# BEST MANAGEMENT PRACTICES

# GUIDE TO

# Water Conservation in the Public Sector

**Produced By**


**Capital Regional District Water Department**
**479 Island Highway**
**Victoria, BC**
**V9B 1H7**
**Telephone 1-250- 474-9683**
**Fax: 1-250- 474- 4012**
**Web:** www.crd.bc.ca/water

**June 2001**

# TABLE OF CONTENTS

# INTRODUCTION

CRD Water is committed to encouraging water conservation across all sectors of our community. It is vitally important that CRD Water, its municipal partners, and the public sector within the Capital Regional District lead by example.

The purpose of this guide is to provide descriptions of Best Management Practices (BMPs) that the CRD Water Department, area municipalities, and all public sector facilities within these areas can use to ensure optimum water conservation. In addition to the practices in this guide, the public sector should be diligent whenever possible, showing commitment to the spirit of best management practices by following the same water restrictions and recommendations that the general public is expected to follow.

Although the term "Best Management Practices" can have several meanings, for the purposes of this guide, **Best Management Practices are defined as**:

> *A practice, policy or program which results in a more efficient use of water. The BMP must also be technically and economically feasible, and environmentally and socially acceptable.*

**Water conservation can be defined as** practices, policies, techniques and technologies that improve the efficiency of water use. Increased efficiency expands the use of the water resource, freeing up water supplies for other uses, such as population growth, new industry, and environmental conservation. Water conservation programs emphasize lasting day-to-day improvements in water use efficiency.

The Examples Section of this manual, Section IV, lists some water efficient practices that are currently being undertaken in other Canadian municipalities by provincial and federal governments and in public sector organizations.

This guide has been designed to specifically reflect conditions in the CRD water system.

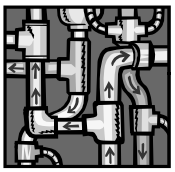
# BEST MANAGEMENT PRACTICES MATRIX

| Category of Action | Page | Best Management Practice Summary |
|---|---|---|
| **SECTION I – WATER DISTRIBUTION SYSTEM OPTIMIZATION** | | |
| **SO 1 Distribution System Audit** | 1-1 | ▪ Conduct a water system audit, with follow-up auditing at ongoing periodic intervals.<br>▪ Develop implementation plan to act on results. |
| **SO 2 Leak Detection** | 1-3 | ▪ Undertake an ongoing leak detection program to reduce water waste and increase available water for customer use. |
| **SO 3 Water Main Breaks** | 1-4 | ▪ Develop a rapid repair and response policy for all system leaks especially those visible outflows of system water, such as hydrant or main leaks.<br>▪ Set a policy that within the CRD water system minor leaks will be responded to within a 48-hour period. Major leaks will be addressed on a rapid response basis. |
| **SO 4 Water Main Flushing** | 1-5 | ▪ Flush all mains only when required and using the minimum amount of water required to carry out the task efficiently.<br>▪ Do not flush, other than in an emergency or for health reasons, during periods where uses are restricted.<br>▪ Develop BMPs to cover the procedures associated with these tasks.<br>▪ Educate staff and area residents about flushing policies and procedures.<br>▪ Implement a unidirectional flushing program while reservoir is filling. |
| **SO 5 Hydrant Use Permits** | 1-6 | ▪ Revamp hydrant use permits policy to reflect efficiency.<br>▪ Ensure every hydrant user requires a permit.<br>▪ Monitor or meter all hydrant uses.<br>▪ Discourage hydrant uses during peak demand times or during restricted use periods.<br>▪ Educate and inform all hydrant users.<br>▪ Ensure that hydrant users use back-flow preventers. |

| Category of Action | Page | Best Management Practice Summary |
|---|---|---|
| **SO 6 Street Cleaning** | 1-7 | ▪ Use non-potable water when possible. Add signage to washers stating that water is not drinking water.<br>▪ Use water for street cleaning as infrequently and with as little volume as possible.<br>▪ Avoid peak season use, or any use during periods where water use is restricted. |
| **SO 7 Rate Structure and Pricing** | 1-8 | ▪ Rates that encourage the efficient use of water should be implemented. |
| **SO 8 By-Laws** | 1-10 | ▪ Use by-laws as needed to regulate non-essential water use within all sectors of water users. |
| **SECTION II – WATER USE OPTIMIZATION** | | |
| **WU 1 Facilities Water Use Audit** | 2-1 | ▪ Conduct a full water use audit to develop a baseline understanding of uses and a water balance.<br>▪ Identify and act on opportunities to become more water use efficient.<br>▪ Ensure that water efficiency is one of the criteria used to select all new engineering designs related to water use, and the purchase or upgrading of all water-using fixtures and equipment. |
| **WU 2 Toilets and Urinals** | 2-4 | ▪ Replace or retrofit fixtures immediately when payback period is cost effective.<br>▪ In ongoing maintenance, replace fixtures and equipment with the most water-efficient model available. |
| **WU 3 Showerheads and Faucets** | 2-6 | ▪ Replace or retrofit fixtures immediately when payback period is cost effective.<br>▪ In ongoing maintenance, replace with the most water-efficient fixture available. |
| **WU 4 Appliances** | 2-7 | ▪ Include water efficiency in the selection criteria for all new equipment.<br>▪ Monitor appliances for performance criteria and institute a policy of replacement with water-efficient models wherever cost-benefit analysis shows this to have a payback of less than 2 years.<br>▪ Institute a maintenance policy to ensure all water-using appliances are checked regularly for operation efficiency, including water use efficiency. Repair all leaks, or other water wastes, immediately. |

| Category of Action | Page | Best Management Practice Summary |
|---|---|---|
| **WU 5 Maintenance Practices** | 2-9 | ▪ Create a clean-up operations policy to ensure water is used as efficiently as possible.<br>▪ Develop a proactive and aggressive plan for plumbing systems maintenance to find and repair water wastes, and to prevent them wherever possible.<br>▪ When leaks, faulty or worn equipment or fixtures are discovered, take repair and replacement action as soon as possible.<br>▪ Educate all staff about the importance of reporting leaks and faulty water-using fixtures and equipment. Ensure all are aware of how to contact the correct department, and what to do to reduce water waste pending repair. |
| **WU 6 Building Systems** | 2-11 | ▪ Replace water-cooled air conditioning units with more water-efficient equipment as regular maintenance planning allows.<br>▪ Ensure that all water-using aspects of the overall building systems operations are maintained at peak system optimization to reduce wear on the system and ensure minimal water losses. |
| **WU 7 Cooling Towers** | 2-12 | ▪ Take cooling tower system optimization steps regularly to ensure losses are minimized. |
| **WU 8 High Volume Uses** | 2-13 | ▪ Minimize the waste of water in high volume use areas, and set up an aggressive maintenance and repair program. |
| **WU 9 Irrigation Effectiveness Auditing** | 2-14 | ▪ Undertake an ongoing and regular assessment of the effectiveness of irrigation and watering systems and methods to ensure landscape care considerations are met and water is used at peak efficiency. |
| **WU 10 Irrigation Equipment and System Assessment** | 2-15 | ▪ Train all staff, including seasonal staff, to use watering and irrigation equipment to maximize both water use efficiency and plant care.<br>▪ Maintain irrigation and watering equipment at peak efficiency, and use appropriately for each task in a water-efficient manner.<br>▪ Set irrigation policies and procedures, and make new equipment choices to take into consideration the importance of water use efficiency. |

# SO 1 DISTRIBUTION SYSTEM AUDIT



## BACKGROUND

The best place to begin the optimization of the water system is with an overall system audit. The purpose is to identify the sources of losses that account for the difference between the water purchased from the CRD and the water sold to retail customers. This water is usually referred to as non-revenue or unaccounted for water. Water managers use the audit results to determine the water distribution system's level of conservation. This requires a thorough examination of records, system control equipment, equipment failures, water main breaks, audit of retail meters and pipe materials.

The audit process will help track and pinpoint any potential problem areas, such as losses through infrastructure leaks or discrepancies related to inaccurate meters. It is an excellent tool to use in developing a profile of the system – a snapshot of where the system is right now with respect to efficiencies of all kinds, including water uses.

