

JUNE 2006

NORTHERN COLORADO
ACTION PLAN FOR
*Industrial, Commercial
& Institutional (ICI)
Water Conservation*

A COLLABORATIVE EFFORT OF PARTICIPANTS FROM:

Aurora Water	City of Thornton
City of Aurora	City of Westminster
City of Boulder	Northern Colorado Water Conservancy District
City of Fort Collins	South Adams County Water & Sanitation District
City of Greeley	Town of Superior
City of Longmont	The Brendle Group, Inc.
City of Loveland	

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City of Aurora

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City of Thornton

City of Westminster

Northern Colorado Water Conservancy District

South Adams County Water and Sanitation District

Town of Superior

Prepared By:



The Brendle Group, Inc.

226 S. Remington St. #3

Fort Collins, CO 80524

(970) 207-0058

www.brendlegroup.com

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Acknowledgements

Project Participants

- Susan Bilo, City of Aurora
- Laurie D'Audney, City of Fort Collins
- Stu Feinglas, City of Westminster
- Judy Hauschulz, Town of Superior
- Paul Lander, City of Boulder – Executive Project Manager
- Debra Mills, South Adams County Water and Sanitation District
- Ruth Quade, City of Greeley
- Kevin Reidy, Aurora Water
- Esther Vincent, Northern Colorado Water Conservancy District
- Lynne Wegley, City of Longmont
- Laura Wing, City of Thornton
- Steve Witter, City of Loveland



Front Row (Left to Right): Julie Sieving, Cynthia Peterson, Susan Bilo, Poppy Staub, Judy Dorsey, Judy Hauschulz
Back Row: Ruth Quade, Laurie D'Audney, Laura Wing, Paul Lander, Stu Feinglas, Steve Witter, Esther Vincent, Debra Mills

Pollution Prevention Advisory Board Liaison Members

- Cynthia Peterson
- Poppy Staub

Consulting Team from The Brendle Group, Inc.

- Judy Dorsey
- Seth Jansen
- Julie Sieving

Executive Summary

This report presents the process and results from a Pollution Prevention Advisory Board (PPAB) grant aimed at increasing industrial, commercial, and institutional (ICI) water conservation in Northern Colorado through a regional partnership.

The issues of water quality and supply, when coupled, easily reflect the State's top environmental priority according to the 2002 Environmental Conditions and Directions Study¹. Water conservation on a statewide level is challenging given the complex and fragmented system of water providers. Moreover, most conservation programs have historically targeted residential and irrigation accounts. As a result, ICI sectors in Colorado present an area of particular need for conservation programs.

As recipient of the grant, The Brendle Group convened and facilitated four meetings of Northern Colorado Water Providers, which culminated in the development of this report. This report serves as a resource guide for other water providers interested in forming regional partnerships to advance ICI water conservation in other parts of the state, as well as an action plan for the Northern Colorado partnership moving forward.

The water providers that participated in this process include the following organizations:

- City of Aurora
- City of Boulder
- City of Fort Collins
- City of Greeley
- City of Longmont
- City of Loveland
- City of Thornton
- City of Westminster
- Northern Colorado Water Conservancy District
- South Adams County Water and Sanitation District
- Town of Superior

As a result of this grant, the group has realized four significant accomplishments:

- Sectors analysis and preliminary benchmark study – the most comprehensive of its kind nation-wide
- A template for general ICI water conservation audits and compilation of resources and best management practices (BMPs) in 5 priority sectors
- Plans to continue meeting as a regional partnership and specific strategies to address in the near and long term
- Plans to establish an ICI Benchmarks task force within the Colorado Water Wise Council (CWWC) to take the preliminary benchmark study to a more robust and state-wide level

¹ Colorado Department of Public Health and Environment, Environmental Conditions and Directions Study, <http://www.cdphe.state.co.us/el/library/ECADS.asp>

The remainder of this report presents the background, process, and specific results of these four accomplishments.

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1 Project Background

The Colorado Department of Public Health and Environment's Pollution Prevention Advisory Board (PPAB) administers an annual grant program to support pollution prevention activities in Colorado. Specifically, these grants are designed to fund pollution prevention programs including education/training and collection of pollution prevention information, as well as to fund technical assistance to small- and medium-sized businesses in the state.

In 2005, The Brendle Group Inc., with the support of Colorado Water Wise Council Co-Chair Paul Lander, was awarded this grant to advance industrial, commercial, and institutional (ICI) water conservation in Northern Colorado through a regional partnership.

1.1 Basis of the Project

The issues of water quality and supply, when coupled, easily reflect the State's top environmental priority according to the 2002 Environmental Conditions and Directions Study² (ECADS). Furthermore, water is intrinsically linked to other top priorities identified by the ECADS report. The energy required for water and wastewater treatment, as well as transportation and distribution, links water to energy use and the associated issues of air quality and greenhouse gas emissions. Water conservation on a statewide level is challenging given the complex and fragmented system of water providers. Statewide, there are more than 2,000 water providers, the majority of which supply less than 2,000 acre-feet of water per year. Denver Water, which is twice the size of any other provider in the state, has more formalized conservation rebates and services, but the majority of medium and small providers in the state do not. Moreover, most conservation programs have historically targeted residential and irrigation accounts. As a result, ICI sectors in Colorado present an area of particular need for conservation programs. Although they do not represent the largest number of customers, ICI customers often represent the largest individual users within a provider's system. Furthermore, their specific use patterns are unique, requiring more technical and tailored conservation approaches.

Water providers agree that coordinating resources would benefit them in efforts to expand ICI water conservation. Examples of topics to which collaboration might be applicable include developing conservation programs, pursuing funding, and sharing technical competence.

The various stages of program development from research through implementation can be costly. For water providers without an ICI conservation budget, cost can severely limit the range of programs they might offer. By fostering cooperation among providers, the cost of program development can be defrayed across a number of entities. Thus, a collective effort would enable some districts to expand their services, while allowing others to provide at least some level of service in this area, even with limited or no ICI conservation budget.

Another area of collaborative advantage revolves around sharing technical competence. As previously mentioned, ICI conservation tends to be more technically demanding than efforts

² Colorado Department of Public Health and Environment, Environmental Conditions and Directions Study, <http://www.cdphe.state.co.us/el/library/ECADS.asp>

with residential and irrigation accounts. As a result, the depth of technical knowledge required can prohibit program development for smaller water providers. By pooling technical and research efforts the collective competence of the larger group can mutually benefit all participants.

This project uses an engineering-supported method to explore resources, needs, gaps, and key areas of cooperation for a partnership of water providers in Colorado's Northern Front Range.

1.2 Objectives

The end goal of this project is to increase ICI water conservation in Northern Colorado. The project objectives for reaching this goal are outlined below:

- Understand the current ICI water conservation situation and resource gaps that may exist.
- Develop an Action Plan to facilitate cooperation among water providers and maximize ICI conservation opportunities.
- Gather data to support the Action Plan based on common sectors and best management practices.
- Create a structure and process for ongoing coordination by the regional water providers participating in this project.
- Assess results and disseminate them to water providers statewide.

1.3 Approach

This project was made possible by a grant from the PPAB. As recipient of the grant, The Brendle Group convened and facilitated four meetings of Northern Colorado Water Providers, which culminated in the development of this regional plan. The water providers that participated in this process include the following organizations:

- Aurora Water
- City of Aurora
- City of Boulder
- City of Fort Collins
- City of Greeley
- City of Longmont
- City of Loveland
- City of Thornton
- City of Westminster
- Northern Colorado Water Conservancy District
- South Adams County Water and Sanitation District
- Town of Superior

Of the in excess of 250,000 accounts receiving water service from these providers, in excess of 11,000 are ICI customers.

Meeting notes and additional detail about the project approach are documented on the project web-site at www.brendlegroup.com/nocoici. A list serve also was established for the group. The project web-site and list serve allowed other interested parties who were unable to attend meetings to stay informed about the project.

The overall method during the four-meeting process was as follows:

- Convene the group – discuss existing activities and resources.
- Conduct a sector analysis to better understand the breadth of ICI activities for each provider and the commonality of ICI sectors for the group as a whole.
- Focus efforts on the following sectors as a result of the previous analysis:
 - Restaurants
 - Hotels and motels
 - Nursing, retirement, and assisted living complexes
 - Retail and shopping centers
 - Hospitals and medical offices
- Develop specific strategies for increasing ICI water conservation in the region using sector analysis data and best management practices (BMPs) as guides

2 Situation Analysis

The purposes of the situation analysis were to determine the status of existing conservation programs in ICI sectors among participating water providers, the perceived challenges to implementing programs, and the highest priority sectors in which to address those challenges.

