Telemetry	Maybe	Existing SCADA/sensors may not support	SCADA sensor upgrades should consider possible requirements
	• Loss-Prevention Program	Yes	Some actions in place, e.g., uni-directional flushing	Other options: proactive "repair", review of other utility uses*

[3] Based on *USEPA Water Conservation Plan Guidelines*.

Table 3 - Potential Water Conservation Measures *(continued . . .)*

Measures	Tools	Applicable to Merritt	Present Status	Comments/Options/Recommendations
Costing and Pricing	• Cost-of-Service Accounting	Maybe		System review to determine applicability.
	• User Charges	No	Parcel tax, older (pre 1992?) Flat rates for commercial, etc.	Only relevant if move to meters and more sophisticated pricing
	• Metered Rates	Maybe	Apply only to metered industrial and commercial	Likely most applicable if high proportion of users are metered
	• Cost Analysis	Maybe		Useful prior to any change in rate structure
	• Non-Promotional Rates	Maybe	Current meter rate is flat	Should be considered only after review of costs and rates *
	• Advanced Pricing Methods	No		Not likely practical at this time
Information and Education	• Advisory Committee	Yes	Current Committee mandate is aquifer only	Public Advisory Committee with specific mandate to include water conservation is recommended *
	• Understandable Water Bill	Yes	Current bill provides basic information only	May want to consider adding information related to actual cost/volumes, etc.
	• Information Available			Brochures available
	• Informative Water Bill	Yes	Current bill provides basic information only	May want to consider adding information related to actual cost/volumes, etc.
	• Water Bill Inserts	Yes	May have been used in past	Could include in utility bills*
	• School Program	Yes	Program under development 2003	Program should be ongoing - directed by Committee*
	• Public Education Program	Yes	Various since 1993 may not run all years	Program should be ongoing - directed by Committee*
	• Workshops	Yes		Program should be ongoing - directed by Committee*

Table 3 - Potential Water Conservation Measures *(continued . . .)*

Measures	Tools	Applicable to Merritt	Present Status	Comments/Options/Recommendations
Water Use Audits	• Audits of Large-Volume Users	Yes	Not done now	Requires understanding of user's process, consider in concert with other initiatives, e.g., cross connection control *
	• Large-Landscape Audits	Yes	Not done now	Could begin with City Parks and School District*
	• Selective End-Use Audits	Yes	Not done now	Could be coupled with Retrofit Programs *
	• Independent Supplies	Yes	Golf Course only - other park supplies abandoned	Cross-connection issue must be addressed - most applicable to larger users *
Retrofits	• Retrofit Kits Available	Yes	Not done now	Could be publicized through bill inserts*
	• Distribution of Retrofit Kits	Yes	Not done now	Distribution through community groups could be effective *
	• Targeted Programs	Yes	Not done now	Options; older homes, motels, public buildings/schools *
Pressure Management	• System-wide Pressure Management	No		Cost of conversion would be very high in Merritt
	• Pressure-Reducing Valves	Yes	Mot done now	Could be mandated for new construction - encourage as part of retrofits *
Landscape Efficiency	• Promotion of Landscape Efficiency	Yes	Some materials developed	Regulatory bylaws regarding landscaping could be utilized *
	• Selective Irrigation Sub-metering	Yes		Could be used in conjunction with landscape audits, must consider costs/benefits *
	• Landscape Planning and Renovation	Yes		Bylaw amendments could be useful *
	• Irrigation Management	Yes		Pricing to encourage use of more elaborate system and public education desirable *

Table 3 - Potential Water Conservation Measures *(continued . . .)*

Measures	Tools	Applicable to Merritt	Present Status	Comments/Options/Recommendations
Replacements and Promotions	• Rebates and Incentives	Yes		Cost and effectiveness should be considered *
	• Promotion of New Technologies	Yes		Partnering with local businesses could be an option *
Reuse and Recycling	• Industrial Applications	Maybe		Should keep in mind during "Large-Volume Audits"/"Independent Supplies" *
	• Large-Volume Irrigation Applications	Maybe		Should be bourn in mind during "Large-Volume Audits"/"Independent Supplies" *
	• Selective Residential Applications	No		Likely not feasible given current health/regulatory standards
Water Use Regulation	• Water-Use Standards, Regulations, Enforcement	Yes	Sprinkling restrictions are in place annually	To date, enforcement of restrictions has been through voluntary compliance. Compliance could be enforced more rigorously if considered appropriate. Other standards/regulations could be implemented if deemed cost effective *
	• Requirements for New Developments	Maybe		Targeted incentives or pricing may be more effective *
Integrated Resource Management	• Supply-Side Technologies	Maybe		Should be considered when land use bylaws are updated
	• Demand-Side Technologies	Maybe		Should be considered in Large-Volume Audits