## APPROACH

- For a self-conducted system audit, use a team of auditing staff representing all areas of system operations. This ensures that expertise from all areas is contributed, and that no subtle areas of water uses are left out. In addition, the involvement of personnel from a variety of areas ensures buy-in across the system. Even if an outside water auditing expert is used, an internal support and advisory team offers advantages, both in developing an accurate audit and in implementing recommended actions resulting from the audit report.

- An overall audit is best approached by developing a water balance – a total map of all the facilities, and water processes. Infrastructure, distribution system elements, storage, and system uses (such as main and sewer flushing) are all part of mapping the water system.

- The primary function of an audit is to determine where losses are occurring. Other results of the audit will pinpoint equipment replacements that may reduce water losses or wastes, and show areas within the system where efficiencies can be found.

# DISTRIBUTION SYSTEM AUDIT (Continued)

### Training

When an audit is done internally, even with the co-operation and assistance of an outside firm, the potential audit group requires some basic audit training. In addition, the costs for internal time spent on the audit, the costs for meeting, planning time, and other essential elements should be calculated in the overall cost of the audit.

### Savings

If your non-revenue water is more than 15%, the potential for water savings may be high. Accounting for the non-revenue water may be sufficient to fund system repairs.

### Follow-up – Implementation

The most critical issue about auditing is the action that follows. Too often organizations undertake an audit and fail to act on the results. By breaking the actions into small steps and undertaking water use reduction actions one at a time, even organizations with tight cost and time budgets can enjoy the benefits of implementing the audit results. The audit should be revisited at periodic intervals to ensure that the process of continuous improvement is constantly underway.

## REFERENCES

Water Audits and Leak Detection. AWWA, Denver, Colorado, 1999.

| SO 2 | NON-REVENUE WATER: LEAK DETECTION |  |
|---|---|---|

## BACKGROUND

Most water systems have a percentage of water that escapes through leaks at pipe joints, service connections, and control valves, etc.

## APPROACH

- Undertake an ongoing leak detection program to ensure that as much treated water as possible is available for sale and to reduce water waste.
- Leak detection programs are normally part of an overall system optimization program. Often leak detection programs find many water waste reduction opportunities.
- Leak detection programs can be carried out by outside firms specializing in the process, or by internal staff if the expertise and the correct equipment are available.
- Staff training can enhance an ongoing leak detection program.
- If unaccounted for or non-revenue water exceeds 15%, a leak detection and repair program is likely to pay off for your system. Not all non-revenue water is from leaks, however, leaks can account for up to 60-80% of all non-revenue water.

## REFERENCES

Leak and Break Detection and Repair of Drinking Water Systems. AWWA, Denver, Colorado, 2000.

Leaks in Water Distribution Systems. AWWA, Denver, Colorado, 1987.

| SO 3 | NON-REVENUE WATER: WATER MAIN BREAKS |  |
|---|---|---|

## BACKGROUND

When water resources are plentiful, many water-producing utilities choose not to repair visible leaks quickly unless they pose a threat to safety or property. How quickly the water supplier responds to a broken main, or some other visible leak event, sends a strong message to the public.

## APPROACH

- Examine any current policy and procedure guidelines associated with repair situations. It is necessary to interview front-line staff to determine how the accepted procedure is implemented.
- Record estimated water loss due to leaks in order to do meaningful water balances.
- Consider the effect that water visibly pouring out "down the drain" in a public area has on the organization's efforts to encourage water use conservation. Put in place a communication method to advise the public.
- Develop a rapid repair and response policy for all system leaks, especially those visible outflows of system water (such as hydrant or main leaks).
- Respond to major leaks on an emergency response basis; respond to minor leaks within a 48-hour turnaround period.

| SO 4 | NON-REVENUE WATER: WATER MAIN FLUSHING |  |
|---|---|---|

## BACKGROUND

The flushing of water mains/sewers sends a strong message to the public about the municipality's level of concern about water waste. Many municipalities flush mains on a regularly scheduled maintenance program and, in many cases, the practices used in undertaking the flushing do not consider efficient use of water as an important factor. Review of the practices and uses in this area is an important element in maintaining public credibility and co-operation in any water conservation program. While this does not mean discontinuing flushing, it does mean examining the way this is done and the timing of the activity.

CRD Water currently uses a unidirectional flushing system. The implementation of a unidirectional system flushing program ensures the efficient use of water by directing the flushing activities away from the areas already flushed. Unidirectional flushing actually uses less water than conventional flushing, achieves higher velocity, and removes biofilm more effectively.

## APPROACH

- Begin by examining your existing policy for water main and sewer flushing. Examine all related current policy and procedures. Ensure that, aside from an emergency situation, flushing is not carried out during the season of peak use and when outdoor use or other water use restrictions are in effect.
- Design a unidirectional flushing program.
- Consider developing simple signage for street crews to use around a flushing area to indicate emergency flushing is being done to protect water quality.
- Undertake unidirectional flushing while reservoirs are filling in the late winter or early spring.
- Educate all staff about the importance of reducing the waste of water during flushing operations.
- Educate front-line customer contact staff about the policy and practices carried out to make main and sewer flushing efficient.
- Encourage front-line staff involved in the flushing activities to prepare a best management practice for flushing with the minimum amount of wasted water.
- Prepare an information piece for staff to hand out to any residents who inquire about the need to use water in this manner. Ensure that the handout contains information about how and why mains and sewers are flushed, and details how the staff has developed a BMP for the most efficient use of water during these operations.

| SO 5 | NON-REVENUE WATER: HYDRANT USE PERMITS |  |
|---|---|---|

## BACKGROUND

Hydrant uses are a very public display of a municipality's water use values and habits. Policies for uses need to reflect a commitment to water use reduction and conservation. When water suppliers who promote water conservation allow free use of hydrant water for parks departments, builders and other potential users, the public can see these uses as a signal that the municipality is not serious about conservation, or is selective in their targets for conservation. This results in mixed messages to water users, and can have a negative effect on conservation or conservation programs.

Municipalities need to insist that back-flow preventers be installed to ensure that hydrant users do not contaminate water supply systems. The cleaning out of contaminated systems results in water waste.

## APPROACH

- Examine your current policy for hydrant use permits. Your policy can either encourage or discourage water waste. Since the waste of water from hydrants is highly visible and public, it is important to ensure that even permitted users understand the importance of using this water wisely. Some education and information about the potential impacts of water waste should accompany the permit.

- If your policy does not now require a formal permit, users such as developers or parks staff should have to apply for a water withdrawal permit. Their subsequent hydrant use should be metered or monitored. Water volumes they are permitted to use should be specified in the permit. They should also be set at a level that will discourage the user from leaving water-using equipment running without check. In addition, if you set a flat rate now, consider raising the rate and setting a penalty for exceeding a specific volume per day. Frequently policies fail to include an upset limit on volumes, and rates for the water are too low to encourage active conservation policies on the part of the users.

- Monitor all water hydrant uses.

- Your hydrant use permits should also take into consideration the peak use hours and seasons, and the permits should be structured to avoid unnecessary uses during peak times. Consider that some outdoor uses, such as watering playing fields, might best be served by using raw water from ponds or streams.

- Develop educational materials on hydrant use for permit holders.

- Ensure that hydrant users have back-flow preventers on new equipment.

| SO 6 | NON-REVENUE WATER: STREET CLEANING |  |
|---|---|---|

## BACKGROUND

Street cleaning is frequently carried out during spring and summer months to reduce dust and debris. In an area where outdoor uses are restricted, or where any efficient use of water is promoted and encouraged, the use of drinking water to wash streets is often seen by the public as a highly visible water waste. This can destroy the credibility of any water conservation program or outdoor use reduction effort.

