FALKLAND WATER SYSTEM

Water Conservation Plan

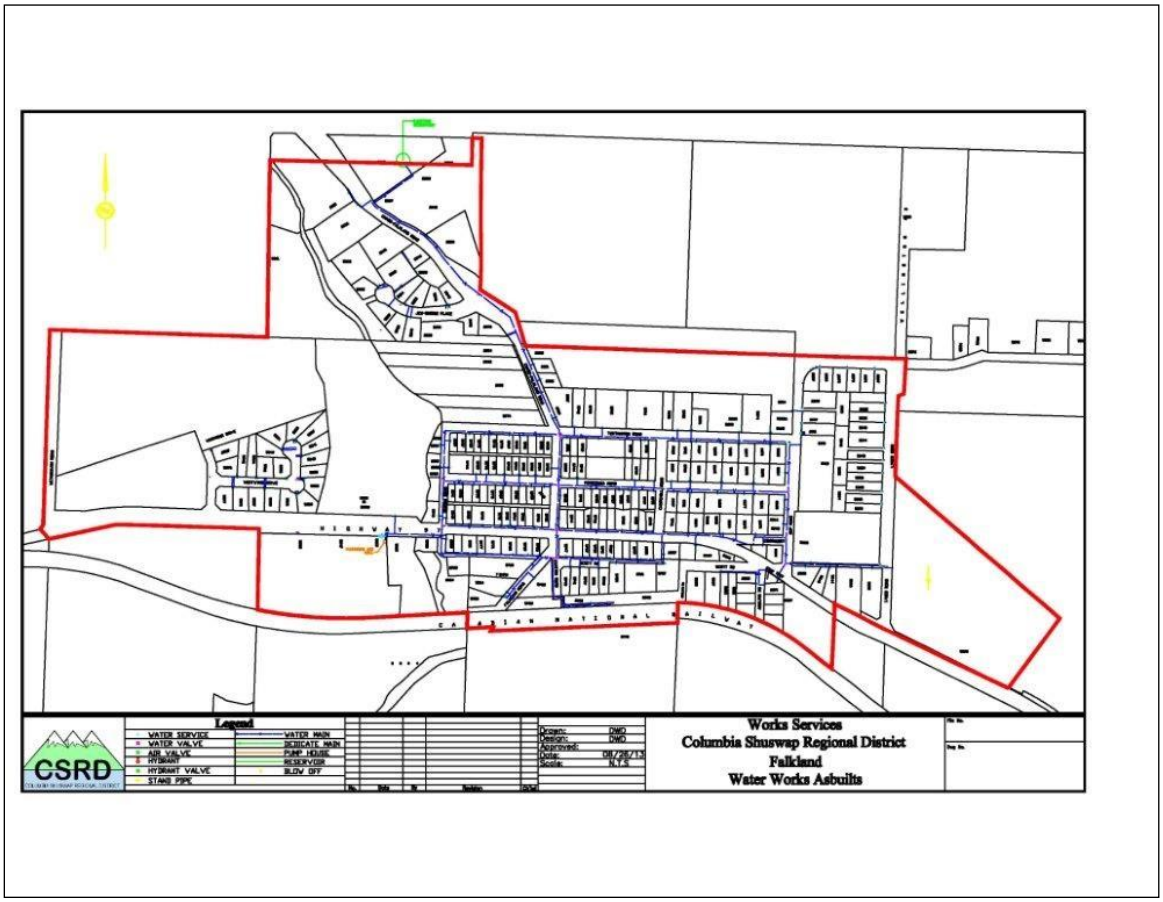
September 2013

2013 Falkland Water Conservation Plan
TABLE OF CONTENTS

APPENDICES

1.0 BACKGROUND

Water conservation may have different meanings for different people. It may remind us of the possibility of collecting rainwater in small tanks for domestic use, or constructing dams and reservoirs; of recharging groundwater tables, or using lower quality water whenever possible in order to save better water. Water conservation encompasses all this. It involves reducing the demand for water by fostering water conservation habits, stopping wasteful uses, decreasing peak consumption and charging for water at the appropriate rates. It also means taking advantage of technological developments and improved management techniques; coordinating water resource planning and management with land-use planning and economic and social planning; and establishing new or updated standards and regulations. In short, water conservation means optimal water use.



Falkland Water System

The Falkland water works is located in Electoral Area 'D' of the Columbia Shuswap Regional District (CSRD) on highway 97 40 km North West of Vernon. The Columbia Shuswap Regional District took over the operation of the Falkland water works system in 1979.

The key components of the CSRD's water system at Falkland include:

- The Falkland water system is served from two wells :

  -Well #1 (Primary well) is a 10 inch well that was constructed in 2012 to a depth of 29 m. The well was completed with an annular seal. A concrete pumphouse has been constructed adjacent to the well and connected via a pitless adapter. The gravel aquifer is inferred to be confined because there is an overlaying clay layer.

  -Well #2 (Secondary well) is a 12 inch well that was constructed in 1979 to a depth of 31.4 m. The well was completed at surface with an annular surface seal. A concrete pump house has been built around the well and contains a floor drain. The gravel aquifer is inferred to be confined because there is an overlaying clay layer.

- System is a water distribution system with chlorination and Ammonia removal. Well #1 has a maximum long term flow rate of 65 L/s and well #2 has a maximum long term flow rate of 63.4 L/s. There is a 682 m^3 storage reservoir.
- The pipe network in Falkland consists of pipe between 150 mm and 200 mm diameter. The pipe materials are unknown. Given the age of the distribution system, it is likely that some of the network consists of AC and/or ductile iron pipe, and that any newer pipe is PVC.
- Two pressure zones.
- 22 fire hydrants within the service area.