* Potential for implementation in Merritt
Requires consideration by Committee/Staff

Recommended to:

- Determine Obstacles/Issues/Costs/Benefits
- Assign Priority
- Develop Implementation Plan
- Recommend Implementation
- Monitor Progress/Effectiveness

Before introducing additional measures within the City or continuing with existing measures, it is recommended that the City prepare the following estimates in order to facilitate a cost-benefit analysis associated with each measure under consideration. Suggested estimates include:

- total implementation costs (dollars);
- anticipated water savings (volume); and
- assess the cost effectiveness of the measure.

6.0 CONCLUSION AND RECOMMENDATIONS

This Water Conservation Strategy provides a summary of water use in Merritt, outlines the unique features of the City's water system and analyses past water conservation efforts. Merritt has had success with water conservation programming, and as such, there is great potential to build on this and to continue to reduce water demands both during peak times and throughout the year. The suggestions presented in this strategy provide direction for the City in terms of moving toward a long-term, coordinated effort that is clearly defined and provides maximum benefit.

Key recommendations of this strategy suggest the following steps be taken:

- **Establish a water resource advisory committee**. This committee should include significant public representation and a specific mandate for water conservation. The committee will provide on-going leadership and direction for water conservation in the City. This will be critical to the overall success of the program and will engage the public in a meaningful way.
- **Determine direction for the program**. A clearly defined framework is necessary to ensure planning and implementation of the program works towards the goals and objectives that have been agreed upon.
- **Promote long-term commitment and continuity**. Once direction has been set for the program, it will be necessary to ensure on-going commitment of the program on an annual basis. This means that water conservation becomes part of the leadership culture in Merritt.
- **Ensure on-going monitoring, evaluation and analysis**. In order to ensure high quality programming that is relevant and effective, evaluation and monitoring of water conservation efforts will be necessary.
- **Quantify information necessary for decision-making**. Accurate and thorough information is necessary to make sound and defensible decisions. Reliable data gathered on an on-going basis will provide decision makers with the tools necessary to assess the existing system and forecast demands.

Successful implementation of water conservation will depend upon the level of commitment demonstrated by City Council and staff. Once that is established, it will be possible to gauge the degree to which water conservation will be promoted and begin working towards a long-term program that integrates the recommendations of this strategy.

APPENDIX A

United States Environmental Protection Agency (USEPA) Worksheets

Worksheet 3-1: Water System Profile

SUMMARIZE SYSTEM CHARACTERISTICS

A	SERVICE CHARACTERISTICS	Number
1	Estimated service population	
2	Estimated service area (square miles)	

B	ANNUAL WATER SUPPLY	Annual volume	Percent metered
3	Total annual water supply		%

C	SERVICE CONNECTIONS	Connections	Percent metered
4	Residential, single-family		%
5	Other		%
6	Total connections		%

C	WATER DEMAND	Annual volume	Percent of total	Per connection
7	Metered residential sales			
8	Metered nonresidential sales			
9	Other metered sales			
10	Unmetered sales			
11	Nonaccount water [a]			
12	Total system demand (total use)			

D	AVERAGE & PEAK DEMAND	Volume	Total supply capacity	Percent of total capacity
13	Average-day demand			%
14	Maximum-day demand			%

F	PRICING	Rate structure [b]	Metering schedule [c]	Billing schedule [c]
15	Residential rate			
16	Nonresidential rate			
17	Other rate			

G	PLANNING	Prepared a plan ☑	Date	Filed with state ☑
18	Capital, facility, or supply plan			
19	Drought or emergency plan			
20	Water conservation plan			

(Worksheet continues)

Worksheet 3-1 (continued)

SUMMARIZE SYSTEM CONDITIONS

H	PLANNING QUESTIONS	Yes	No	Comment
21	Is the system in a designated critical water supply area?			
22	Does the system experience frequency shortages or supply emergencies?			
23	Does the system have substantial unaccounted-for and lost water?			
24	Is the system experiencing a high rate of population and/or demand growth?			
25	Is the system planning substantial improvements or additions?			