## APPROACH

- Examine the policy and procedures currently in place. Assess the importance of the action and determine if all street cleaning can be avoided, or if it can be done with non-potable water.
- If street cleaning cannot be avoided, be sure to take some or all of the following steps to reduce impact on available water, and on public image.
- Use gray or non-potable water when possible. Add signage to washers to state that the water is not drinking water.
- Use water for street cleaning as infrequently and with as little volume as possible.
- Avoid peak season use, or any use during periods where water use is restricted.

| SO 7 | RATE STRUCTURE AND PRICING | $$$$ |
|---|---|---|

## BACKGROUND

Rate structures and water pricing that provide incentive for customers to reduce their water use are appearing in utilities around the world. It has been proven in numerous studies that water rates and water rate structures can play an important role in water conservation. Ensuring that "conservation" rates are in effect is an important practice.

A conservation water rate study was completed in May 2001 for the CRD. The study was undertaken to help the CRD pursue water demand management objectives within the Greater Victoria Service Area. Demand management objectives, defined in the 1999 "Strategic Plan for Water Management", include reductions in peak summer demands, base demands and non-revenue water. Conservation rate structures, used primarily at the retail level, can help achieve these objectives.

## APPROACH

The CRD study approach concentrated on an evaluation of alternative rate structures focused on retail rates, since only these rates have a direct impact on the water demand of end users. CRD Water, the wholesaler of water to municipalities, currently recovers water supply costs using a uniform volumetric charge. The study commenced with an assessment of opportunities for reform using existing rates and then moved on to an assessment of alternative rate structures

The following rate structures were evaluated (all of these options, save the last one, include a fixed charge based on meter size):

- Uniform
- Declining Block
- Increasing Block
- Humpback
- Seasonal
- Excess Use
- Demand Charge

Some of the water retailers now recover a portion of their costs using parcel taxes or other charges that do not appear on the water bill. In evaluating existing and alternative rate structures, consideration was therefore given to the recovery of all costs for both water and sewer systems from the water bill.

A screening exercise was used to evaluate the rate options. The exercise involved considerable input and commentary from staff of the CRD and local municipalities, and from the Water Advisory Committee. Case study analysis was completed for three local municipalities to assess changes in water demands and impact on water rates, customer bills, and the stability of water sale revenues.

# RATE STRUCTURE AND PRICING (Continued)

### Recommendations

The principal recommendations of the study are as follows:

- Retain the uniform rate structure at the retail level.
- Use the retail water bill, where possible, to recover all water and sewer costs, including costs now recovered using property and parcel taxes.
- Fixed charges in the retail rate structure should be set to recover no more than about 15% of total water bill revenues.
- Municipalities should increase the frequency of retail meter reading and billing to a quarterly schedule for residential customers (i.e., every 3 months) and a bimonthly schedule for large ICI customers.
- Retain the existing wholesale rate structure.
- Continue to lobby the Lieutenant Governor in Council to allow CRD municipalities to recover trunk sewer and sewage disposal costs by way of fees and charges set independently within each municipality.
- Continue the existing demand management program to promote efficient water use.
- Complete more detailed studies at the retail level to develop implementation plans for rate reform and to address a number of outstanding issues.
- Phase in rate reform over a two-year period.
- Develop and implement an effective communication plan to promote rate reforms.

## REFERENCES


Achieving Water Conservation through Rate Design. The Irrigation Association, 8260 Willow Oaks Corporate Drive, Suite 120, Fairfax, Virginia, 22031, 1993.

CRD Conservation Water Rate Study. New East Consulting Services Ltd., R.M. Loudon Ltd., M. Fortin, May 2001.

Designing, Evaluating and Implementing Conservation Rate Structures. The California Urban Water Conservation Council, 1997.

Municipal Water Rates in Canada 1989, Current Practices and Prices. Environment Canada, Ottawa, 1992.

Revenue Effects of Water Conservation and Conservation Pricing: Issues and Practices. The National Regulatory Research Institute, Ohio State University, 1994.

The Role of Price in Water Conservation: Evidence and Issues, Conserv 96 Conference Proceedings. AWWA, Denver, Colorado.

Water Rate Structures and Pricing (M34), revised 1999. AWWA, Denver, Colorado.

| SO 8 | BY-LAWS |  |
|---|---|---|

## BACKGROUND

When working to encourage the efficient use of water in a community, one of the tools at your disposal is by-law creation. This tool allows water systems to reduce the waste of water among all sectors of water users. By-laws set standards for water use, and show water users in the community that there are specific ways in which the water supplier needs to control the waste of water and/or reduce the use of water during specific periods.

## APPROACH

Before enacting by-laws, a number of issues need to be explored, including current by-laws related to water use, water use practices that should be eliminated, and water uses that need to be limited or curbed during specific times or seasons.

A number of options have been selected in other Canadian cities, including by-laws that:

- Prohibit the installation of new single-pass or once-through coolant.
- Phase out the use of existing once-through coolant processes.
- Phase out water-cooled air conditioning units by prohibiting the installation of new units.
- Restrict or eliminate outdoor uses of water by residential property owners during specific times or seasons.
- Eliminate the installation of water-using equipment and fixtures, through changes to plumbing and building code standards, that do not meet specific water conservation standards in both new construction and refits (i.e., 6-litre toilets and low-flow showerheads).
- Automatic restrictions on specific uses of water by commercial and industrial users when required, such as outdoor water uses, car washes, landscape care uses, and pool uses.

When selecting one or more of these options, the following things should be considered:

- Information and education programs to support the initiative.
- Communication and dialogue with affected parties, including business and commercial operations.
- Enforcement options.

# WU 1 FACILITIES WATER USE AUDIT

## BACKGROUND

For all facilities and operations where water use volumes are high, the first and most critical step to water conservation and cost savings is the full water audit. Auditing is the only way for an operation to achieve the largest possible water savings, to find energy and other cost savings opportunities, and to determine the best and most cost effective steps to take.

Without auditing, many opportunities are lost and many potential savings, both in water and cost, are never discovered. High volume water users who do a thorough water audit can expect a minimum of 25% savings of the overall volume of water currently used. In addition, energy costs can often be reduced dramatically as a result of tracking and implementing water use reductions.

## APPROACH

For the audit, gather a team of staff who represents all areas of the operation. You may choose to include an outside firm to assist you. Building an internal team ensures that expertise from all areas is contributed and that no subtle areas of water uses are overlooked, and can help buy-in across the organization.

### The Audit Process

- Create a map of your overall facility (a hand-drawn sketch is fine). If your operation is large, map one area at a time and then put all the maps together to make up the whole picture.
- On the map, draw or sketch a diagram showing the flow of water through your whole operation, from intake point (municipal cold water intake or MCW) to the outflow points where water goes to sewer or storm sewer.
- Ensure that all the water uses and processes throughout the operation are included and recorded on the map. Measure the flow of each process or water use. (For example, if you have equipment that is water-cooled, mark down the rate of water that it uses per hour, per day, or per shift. Manufacturer guides usually provide this information.)
- As you mark each process or water use on the map, use a chart to collect and record all pertinent details at each use point through every process. Record details about quantity (how much is used), quality and state (is water cold, heated, clean, treated, etc.), and destination of water (to sewer, to rinse, etc.). This information will help you identify opportunities to reduce, reuse or recycle water.

# FACILITIES WATER USE AUDIT (Continued)

## Potential Benefits of Measurements

- When you know exactly how much water is used, where, and what quality and state it is in, you may find potential savings. For example, in a laundry area if you find machines are sending clear, heated final rinse water to sewer, you may be able to reuse it as a pre-soak for the next load. The retrofit involved may be far cheaper than the cost of heating the first rinse water. You could save not only water but also energy.
- Note you may have to use a bucket and stop watch, portable meters, or other tools to help you identify the flow rate of equipment and processes.
- Take the time to measure flow rates and assess volumes used accurately – the information will help you determine what savings you can get by changing a process or a piece of equipment.

## Discretionary Water Use

- When your physical system and equipment audit is complete, begin again and note, at each use or process, where use of water is at the discretion of staff or other users. For example, toilet flushing, showers, drinking fountains, washing up sinks, etc.
- Note observed habits and practices of discretionary users on the chart you have created. (For example, is kitchen staff allowing taps to run continually or are drinking fountains propped fully open all day.)