This water conservation plan has been prepared in accordance with the U.S. Environmental Protection Agency's Water Conservation Plan Guidelines – Basic Guidelines for utilities with service populations less than 10,000. It contains the following sections:

- Description of water conservation planning goals
- Profile of the CSRD's water system
- Identification of water conservation measures
- Review of implementation strategy

It is also important to note the benefits of efficient water use with respect to the environment. All properties at Falkland have on-site sewer systems which gives added importance to a water conservation plan. Reduced water use, and therefore sewage generation, would therefore reduce the cumulative impacts to the groundwater of septic effluent.

2.0 DESCRIPTION OF WATER CONSERVATION PLANNING GOALS

The CSRD wishes to accomplish the following goals through implementation of a water conservation program:

- Sustainability – to ensure availability for future generations, the withdrawal of fresh water from a well should not exceed its natural replacement rate.
- Energy Conservation – Water pumping and delivery consume a significant amount of energy. Reducing water use will result in a reduction in greenhouse gas emissions adversely impacting our environment.
- Reduce Operating Costs – decreased water consumption will result in reduced operating costs for items such as power and chemicals. There are environmental benefits associated with these operating efficiencies as well.
- Change Habits- encourage consumers to reduce waste by making small behavioural changes and by choosing more water efficient products. To be water efficient, users can fix leaking taps, take showers rather than baths, use a Hippo (or other product) in the toilet, and do a full load of dishes or laundry. All of these things will aid in decreasing the waste of water on an everyday basis. It is extremely important as a consumer to understand the usefulness of water efficiency and how to continually use water wisely.

3.0 PROFILE OF THE FALKLAND WATER SYSTEM

Some of the key components of the Falkland system were noted above in Section 1. There are additional elements which are important in gaining an understanding of the system. These are presented below:

3.1 Service Population

The community of Falkland is mostly residential with a commercial component along the highway through the community. Recent statistics Canada results (2011) estimate that the Falkland area's residential population is 805. This population includes some people who do

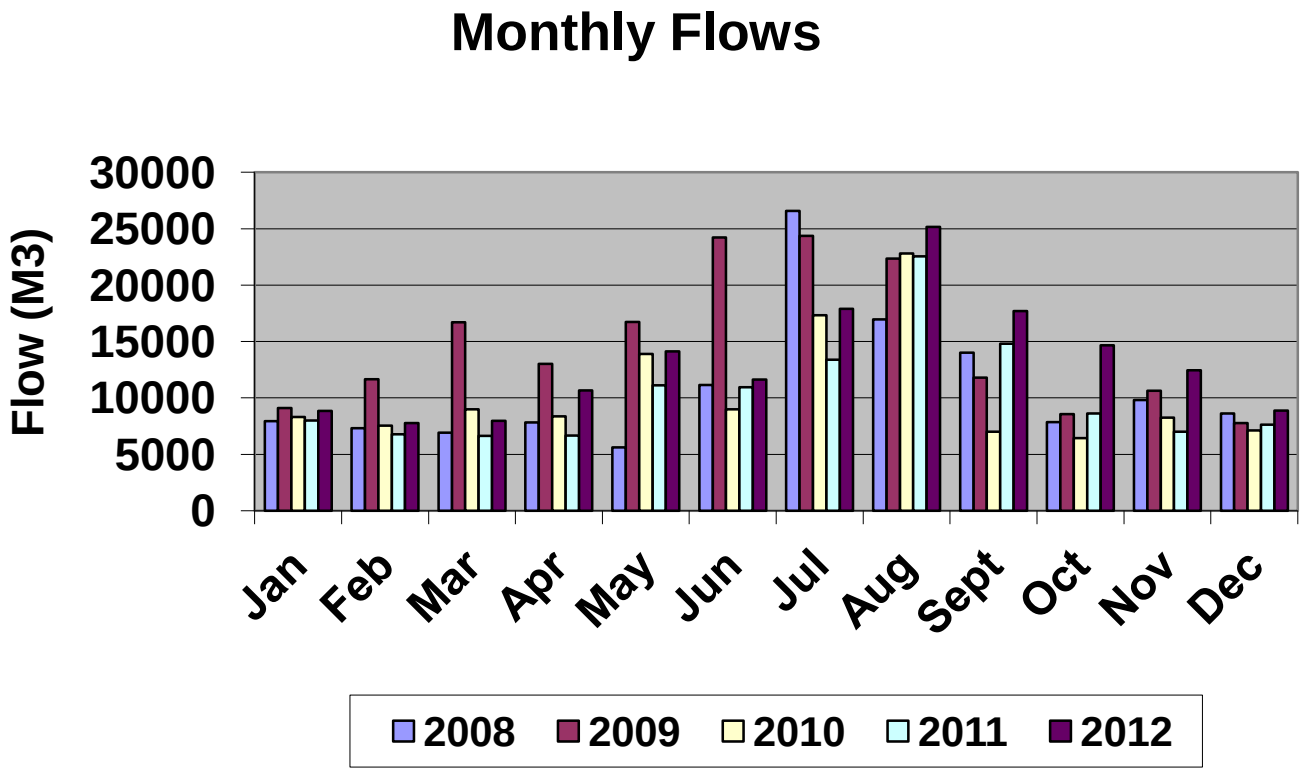
not live within the water system service boundary. There are 210 residential service connections in the water service area, and at 2.6 people/connection, this equates to 546 people in the water service area. There is a community hall, several restaurants and some limited industrial buildings connected to the Falkland water system.