SUMMARIZE CURRENT CONSERVATION ACTIVITIES

Water conservation measures	*Approximate* annual water savings [if known]	Implemented since (date)	Is continued implementation planned?

[a] Nonaccount water is water not metered and sold to customers (including authorized and unauthorized uses). See Appendix A, figure A-7 and Worksheet A-2.
[b] Uniform, increasing-block, decreasing-block, seasonal, or other.
[c] Quarterly, monthly, or other.

Worksheet 3-2: Water Demand Forecast [a]

Line	Item	Current Year	5-Year Forecast	10-Year Forecast
A	**TOTAL ANNUAL WATER DEMAND**			
1	Current total annual water demand (from Worksheet 3-1) [a]			
2	Current population served [b]			
3	Total water demand per capita (line 1 divided by line 2) [b]			
4	Projected population [b]			
5	Projected total annual water demand (line 3 multiplied by line 4)			
6	Adjustments to forecast (+ or -) [c]			
7	Adjusted total annual water demand (line 5 plus line 6)			
8	Current annual demand (line 1) and adjusted annual water demand forecast (line 7 for forecast years)			
9	Current and projected annual supply capacity (from Worksheet 3-1) [d]			
10	Difference between total annual water demand and total annual supply capacity (+ or -) (subtract line 8 from line 9)			
B	**AVERAGE-DAY AND MAXIMUM-DAY DEMAND**			
11	Current and forecast average-day demand (line 8 divided by 365)			
12	Current maximum-day demand (from Worksheet 3-1)			
13	Maximum-day to average-day demand ratio (line 12 divided by line 11)			
14	Projected maximum-day demand (line 13 multiplied by line 11 for all forecast years)			
15	Adjustment to maximum-day demand forecast [c]			
16	Current (line 12) and adjusted maximum-day demand forecast (add lines 14 and 15)			
17	Daily supply capacity (line 9 divided by 365)			
18	Ratio of maximum-day demand to daily supply capacity (line 16 divided by line 17)			

[a] Separate forecasts should be prepared for large-volume users, as well as for nonaccount water (water not billed to customers) if nonaccount water is a significant amount (such as more than 10 percent of total production).

[b] Managers can use connections instead of population and per-connection water use instead of per-capita water use.

[c] Please explain adjustments to your forecast (lines 6 and 15), including effects of installed conservation measures and rate changes.

[d] Supply capacity should take into account available supplies (permits), treatment capacity, or distribution system capacity and reflect the practical total supply capacity of the system, including purchased water.

APPENDIX B

Potential Water Conservation Measures

As identified by the United States Environmental Protection Agency (USEPA)
in
USEPA Water Conservation Plan Guidelines

POTENTIAL WATER CONSERVATION MEASURES

The following water conservation measures are provided to supplement information provided in Section 5.0 Water Conservation Measures. These measures are suggested as part of the USEPA Water Conservation Plan Guidelines. This section explains each water conservation measure including a description and potential implementation options.

1. Universal Metering

- **Source-water metering** Both the supplier and the customer benefit from metering. Source metering is essential for water accounting purposes.

- **Service-connection metering** Service-connection metering is needed to inform customers about how much water they are using; suppliers use metering data to more accurately track water usage and bill customers for their usage.

- **Public-use water metering** All water provided free of charge for public used should be metered and read at regular intervals. This will allow the utility to more accurately account for water. Lack of metering undermines loss control, costing and pricing, and other conservation measures.

2. Water Accounting and Loss Control

In many respects, water conservation begins on the supply side. All water systems will benefit from a water accounting system that helps track water throughout the system and identify areas that may need attention, particularly large volumes of non-account water. Non-account water includes water that is *metered but not billed*, as well as *all unmetered* water. Unmetered water may be authorized for such utility purposes (such as operation and maintenance) and for certain public uses (such as fire hydrant maintenance). Unmetered water also includes unauthorized uses, including losses from accounting errors, malfunctioning distribution system controls, thefts, inaccurate meters, or leaks. Some unauthorized uses may be identifiable. When they are not, these unauthorized uses constitute *unaccounted-for water*.