At this point you will have a full "water use balance sheet" showing how much MCW water comes into your site daily, how it is used, how much is used and how much flows out. The inflow and outflow should balance to within about 5-10%. If it does not, you will need to recheck your balance.

## Make Cost-Effective Water Conserving Change

- The audit balance sheet will show you where the most likely water and energy savings can be found. For example, you may find that some clean coolant water is now going through as a single pass and runs to the sewer once the temperature is increased beyond tolerance. Reuse of this water in some other operation, or installing a chiller, may save many thousands of litres of water a day.
- By examining the areas of the operation with the greatest volume of use you can usually find opportunities to save water, energy, and possibly other costs.
- Where discretionary users are using water wastefully, training, education and, in some cases, equipment change, will help reduce the flow.

# FACILITIES WATER USE AUDIT (Continued)

### Training

When an audit is done internally, even with the co-operation and assistance of an outside firm, the potential audit group requires some basic audit training. In addition, the costs for internal time spent on the audit, the costs for meeting, planning time, and other essential elements should be calculated in the overall cost of the audit.

### Savings

A wide range of savings are possible, however, most organizations with high volume and/or complex uses find a minimum of 25% reduction in current water uses through a complete audit. More can be discovered when staff is encouraged to reduce consumption through behaviour change and discretionary use reductions. In addition, many organizations will enjoy high volume reductions in energy uses and other resources as a result of the water use audit. Implementing water use reductions frequently impacts more than simply water costs. This is especially true in organizations where cooling towers, high volumes of heated, treated or chilled water is used, and in areas where discretionary uses are high.

### Follow-up – Implementation

The most critical issue about auditing is the action that follows. Too often organizations undertake an audit and fail to act on the results. By breaking the actions into small steps and undertaking water use reduction actions one at a time, even organizations with tight cost and time budgets can enjoy the benefits of implementing the audit results. Consider that water uses are constantly changing and evolving in every organization as new equipment is added, new processes begin, or new discretionary users are hired. The audit should be revisited at periodic intervals to ensure that the process of continuous improvement is constantly underway.

## REFERENCES

A Facility Managers Guide to Water Management, Version 2.2, August 2000. Arizona Managers Water Association.

A Water Conservation Guide for Commercial, Industrial and Institutional Users. New Mexico Office of the State Engineer, 1997.

Identifying the Conservation Opportunities in the Commercial, Industrial and Institutional Sector, Proceedings from the AWWA 1997 Annual Conference. The California Urban Water Conservation Council.

For more specific savings examples, contact CRD Demand Management for copies of case studies.

| WU 2 | TOILETS AND URINALS |  |
|---|---|---|

## BACKGROUND

Two of the largest water wasters are toilets and urinals. If your facility has numerous washroom areas, these can account for a high percentage of your overall water use. Older toilets typically use between 13-25 litres for every flush, depending on the age of the toilet. Water efficient 6-litre toilets have shown an acceptance or satisfaction rate of more than 80%.

For tankless toilets a number of devices are available to reduce the flush volume.

## APPROACH

### Operation and Maintenance Options

- Establish a simple method to encourage the reporting of leaks by cleaning or custodial crews, staff, and other users.
- Institute a procedure that will ensure leaks are repaired immediately.
- When performing maintenance, replace worn parts and adjust mechanisms to ensure that the water consumed per flush meets manufacturer's guides.

### Retrofit Options

- Retrofits for tank-style toilets, such as displacement dams or bags, may hamper overall operation of the toilet and increase maintenance costs as they often have a short life span and require frequent replacement or adjustment. Their use is not recommended outside of the residential setting.
- For flush valve-style toilets, infrared or ultrasonic sensors can be used to automatically activate flushing, making it unwieldy for users to flush twice. However, these devices need to be set properly to avoid multiple flushing.
- Early closure or valve insert or replacement devices can reduce flush volumes from 22.7 litres per flush to 7.5 litres per flush. However, they often require frequent replacement or adjustment. Therefore, they may not be appropriate for high use facilities.

# TOILETS AND URINALS (Continued)

### Replacement Options

- To maximize water savings, replace high water use toilets with 6-litre per flush models. Many manufacturers have models to handle non-residential use areas. Site specific evaluation of existing waste lines, water pressure, distance, usage, settling, and types of users (employees, residents, occasional members of the public, high visitor populations, etc.) is necessary to determine the appropriate model for a specific site. Replace high water use urinals with models designed to use 3.78 litres per flush.
- Consider replacing water-using toilets and urinals with alternative technologies, such as composting or incinerator toilets. These options may be appropriate for parks or other outdoor recreational facilities.

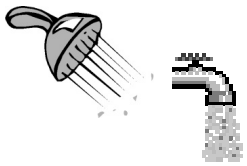
## REFERENCES

A Performance Evaluation of 1.6GPF (6-litre) Flush Valve Water Closets in Commercial Settings. W.L. Corpening and Associates, 2882 Love Creek Road, Avery, California, 95224.

Low Plumbing Products Fact Sheet. National Association of Plumbing, Heating and Cooling Contractors (NAPHCC), 1992.

Study Documents Water Savings with Ultra-Low Flow Toilets, *Small Flows.* Pearson, F.H., 1993, 7(2), pp. 8-9, 11.

Water Savings From the Installation of Ultra-Low Flush Toilets in Commercial, Industrial and Institutional Settings, 1997 American Water Works Association Annual Conference Proceedings. AWWA, Denver, Colorado.

| WU 3 | SHOWERHEADS AND FAUCETS |  |
|---|---|---|

## BACKGROUND

Non-efficient showerheads and faucets waste a tremendous amount of water and energy. By replacing these heads with low-flow models, you can reduce water consumption by as much as 65%, also reducing water heating energy costs. Public sector facilities, such as schools and recreation complexes, often have showers that are well used, where real savings are possible.

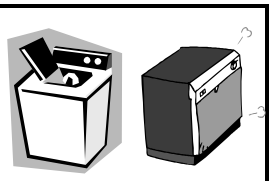
## APPROACH

### Operation and Maintenance Options

- Establish a simple method to report leaks and fix them immediately. Encourage cleaning or custodial crews to report problems.
- Test system pressure to make sure it is between 20-80 PSI. If the pressure is too low, then low consuming devices won't work properly; if it's too high, they will consume more than their rated amount of water.
- Install expansion tanks, pressure reducing valves, and reduce water heater settings, where appropriate, to prevent temperature and pressure relief valves from discharging water.
- Correctly adjust and maintain automatic sensors to ensure proper operation.
- Encourage users to take shorter showers.
- Post energy/water awareness information to encourage conservation from users.

### Retrofit/Replacement Options

- Install showerheads that use no more than 9.5 litres per minute, and faucet aerators that use no more than 8.3 litres per minute.
- Install temporary shut-off valves in faucets. These valves cut off the water flow during intermittent activities like scrubbing or dishwashing. The water can be reactivated at the previous temperature without the need to remix the hot and cold water.
- Install automatic shut-off valves. These can be operated by infrared or ultrasonic sensors, which detect the presence of someone's hands and will shut off water when the hands are removed. However, these devices need to be set properly to operate properly.

| WU 4 | APPLIANCES |  |
|---|---|---|

## BACKGROUND

Water-using appliances are essential equipment in many types of facilities. Health care, day care, food and beverage services, and many other settings make use of a variety of appliances daily. Their water use can account for a large percentage of the monthly water and energy costs.

There are a number of steps to take that can ensure that appliances are operated at maximum water efficiency. Frequently these appliances use 40% or more of their total flow rate as heated water. It is also often true that they use a variety of chemical additives, dishwashing detergents, softeners and other substances that can be reduced by efficient operation.

## APPROACH

Prepare a chart for each of your water-using appliances. On each chart note:

- The age and condition of the appliance and the maintenance record for each.
- How much water each uses and note if the water is heated or pre-treated. The manufacturer can often provide the flow rate or water use numbers for you if the appliance's information has been lost.
- The number of uses the appliance has in a day. Be sure to track this information over a number of days before settling on an average use figure. If seasonal use is higher, for example more uses in winter than in summer, or time of day use varies, for example more uses at mealtimes, take this into consideration in determining total usage per week or month.
- What is added to the water, such as softeners, detergents, disinfectants, etc.?
- All of the water outflows and their condition. For example, note if the final heated water rinse in a belt or conveyor washer is going to sewer.
- The energy use rating. If this is not posted on the equipment, the manufacturer can usually provide this data.