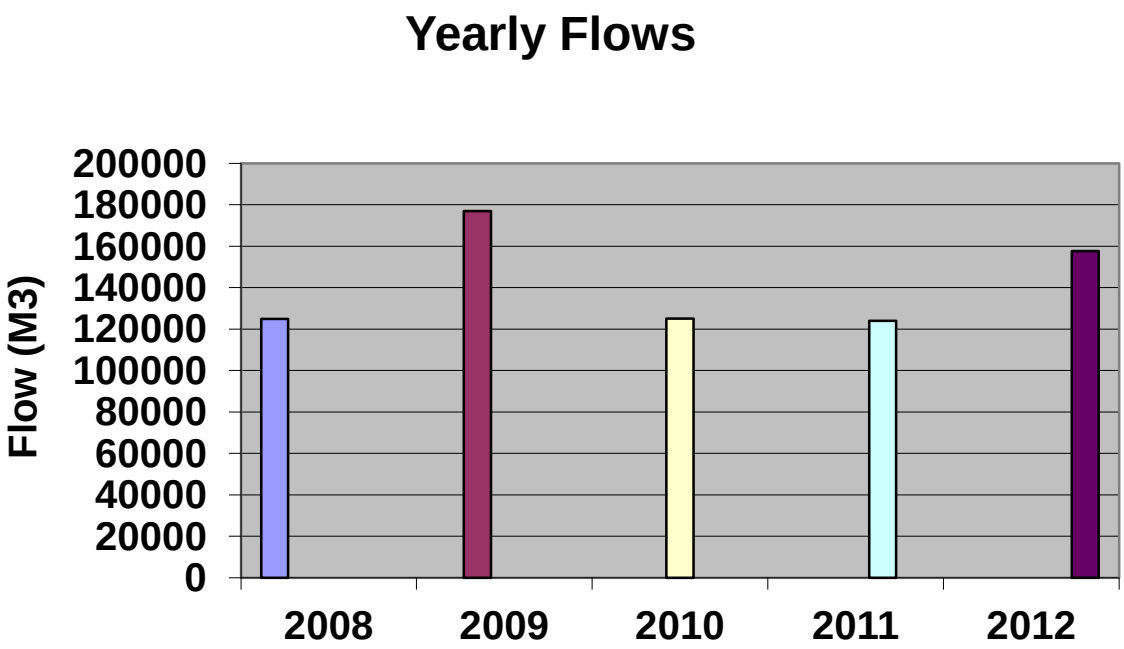
3.2 Number of Connections

There are a total of 243 water service connections; 632 existing residents, 116 vacant lots, and a connection for a community hall, school, several restaurants and businesses, and 1 industrial connection.

3.3 Water Consumption

A flowmeter located at the pump house is used to record water usage. Monthly and yearly water use data is illustrated in the following graphs. The water use records indicate that average day demand ranged from 650 to 720 L/cap/d over these years.





3.4 Water Use Reduction Target

In the past, the sizing of infrastructure components was based on the CSRD Subdivision Requirement of 6200 L/lot/d. The Subdivision Servicing Bylaw is currently under review. This water use rate works out to an MDD of 2385 L/cap/d, based on 2.6 people per dwelling. A recent review of the water system recommended that an MDD of 1800 L/cap/d be used for design purposes.

The following table presents the estimated maximum and average day demands for the current and future population based on this reduction target of 25%. Future population growth beyond buildout (350 lots) would be possible through further water use reduction.

Calculated Maximum and Average Day Demands

Year	Pop	MDD		Required Pump Rate in 18 hours L/s	ADD	
		Lpcd	L/s		Lpcd	m^3/yr
2008	563	2400	15.6	20.9	800	164,396

2018	653	1800	13.6	18.1	600	143,007
2033	816	1800	17.0	22.7	600	178,704
buildout	910	1800	19.0	25.3	600	199,290

3.5 Pricing – Single-Family Residences

The CSRD currently uses a two-part pricing structure comprising an annual tax of $144.55 per parcel (occupied or vacant lot) and an annual user fee of $165.00 (less 10% if paid prior to April 30) for each single-family residence. All Community Facilities pay the same fee of $165.00. Schools pay $165.00 per classroom. Motels / Hotels pay $85.00 per unit. and Restaurants or Pubs pay $250. Any other businesses pay $165.00. The 10% discount also applies to the non-residential fees.

3.6 Water Metering

No subscribers of the water utility are currently metered. New construction will be required to have meters as of 2009.

4.0 IDENTIFICATION OF WATER CONSERVATION MEASURES

The CSRD considered a wide range of potential measures as part of its water conservation plan (see Appendix C), and determined the following measures are appropriate for the water system now and in the future:

4.1 Universal Metering Program

The CSRD recognizes that a universal metering program is fundamental to achieving significant results in water conservation. Universal metering will be reviewed once Area D has building inspection service.