2.1 Inventory of Existing Activities

The premise of this project was that ICI conservation programs are underdeveloped in Northern Colorado. As the following tables confirm, very few Northern Colorado water providers are addressing ICI conservation in a strategic manner for specific accounts. Understanding the scope of existing programs provides insight into unrealized opportunities for conservation as well as collaboration.

These data were collected using a written survey issued to each of the participating water providers. The results were then filtered to include only programs that address ICI conservation.

The data indicate that participating providers are indirectly addressing ICI conservation through a number of educational, informational, and regulatory programs. The value of these programs should not be understated given that many of them are developed and operated with limited resources. However, programs providing audits or direct technical assistance are small in scale or simply do not exist for most providers. Therefore, audits and direct technical assistance represent significant opportunities for growth through provider collaboration .

City of Aurora

Program	Program Type	Sector Served	Description
Water Smart Partner Program	Information	Commercial	Programs for businesses to promote water conservation including water smart car washes, restaurants, hotels/motels, and general business.
Car Wash Certification Program	Certification	Commercial	Certifies commercial car wash companies that have achieved certain water conservation measures. The list of companies is available to residents to encourage patronage of these companies.

City of Boulder

Program	Program Type	Sector Served	Description
Water Conservation Tips	Information	Commercial/ Residential	Website offers conservation tips for homes and businesses, indoor conservation tips such as "20 Ways to Save Water" and "Interesting Water Facts", and outdoor conservation tips such as watering, reducing use by 10%, lawn care methods, turf management befo
How are we doing?	Information	Commercial/ Residential	Shows graphs to inform residents of the City of Boulder drought watch.
Rebates	Incentives	Commercial/ Residential	Rebates are extended to commercial customers as well as residential
Slow the Flow	Audits	Commercial/ Residential	Free irrigation audits
Site Audits	Audits	Commercial/ Residential	Site audits provided by third party consultant
Landscape Regulations	Regulation	Commercial	Landscaping regulations are primarily directed at non-residential accounts

City of Fort Collins

Program	Program Type	Sector Served	Description
High Plains Landscape Workshop	Education	Commercial/ Residential	One-day workshop designed to promote high quality, sustainable landscapes.
Landscape & Irrigation Standards for Water Conservation	Regulation	Commercial	Landscape and irrigation plans must be reviewed by the City for compliance with requirements to promote water-efficient landscapes.
Sprinkler Systems	Information	Commercial/ Residential	Information about sprinkler systems including backflow prevention requirements and water-efficient sprinkler systems.
Lawn Watering Guide	Information	Commercial/ Residential	Daily lawn watering data in the Fort Collins Coloradoan. Shows how much water a lawn might need.
Public Programs	Education	Commercial/ Residential	Programs offered throughout the year on a broad range of water conservation topics.

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Commercial Audits	Audits	Commercial	Facility water audits for small commercial customers.
Wasting Water	Regulation	Commercial/ Residential	Enforce City's wasting water ordinance.
Xeriscaping	Information	Commercial/ Residential	Information programs and Xeriscape demonstration garden

City of Greeley

Program	Program Type	Sector Served	Description
Water Conservation Store	Information	Commercial/ Residential	Water conservation products and xeriscaping gardening books available for sale.
Seminars	Workshops	Commercial/ Residential	Upcoming Seminars: Environmental Choices for Restaurants, Environmental Landscaping and Automotive Dealer and Repair
Demonstration Gardens	Information	Commercial/ Residential	The Water Department has or has participated in starting several Xeriscape Demonstration Gardens around town to give customers ideas for their water conserving gardens.
Xeriscaping Information	Information	Commercial/ Residential	Information for the planning and design of a xeriscaped lawn.

City of Longmont

Program	Program Type	Sector Served	Description
Xeriscaping	Information	Commercial/ Residential	Information, demonstration xeriscape gardens, and garden-in-a-box for water conservation available to residents of Longmont.
Irrigation Efficiency Audits	Audits	Commercial/ Residential	Free irrigation efficiency audits offered annually June-August.
Appliance Rebates	Incentive	Commercial/ Residential	Rebates on the purchase of Energy Star rated clothes washers and dishwashers, and on ULV and dual-flush toilets.
Soil Amendment Rebates	Incentive	Commercial	Rebate provided to home-builders for installing soil amendment to specifications mandated by City Code.
Water Wasting Prohibited	Regulation	Commercial/ Residential	Ordinance prohibits waste of water.
Soil Amendment Required	Regulation	Commercial/ Residential	Ordinance requires soil amendment applied to specific standards for all new construction before a Certificate of Occupancy is issued.
Business Environmental Series	Information	Commercial	Piloted 2005 by electric and water/wastewater departments to target ICI conservation. Attendance low, not anticipated to continue in 2006.
Arterial Landscaping Guidelines	Information	Commercial	Alternative design standards for arterial landscaping to encourage water conservation.

City of Loveland

Program	Program Type	Sector Served	Description
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Water Conservation Publications	Information	Commercial/ Residential	City provides many different publications free of charge that address wise water use, lawn watering and xeriscape design. Over 2,000 distributed to date.
Water Wasting Regulation	Regulation	Institutional	A city ordinance regulates against the wasting of water.
Xeriscape demonstration Garden	Information	Commercial/ Residential	Loveland's Jeff Peterson Xeriscape Garden provided examples of xeric plantings and ideas and information about xeriscape design and plant selection. City's Service Center is also a good display of xeric design.
Utility Bill Messages	Information	Commercial/ Residential	Provide timely water wise tips on monthly utility bill.
Website	Information	Commercial/ Residential	Extensive web pages full in information about water conservation including plant lists that can be accessed by all.
Leak Detection Dye Tabs	Information	Commercial/ Residential	Provide customers the ability to check for leaks in their toilets.

Northern Colorado Water Conservancy District

Program	Program Type	Sector Served	Description
Public Education	Education	All	Water festivals, water schools, publications, speakers bureau, drought campaigns, training and seminars for teachers, and legislator workshops.

Town of Superior

Program	Program Type	Sector Served	Description
Superior Water Conservation Tips	Information	Commercial/ Residential	A list of suggestions on how to save water. The community's goal is an approximate 20% overall reduction.
Irrigation	Re-use of reclaimed domestic wastewater	Commercial/ Residential	Educating applicators about safe and waterwise practices, inspecting application sites, and monitoring for excessive use per CDPHE Reg. 84.

City of Thornton

Program	Program Type	Sector Served	Description
Voluntary Watering Restrictions	Regulation	Commercial/ Residential	Stage I Drought Designation/Voluntary Watering Restrictions
Water Conservation Plan	Planning	Commercial/ Residential	City of Thornton's Water Conservation Plan
Conservation of Water Resources	Regulation	Commercial/ Residential	Chapter 74, Article III - Water waste is prohibited, Drought Management Plan
Tiered Water Rate Structure	Regulation	Commercial/ Residential	Water rates encourage water conservation by increasing after average winter consumption plus an allowance.

Landscape Planting Standards	Regulation	Commercial/ Residential	Incorporates water wise landscaping principles into City Code/Standards and Specifications.
Plant Lists by Water Demand	Regulation	Commercial/ Residential	Approved plant list by water demand for city owned properties.
Irrigation Standards	Regulation	Commercial/ Residential	Incorporates water wise irrigation principles into City Code/Standards and Specifications.

City of Westminster

Program	Program Type	Sector Served	Description
Reclaimed Water	Information	Commercial/ Residential	Information about reclaimed or recycled water.
More Water Conservation Information	Information	Commercial/ Residential	Links to other websites including turf management and information on water conservation.
Development Inspection and Review	Regulation	Commercial/ Residential	Mandatory review and inspection of landscape and irrigation plans and installations for new development projects.