When you have completed a chart, you will have a clear picture of the cost of operating the appliance in water costs, energy, maintenance, and chemicals. This provides cost-benefit analysis data to help make decisions about replacements, repairs, or retrofits.

# APPLIANCES (Continued)

## Decision-Making Tips

- Water-using appliances with a high volume of heated water are cost effective to replace if they are using more water than is necessary. For example, replacing industrial washers in a commercial laundry with tunnel washers can reduce water and energy consumption by up to 50% without sacrificing the quality of the finished load. Newer models of dishwashers are available with energy and water conservation options that reduce the waste of both resources, and reduce the use of detergents.
- If appliances are older and your chart shows they are being repaired frequently, consider replacement with new water and energy efficient models.
- Where replacement or retrofitting water efficient parts is not an option, consider the value of simple staff training to ensure the appliance is being used correctly. For example, full loads before running the appliance can mean a significant saving in water and energy.
- If your operation has appliances such as ice machines, investigate the costs associated with their outflows to sewer. Replace water-cooled units with air-cooled units. Adjust the settings on water-cooled machines to ensure that water waste is minimized.

# WU 5 MAINTENANCE PRACTICES

## BACKGROUND

Day-to-day maintenance practices can use a surprising amount of water. Some of these uses relate to clean-up maintenance steps. Some maintenance can reduce wasted water lost in leaks or drips. Some facilities, such as large public buildings, health clubs, food services areas, vehicle wash areas, recreation centres and other such facilities have regular and high volume water use clean-up operations. High volume water use reductions here are almost always associated with heated water and mean reductions in energy costs. Regular maintenance of plumbing systems and water-using fixtures yields water loss and water waste reductions.

## APPROACH

### Clean-up Water

- A full audit of overall water uses will help detail how much of a facility's water use is associated with maintenance efforts. However, if you have regular maintenance operations in areas where clean-ups are frequent and where water is the major clean-up tool, it is likely that at least some efficiencies can be found.

- Chart all maintenance steps. On the chart, note beside each maintenance step how frequently it is done, the type of equipment used, and the type of water (for example, is it municipal cold water, heated water, recycled or reused water) involved in the maintenance step.

- There are four major categories of savings opportunities in maintenance:

    1. Change of practice – e.g., sweep before hosing down a specific area.
    2. Frequency or duration adjustment – e.g., with health regulations respected, reduce the frequency or duration of a pool back-washing operation, wash vehicles less often (as appropriate), and reduce shower room wash-down periods.
    3. Equipment change or retrofits – replace wash-down equipment with water-conserving heads, use flow restricted hoses, or add a retrofit device to maintenance equipment to reduce water flow.
    4. Change of water source – use water collected from cooling jackets rather than heated municipal water in sterile wash-downs, use grey water where appropriate or possible.

# MAINTENANCE PRACTICES (Continued)

## Plumbing System Maintenance

- Regular maintenance of fixtures and plumbing systems can reduce water waste.
- Dripping faucets, leaking toilets, and leaking pipes can go unnoticed in larger facilities for many weeks. Even pinpoint leaks can add up to a lot of water over time. For example, a leak from a 1/32" hole in a pipe, at 60PSI, wastes 6,300 gallons or 28,665 litres of water per month.
- If the facility has tank-type toilets, spotting and repairing leaks in these is also beneficial. A standard toilet leak is wasting about 75 gallons or 341 litres a day, making repairs well worth the time and effort.
- It is well worth the effort to have a facility policy to have all leaks and repair situations reported immediately, and to act on this information in a timely fashion. Visible signage should be placed in public areas to encourage visitors to report leaks.
- Further, by taking a proactive approach to plumbing system maintenance water, energy and treatment costs can all be reduced significantly.
- When possible, do high volume use maintenance when water reservoir levels are highest.

| WU 6 | BUILDING SYSTEMS |  |
|---|---|---|

## BACKGROUND

Exploring the opportunity for water savings in building systems may include examining both boilers, volume of make-up water and air conditioning.

## APPROACH

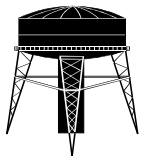
- Assess your overall building systems carefully, from air conditioning to boiler rooms. Simple steps, such as routine inspections, calibrations, seals and other replacements, and general maintenance can fine-tune the overall system. Ensure that all water-using aspects of the overall building system operations are maintained at peak optimization to reduce wear on the system and to ensure minimal water loss.

- Replace water-cooled air conditioning units as regular maintenance planning allows, and install more water-efficient cooling equipment. Water-cooled A/C units use high volumes of water which frequently drains to a storm drain or sewer without being measured. This makes the A/C unit's water drain virtually invisible over time. Elimination of this high volume water waster can offer huge water savings.

- Steam generated in boilers is a commonly used source of heat. Steam may be consumed, but is usually condensed and returned to the boiler.

- Evaporative losses can be estimated in a number of ways – for example, most large boilers have a make-up water meter. This meter represents maximum evaporative losses, including blow-down. The losses should be calculated during an overall audit. Unacceptable or extraordinary losses may indicate your system requires some maintenance or system optimization steps. Where losses and make-up water levels are deemed high, consult a boiler professional for more ideas.

# WU 7 COOLING TOWERS



## BACKGROUND

Cooling towers eliminate the need for single-pass cooling and reduce water uses dramatically in many types of operations and facilities. However, although they virtually eliminate vast quantities of wasted water, they can be run inefficiently and negate some of the savings potential they offer.

Cooling towers lose water in three primary ways: evaporation, drift, and splash. Drift and splash can occur at any time, however, evaporation is only significant when a cooling load is imposed on the system. Water losses related to splash are minimal and can be ignored. The evaporation from a cooling tower is based on heat energy loading. Water use efficiencies can often be found by calculating the losses from a cooling tower and investigating the reasons for the losses. In some cases, significant savings will be the result of taking the appropriate actions.

## APPROACH

- Cooling tower efficiencies are complex and as individual as the system itself. There are a number of publications devoted to cooling tower conservation, and a number of professional organizations can also offer assistance.

- Take the time to quantify your losses and determine the acceptable loss factor for your system. Since the cooling tower equipment maintenance is frequently improved by the use of conditioned water, water losses here involve more than just water waste. Chemicals used to soften or de-scale water are also sent to sewer when blow-down levels increase.

## REFERENCES

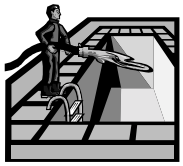
A Guide to Water Conservation for Cooling Towers. AWWA, Denver, Colorado, 1991.

Ozonation of Cooling Tower Water: A Case Study. California Department of Water Resources, P.O. Boa 942836, Sacramento, California, 94236-0001, 1991.

Uses of Water and Water Conservation Opportunities for Cooling Towers. Proceedings of Conserv 93. AWWA, Denver, Colorado.

Water Conservation Guide for Cooling Towers and Other Cooling Related Uses of Water. AWWA, Denver, Colorado, 1990.

# WU 8 HIGH VOLUME USES



## BACKGROUND

Some specific equipment, such as swimming pools, uses very high volumes of water by the nature of the use. However, if the equipment in these types of uses is not properly set up and maintained, they can waste a great deal of water. If the facility has a high volume use, such as ornamental fountains (indoors or outdoors), pool areas (either recreational or therapeutic), an ice rink or other high volume uses, they need to be considered in an overall conservation plan.