4.2 Water Accounting and Loss Control

The CSRD will work towards installation of water meters at the Community Hall, Rodeo grounds and Curling rink, as well as all commercial and industrial buildings to monitor their water use. The CSRD will conduct an annual audit of water consumption comparing the total water measured through the pump house flow meter with the projected water consumption based on the number of connections on the water system, taking into consideration water used for main flushing, fire fighting, water breaks, and other non-account water. The non-account water loss will be compared to average industry standards, and in the event the water loss exceeds industry standards, funds will be budgeted to conduct a leak detection survey to isolate and pin point the water leaks and have them repaired. The CSRD will continue to respond immediately to water breaks and record relevant information pertinent to all leaks on the system.

4.3 Education

The CSRD will add additional information to its annual water invoice to the Falkland water works customers to encourage water conservation. The CSRD will continue to distribute a brochure with the annual water bill. A sample brochure is included in Appendix B. This brochure will provide information on tips to save water, the advantages on an underground irrigation system, sprinkling regulations, plumbing retrofits and replacements such as dual 3/6 litre flush toilets, high efficiency washing machines, conservation landscaping, etc. The CSRD will introduce a new site for each of its water systems on the CSRD website, and link each water system to a site that has comprehensive information on water conservation.

4.4 Water Restrictions and Enforcement

Water restrictions will continue to be implemented to reduce the maximum daily demand on the system in the summer months, increase public awareness of water conservation, and conserve water. The current restrictions specify watering of landscaping is permitted from 6:00 A.M. to 10:00 A.M. and from 6:00 P.M. to 10:00 P.M. Odd numbered houses sprinkle on odd numbered dates, and even numbered houses sprinkle on even numbered days. More stringent water restrictions may be imposed as required. Compliance is mandatory and MTI fines can be issued if in contravention.

5.0 IMPLEMENTATION STRATEGY

The timing of implementation of the initial elements of the CSRD's water conservation plan is set out in the following table. In addition, required funding resources along with their sources are identified.

Implementation of Initial Elements of Falklands Water Conservation Plan

Element	Timing	Funding	
		Amount	Sources
Water Restrictions	Annually		
Universal Metering Program	Review once building inspection occurs		
Education Program • Enhance brochure • Website • Water Bill- add information	Reviewed(yearly) Reviewed(yearly) completed(yearly)	E&E staff	CSRD
Water Loss/Accounting- water audit	Yearly	E&E staff	CSRD
Confirm Water Reduction Targets	Fall (yearly)	E&E staff	CSRD
Install Water Meters for Community Hall, Rodeo grounds and Curling rink.	ongoing	$ 8,000	Falkland Service area reserve fund
Leak Survey (if required)	ongoing	$ 5,000	Falkland Service area reserve fund

APPENDIX A

USEPA Water Conservation Plan Guidelines

APPENDIX A
WATER CONSERVATION MEASURES

This Appendix to the EPA Guidelines for Preparing Water Conservation Plans describes the water conservation measures that water utilities can use in designing water conservation programs. As part of their conservation plans, planners should consider, *at a minimum,* each of the measures specified in the Basic, Intermediate, or Advanced Guidelines, depending on which set of Guidelines apply to the water system.

The measures are organized into three general categories: Level 1, Level 2, and Level 3. Within each level are four subcategories that are used to organize a variety of specific conservation measures:

- Level 1 Measures
  - Universal metering
  - Water accounting and loss control
  - Costing and pricing
  - Information and education

- Level 2 Measures
  - Water-use audits
  - Retrofits
  - Pressure management
  - Landscape efficiency

- Level 3 Measures
  - Replacements and promotions
  - Reuse and recycling
  - Water-use regulation
  - Integrated resource management

This system of organizing the conservation measures recognizes that the measures considered can vary with the size and capability of the system. *Water systems are strongly encouraged to explore the fullest range of conservation measures practical, including measures beyond the minimum measures suggested in the Guidelines that they are following.* Many smaller and middle-sized utilities have been very successful in implementing a wide range of beneficial conservation programs.

What follows is a description of each of the twelve subcategories of measures. The Guidelines provide checklists that planners can use in reviewing measures. However, planners are encouraged to consider as many measures as practical given their capability and the conditions they seek to address. In some cases, planners may choose to consider and implement selected measures beyond those minimally recommended for consideration.

Although this list of conservation measures is relatively current and comprehensive, planners should not limit their analysis only to the measures mentioned here. Planners also should consider new technologies and approaches as they become available. Letters next to each category indicate whether the measures in that category are considered particularly useful in reducing average-day demand [A], maximum-day or peak demand [P], both [B]. Worksheets for some of the conservation measures are provided at the end of this Appendix.

Level 1 Measures

Universal Metering [B]

Measures	← Advanced Guidelines → ← Intermediate Guidelines → ← Basic Guidelines →		
Universal metering [B]	▪ Source-water metering ▪ Service-connection metering and reading ▪ Meter public-use water	▪ Fixed-interval meter reading ▪ Meter-accuracy analysis	▪ Test, calibrate, repair, and replace meters

Metering is a very fundamental tool of water system management and conservation. Worksheet A-1 can be used by systems to assess their metering practices.

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 use 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.

Fixed-interval meter reading. A program of fixed-interval meter reading is essential to determine the amount of nonrevenue-producing water. Source meters and service connection meters should be read at the same relative time in order to facilitate accurate comparisons and analysis. Readings generally should occur at regular intervals, preferably monthly or bimonthly. Estimated bills should be kept at a minimum, subject to state and local regulations.

Meter accuracy. Water meters can be damaged and deteriorate with age, thus producing inaccurate readings. Inaccurate readings will give misleading information regarding water

usage, make leak detection difficult, and result in lost revenue for the system. All meters, especially older meters, should be tested for accuracy on a regular basis. The system also should determine that meters are appropriately sized. Meters that are too large for a customer's level of use will tend to under-register water use.