Implementing a system of water accounting is a necessary first step in developing strategies for loss control. The USEPA provides worksheets for in the USEPA Water Conservation Plan Guidelines.

- **Account for water.** All water systems, even smaller systems, should implement a basic system of water accounting. This accounting exercise provides a basis for a strategy to control losses over time.

- **Repair known leaks.** The cost of water leakage can be measured in terms of the operating costs associated with water supply, treatment, and delivery especially in community with universal water metering. Repairing larger leaks can be costly, but it also can produce substantial savings in water and expenditures over the long run.

- **Analysis of non-account water.** Non-account water use should be analyzed to identify potential revenue-producing opportunities, as well as recoverable losses and leaks. Some utilities might consider charging for water previously given away for public use or stepping up efforts to reduce illegal connections and other forms of theft.

- **System audit.** A system audit can provide information needed to make a more accurate analysis of non-account water.

- **Leak detection and repair strategy.** Systems also should institute a comprehensive leak detection and repair strategy. This strategy may include regular on-site testing using computer-assisted leak detection equipment, a sonic leak-detection survey, or another acceptable method for detecting leaks along water distribution mains, valves, services, and meters. Recently, the Merritt tank was drained, inspected and cleaned.

- **Automated sensors/telemetry.** Water systems also consider using remote sensor and telemetry technologies for ongoing monitoring and analysis of source, transmission, and distribution facilities. Remote sensors and monitoring software can alert operators to leaks, fluctuations in pressure, problems with equipment integrity, and other concerns.

- **Loss-prevention program.** This may include pipe inspection, cleaning, lining, and other maintenance efforts to improve the distribution system and prevent leaks and ruptures from occurring. Utilities might also consider methods for minimizing water used in routine water system maintenance procedures in accordance with other applicable standards.

3. Costing and Pricing

Costing and pricing are conservation strategies because they involve understanding the true value of water and conveying information about that value, through prices, to water customers. The use of user charges often is considered a necessary (but not always sufficient) part of a water conservation strategy. Many resources are available on how to account for costs and design water rates.

- **Cost-of-service accounting.** Water systems should use cost-of-service accounting, consistent with generally accepted practices. Many resources are available for this purpose. Understanding and tracking system costs also is a capacity-development strategy for small systems.

- **User charges.** Once costs are established, systems can develop more accurate user charges (or rate structures).

- **Metered rates.** Metered rates should be used so that the customer's water bill corresponds to their water usage. For many systems, change in water rates must be approved by regulators or other oversight bodies. It is important for water systems to communicate with regulators about costs and the need for cost-based pricing.

- **Cost analysis.** Systems should conduct a cost analysis to understand what types of usage drive system costs. For example, systems should analyze patterns of usage by season and class of service.

- **Nonpromotional rates.** Systems also should consider whether their current rate structures promote water usage over conservation; nonpromotional rates should be implemented whenever possible in order to enhance the conservation signal of rates.

  Systems seeking to encourage conservation through their rates should consider various issues: the allocation between fixed and variable charges, usage blocks and breakpoints, minimum bills and whether water is provided in the minimum bill, seasonal pricing options, and pricing by customer class.

  Systems also should consider the effect of introducing a new rate structure on revenues. Conservation-oriented pricing requires planners to make certain assumptions (based on the

available empirical evidence) about the elasticity of water demand, or the responsiveness of water usage to a change in price. Elasticity is measured by the ratio of a percentage change in quantity demanded to a percentage change in price. Changes in the rate structure should allow the system to achieve demand reduction goals recovering water system costs. In allocating costs, the impact of the rate structure on user demand and revenues for specific customer classes should be considered.

- **Advanced pricing methods.** Advanced pricing methods generally allocate costs by customer class and/or type of water use. Advanced pricing might consider seasonal variations or other methods for pricing indoor and outdoor usage based on differing contributions to system peaks. The conservation orientation of the rate structure can be enhanced by considering the elasticity factors for different classes of water use. Marginal-cost pricing, which considers the value of water relative to the cost of the next increment of supply, can be considered as well. Systems also can consider special ratemaking provisions (such as cost-recovery or lost-revenue mechanisms). Potential revenue instability can be addressed with additional rate structure modifications (such as revenue-adjustment mechanisms).