## APPROACH

- Determine the volume of water being used by your high volume use equipment.
- Determine current make-up water volumes or replenishing volumes, and pinpoint the reason for the use. For example, if replenishing an ornamental fountain is required constantly, it is clear that a recirculating pump will reduce the waste of water.
- Consider pool backwash requirements related to health regulations and chart them against current practices. If possible, reduce the number of backwash events, or reduce the duration. Talk to your filtration supplier about other water-saving options. In the case of a therapeutic pool, if health regulations require fully emptying the equipment after use, estimate how much water is being discharged on an average day. Then you can determine if capture and storage of the resulting grey water would be an economical and safe way of handling other tasks, such as landscape care.
- Ice rink operations may benefit by the addition of a cooling tower or a surfacing water recapture device. When snow is cleared from ice surfaces by the Zamboni machine, it may be worthwhile to set up a recapture and reuse system.
- Whatever efficiencies you find in the large volume use areas, an aggressive and proactive maintenance program will offer water-wasting reduction benefits as well.

# WU 9

# IRRIGATION EFFECTIVENESS AUDITING

## BACKGROUND

If your organization has a large outdoor area with an irrigation system in place, it is wise to do an irrigation audit to ensure that water use is optimized for both the plantings and water conservation. In the WU 10 section of this guide, the assessment of the equipment is discussed briefly. This is an important step to take in assessing or auditing overall irrigation for properties. However, it is also important to audit from a plant-care effectiveness perspective. This section discusses the effectiveness of the irrigation system or methods you currently have in place.

## APPROACH

- Chart all property areas or features, such as planters and hanging planters, which are currently being irrigated. Note how frequently irrigation takes place and how much water is being added to properties. Divide larger properties or large groups of features, such as a whole block of hanging planters, into small sections. Test sample areas of each section to determine:

    1. The general health of turf, landscape or plantings, and
    2. The amount of water turf or plantings are getting (test before and after regular watering has occurred).

- Observe the effectiveness and efficiency of the method used to irrigate the plantings, hangers or turf areas. Determine if changes need to be made to ensure that plantings and turf areas remain healthy and water waste is reduced. Determine where and when grey water or some non-potable source could be used to replace drinking water in your irrigation operations. A few examples of things to watch for:

    1. A plantings or turf area where water has puddled, indicating that too much water is being added.
    2. Plantings where the pressure or flow of irrigating water is too high and damage to vegetation results.
    3. Areas where an in-ground system or another irrigation method has failed to reach plantings or turf areas with sufficient water.

These issues and many others can indicate a need to adjust or reassess the irrigation effectiveness. Not only can these inefficiencies have an impact on water waste, they can often damage landscape plantings and turf areas. Consult your irrigation specialist and your horticulturist for more information and assistance.

## REFERENCES

The Complete Irrigation Workbook – Design, Installation, Maintenance and Water Management. GIE Publishers, 412 Bridge Ave., Cleveland, Ohio, 44113, 1995.

| WU 10 | IRRIGATION EQUIPMENT AND SYSTEM ASSESSMENT |  |
|---|---|---|

## BACKGROUND

For many organizations, outdoor water use is high, especially during the landscape care seasons. Playing fields, landscaped properties around facilities and public buildings, parks, and other landscaped areas are frequently watered using a variety of staff, methods, and equipment. It is worth assessing both the equipment and the policy and procedures staff follow, as well as the training staff have, when using water outdoors. Doing an irrigation audit to determine if your current irrigation practices are meeting the needs of vegetation and landscape uses is a separate issue. The results of that audit, however, might have an impact on equipment selection and staff training. It is best to begin your outdoor assessment process with an irrigation effectiveness audit, followed by a landscape planning process. At that point, you can assess the equipment and practices to determine if they meet current or planned needs.

## APPROACH

### Equipment

- Make a chart of all equipment currently used in landscape watering/irrigation. Determine what is used, where, when, and by whom. Chart the maintenance schedule for the equipment where applicable. Determine why each piece of equipment is being used to do specific jobs, and if it was selected with the ease of operation, landscaping needs, availability, costs or conservation as the reasons for selection.

- Often, availability is the primary selection criteria, and that may not always be the most effective or water conserving use. For example, if a mobile water truck is used to water hanging outdoor plants, is the extension hose equipped with a shut-off valve and does the head adjust to meet the needs of the various hanging plant types. If not, your staff are likely to waste almost as much water as the planters get, and some plants may be getting too much or too little for their needs. If high-pressure hoses are being used to wash park walkways and water turf, it is likely that a high volume of water is being wasted.

- If your watering equipment is not subjected to a routine maintenance process, it may be leaking, requiring new seals, washers, or other parts to avoid water waste.

# IRRIGATION EQUIPMENT & SYSTEM ASSESSMENT (Continued)

- If staff is watering large open areas exposed to sunlight at peak evaporation hours, the water being applied is mostly wasted to evaporation. Scheduling of water application needs to respect both restricted hours during peak demands on the water system, and hours when evaporation rates are lower. This policy not only reduces water waste but also allows plantings to get more benefit from the water applied with less risk of burning.

- Irrigation systems – Underground systems with pop-up or fixed heads need to be checked regularly to ensure efficiency of operation. Timers that allow the system to operate regardless of weather conditions should be set to a manual activation. This avoids wasting water during rain events. If an in-ground system was installed some time ago, it is worth inspecting the heads to ensure they are still placed effectively. For example, heads placed in a new garden area several years ago might now be blocked by maturing trees or shrubs that have grown up around their placement.

- Irrigation equipment of all types needs to be examined for leaks and faulty parts. An aggressive and proactive maintenance program will help reduce the waste of drinking water supplies outdoors.

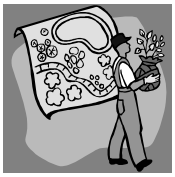
- Signage should be created that encourages the public to notify staff of leaks or other problems.

### Staff

Training staff in the most efficient way to use water outdoors is a wise investment. Outdoor staff are frequently seasonal employees and may not have appropriate skills or knowledge to allow them to water correctly for the plantings, or for water conservation. They may be using equipment inappropriately, without realizing the water waste implications.

### Links

For a complete picture of the best ways to make your outdoor water uses efficient, see WU 9 and WU 11.

| WU 11 | PLANTINGS AND LANDSCAPE CARE AND PLANNING |  |
|---|---|---|

## BACKGROUND

Planning and caring for landscapes is an important way to ensure healthy and hardy landscape plantings while reducing water waste. By eliminating some turf, using plantings that need less water, planting some areas using native species, and allowing some borders and other small areas in larger landscapes to naturalize, outdoor water use can be reduced by 50% or more. The water use reduction benefits are, however, only a small part of the overall benefits the care and planning steps bring. These steps significantly reduce the time, money, and effort spent mowing, fertilizing, weeding and removing green wastes, and maintaining your landscapes.

Assessing your irrigation needs carefully and adjusting your system to ensure over-watering does not occur will be important for outdoor water savings, and has many other property protection benefits as well. Over-watering is likely to cause more damage to plants, curbs, streets, paving stones and other features than under-watering.

## APPROACH

### Turf Care

Turf is always the most water intensive part of landscapes. These practices can help reduce the need to irrigate turf:

- Set mowers to leave grass blades longer, removing no more than 1/3 of the blade at a time. Longer blades shade the soil and reduce evaporation, and help the turf cope with heat or drought stress.
- Leave these shorter grass clippings on the lawn. They provide some natural nutrients and reduce water loss from the soil.
- Never mow when turf is stressed.
- Over-seed with drought tolerant species in spring and fall.
- Select turf species to match uses, such as for playing fields – ensure they are seeded with drought and stress tolerant grasses. Over-seed annually with these types of mixtures until they become the dominant species.
- Water infrequently but slowly and deeply. Allow water to penetrate deeply to roots, while encouraging longer, deeper root growth.

# PLANTINGS & LANDSCAPE CARE & PLANNING (Continued)

## Turf Planning

- Examine turf areas and determine where some areas of turf can be removed. Consider areas where turf is not doing well, such as under tree borders, near walkways, in deeply shaded areas, or on steep slopes.
- Consider replacing these areas with mulched areas, stone-scape, groundcovers, naturalized plantings, or other alternatives to turf. By allowing naturalized areas to encroach somewhat on borders of large playing fields or park areas, turf is reduced, and it can restore wildlife habitat. As well, water use needs are significantly lowered.
- Replace playing field turf with artificial, all weather fields.