Meter testing, calibration, repair, and replacement. After determining the accuracy of the metering system, the utility should provide a schedule of activities necessary to correct meter deficiencies. Meters should be recalibrated on a regular basis to ensure accurate water accounting and billing.

Water Accounting and Loss Control [A]

Measures	← Basic Guidelines →	← Intermediate Guidelines →	← Advanced Guidelines →
Water accounting and loss control [A]	▪ Account for water ▪ Repair known leaks	▪ Analyze nonaccount water ▪ Water system audit ▪ Leak detection and repair strategy ▪ Automated sensors/ telemetry	▪ Loss-prevention program

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 nonaccount water. Nonaccount 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. A system of water accounting is provided in Figure A-1. This system for tracking water begins with total water produced and ends with unaccounted-for water. Worksheet A-2 (which follows figure A-1) and Worksheet A-3 can assist water systems in developing a water accounting and loss control strategy.

Account for water. All water systems, even smaller systems, should implement a basic system of water accounting (as appears in Worksheet A-3). 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; water lost produces no revenues for the utility. Repairing larger leaks can be costly, but it also can produce substantial savings in water and expenditures over the long run.

Water accounting is less accurate and useful when a system lacks source and connection metering. Although the system should plan to meter sources, unmetered source water can be estimated by multiplying the pumping rate by the time of operation based on electric meter readings.

Analysis of nonaccount water. Nonaccount 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 nonaccount 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. Divers can be used to inspect and clean storage tank interiors.

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.

Costing and Pricing [B]

Measures	← Advanced Guidelines → ← Intermediate Guidelines → ← Basic Guidelines →		
Costing and pricing [B]	▪ Cost-of-service accounting ▪ User charges ▪ Metered rates	▪ Cost analysis ▪ Nonpromotional rates	▪ Advanced pricing methods

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. Worksheet A-4 is provided for this purpose. 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.

Information and Education [B]

Measures	← Advanced Guidelines → / ← Intermediate Guidelines → / ← Basic Guidelines →		
Information and education [B]	▪ Understandable water bill ▪ Information available	▪ Informative water bill ▪ Water-bill inserts ▪ School program ▪ Public-education program	▪ Workshops ▪ Advisory committee

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. Worksheet A-5 is provided for systems to use in assessing their information and education programs.

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.

Advisory committee. A water conservation 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.

Level 2 Measures

Water-Use Audits [B]

Measures	← Advanced Guidelines → ← Intermediate Guidelines → ← Basic Guidelines →
Water-use audits [B]	▪ Audits of large-volume users ▪ Selective end-use audits ▪ Large-landscape 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. Worksheet A-6 summarizes the components of a residential water audit. 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.

Retrofits [A]

Measures	← Advanced Guidelines → ← Intermediate Guidelines → ← Basic Guidelines →	
Retrofits [A]	▪ Retrofit kits available	▪ Distribution of retrofit kits ▪ Targeted programs

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:[1]

- 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)

[1] Duane D. Baumann, John J. Boland, and W. Michael Hanemann, *Urban Water Demand Management and Planning* (New York: McGraw Hill, 1998): 254.

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.

Pressure Management [A]

Measures	← Advanced Guidelines → ← Intermediate Guidelines → ← Basic Guidelines →	
Pressure management [A]	▪ Systemwide pressure management	▪ Selective use of pressure-reducing valves

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.

Systemwide 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.

Landscape Efficiency [P]

Measures	←——— Advanced Guidelines ———→ ←——— Intermediate Guidelines ———→ ← Basic Guidelines ——→	
Landscape efficiency [P]	▪ Promotion of landscape efficiency ▪ Selective irrigation submetering	▪ Landscape planning and renovation ▪ Irrigation management

Outdoor water usage drives maximum-day demand, which in turn drives requirements for transmission and treatment facilities. Reducing outdoor usage can thus be a very effective conservation strategy. Outdoor water use can be reduced through efficiency-oriented landscaping principles.

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.

Level 3 Measures

Replacements and Promotions [B]

Measures	← Advanced Guidelines → / ← Intermediate Guidelines → / ← Basic Guidelines →
Replacements and promotions [B]	▪ Rebates and incentives [nonresidential] ▪ Rebates and incentives [residential] ▪ Promotion of new technologies

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).

Reuse and Recycling [B]

Measures	← Advanced Guidelines → / ← Intermediate Guidelines → / ← Basic Guidelines →
Reuse and recycling [B]	▪ Industrial applications ▪ Large-volume irrigation applications ▪ Selective residential applications

Industrial applications. An alternative water source for some systems is "graywater," or treated wastewater for nonpotable water uses. Water reuse and recycling practices reduce production demands on the water system. Water utilities should work with their nonresidential 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 and recycling 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.

Water-Use Regulation [B]

Measures	← Basic Guidelines → / ← Intermediate Guidelines → / ← Advanced Guidelines →
Water-use regulation [B]	▪ Water-use standards and regulations ▪ Requirements for new developments

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 nonemergency 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.

Integrated Resource Management [B]

Measures	←——— Advanced Guidelines ———→ ←——— Intermediate Guidelines ———→ ← Basic Guidelines ——→
Integrated resource management [B]	▪ Supply-side technologies ▪ Demand-side technologies

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.