  Obviously, the pricing strategy must be consistent with overall system goals and approved by regulatory or other governing bodies.

4. Information and Education

Information and education are critical to the success of any conservation program. Information and education measures can directly produce water savings, as when customers change their water-use habits. These savings can be difficult to estimate. Also, public education alone may not produce the same amount of sustained water savings as other, more direct approaches (such as leak repairs and retrofits).

But educational measures also can enhance the effectiveness of other conservation measures. For example, it is widely believed that information plays a role in how water consumers respond to changes in price. More generally, customers that are informed and involved are more likely to support the water system's conservation planning goals.

- **Advisory committee.** A water advisory committee can involve the public in the conservation process; potential committee members include elected officials, local business people, interested citizens, agency representatives, and representatives of concerned local groups. The committee can provide feedback to the utility concerning its conservation plan and develop new material and ideas about public information and support for conservation in the community. Of course, to be meaningful, the utility must be receptive to ideas offered by the committee.

- **Understandable water bill.** Customers should be able to read and understand their water bills. An understandable water bill should identify volume of usage, rates and charges, and other relevant information.

- **Information available.** Water systems should be prepared to provide information pamphlets to customers on request. Public information and education are important components of every water conservation plan. Consumers are often willing to participate in sound water management practices if provided with accurate information. Furthermore, providing information and educating the public may be the key to getting public support for a utility's water conservation efforts. An information and education program should explain to water users all of the costs involved in supplying drinking water and demonstrate how water conservation practices will provide water users with long term savings.

- **Informative water bill.** An informative water bill goes beyond the basic information used to calculate the bill based on usage and rates. Comparisons to previous bills and tips on water conservation can help consumers make informed choices about water use.

- **Water bill inserts.** Systems can include inserts in their customers' water bills that can provide information on water use and costs. Inserts also can be used to disseminate tips for home water conservation.

- **School program.** Systems can provide information on water conservation and encourage the use of water conservation practices through a variety of school programs. Contacts through schools can help socialize young people about the value of water and conservation techniques, as well as help systems communicate with parents.

- **Public education program.** Utilities can use a variety of methods to disseminate information and educate the public on water conservation. Outreach methods include speakers' bureaus, operating booths at public events, printed and video materials, and coordination with civic organizations.

- **Workshops.** Utilities can hold workshops for industries that might be able to contribute to water conservation efforts. These might include, for example, workshops for plumbers, plumbing fixture suppliers, and builders or for landscape and irrigation service providers.

5. Water Use Audits

Water-use or end-use audits can provide water systems and their customers with invaluable information about how water is used and how usage might be reduced through specific conservation strategies.

- **Audits of large-volume users.** Utilities can facilitate water audits for large-volume users, both commercial and industrial. Water audits should begin by identifying the categories of water use for the large-volume user. These may include process, sanitary, domestic, heating, cooling, outdoor, and other water uses. Second, a water audit should identify areas in which overall water use efficiency can be improved through alternative technologies or practices.

- **Large-landscape audits.** Water audits can be used for outdoor usage, as well as for indoor processes. Audits of irrigation practices can provide large-volume commercial, industrial, and public users with information about usage and usage-reduction techniques. These audits can be used in conjunction with irrigation submetering and other landscaping efficiency practices.

- **Selective end-use audits.** Water audits can be widened to include selective end-use audits by customer class, focusing on typical water-use practices within each class. An audit program can be selective in terms of targeting customer groups that have particular needs or for which water conservation could be particularly beneficial. Audits targeted to older housing, for example, can be particularly beneficial in terms of identifying and fixing plumbing leaks.

  End-use audits also can be tailored to the usage practices within user groups. For example, residential water audits may focus on plumbing fixtures, lawn and garden water practices, and customer behavior. Residential water audits can be used to make immediate repairs and

retrofits. All water audits should include a written report to the customer that includes specific ideas for conservation. Water audits can be planned and implemented in conjunction with electric power companies or others interested in promoting conservation practices.