Existing collaboration and networking takes place among participating providers through the Colorado Water Wise Council (CWWC) and the Rocky Mountain Section of the American Water Works Association (RMSAWWA). While both of these groups provide good platforms for communication and collaboration, neither group has specifically addressed ICI program development. They are collectively responsible for the following programmatic efforts that could potentially support enhanced ICI conservation practices:

1. Conservation training for water providers
2. Metro Mayors Caucus Best Management Practices for Water Conservation and Stewardship³
3. Statewide water conservation workshops with Western Resource Advocates and Great Western Institute
4. Newly created RMSAWWA Alice Darilek Award in conservation given each September
5. Development of state guidelines in concert with Colorado Water Conservation Board
6. Cooperative publications: Xeriscape Maintenance Journal series; Irrigation Audit form
7. Educational sessions offered quarterly in conjunction with the RMSAWWA

³ Colorado Water Wise Council, Metro Mayors Caucus Best Management Practices for Water Conservation and Stewardship, <http://cwcb.state.co.us/Conservation/pdfsDocs/MMBMPs.pdf>

2.2 Known Challenges

A number of barriers to developing ICI water conservation programs were identified by the participants. These include a lack of benchmarks for ICI water use, funding limitations, and the difficulty inherent in developing the depth of technical understanding necessary to implement programs.

Benchmarks for water consumption, such as those commonly employed in the energy industry, are a key component in developing water conservation programs. Accurate benchmarks allow priority customers to be targeted based on their use, improve the fairness of water budgeting, and help end-use customers anticipate the water consumption impacts of operational changes. The task of developing consumption benchmarks for ICI sectors poses its own unique challenges. ICI consumers, even within a single sector, can have complex and widely varying processes that lead to significantly different use patterns. Seasonal variations, irrigation practices, and economic influences can introduce additional complexity into the analysis. The next section of this report develops an analysis of water use by sector that provides a solid step in the direction of building the needed benchmarks. Upcoming sections also explore previously completed benchmarking efforts by other entities that might be of comparative use.

Embedded within the barrier of lacking benchmarks are the data collection issues associated with developing useable benchmarks. As further described in upcoming sections, benchmarks require accurate categorization of accounts as well as an appropriate factor against which data can be normalized. While sub-metering, which is strongly recommended for users in these sectors, and appropriate account classification can facilitate categorizing use data, some other method of data collection will be necessary to increase the availability of normalizing data factors.

Funding can be a severe limitation to the scope and magnitude of ICI water conservation programs. Small water providers, in particular, often will not have the budget to develop programs. The participants in this project recognize the potential for mitigating this issue through resource sharing and collaborative financing efforts. Opportunities for collaboration and potential funding sources will be discussed in Section 4.

Technical challenges present the last major barrier identified by participating water providers. The number of water conservation products and services on the market makes it difficult for water providers to understand and anticipate the effectiveness of various measures. Similar to funding, technical barriers also have the potential to be surmounted through collaboration. As demonstrated in Section 3.3, numerous opportunities exist for regional water providers to coordinate training efforts and share experiences with products and services in order to reduce the development cost of water conservation programs.

2.3 Sectors Analysis

To supplement the inventory of existing programs, a Sectors Analysis was performed using ICI account data from six participating water providers. The purpose of the sectors analysis was to identify and prioritize particular areas of collaboration for the regional partnership. An early analysis of the data found that the water providers generally have very similar break-downs by sector within their respective ICI accounts mix, both in terms of numbers of accounts and total water use by sector. These data were then used to help set priority sectors to target for the balance of the grant while setting the stage for more robust benchmarks development.

The effort was based on data provided by six of the communities participating in this project: Aurora, Boulder, Fort Collins, Longmont, Thornton, and Westminster. Generally, the data were prescreened by each participant to include primarily ICI sector accounts, though additional filtering was necessary as described below. In all cases, these data come from the respective community’s utility billing system and included, at a minimum, annual consumption by account. Each community provided data for the most recent year that was readily available, which varied from 2001 to 2004.

Methods

Four of the six data sets were provided with the accounts already categorized in order to protect the identities of individual customers. In these instances, the provided categories were mapped to the sectors that were identified by project participants. This was generally a one-to-one mapping since the data providers were aware of this project’s categorization scheme as they prepared the data sets. Accounts explicitly serving irrigation or multi-family housing were omitted from the analysis since they are outside of this project’s scope of interest.

One data set separated consumption data and account categories into two files, both containing account numbers. Account numbers were matched between the files allowing corresponding categories and consumption to be synthesized into a single file. As with the previously mentioned data sets, provided categories were mapped to this project’s sectors and irrigation or multi-family accounts were omitted from the analysis.

The final data set used North American Industry Classification System⁴ (NAICS) codes to identify consumer sectors. These codes were mapped to this project’s sectors as shown in Attachment 1. In general, the first three digits of the NAICS code were sufficient to match the code with a category in this project’s more general scheme. However, in some cases, such as car washes, more NAICS digits were necessary to isolate a particular sector.

The sectors selected for this analysis are summarized in Table 2.1.

Auto service stations	Laundromats or laundry facilities
Car washes	Manufacturing or industry
Child care	Food processors
Churches	Property management, general commercial, offices
Gas stations	Recreation
Grocery or food stores	Restaurants

⁴ U.S. Census Bureau, North American Industry Classification System, <http://www.census.gov/epcd/www/naics.html>

Government facilities	Retail or shopping centers
Health and fitness clubs	Schools or colleges
Hospitals and medical offices	Salons
Nursing homes, retirement, or assisted living complexes	Unknown or miscellaneous others
Hotels or motels	Utilities or water districts

Table 2.1. ICI Sectors Identified in this Analysis

Results

The results of the Sector Analysis are presented in Table 2.2. From the 7,594 data points collected, average consumption per connection and total consumption by sector were determined. The sectors consuming the most water were property management/general commercial/office, retail/shopping centers, restaurants, and manufacturing/industry. The largest average consumers per connection (in this case a connection is defined to be equivalent to a billable account) were food processors, nursing/retirement facilities, hotels/motels, and health and fitness clubs.

Sector Name	Consumption (kgal/yr)	Percentage of Total Water Use	Rank of Total Water Usage	Count by Type	Average Use N. Colorado (kgal/yr)
Food processors	291,145	5.7%	5	23	12,658
Nursing homes, retirement/assisted living complexes	151,965	3.0%	8	48	3,166
Hotels/motels	284,179	5.5%	6	103	2,759
Health and fitness clubs	52,540	1.0%	19	21	2,502
Car washes	85,406	1.7%	15	69	1,238
Utilities/water districts	8,583	0.2%	22	9	954
Restaurants	625,509	12.2%	3	671	932
Gas Station	96,407	1.9%	13	106	910
Hospitals and medical offices	264,153	5.1%	7	315	839
Government	99,587	1.9%	12	122	816
Schools and colleges	127,214	2.5%	9	163	780
Recreation	80,925	1.6%	16	106	763
Grocery/food stores	102,282	2.0%	11	139	736
Salon	41,582	0.8%	20	58	717
Manufacturing/industry	621,928	12.1%	4	892	697
Retail/shopping centers	858,514	16.7%	2	1,484	579
Churches	103,092	2.0%	10	189	545
Laundromats/laundry facilities	57,795	1.1%	18	128	452
Property management/general commercial/office	1,005,805	19.6%	1	2,246	448
Child care	72,751	1.4%	17	185	393
Auto service stations	95,541	1.9%	14	361	265
Unknown or miscellaneous other	13,328	0.3%	21	156	85
	5,140,230			7,594	

Table 2.2. Results of Sector Analysis

Examining total water use per sector in conjunction with average water use per connection can begin to inform a water provider’s choice of which sectors to target with water conservation programs. For example, while the utilities and water districts sector has fairly high use per connection, it is a relatively small consumer overall and may not be the highest priority sector for ICI water conservation attention. In contrast, nursing facilities have high average use per connection and contribute significantly to overall consumption. Therefore, this sector may be a higher priority. In addition to informing programmatic direction, these metrics can help to prioritize particular customer targets within a sector. For providers with limited budgets for ICI water conservation, targeting high intensity customers is imperative.

The maximum use by sector is presented to give some indication of the range of values reported within a sector. Clearly, the actual water use by connection can vary greatly from the average water use by connection. However, more robust benchmarks can be developed by incorporating a normalizing factor that accounts for variations in an end user’s size, operational characteristics, and production levels.

Average water use per connection by sector and percentage of total water use by sector are presented graphically in Figures. 2.1 and 2.2, respectively.