Worksheet A-1: Metering

A. BASIC GUIDELINES

Source metering

What percentage of source withdrawals is metered? _____

Connection metering

	Percent of connections metered by customer class:	Percentage of meters that are outdoors:
Residential	_____ %	_____ %
Industrial	_____ %	_____ %
Commercial	_____ %	_____ %
Public	_____ %	_____ %
Other	_____ %	_____ %

	Number of meters needed:	Estimated cost/meter	Estimated total cost
Residential	_____	_____	_____
Industrial	_____	_____	_____
Commercial	_____	_____	_____
Public	_____	_____	_____
Other	_____		

B. INTERMEDIATE GUIDELINES [Basic Guidelines above plus the following]

	Frequency of meter reading	Billing frequency	Estimated bills/year
Residential	_____	_____	_____
Industrial	_____	_____	_____
Commercial	_____	_____	_____
Public	_____	_____	_____
Other	_____	_____	_____

Are authorized uses of nonaccount water metered? _____

Schedule for testing source water meters: _____

Schedule for testing connection meters: _____

Are meters correctly sized? _____

C. ADVANCED GUIDELINES [Basic and Intermediate Guidelines above plus the following]

Describe the systems' program to test, calibrate, repair, and replace meters (including schedules): _____

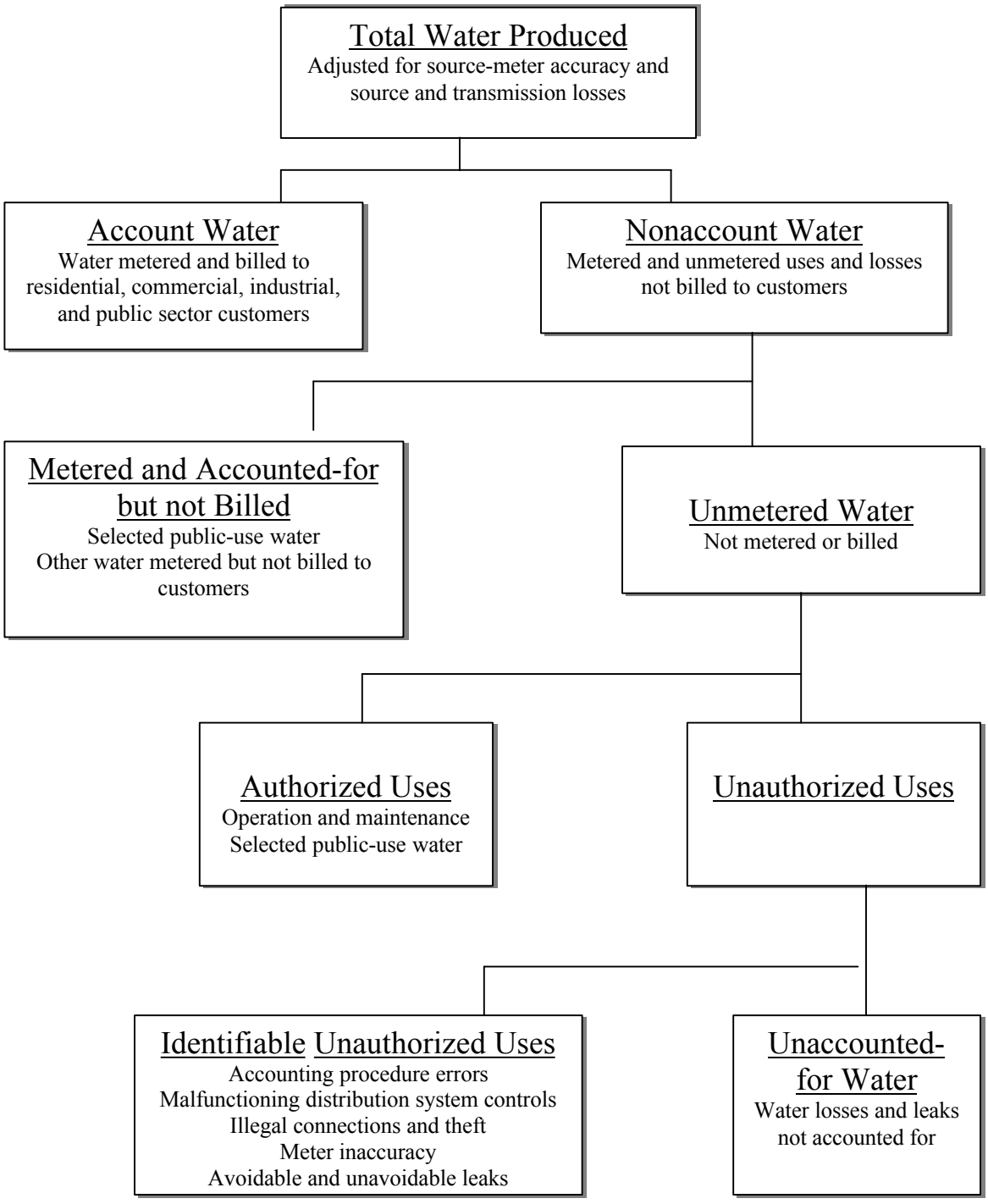


Figure A-1. Water Accounting System

Worksheet A-2: Water Accounting and Loss Control

Line	Item	Volume (gallons)		% of Amount in Line 1
1	**Total Source Withdrawals and Purchases**			100%
2	*Adjustments to source water supply [a]*			
2A	Adjustment for source meter error (+ or -)			
2B	Adjustment for change in reservoir or tank storage (+ or -)			
2C	Adjustment for transmission line losses (-) [a]			
2D	Adjustments for other source contributions or losses (+ or -) [a]			
3	Total adjustments to source water (add lines 2A through 2D))			
4	**Adjusted Source Water (subtract line 3 from line 1)**			%
5	*Metered Water Sales*			
5A	Metered residential sales			
5B	Metered commercial sales			
5C	Metered industrial sales			
5D	Metered public sales			
5E	Other metered sales			
6	Total metered sales (add lines 5A through 5D)			
7	Adjustment for meter reading lag time (+ or -)			
8	Adjustment for meter errors (+ or -) [a]			
9	Adjusted total meter sales (add lines 6 through 8)			
10	**Nonaccount Water (subtract line 9 from line 4)**			%
11	*Metered and accounted-for but not billed*			
11A	Public-use water metered but not billed			
11B	Other water metered but not billed			
12	*Authorized unmetered water: operation and maintenance*			
12A	Main flushing			
12B	Process water at treatment plant			
12C	Water quality and other testing			
13	*Authorized unmetered water: public use*			
13A	Storm drain flushing			
13B	Sewer cleaning			
13C	Street cleaning			
13D	Landscaping in large public areas			
13E	Firefighting, training, and related maintenance			
14	*Other authorized unmetered use*			
14A	Swimming pools			
14B	Construction sites			
14C	Other unmetered uses			
15	Total authorized unmetered water (add lines 11A through 14C)			
16	**Total Unauthorized Losses (subtract line 15 from line 10)**			%
17	*Identifiable water losses and leaks*			
17A	Accounting procedure errors [a]			
17B	Malfunctioning distribution system controls			
17C	Illegal connections and theft			
17D	Meter inaccuracy			
17E	Unavoidable water leaks			
17F	Avoidable water leaks			
18	Total identifiable water losses and leaks (add lines 17A through 17F)			
19	**Unaccounted-For Water (subtract line 18 from line 16)**			%

[a] Methodology subject to industry and regulatory standards.