6. Retrofits

Water systems can promote conservation through a retrofit program. Retrofitting involves making an improvement to an existing fixture or appliance (versus replacement) in order to increase water-use efficiency. Retrofit programs usually target plumbing fixtures.

- ***Retrofit kits available.*** A basic retrofit kit may include low-flow faucet aerators, low-flow showerheads, leak detection tablets, and replacement flapper valves. Retrofit kits may be made available free or at cost.

  Calculating the savings from a retrofit program requires planners to make a number of assumptions about water use and savings. Some of the assumptions used in retrofitting are:

  - Toilets (4-6 flushes per person per day)
  - Showerheads (5-15 shower-use minutes per person per day)
  - Bathroom Faucets (.5-3 faucet-use minutes per person per day)
  - Kitchen Faucets (.5-5 faucet-use minutes per person per day)

  Many useful textbooks and manuals are available to help planners estimate typical water use and potential savings from retrofits (See Appendixes B and D.)

- ***Distribution of retrofit kits.*** Water systems can actively distribute retrofit kits directly or through community organizations. Retrofit kits also can be distributed in conjunction with audit programs.

- ***Targeted programs.*** Utilities might institute targeted programs for different customer classes (residential, commercial, industrial, public buildings, and so on). Retrofits of industrial premises can include facilities used by the public and employees, as well as facilities used for production purposes. A program to retrofit low-income housing units may conserve considerable water in older residential housing units with inefficient plumbing fixtures. Targeted programs also could be designed in cooperation with community organizations. An

active retrofit program might be part of a residential water-use audit program. It is important that planners ensure that retrofit programs conform to local plumbing codes and ordinances.

7. Pressure Management

Reducing excessive pressures in the distribution system can save a significant quantity of water. Reducing water pressure can decrease leakage, amount of flow through open faucets, and stresses on pipes and joints which may result in leaks. Lower water pressure may also decrease system deterioration, reducing the need for repairs and extending the life of existing facilities. Furthermore, lower pressures can help reduce wear on end-use fixtures and appliances.

- ***System-wide pressure management.*** For residential areas, pressures exceeding 80 psi should be assessed for reduction. Pressure management and reduction strategies must be consistent with state and local regulations and standards, as well as take into account system conditions and needs. Obviously, reductions in pressure should not compromise the integrity of the water system or service quality for customers.

- ***Pressure-reducing valves.*** A more aggressive plan may include the purchase and installation of pressure-reducing valves in street mains, as well as individual buildings. Utilities might also insert flow restrictors on services at the meter. Restrictors can be sized to allow for service length, system pressure, and site elevation. Utilities can consider providing technical assistance to customers to address their pressure problems and install pressure-reducing valves to lower the customers' water pressure. This may be especially beneficial for large-use customers.

8. Major Users and Landscape Efficiency

Major water users demand a significant amount of water for a variety of purposes throughout the year. In addition, outdoor water usage drives maximum-day demand. These both contribute to increased requirements for transmission and treatment facilities. Reducing major users and outdoor usage can thus be a very effective conservation strategy. In some cases in Merritt, major water users include those that rely on water for outdoor use. This can be reduced through efficiency-oriented landscaping principles.

- **Drill their own wells** In some cases, major water users may be able to drill their own dedicated wells for irrigation purposes. This would reduce overall water withdrawn through the City's water system, and reduce energy costs required to pump water in Merritt's high-pressure water system. However, in order for this to be effective, appropriate guidelines would need to be prepared.

- **Promotion of landscape efficiency.** Utilities can promote the development of water conserving principles into the planning, development and management of new landscape projects such as public parks, building grounds, and golf courses. Utilities can also promote low water-use landscaping by residential and nonresidential customers, especially those with large properties. Utilities can cooperate with local nurseries to ensure the availability of water conserving plants.

  Water systems may promote Xeriscaping™, an efficiency-oriented approach to landscaping that encompasses seven essential principles:

  - Planning and design
  - Limited turf areas
  - Efficient irrigation
  - Soil improvement
  - Mulching
  - Use of lower water demand plants
  - Appropriate maintenance

- **Selective irrigation submetering.** Selective submetering for irrigation water can be used to improve irrigation management, as well as to introduce irrigation pricing.