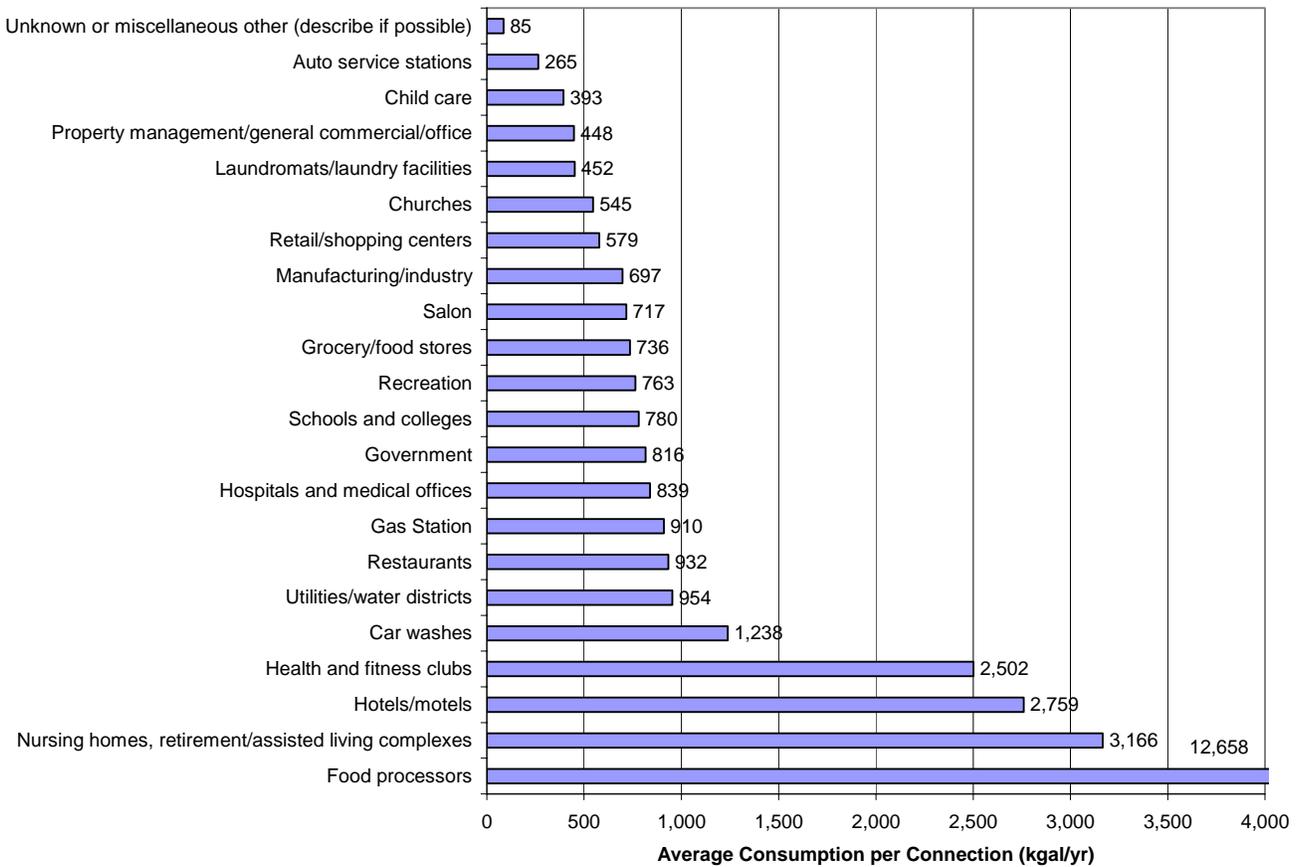


Figure 2.1. Average Consumption per Connection by Sector

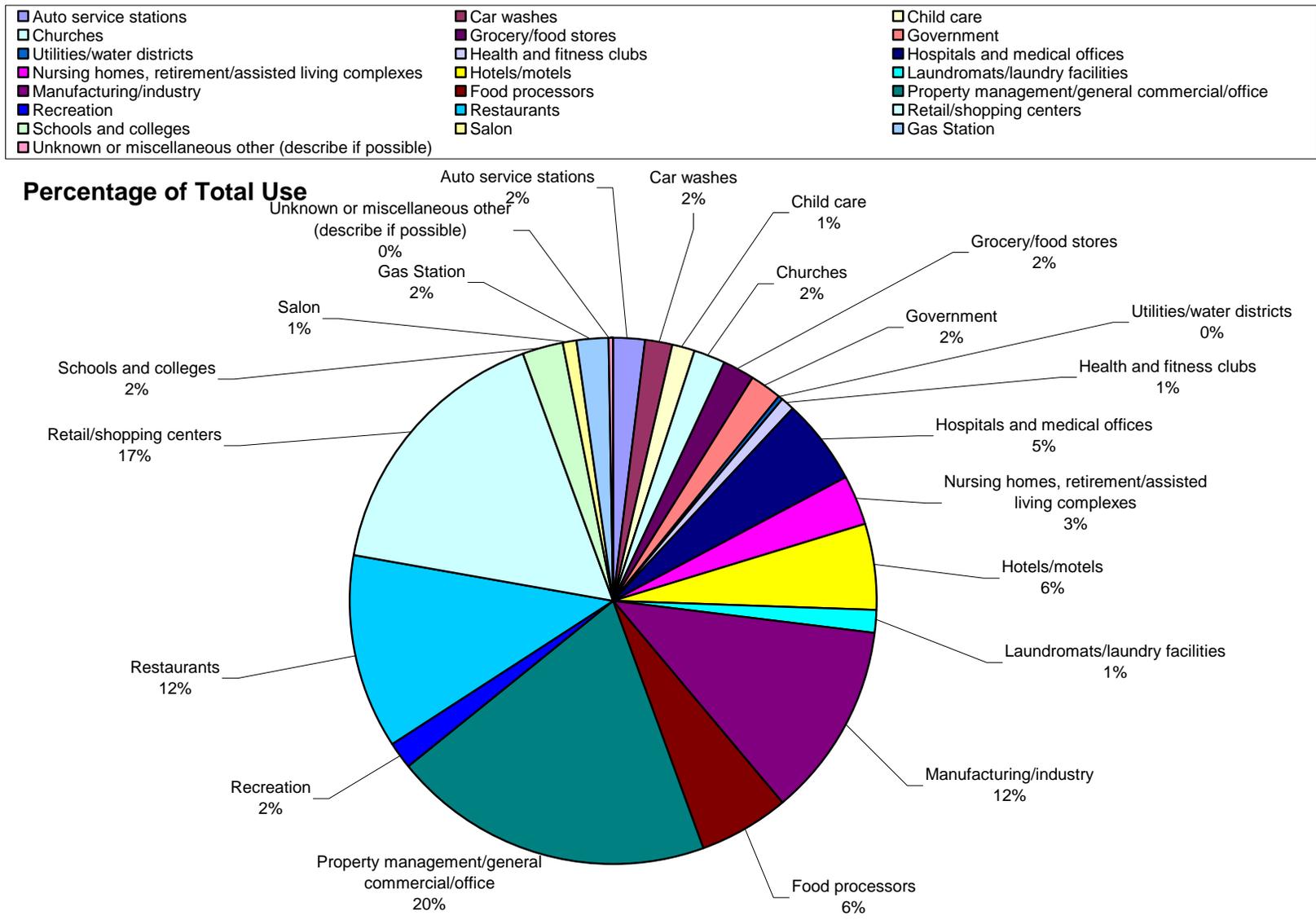


Figure 2.2. Percentage of Total Use by Sector

Correction for Irrigation Use

During the process of the sectors analysis, participants recognized that irrigation use would be embedded in many ICI accounts and that this would result in a skew of the resulting metric. Since this project is intended to focus on indoor ICI use — irrigation use is already widely addressed by conservation programs — it was desirable to separate irrigation from indoor use.

Ideally, a separate meter would be used for each customer’s irrigation. Unfortunately, this is rarely the case in practice and most water providers will have to deal with the challenge of embedded irrigation use.

Common practice amongst water providers has been to use only winter months in the determination of metrics, thereby isolating the data from irrigation use that occurs primarily during the summer. While this method may introduce additional skew by not accounting for other seasonal cycles, such as those related to process or production, it probably produces the most relevant indoor-only consumption data that can be obtained without separate meters.

A comparison was made between monthly variability over the year versus monthly variability over the three winter months from December to February, as presented in Table 2.3. This analysis was based on one of the six data sets used in the sector analysis. This data set was selected because it provided a monthly breakdown of use.

The variability was expressed in terms of percentage variation, which is the ratio of the standard deviation to the mean, in this case, the standard deviation of monthly use to the monthly mean use.