Worksheet A-3: Strategies for Reducing Water Losses

A. TRANSMISSION LOSSES

Describe strategy for reducing transmission line losses: _____

_____

_____

_____

_____

Estimated annual water savings: _____

B. NONACCOUNT WATER

Describe strategy for reducing authorized unmetered uses: _____

_____

_____

_____

_____

Estimated annual water savings: _____

C. LOSSES AND LEAKS

Describe strategy for reducing identifiable leaks: _____

_____

_____

_____

_____

Estimated annual water savings: _____

D. UNACCOUNTED-FOR WATER

Describe strategy for reducing unaccounted-for water: _____

_____

_____

_____

_____

Estimated annual water savings: _____

Worksheet A-4: Evaluating Effects of Water Rate Changes

Line	Item	Value
1	Current price per gallon	$
2	Current revenue-producing gallons (or cubic feet)	gallons
3	Current annual revenues (line 1 multiplied by line 2)	$
4	Conservation goal (reduction in water use)	gallons
5	Conservation goal as percentage of current annual revenue-producing gallons (line 4 divided by line2)	%
6	Estimate price elasticity of demand (by customer class and/or type of use if applicable)	%
7	Percentage change in price needed to induce conservation (line 5 divided by line 6)	%
8	Calculate revised price level (line 1 multiplied by (1.00 plus line 7))	$
9	Revised annual water usage (line 1 less line 4)	gallons
10	Revised revenues (line 8 multiplied by line 9)	$
11	Annualized fixed costs	$
12	Annual variable costs for revised water usage	$
13	Revised revenue requirements	$
14	Net revenue effect (line 10 less line 13)	$

Note: Prepare for each customer class to the extent feasible.

Worksheet A-5: Checklist for Information and Education

BASIC GUIDELINES	☑
Understandable water bill	
Understandable information about water rates and usage	❒
Information available	
Pamphlet on basic home water conservation practices	❒
Pamphlet on plumbing retrofits and replacements	❒
Pamphlet on summer lawn watering and conservation landscaping	❒

INTERMEDIATE GUIDELINES [Basic Guidelines above plus the following]	☑
Informative water bill	
Compare to past usage (previous month, same period previous year)	❒
Flag unusually high recorded uses and notify customers	❒
Information tailored to customer class	❒
Water-bill inserts	
Information on the cost and value of water	❒
Basic water conservation tips	❒
Information on conservation programs	❒
School program	
Visit classrooms	❒
Distribute curriculum materials, such as worksheets and coloring books	❒
Show short information films or slide shows	❒
Field trips to water system facilities	❒
Contests and recognition for posters, ideas, etc.	❒
Public-education program	
Press releases, public space advertising, and public service announcements (various media)	❒
Conservation information centers and mobile information booths	❒
Speakers bureau, films, and slide shows for community organizations	❒
Coordination with civic and professional organization resources	❒
Special events, such as water conservation fairs	❒
Displays at home shows, garden shows, fairs, libraries, and town halls	❒
Cooperation with retail plumbing to promote conservation	❒
Recognize conserving businesses and industries	❒

ADVANCED GUIDELINES [Basic and Intermediate Guidelines above plus the following]	☑
Workshops	
Workshops for plumbers, plumbing fixture suppliers, and builders	❒
Workshops for landscape and irrigation service providers	❒
Advisory committee	
Creation of a public advisory committee	❒