## Plant Care

Water needs, maintenance costs, and fertilizer requirements are all reduced when plantings are cared for properly.

- Consider the watering requirements of plantings carefully. Ensure that those areas that require additional water are being irrigated efficiently. For example, shrubs and dense beds of flowering plants that require similar levels of water can easily be irrigated using bubbler or drip irrigation systems. These are more efficient, wasting less water, and ensure that the water is delivered to where the plantings can make the most use of it.
- Mulch beds deeply. This reduces weed growth, gives a finished appearance to the beds, and helps keep soil moist.
- Soil health is vital to healthy plants, and healthy plantings require less water. Have soil sampled and tested in areas where plantings are not as healthy as they could be, and make amendments to soils as required.

## Planning for Water Efficient Plantings

- Examine planting areas for health and hardiness. For example, large ornamental annual beds placed too close to paved areas frequently die back at the edges due to radiant heat reflected from walkways. Consider repositioning or replacing the beds with naturalized plantings or native plants that are more heat and drought tolerant.
- On steep slopes, consider replacing weaker turf or plantings with hardy native groundcovers that will reduce maintenance and mowing, while maintaining soil health through reduced erosion. Water use will decrease immediately.
- Plan planted areas to ensure that all the plants that are grouped together require the same amount of water. This simplifies irrigation planning and reduces the waste of water considerably.
- Plant as much of the property as is reasonable using native species. Allow some areas, such as bordering treed areas, to return to natural landscape. The native species, once established, will need little or no water, even during times of drought. In addition, there will be no need to chemically treat for pests or weeds, and the established planting areas will require little maintenance. Fertilizer use will also be reduced.

# PLANTINGS & LANDSCAPE CARE & PLANNING (Continued)

## REFERENCES

Practical Xeriscape Landscaping for Public Facilities. Proceedings from Conserv 96 AWWA, Denver, Colorado.

Xeriscape Handbook. 1992, AWWA, Denver, Colorado.

Save Water, Save Maintenance, Save Money: A Guide to Planning and Designing Water-Conserving Landscapes. AWWA, Denver, Colorado.

# EDUCATION & INFORMATION

## BACKGROUND

Education and information programs are overall components of any Best Management Practice. To realize the full potential of water-saving technologies and practices, it is extremely important that good methods of communication are in place. Numerous studies and experiences have shown that new technologies will not be as successful without this important step. New policies, procedures and technologies will be most effective if employees and the public know what the technology is for and how to use it correctly.

There are several audiences that must be addressed in education and information efforts. The first and often most overlooked group is the internal audience – your employees. The second audience is the general public, contractors, public officials, and the media. It is good public relations to let the public and the media know that you are doing your part to make facilities and systems as water conserving as possible. This is particularly important if you have water conservation programs that encourage water reduction efforts from all areas of your community.

## APPROACH

### Internal Audiences

- Organize and conduct regular training workshops for maintenance personnel to keep them informed about new technologies, operational or procedural changes.
- Encourage sharing of information across all departments so everyone recognizes water-conserving efforts, and policies or changes do not remain within one department only.
- Make sure signage is created and placed near new equipment explaining how to use it properly and its benefits.
- Start a water conservation idea box and reward for the best-implemented idea.
- Use communication methods (such as posters, newsletters, etc.) that keep staff informed of water savings within facilities.

### External Audiences

- Write news releases and/or invite the media to your facility to view water-saving efforts.
- Signage explaining benefits should be created and placed in public areas where new technologies have been installed, or where the public might view water-using processes.
- If appropriate, apply for water conservation awards and publicize your success.

# EXAMPLES

The following are examples of water efficient practices, which correspond with practices listed in this guide, that other municipalities and public sector organizations in Canada have undertaken. The examples are listed under municipal, provincial/federal, and institutional sectors. While these examples are by no means exhaustive, they are representative water conservation efforts.

## MUNICIPAL EXAMPLES

### Banff, Alberta

**Leak Detection and Repair**

- Initiated a staged leak detection and repair program in 1992. Repeated in 1998 and 1999. In each year, excavation and repair was done on confirmed leaks. Water consumption was reduced by 10% per year. This leak detection initiative, along with a water metering program and conservation program, has postponed building two additional wells, at a cost of $185,000 each. This program will be repeated every fifth year.

### Calgary, Alberta

**Leak Detection and Repair**

- Initiated a leak detection and repair program in 1980. Since then, water main leakage has been reduced from 30% of annual production to 12%. It is estimated that the program has saved $4.1 million in operating costs.

### Chilliwack, British Columbia

**Best Management Practices**

- The District of Chilliwack is currently implementing a groundwater management plan to help protect the district's groundwater sources. The following is a list of studies that the District has undertaken to help manage its water distribution system in the last few years.

  1. Groundwater Protection Plan, Golder Associates Ltd., 1997
  2. Enhanced Groundwater Flow Model, Emerson Groundwater Consultants Inc., 1997
  3. Review of Geotechnical Aspects of Seismic Performance of Municipal Infrastructure, AGRA, 1996
  4. Waterworks Emergency Response Plan, Stanley Associates, 1995

## Greater Vancouver Regional District – Water District, British Columbia

### Lead-By-Example

- A lead-by-example program, including water audits and recommendations for improving water use conservation is currently underway at all GVRD (including Water District Sewerage and Drainage District and Housing Corporation) metered facilities. A total of 40 sites, with total annual consumption of almost 2 million cubic metres, throughout GVRD.

### Seasonal Pricing Study

- The objective of the study is to identify and summarize the major issues and ramifications related to seasonal water rates, at wholesale and retail levels, within the GVRD.

## Kamloops, British Columbia

### Leak Detection Programs/Practices

- As a new initiative, two data loggers were purchased. These devices will be used to monitor water use for businesses and facilities where water leaks are suspected, to determine if leaks exist.

### Sector Demand Study or Pilot Project

- Kamloops is undertaking more thorough analysis of water use records to determine variations in water use habits in different parts of the community.

### Climate Comfort System

- Is under consideration for city parks. An underground irrigation emitter test area was established at the median on Columbia Street near Sahali Terrace. If this system works well, it could be used to replace existing irrigation systems in areas where overspray or vandalism is a problem.

## Logan Lake, British Columbia

### Leak Detection Programs/Practices

- 1998 is the pilot year for the district's leak detection program. It is ongoing.
- Keys to success – consistency, positive reaction
- Costs – $5,000

## Lumby, British Columbia

### Low-flow and Retrofit Programs

- Water-saving devices were installed in the newly constructed Village office.

## North Okanagan, Regional District of, British Columbia

### Low-flow Fixture By-Law

- As of July 1, 1999, all new residential construction must install 6-litre per flush toilets, low-flow showerheads and aerators.
- Keys to success – mandatory by-law, inspections by Building Inspector

## Parksville, British Columbia

### Leak Detection Programs/Practices

- Costs – $10,000 per year

## Port Alberni, British Columbia

### Leak Detection Programs/Practices

- Costs – $10,000 per year

## Tumbler Ridge, British Columbia

### Water Recovery, Reclamation, Reuse, and Recycle Programs

- A wastewater reuse program is ongoing in Tumbler Ridge. The golf course does not use domestic water for irrigation, but instead uses the municipality's treated effluent. This water conservation program has also resulted in a reduction of the quantity of fertilizer applied to the golf course.

## Vancouver, British Columbia

### Water Audits

- The City has been working closely with the Park Board on water consumption issues. In 1995, the City funded an irrigation audit of Van Dusen Gardens and Jericho Playing Fields. This was followed by an irrigation workshop, using information gathered from the audit, for those employees involved in irrigation.