Sector Name	Percentage Variation (ratio of standard deviation to monthly mean)	
	12 Months	Dec. to Feb.
Auto services	72%	37%
Beauty Salon	57%	17%
Car Wash	35%	11%
Church	70%	35%
Cleaners	27%	5%
Food processors	22%	24%
Gen commercial/office	69%	62%
Government	79%	89%
HOA	82%	44%
Hospital/medical	91%	15%
Manufacturing/industry	76%	22%
Multi-family housing	40%	17%
Recreation	32%	32%
Restaurant	44%	29%
Retail/shopping centers	110%	47%
Schools/colleges	141%	57%

Table 2.3. Percentage Variation for Annual and Winter-Only Periods

The percentage of variation remained equal or was reduced for 14 of the 16 sectors present in this data set. This suggests that, for the most part, using winter months produces a benchmark based on more consistent use patterns. Logic suggests that at least irrigation use will be eliminated because of the choice of winter months for evaluation. However, as in the case of schools and universities, this method may also eliminate a process or production oriented use pattern, such as the summer recess of a school or university.

3 Project Outcomes

Based on the situation analysis presented in Section 2, participants completed two specific tasks for this project. First, participants wanted to compare the metrics developed in the sector analysis to other published benchmarks and determine the necessary steps to make the results more robust. Second, there was an interest in collaboratively developing some resources to support ICI water conservation programs in high priority sectors.

3.1 Benchmark Comparison and Improvement

In the energy industry, benchmarks are fundamental tools for planning and conservation efforts. Though not yet prevalent for the ICI sectors in the water industry, benchmarks could be equally powerful tools for water providers. Benchmarks facilitate rapid evaluation of a customer's use, aid in water budgeting, and provide a baseline against which to measure the success of conservation programs.

The metrics developed in the sector analysis of Section 2.3 are effectively benchmarks normalized per connection. A number of published benchmarking efforts provide similar data for comparison that provide some insight into the consistency of the numbers across regions.

This section examines the process of developing benchmarks for indoor use in ICI sectors, compares the results of the sector analysis to previously published data, and draws some conclusions relevant to ongoing benchmarking efforts.

Background

The components necessary to define a benchmark are quantity of consumption, consumer category, a normalizing demographic, and timeframe. For example, 2 gallons per meal or 2 gallons per square foot per day are both reasonable hypothetical benchmarks for the consumer category of restaurants. The combination of these four factors can produce a significant variety of outcomes.

Consumption is obviously the most straightforward component in a benchmark. In the United States, consumption typically is measured in units of gallons (gal) or thousand gallons (kgal). This number can be obtained through field measurements or utility bill analysis.

The importance of categorizing a consumer stems from the previously mentioned variation that exists even within narrowly defined consumer sectors. For example, the presence of a swimming pool at a school will result in very different consumption when compared with a

school that does not have a pool. The resolution of a benchmark will be determined by the care that is taken in categorizing the consumption data used.

The final component of a benchmark is the demographic factor against which the consumption is normalized. Potential factors include the following:

- Count of persons (customer, visitor, student, prisoner, passenger, etc.)
- Level of production (meal, items laundered, cars washed, etc.)
- Floor space
- Connection (account, meter, tap, etc.)

Some normalizing factors imply a period of time and do not require it to be defined. As in the previous restaurant example, using *gal/meal* implies the timeframe of a single meal. However, in the case of floor space, the timeframe is not explicit and must be defined *gal/ft²/day*.

Existing Benchmark Studies

A number of organizations have undertaken benchmarking studies involving ICI sectors in support of water conservation program development. These resources are potentially valuable for comparison with benchmarking efforts undertaken through this grant.

In 2003, the Office of Government Commerce in the United Kingdom produced the *Watermark*⁵ study focusing primarily on institutional sectors. This study establishes median and high performance (top quartile) benchmarks for various institutions. It was completed using a combination of utility bill analysis and end-user surveys. Normalizing factors of per person and per floor space were used as appropriate. It should be noted that this study has been used by a number of water providers in this country (e.g., State of Georgia⁶) to develop water conservation programs, despite its international origins.

In 2000, the AWWA sponsored and published a study entitled *Commercial and Institutional End Uses of Water*⁷. This study provides a fairly comprehensive review of existing resources, presents the results of field studies in five urban areas, and develops efficiency benchmarks based on a number of normalizing factors. This study focuses on restaurants, hotels and motels, supermarkets, offices, and schools.

Amy Vickers' *Handbook of Water Use and Conservation*⁸, published in 2001, summarizes benchmarks from a number of sources, including Dewberry and Davis (gal/customer/day), IWR-MAIN Water Demand Analysis Software (gal/employee/day), and the Greater Vancouver (British Columbia) Regional District (gal/connection/year). Beyond just benchmarks, The *Handbook* is a valuable resource for ICI water conservation technologies and implementation strategies.

⁵ ADSM and WatermarkPLUS, Final Watermark Project Report, http://www.adsm.com/docs/Final%20Report_version%202_short.pdf

⁶ Department of Natural Resources, State of Georgia, Water Conservation Program: Water Conservation Plan Guidelines, <http://www.georgiaplanning.com/enviro/waterconservation/FinalPlan.htm>

⁷ AWWA Research Foundation, Commercial and Institutional End Uses of Water, <http://www.awwarf.org/research/topicsandprojects/execSum/241b.aspx>

⁸ Amy Vickers, *Handbook of Water Use and Conservation*, Waterplow Press, 2001

It was not possible to directly compare all the benchmarks produced by these three studies because of the different benchmarking approaches. With the few exceptions where categories overlapped, the normalization factor of choice was different. This emphasizes the importance of standardizing data collection methods in order to facilitate sharing and comparing benchmarks, as discussed later in this section.

Both the AWWA study and Vickers' summary of the Vancouver Regional District data provide benchmarks in gallons per connection per year that can be compared to this project's Sector Analysis. It should be noted that the Northern Colorado data set included 7,594 accounts, compared to 5,000 accounts in the Vancouver Regional District Study, and about 25 customers reviewed in detail by the AWWA study.

Sector Name	Average Use N. Colorado (kgal/yr)	BC (kgal/yr)	AWWA (kgal/yr)
Auto service stations	265	216	
Car washes	1,238	840	
Child care	393	260	
Churches	545	350	
Grocery/food stores	736	2,733	3,156
Government	816		
Utilities/water districts	954		
Health and fitness clubs	2,502		
Hospitals and medical offices	839	2,997 ¹	
Nursing homes, retirement/assisted living complexes	3,166		
Hotels/motels	2,759	5,234	18,809
Laundromats/laundry facilities	452	22,027 ²	
Manufacturing/industry	697		
Food processors	12,658		
Property management/general commercial/office	448	899	10,105
Recreation	763	2,160	
Restaurants	932	1,635	2,824
Retail/shopping centers	579	858 ³	
Schools and colleges	780	1,639 ⁴	11,592
Salon	717		
Gas Station	910	614	
Unknown or miscellaneous other	85		
Notes:			
-Blank cell indicates no suitable equivalent sector			
¹ Related sector of "general medical and surgical facilities" - 11,355 kgal/yr			
² Described as "industrial laundries"			
³ For "stores and offices", related sector "shopping centers / malls" -- 2,585 kgal/yr			
⁴ For "elementary and secondary schools, related sector "colleges/universities" -- 30,497 kgal/yr			

Table 3.1. Comparison of Average Consumption per Connection

Clearly, some of the sectors demonstrate similar use per connection across the studies while others vary widely. This comparison supports conclusions regarding the use of these initial benchmarks as well as the future development of more robust metrics.

As previously discussed, participants using these results in their conservation efforts must remain aware of the wide variation between accounts of the same sector when the use is normalized per connection. These data can help guide priorities, but a particular ICI customer's characteristics such as size will have a large influence on use.

In the development of more robust benchmarks this comparison highlights two important lessons.

First, comparable *benchmarks rely on a consistent and thorough categorization of the sectors*. In the case of the above comparisons, many blanks exist where sectors did not map from study to study. In addition, the definitions of the sectors in the comparison studies are not sufficiently known to be able to say with confidence that the above comparisons are truly between analogous sectors. As the Table 3.1 footnotes indicate, some studies separated more specific sub-categories with very different use characteristics.

Second, *efforts at comparison are hampered by the lack of a demographic factor for normalizing the data*. While the data are technically normalized per connection, that does not account for the size or operations of a particular account. A robust benchmark requires more detailed information on end-users. Without such information, making comparisons must be done cautiously.

As the Task Force, described in Section 4, moves forward with benchmarking efforts a standardized data collection methodology will be developed. The two primary issues to be addressed are account categorization and normalization factor.