Worksheet A-6: Checklist for a Residential Water Audit

Service Meter	☑
Calibration/flow test	❒
Leak test	❒
Report findings to maintenance personnel	❒
Kitchen	☑
Check faucet flow rate	❒
Offer to install aerator or flow restrictor	❒
Check for drips and leaks	❒
Bath	☑
Shower	
Check showerhead flow rate	❒
Offer to install low-flow showerhead or flow restrictor	❒
Check for drips and leaks	❒
Sinks	
Check faucet flow rate	❒
Offer to install aerator or flow restrictor	❒
Check for drips and leaks	❒
Toilets	
Check for leaks (dye test)	❒
Clean or replace flapper	❒
Check the adjustment of the float arm	❒
Offer to install retrofit devices	❒
Provide information on available rebates	❒
Outside Water Use (Irrigation Season)	☑
Measure the flow rate of sprinklers	❒
Check for leaks in the sprinkler, hose, or sprinkler system	❒
Check the position of sprinklers	❒
Instruct homeowner on efficient water techniques	❒
Recommend a watering schedule based on:	❒
▪ Any water restrictions imposed by local government	❒
▪ Best time of day for watering	❒
▪ Frequency of watering	❒
▪ Length of time for watering	❒
Provide information about water-efficient landscaping practices	❒

Source: Adapted from American Water Works Association, Pacific Northwest Section, *Water Conservation Guidebook for Small and Medium-Sized Utilities* (August 1993). Appendix B.

APPENDIX B

Potential Water Conservation Measure table

Measures	Tools	Applicable to Falkland Waterworks	Present Status	Comments/Options/Recommendations
Universal Metering	• Source-water metering	Yes	meter at pump house	Meter accuracy should be verified periodically
	• Service – connection metering	Yes	No meters in place	New builds to have meters installed since 2009
	• Public – use water metering	Yes	No meters in place	Meter recommended for Rodeo grounds
Water Accounting And Loss Control	• Account water	No		Requires universal metering to be effective
	• Repair known leaks	Yes	Repair when leaks are observed	Location and date of leaks are recorded
	• Analysis of non-account water	No		Relevant if revenue received from metered water
	• System audit	Yes	Annual audit	Comparison of average water use per residence with pump house meter
	• Leak detection and repair strategy	Yes	No leak detection undertaken to date	Review when universal metering is in place
	• Automated sensors/telemetry	Yes	Alarm system monitors reservoir levels	SCADA telemetry in place
	• Loss prevention	Yes	Some actions in place, e.g. unidirectional flushing	Other options- proactive repair
Costing And Pricing	• Cost-of-service accounting	Yes		Annual system review
	• User charges	Yes	Parcel tax to all properties, flat user fee to users of system	Annual tax- capital cost recovery, user fee- annual operating and maintenance cost
	• Metered rates	Yes	No meters in place	Consider with building inspection
	• Cost analysis	No		Only 1 class of service- residential
	• Non-promotional rates	No	Current rate is flat	Only 1 class of service-residential
	• Step Water Rates	Yes	Current rate is flat	Applicable with universal metering

Measures	Tools	Applicable to Falkland Waterworks	Present Status	Comments/Options/Recommendations
Information And Education	• Advisory committee	Yes	Established by CSRD Bylaw	Advisory Committee has mandate that includes water conservation
	• Understandable water bill	Yes	Current bill provides basic information only	Consider adding information related to actual cost, volumes, etc.
	• Information available	Yes	Brochure distributed annually	Brochure provided on request also
	• Informative water bill	Yes	Current bill provides basic information only	Consider adding information related to actual cost, volumes, etc.
	• Water bill inserts	Yes	Insert in annual water bill	
	• School program	No	No educational program in place	
	• Public education program	Yes	Limited scope	Expand public education, post information on water conservation on CSRD website
	• Workshops	No	Not done now	
Water Use Audits	• Audits of large-volume users	No		
	• Large – landscape audits	No	Not done now	
	• Selective end-use audits	No		Only 1 class of water user
	• Independent supplies	No		
Retrofits	• Retrofit kits available	Yes	Not done now	Facilitate best prices on products, encourage replacement
	• Distribution of retrofit kits	Yes	Not done now	Distribution through community association could be effective
	• Targeted programs	No		Only 1 class of user

Measures	Tools	Applicable to Falkland Waterworks	Present Status	Comments/Options/Recommendations
Pressure Management	• System-wide pressure management	Yes		2 pressure zones in system
	• Pressure-reducing valves	No		
Landscape Efficiency	• Promotion of landscape efficiency	Yes	Not done now	If sufficient CSRD resources
	• Selective irrigation sub-metering	No		No large water users
	• Landscape planning and renovation	No		
	• Irrigation management	Yes	Not done now	Encourage underground irrigation systems
Replacements and Promotions	• Rebates And Incentives	Yes	Not done now	Possible if water systems amalgamate
	• Promotion Of New Technologies	Yes	Not done now	Via CSRD website, e.g. high efficiency washing machines
Reuse And Recycling	• Industrial Applications	No		No water using industries
	• Large-Volume Irrigation Applications	No		
	• Selective Residential Applications	No		IHA prohibits use of grey water
Water Use Regulation	• Water-Use Standards, Regulations, Enforcement	Yes	Sprinkling restrictions are in place annually	Mandatory compliance, MTI fines through Bylaw enforcement
	• Requirements For Developments	No		
Integrated Resource Management	• Supply-Side Technologies	No		
	• Demand-Side Technologies	No		