### Xeriscaping

- The planting of native vegetation is promoted through the Greenways and other city projects.
- Guidelines are being put together for the reclamation and storage of plants from constructions sites, for use on City projects.
- With funding obtained from Environment Canada, the City undertook the construction of a low irrigation (Xeriscape) demonstration garden at City Farmer (at 6$^{th}$ and maple).
- Costs – $20,000

### Water Recovery, Reclamation, Reuse, and Recycle Programs

- **Uses of Storm Water – A number of streams that were maintained with potable water are** presently being reconstructed to use storm water (Tatlow Park, Langara Gold Course). Sewers is also working to bring storm water to Jericho Ponds, which are presently topped up with potable water, and Trout Lake will be using storm water once the sewer system has been separated.
- **Bloedel Conservatory** – The Park Board submitted a business case to replace the Bloedel Conservatory's non-recycling cooling system with a refrigeration unit which would reduce Park Board consumption by about 26.5 million Imperial gallons per year (1997 rates).

## Vernon, British Columbia

### Water Reuse Program

- In 1977, the City implemented the area's first full-scale water reuse program. As a result, there has been almost no direct discharge of treated wastewater from Vernon and Coldstream to Okanagan Lake since May 1977. In 1984 and 1985, one small discharge per year went into Vernon Creek (which flows into Okanagan Lake) lasting for five weeks each. In February 1998, the first direct discharge began, as a result of a wet summer during which the recycled water could not be used to irrigate. The 1998 discharge represents the first use of the deep lake outfall that was built in 1987.
- During the 125-day irrigation season that commences in early May, the City's entire yearly wastewater flow is treated and applied to irrigation fields.
- Currently, 2,700 acres of agriculture, forestry, and recreational lands participate in the "water reuse" program. Agriculture operations participating in the program include cattle and horse grazing, as well as hay production. Participating silviculture operations include a forestry nursery, a seed orchard, and experimental tree plantations. Recreational lands currently involved in the irrigation program include golf courses and playing fields.

### Other

- To reduce water consumption and resulting wastewater in all area schools, automatic flush urinals were installed with a solenoid valve on the water line leading to the urinal tank. The valve is wired into the bathroom light switch so that the tank only fills during the day, when washroom lights are on. Millions of gallons are estimated to be saved per year as a result.

## Region of Waterloo, Ontario

### Water and Wastewater Treatment Plants

- Reduced filter back-washing frequencies and duration to provide significant water use savings.
- Repaired and eliminated leaks in water lines.
- Follow a rigorous maintenance program in plants.
- Use effluent water instead of potable water for foam control, chemical makeup, and other uses.
- Retrofitted or replaced all sanitary fixtures will low water using replacements.

### Other Initiatives

- Retrofitted 63 washrooms with low-flush or water-saver toilets.
- Installed an underground drip irrigation system for landscaping.
- Replaced a water-cooled refrigerator (savings 5 million litres of water per year).
- Occupancy sensors installed at Courthouse (reduced water usage by 50%).
- Changed water treatment chemicals in cooling towers of Regional buildings (reduced water usage by 35-40%).

## Toronto, Ontario

### Water Audit

- The City had a water audit conducted at City Hall.

### Fixture Replacement in City-owned Buildings

- The City of Toronto installed electronic urinal controls and toilet tank retrofits in a variety of City-owned properties, such as fire halls, community centres, historic buildings.

## Sillery, Quebec

### Leak Detection/Repair

- A leak detection/correction program uncovered daily losses of 3.8 million litres of treated potable water – 35% of their treatment plant's total production.

## Regina, Saskatchewan

### City parks and Athletic Playing Fields

- An automated irrigation system for all City parks run by a central computer. It maximizes the conservation of water use by automatically matching the timing and duration of water application to weather conditions. The system easily identifies system failures for maintenance staff.

# PROVINCIAL & FEDERAL GOVERNMENT EXAMPLES

## Municipal Water Reduction Branch, British Columbia

### Water Recovery, Reclamation, Reuse, and Recycle Programs

- The proposed "Municipal Sewage Regulations" are encouraging the use of reclaimed water to address the issues of water shortages. The use of reclaimed water will decrease supply needs from, and discharges to, fish-bearing streams.
- The Branch has identified potential water savings of 35% with the implementation of water reclamation and reuse technologies.

## Parliament Buildings, Ottawa, Ontario

### Water Audits

- Conducted water audit/feasibility studies for 10 federal facilities, including the House of Commons, to establish a water use master plan for conservation. Potential water savings found 3,750 cubic metres per month. The outfall of this audit was the following water conservation activities.

### Water Conservation Activities

- Installation of automatic electronic flush valves, saving 2 litres per flush.
- Conversion of 5 refrigerator compressors for food services in 2 floors' cafeteria and kitchen.
- Retrofitting of 34 standard toilets in all buildings in the Parliamentary Precinct with a 15% water saving. Initial cost – $153.00.

# INSTITUTIONAL EXAMPLES

## British Columbia Buildings Corporation (BCBC)

### Xeriscaping

- In spring 1997, the corporation adopted technical standards that require increased efficiencies in irrigation and landscaping for all BCBC owned and operated buildings.
- Section 9.1 of the standards states "landscapes should be designed to minimize the effect they will have on the surrounding area by giving preference to regionally native plant species and the use of water-conserving landscaping techniques such as xeriscaping.

### Climate Comfort System

- BCBC has endorsed the installation of timers and sensors in landscaped areas.
- The fountain located adjacent to the legislative buildings has been equipped with a sensor which stops water flow to the fountain when winds reach 25 kilometres per hour.
- Other "climate comfort system" sensors, which turn sprinklers off when it rains.
- A water efficient government health building has been constructed in Sooke.

## Grand River Hospital, Kitchener, Ontario

**Low-flow Fixture or Retrofit Program**

- The K-W hospital retrofitted toilets and urinals, and replaced faucet aerators and showerheads with low-volume models. They saved 49 cubic metres of water per day at $1.39 per cubic metre. One time cost was $20,000.

## Riverdale Hospital, Willowdale, Ontario

**Low-flow Fixture or Retrofit Programs**

- The hospital undertook a urinal flush valve upgrade, and replaced faucet aerators and showerheads with low-flow models. Savings were $15,000 per year. The initial cost was $22,000.

## St. Mary's Hospital, Kitchener, Ontario

**Low-flow Fixture of Retrofit Programs**

- The hospital undertook a urinal flush valve upgrade, and replaced faucet aerators and showerheads with low-flow models. Savings were $20,000 per year. The initial cost was $74,000.

## Metro Toronto School Board, Toronto, Ontario

**Low-flow Fixture or Retrofit Programs**

- The school board undertook the installation of an electronic urinal control system, toilet tank retrofits, flushometer retrofits, and the replacement of faucet aerators and showerheads with low-flow models. The savings for the 150 schools are $250,000 per year. The initial cost was $700,000.

## London School Boards, London, Ontario

**Low-flow Fixture or Retrofit Programs**

- The public and separate school boards undertook installation of an electronic urinal control system, toilet land retrofits, flushometer retrofits, and the replacement of faucet aerators and showerheads with low-flow models. The savings for the 70 schools are $100,000 per year. The initial cost was $300,000.

## Ottawa Carleton District School Board, Ottawa, Ontario

**Low-flow Fixture or Retrofit Programs**

- In 1987, the school board undertook Phase I of a low-flow fixtures retrofitting/ replacement program in 160 schools within the board. Low-flow toilets, water efficient faucets, and urinal valves were replaced. Phase II of their replacement program ran from 1998 to 2000.
- The Phase I results show yearly water savings of 241,300 cubic metres, which is a 47% per year saving. This water saving translates into $200,000 per year in monetary savings. Phase I cost approximately $500,000.
- Phase II of the project resulted in annual savings of $183,000 with an initial investment of $800,000.

## Ryerson Polytechnical University, Toronto, Ontario

**Low-flow Fixture or Retrofit Programs**

- The university undertook installation of an electronic urinal control system, toilet tank retrofits, flushometer retrofits, and the replacement of faucet aerators and showerheads with low-flow models. Savings from the program in the 28 campus buildings are $150,000 per year. The initial cost was $350,000.

## Toronto YMCA, Toronto, Ontario

**Low-flow Fixture or Retrofit programs**

- This fitness/office complex undertook a program to upgrade flushometers, and replaced faucet aerators and showerheads with low-flow models. Savings from the program are $5,000 per year. The initial cost was $31,000.