It is the recommendation of this report that the Task Force adopts an external standard for account categorization. Two available options are the Standard Industrial Classification⁹ (SIC) and North American Industry Classification System¹⁰ (NAICS). The NAICS is a more modern standard, it is the replacement for the SIC system, and it is already in use by at least one of the participating water providers. It is therefore recommended that NAICS be the system of choice.

Choosing appropriate normalization factors for each of the sectors will involve an understanding of the sector's processes and consideration of the ease by which the information can be obtained. Desirable normalization factors will have minimal sensitivity to other influences.

3.2 Sample Benchmarks

Having emphasized the components and process necessary in the development of robust benchmarks, it is worthwhile to present some benchmarks that demonstrate the use of normalization factors. Stu Feinglas, Water Resource Analyst for the City of Westminster and

⁹ U.S. Department of Labor, Standard Industrial Classification, <http://www.osha.gov/pls/imis/sicsearch.html>

¹⁰ U.S. Census Bureau, North American Industry Classification System, <http://www.census.gov/epcd/www/naics.html>

participant in this study, contributed the following micro-benchmarking effort. It should be noted that these benchmarks are not statistically robust due to the limited size and informal selection of customer accounts. However, they do reveal the challenges of collecting normalizing factor data.

The data collection process for these benchmarks was informal. For each sector, one to three customers that were perceived to be representative – without any formal qualification of this – were selected. For each customer, billing records were pulled and contact was made to determine the necessary normalization factor (see Units, Table 2.4.). The ratio of use to normalization factor was determined and averaged across the sector (see Unit Use, Table 2.4).

Collecting the normalizing data for these benchmarks was a reasonable process due to the small number of data points. However, surveying the number of customers necessary to develop statistically significant benchmarks would require a more formal data collection process. For retroactively collecting data from existing customers, written surveys mailed with bills or an online web tool might be appropriate. Ideally, the collection of appropriate normalization factors would take place during the process of initiating a new account. Database support will also be necessary to capture this additional data. Thus, the data collection process will require coordination from a number of departments within the water provider.

Sector Name	Units	Unit Use (gal/unit/yr)
Auto Service & Repair	ft ²	21.7
Car Wash	bay	96445
Childcare	ft ²	60
Church	ft ²	31.5
Clubhouse/Pool	unit	140000
Grocery Store	ft ²	38.5
Gas Station w/ Car Wash	ft ²	1447
Gas Station w/o Car Wash	ft ²	242
Hospital	ft ²	59.97
Hotel/Motel	room	23566
Medical Office	ft ²	35.7
Multi-family includes irrigation	unit	69925
Office	ft ²	8
Recreation w/ pool	ft ²	148.8
Recreation w/o pool	ft ²	27.3
Restaurant	ft ²	200
Retail	ft ²	29
School	ft ²	12.4

Sector Name	Units	Unit Use (gal/unit/yr)
Senior Housing includes irrigation	room	63000
Warehouse/Industrial	ft ²	7

Table 3.2. Sample Benchmarks with Normalization Unit from Limited Study by City of Westminster

As previously discussed in Section 3.1, benchmarks such as these can be particularly useful because they are less sensitive to the size of an account, whether that size is measured in square feet of floor space or number of car wash bays. Thus, disparities in customer use can more easily be attributed to potential for conservation rather than magnitude of operation.

3.3 Resources in Priority Sectors

In addition to the benchmarking efforts, participants also explored the collaborative benefits of sharing conservation related research efforts. Top priority sectors for ICI water conservation were identified by participants based on the situation analysis in Section 2 and knowledge of their own particular sector demographics and needs. A voting process was used to identify the following high priority sectors:

- Restaurants
- Hotels and motels
- Nursing, retirement, and assisted living complexes
- Retail and shopping centers
- Hospitals and medical offices

The following sections explore available resources, provide valuable tools for starting program development, and help to compile the variety of resources already available for five priority sectors identified by project participants.

3.3.1 General

To support ICI conservation in general, participants saw value in preparing a water audit form. The form can help water provider staff perform audits or customers to perform self-audits. The ICI water form provided in Attachment 2 was compiled by the team from a variety of resources and personal auditing experience.

3.3.2 Restaurants

Books

***Handbook of Water Use and Conservation* by Amy Vickers, 2001.**

4.4 Commercial Kitchens and Restaurants. Pages 267-277.

Topics include:

- How to audit kitchens and restaurants
- Food and drink preparation tips
- Commercial dishwashers – use 2.5 to 8 gpm
- Garbage disposals and scrapping troughs – use 3 to 8 gpm
- Icemakers – use 20 to 90 gallons to produce 100 pounds of ice
- Ice cream and frozen yogurt machines – use 2 to 3 gpm

***Commercial and Institutional End Uses of Water* by AWWA Research Foundation, 2000.**

This study presents findings of field studies of commercial and institutional (CI) customers in five urban areas. The book provides a set of efficiency benchmarks for five CI categories.

Web Resources

***Evaluating the Water Savings Potential of Commercial “Connectionless” Food Steamers* by Fisher, Nickel, Inc., June 2005**

This study confirmed that boiler-based steamers consume significantly more water than compartment steamers that incorporate connectionless or boilerless technology. Applying the nominal savings of 40 gal/hour per compartment, the water-saving potential of a two-compartment steamer operating 12 hours per day would be equivalent to an acre-foot of water use per year. For a single compartment steamer that is operated 6 hours per day, the water savings potential would be on the order of .25 acre-feet per year.

www.cuwcc.org/uploads/product/Steamer-Field-Study-Final-Report.pdf

***Water Efficiency: Water Management Options: Kitchen and Food Preparation* by North Carolina Department of Environment and Natural Resources, April 1998**

This is a six-page fact sheet with water use information about dishwashers, faucets, ice machines and garbage disposals.

<http://www.p2pays.org/ref/04/03103.pdf>

***Water Efficiency Guide for Business Managers and Facility Engineers*, CA Dept. of Water Resources, 1994. Pages 67-69**

Restaurant efficiency methods.

http://www.owue.water.ca.gov/docs/water_efficiency_guide.pdf

***A Water Conservation Guide for Commercial, Institutional and Industrial Users*, New Mexico Office of the State Engineer, 1999. Pages 38-40.**

This book includes information about dishwashers, garbage disposers, ice machines, and frozen yogurt and ice cream machines.

http://www.owue.water.ca.gov/docs/water_efficiency_guide.pdf

WaterWise Restaurant Program

The City of Austin offers a water audit of current appliance and practices for restaurants. It includes retrofitting spray valves and faucet aerators. Rebates are available to upgrade certain kitchen equipment. When completed upgrades and repairs are made, the restaurants are listed on the City's website.

<http://www.ci.austin.tx.us/watercon/restaurants.htm>

CEE Commercial Kitchens Project, launched Dec. 2005

The objective of this project is to increase market share of water-efficient products. Specifications have been set for the water savings potential for ice machines and pre-rinse spray valves. More products will be added as specifications become available.

The goals of the initiative are as follows:

- Research opportunities for additional energy and water savings opportunities in commercial kitchens and develop water/energy equipment specifications.
- Initiate and/or strengthen relationships with manufacturers, trade associations, and key end-user associations.
- Increase specification use in programs through promotion and exploration of program approaches.

<http://www.cee1.org/com/com-kit/com-kit-init-des.pdf>

PG&E Food Service Technology Center

The PG&E Food Service Technology Center is the industry leader in commercial kitchen energy efficiency and appliance performance testing. It has developed over 30 Standard Test Methods for evaluating commercial kitchen appliance performance, including steam tables, dishwashers and spray valves.

www.fishnick.com

Best Management Practices

Dishwashers

- Wash full loads in rack-type machines.
- Presoak and wash items in basins of water rather than under running water.
- When possible, scrape or brush dishes and pots rather than using running water or pre-rinse sprayers.
- Replace pre-rinse sprayers with water-saving 1.6-gpm sprayers.

- Install pressure reducing valves on dishwasher water supply lines when the supply pressure exceeds the pressure recommended by the manufacturer.
- Operate scraping troughs only during dishwashing operations.
- Replace older dishwashers with new water and energy efficient models.
- Turn dishwashers off when not in use.

Food & Drink Preparation

- Install kitchen faucet aerators that use 2.5 gpm. Where higher flows are needed, install a fingertip control valve for aerated or full-flow operation.
- Reduce or eliminate using water to thaw food. If food must be thawed using water, reduce flows to the minimum needed.
- Turn off continuous flows used to clean drain trays installed at coffee/milk/soda/beverage islands.
- Install hands-free or foot activated valves on faucets.