- **Landscape planning and renovation.** Existing landscapes can be renovated to incorporate water-conserving practices. Public parks, for example, could be managed to incorporate water-efficient landscaping and reduce or eliminate irrigation. Utilities can work with commercial and industrial customers to plan and renovate landscaping in accordance with water conserving practices.

- **Irrigation management.** Irrigation management systems, using metering, timing, and water-sensing devices, also can be promoted by the water utility for large-volume customers.

9. Replacements and Promotions

- **Rebates and incentives.** In order to accelerate the replacements of older fixtures, utilities can offer rebates and other incentives. Utilities can install water-efficient fixtures by providing fixtures at no cost, giving a rebate for consumer purchased fixtures, or arranging suppliers to provide fixtures at a reduced price. Utilities can design incentive rebate programs that are targeted to the nonresidential and residential sectors, and to indoor and outdoor uses.

  The feasibility and effectiveness of replacements may depend on state and local plumbing codes. A program to accelerate replacements, coupled with high-efficiency standards, can yield substantial water savings.

- **Promotion of new technologies.** Utilities also can get involved with promoting new technologies by manufacturers and distributors of fixtures and appliances. Demonstrations and pilot programs, and even contests, can be used to introduce and promote new products (such as high-efficiency washing machines).

10. Reuse and Recycling

- **Industrial applications.** An alternative water source for some systems is "graywater," or treated wastewater for non-potable water uses. Water reuse and recycling practices reduce production demands on the water system. Water utilities should work with their non-residential customers to identify potential areas for reuse or recycling. Some industries can substantially reduce water demand through water reuse (or multiple use) in manufacturing processes. Recycled wastewater can be used for some industrial purposes, agricultural purposes, groundwater recharge, and direct reuse.

- **Large-volume irrigation applications.** Reuse, recycling or replacement can be encouraged for large-volume irrigation.

- **Selective residential applications.** In some areas, reuse and recycling can be used in residential applications. Water systems will need to check with local plumbing codes and ordinances for possible conditions and restrictions.

11. Water Use Regulation

Merritt has implemented water use regulations in the form of outdoor sprinkling restrictions. These help to reduce peak demand during the summer months when outdoor water use increases.

- ***Water-use standards and regulations.*** Regulations should be in place to manage water use during droughts or other water-supply emergencies. In some cases, utilities may find it desirable to extend water-use regulations to promote conservation during non-emergency situations. Examples of water-use regulations are:

  - Restrictions on nonessential uses, such as lawn watering, car washing, filling swimming pools, washing sidewalks, and irrigating golf courses.
  - Restrictions on commercial car washes, nurseries, hotels, and restaurants.
  - Standards for water-using fixtures and appliances (in addition to the federal efficiency standards, which can be found at the end of this Appendix).
  - Bans or restrictions on once-through cooling.
  - Bans on non-recirculating car washes, laundries, and decorative fountains.
  - Bans on certain types of water use or practice.

- **Requirements for new developments.** Another type of regulation is to impose standards on new developments with regard to landscaping, drainage, and irrigation practices.

  Many water systems, including privately owned systems, lack authority to implement this measure. Systems that have such authority must exercise it carefully. In general, restrictions on water use should be justified by the system's circumstances and should not unduly compromise the customer's rights or quality of service.

12. Integrated Resource Management

- **Supply-side technologies.** The idea of integrated resource management is that water often is used jointly with other resources. Systems following the Advanced Guidelines might have opportunities to consider and implement measures that can accomplish integrated resource management, where water conservation is jointly accomplished with the

conservation of other resources. On the supply-side, the utility can institute operating practices (including various automation methods, strategic use of storage, and other practices) that achieve energy, chemical, and water savings. Source-water protection strategies, including land-use management methods, can be used to conserve water resources and avoid costly new supplies. Water and wastewater utilities can jointly plan and implement conservation programs to realize savings and share in the benefits.

- **Demand-side technologies.** Integrative practices also can be accomplished on the demand side. Water and energy utilities can conduct comprehensive end-use audits and jointly promote conservation practices by end-users. Large-volume users can work with the utility to make adjustments to processes that reduce water and energy usage and wastewater flows, while saving other resources as well. Utilities that provide wholesale water can work with wholesale customers to design a water conservation program that will be mutually beneficial.