Food Disposers

- Replace disposers with garbage strainers which use less water.
- Use the minimum acceptable flow of water through the disposer.
- Install electronic sensors to detect food in the disposer's grinding chamber.
- Install solenoid valves to stop water flow when the disposer is off.
- Reduce the amount of time the disposer operates, as well as the amount of water used, for models with preset controls.

Icemakers

- Replace old icemakers with air-cooled, water efficient models. However, consider energy use too.
- Use ice flake machines rather than ice cube machines. Producing ice flakes uses less water.
- Use softened water in ice cube machines to minimize bleed-off.
- Collect spent cooling water from water-cooled ice machines and use it for nonpotable purposes, such as mopping floors.

Building Maintenance

- Repair leaks and malfunctioning equipment promptly.
- Install low-flow toilets and faucet aerators in restrooms.
- Replace fixtures with water-conserving models when they wear out.

More BMP Lists

CA Dept. of Water Resources: <http://www.owue.water.ca.gov/docs/Restaurants.pdf>

Denver Water: www.denverwater.org

NC Dept. of Environment & Natural Resources: <http://www.p2pays.org/ref/23/22003.pdf>

Salt Lake City Dept. of Public Works: <http://www.slcgov.com/utilities/conservation/pdf/restaurant.pdf>

Benchmarks

From *Commercial End Uses of Water*.

Efficiency benchmarks for restaurants – p. 138

(excludes water use for cooling or irrigation)

- 130-331 gallons per square foot of building area in a year
- 6-9 gallons per meal served
- 20-31 gallons per seat per day
- 86-122 gallons per employee per day

3.3.3 Hotels and Motels

Motel and Hotels

Books

***Handbook of Water Use and Conservation* by Amy Vickers, 2001.**

4.5 Laundries and Laundromats. Pages 277-280.

- Place "save water" notices or table tents in hotel and motel guest rooms, urging visitors to save water by minimizing the amount of linen that needs to be laundered. For example, the city of Santa Fe, New Mexico, and the Santa Fe Lodgers Association provide cards for guest rooms encouraging visitors to forego daily linen changes. The card states: "Help save water. Laundering linens uses lots of water! Sheets and towels are customarily changed daily. However, if you feel this is unnecessary, please leave this card on your pillow in the morning. Your towels will be straightened, the bed will be made, but the sheets will not be changed. If you wish fresh towels, place the used towels in the tub. Thank you for helping our community conserve water."
- "It's a crazy thing to demand fresh sheets and towels every day. No one does that at home." --Patricia Griffin, President Green Hotel Association.
- An average sized hotel, comprising of 150 rooms can save about \$30,000 per year if 65% of its guests participate in its linen-reuse program.
- Some hotels are concerned that they might be perceived as "cheap" for asking guests to reuse their linens, but many have received positive feedback from customers who appreciate the environmental and cost benefits of not wasting.

- The laundry facility for seven Red Lion Hotels (now part of the Doubletree Hotel system) in the Portland, Oregon, area is saving more than \$40,000 from reduced water, sewer, and gas bills after installing a wastewater recovery and recycling system. The laundry achieved these savings by replacing its twenty year-old conventional, single-pass system with a pumped, closed-loop, three phase micro filtration and water recycling system. In addition to the cost savings achieved, the recycling system reduced carbon dioxide emissions by about 182 tons and is expected to extend the life of the facility's boiler equipment by 50%. The new system cost about \$200,000, yielding a simple payback period of 4.1 years. In addition, the hotel now asks guests who are staying than one night to agree not to have their sheets laundered every day.

4.6.1 Swimming Pools. Pages 282-284.

- About 95% of pool water lost to evaporation can be saved through use of a pool cover.
- A study of an athletic facility in Boston indicated that the evaporation and heat losses of a swimming pool normally kept at 84°F could be reduced by lowering the temperature to 80°F. The company saved \$2,350 in water and heating costs.

Web Resources

Hotel Water Conservation—A Seattle Demonstration

This study was conducted by Seattle Public Utilities. It is a report on a pilot program combining engineering and behavioral/educational approaches to reduce water use in hotels.

http://www.seattle.gov/util/stellent/groups/public/@spu/@csb/documents/webcontent/hotelwate_200407081359093.pdf

Green Hotels Association

The Green Hotels Association encourages, promotes and supports the “greening” of the lodging industry through proper management of natural resources.

<http://www.greenhotels.com/>

GREEN HOTELS: Opportunities and Resources for Success

Water-efficient practices use improved technologies that deliver equal or better service using less water. Water conservation encourages hotels to better manage how and when water is being used, addressing both the technical and human side of water management issues. It is estimated that by 2010, water use will increase to approximately 475 gallons per day for each room in high luxury facilities. However, in other accommodations, water use is still a cost and an important stress on the local environment.

http://www.zerowaste.org/publications/GREEN_HO.PDF

Best Management Practices

Restrooms and Guest Bathrooms

- Repair all leaks, including dripping faucets and showers and running or leaking toilets.
- Showerheads, faucets and toilets should be replaced with low-volume models.
- Replace or Retrofit old toilets (pre-1994) with toilet tank water displacement devices, such as toilet dams, bags, or weighted bottles.
- Install aerators to all plumbing fixtures.

Kitchen, Dining Room and Bar

- See Restaurant BMPs

Building Maintenance

- Check the water supply system for leaks, and turn off unnecessary flows.
- Shut off the water supply to equipment and areas that are unused.
- Check the pressure. Where system pressure is higher than 60 psi, install pressure-reducing valves.
- Shut off water-cooled air conditioning units when not needed, or replace water-cooled equipment with air-cooled systems.
- Insulate hot water pipes.
-

Cleaning/Housekeeping

- Instruct cleaning crews to use water efficiently for mopping.
- Switch from "wet" carpet cleaning methods, such as steam, to "dry," powder methods.
- If you have to, powerwash paved surfaces. Do not use an open hose.
- Wash exterior windows with a bucket and squeegee rather than powerwashing.
- Change window cleaning schedule from "periodic" to "as required."

Laundry

- Wash only full loads.
- Evaluate the wash formula and machine cycles for efficiency. It may be appropriate to reprogram machines to eliminate a cycle.
- Consider upgrading to water-efficient washing machines. You will save water and energy.
- Lodging establishments should not change sheets more often than every four days for guests staying more than one night, except for health or safety reasons.

Pools & Spas

- Lower pool level to avoid splash-out. Water that is unavoidably splashed-out can be channeled onto the landscape or back into the pool.
- Reduce the water used to back-flush pool filters.
- Check the pool regularly for cracks and leaks (including pressure grouting, liners and drain valves) and make repairs regularly.
- Use a pool cover to reduce evaporation and heat loss when the pool is not being used.
- Lower the pool temperature, if possible—particularly when the pool is not being used.

Outdoor

- Apply water, fertilizer, or pesticides to your landscape only when needed. Look for signs of wilt before watering established plants.
- Core aerate and apply compost annually for established lawns.
- Install an automatic rain/wind shut-off device on sprinkler systems.
- Consider using low-volume irrigation, such as a drip system.
- Make sure sprinklers are directing water to landscape areas, and not to parking lots, sidewalks, or other paved areas.
- Use mulch around landscape plants to reduce evaporation and weed growth.
- Be sure all hoses have shut-off nozzles.
- When it snows, pile plowed snow around the landscape rather than a paved surface. Not only do you benefit from the slow percolation of the snowmelt, but you don't lose any parking space.
- Use a broom to clean sidewalks and driveways instead of hosing them down.
- Avoid landscape fertilizing and pruning that would stimulate excessive growth.

Other

- Increase employee awareness of water use efficiency.
- Install signs encouraging water efficiency in restaurants, restrooms and guest rooms.

More BMP Lists

CA Dept. of Water Resources: <http://www.owue.water.ca.gov/docs/Hotels.pdf>

Denver Water:

http://www.denverwater.org/cons_xeriscape/conservation/best_management_practices.html

NC Dept. of Environment & Natural Resources: <http://wrrc.p2pays.org/industry/hotels.htm>

SW Florida Water Management District:

<http://www.swfwmd.state.fl.us/conservation/waterwork/checkhotel.htm>

City of Greeley: <http://www.greeleygov.com/cog/PageX.asp?fkOrgId=44&PageURL=hotels>

Benchmarks

BenchmarkHotel

BenchmarkHotel is an environmental benchmarking tool designed to help hotels around the world improve their environmental performance.

<http://www.benchmarkhotel.com/index2.htm>

Other ICI Resources

Strategy to Involve the Commercial, Industrial and Multifamily Sectors in Water Conservation
http://www.seattle.gov/util/stellent/groups/public/@spu/@csb/documents/webcontent/commercial_200407081359135.pdf

3.3.4 Nursing, Retirement, and Assisted Living Complexes

There is a lack of information available regarding water conservation programs and projects for nursing home or assisted living facilities. One reason may be that there are no unique water appliances or fixtures used in these facilities.

There is information about these facilities and who will occupy them that can help conservation professionals develop guidelines and programs for water conservation facility retrofits or new facilities.

In an effort to save money and meet consumers' preferences, many state governments are moving public long term care dollars away from nursing facilities and into community based alternatives that provide comprehensive care in an environment that is more home-like than the typical nursing home¹¹.

If this is the trend, it would be possible for those who promote water and energy efficiency to "sell" the importance of conservation as a tool to keep operation and maintenance costs low.

The move to develop more home-like facilities will result in a change in the type of water appliances and fixtures used. Nursing homes tend to have commercial equipment while the more home-like facilities will likely have individual bathrooms and kitchenettes with more home-type appliances and fixtures.

Another consideration is the customer. The literature on assisted living and other forms of housing services indicates the population served by and in need of these services is dominated by single women (widowed, unmarried, divorced) in their early 80's¹².

With nursing home and assisted living water-using appliances and fixtures being the same as those used in the commercial and residential sectors, **the Best Management Practices will be the same for the following nursing home and assisted living facility appliances, fixtures and processes:**

¹¹ Maine Rural Health Research Center, April 2000

¹² Lewin – VHI, 1996

Indoor

Kitchen/Dining Room Areas: dishwashers, sinks, food and drink preparation, food disposals, icemakers

Bathrooms: toilets, bathtubs, showers, sinks

Laundry: washing machines, sinks

Outdoor

Landscape Irrigation (possible golf courses)

Pools

Water features (fountains, etc.)

3.3.5 Retail and Shopping Centers

Best Management Practices

- Individually meter or sub-meter
- Low-flow fixtures
- Periodic leak detection/maintenance schedule
- Landscape
- Irrigation
- Employee training
- Water use BMPs
- Water budget
- Information on water bill
- High-efficiency washing machines

Incentive Programs

<http://www.bewaterwise.com>

Plumbing Retrofit Ordinances

<http://www.twdb.state.tx.us/assistance/conservation/TaskForceDocs/WCITFBMPGuide.pdf>

<http://www.sandiego.gov/water/conservation/selling.shtml>

3.3.6 Hospitals and Medical Offices

Best Management Practices

Green Guide for Health Care Project offers a 90-item list of green features for healthcare facilities, including water conservation in construction and operations. <http://www.gghc.org>

Project Contacts: Adele Houghton, Austin, TX. 512. 928-4786 or adeleh@gghc.org
Gail Vittori, Austin, TX. 512. 928-4786 or gvittori@cmpbs.org

Information on the first LEED Accredited Hospital in Colorado

http://www.colorado.gov/rebuild/resources/presentations/LEED/LEED_Boulder_Community_Hospital.pdf#search=%22kai%20abelkis%20boulder%22

http://www.swenergy.org/casestudies/colorado/Boulder_Foothills_Hospital.pdf#search=%22kai%20abelkis%20boulder%22

General Green Construction Info

www.construction.com/greensource/
www.BuildingGreen.com
www.usgbc.org

Subscribe FREE to eco-structure magazine

www.eco-structure.com

4 Action Plan

Based on the inventory of existing conservation resources among participating members, as well as the results of the grant research identifying common sectors of interest, the project participants developed an action plan of priorities for advancing ICI water conservation in Northern Colorado.

The participants identified a number of specific strategies for coordinating resources and setting priorities:

- Water auditing templates with information organized by sector
- Regional brochure on ICI water conservation
- Regional factors for greenhouse gas emissions related to water use and conservation
- Outreach materials organized by sector
- Data collection/process matrix
- Technology-based education programs organized by sectors

- Central technical expertise for screening new technology products related to ICI water conservation with information distribution
- Benchmarks and/or normal usage information for top ICI sectors relevant to region, including evaluation strategies for conglomerate organization (e.g., multiple businesses of numerous sector types within a shopping center, master water meter, etc.)
- Program coordination or resource sharing within various water providers or other interested organizations within region
- An ICI water conservation handbook with relevant information, including benchmarks and audit templates
- A dynamic, interactive, and up-to-date regional website for ICI water conservation
- Group-level advocacy and related effort toward State of Colorado government support for ICI water conservation
- AWWA report based on information from this study

After facilitated discussion about what it might take to address each strategy and the expected outcomes, the participants prioritized the following strategies, providing the basic framework for the work plan:

- 1. Continued regular meetings for Northern Colorado providers. In general, great value was perceived in simply convening meetings to discuss ICI conservation-related topics. Sharing resources and the potential opportunities for collaboration, including collectively seeking funding, make these meetings worthwhile.**
- 2. Many of the project participants have committed to take part in a Task Force to develop benchmarks. This effort, likely to be implemented as a sub-committee of CWWC, will use the sector analysis completed for this project as the basis for ongoing benchmarking efforts. These efforts will likely include developing data collection standards, establishing the data infrastructure necessary to manage the newly collected data, and analyzing and developing appropriately normalized and statistically significant benchmarks. Participants are seeking funding to facilitate this effort.**

While these two priorities emerged as specific tasks to address as a group in the coming year, the entire list of strategies should be considered as progress is made and as a blueprint for the ongoing meetings of the regional partnership.

5 Conclusion

The preliminary value of this project was immediately evident in bringing providers together around the topic of ICI water conservation. The participants clearly seized the opportunity to collaborate and share their experiences on the topic. Even at this informal level, it became obvious that the participants shared many of the same challenges in ICI conservation and that there was much potential for formal collaboration to address the issues. However, the two primary outcomes of this group's efforts are initial benchmarking results and a resource guide to five high priority sectors.

Benchmarking results include numerical metrics as well as experience that will guide future efforts at refining the numerical results of this study. In the short term, these metrics can begin to inform the ICI water conservation decisions of participants. In the future, they can serve as the basis for developing more comprehensive benchmarks that include normalization factors.

In order to address some of the technical needs in top priority sectors, the participants developed a resource guide. This resource guide covers restaurants; hotels and motels; nursing, retirement, and assisted living complexes; retail and shopping centers; and hospitals and medical offices.

The Action Plan developed in Section 4 will guide the efforts of participants in achieving and furthering the goals of this project. The two primary efforts in the near term will revolve around continued meetings in the interest of general communication and collaboration around the topic of ICI conservation. More specifically, most of the participants in this project will seek to form and fund a Task Force for the continued refinement of benchmarks.

Participants in this project submitted the following testimonials to illustrate the value of the process for them and their organizations:

Laurie D'Audney, City of Fort Collins

It has been invaluable for me to work with this group investigating the best ways to support our ICI customers. With a majority of my time spent reaching out to residential customers, these important customers are often neglected. Putting our heads together provided many ideas for effectively reaching this sector. I am very excited to continue work on the benchmarking project. I believe this work will be valuable to many other conservation professionals. It is very impressive how much work was done in only four short meetings.

Stu Feinglas, City of Westminster

I found the Northern Colorado ICI project very helpful. The ICI market is a very difficult one to address for Westminster in terms of water conservation. Westminster water use is comprised of mostly residential uses, but the ICI market does use a significant portion of our water production.

Working together with other local communities has been, and continues to be, a very valuable process. Each community, though small in terms of the ICI sector, can join together to pool

resources and staff, and focus on a portion of the technical research required to provide a comprehensive ICI outreach. Westminster plans on continuing the collaborative process to provide conservation services to our ICI sector customers. As a result, all customers will benefit from an improved water supply at a reasonable cost.

I would like to express my thanks to the PPAB for enabling the process and making a real contribution to regional ICI water efficiency, including all the benefits that are associated.

Esther Vincent, Northern Colorado Water Conservancy District

The collaborative project that was started via The Brendle Group to develop a strategy to approach ICI water conservation has been very beneficial to the Northern Colorado Water Conservancy District. As a regional water provider, we seek to support cooperative enterprises at a regional scale to address the many aspects of water conservation. ICI water conservation had not been addressed very proactively until The Brendle Group, with the financial support of the PPAB grant, was able to help various entities coordinate their efforts to develop a regional action plan. This plan will take our ICI water conservation to another level by delineating further collaborative activities and programs in which we will be able to engage. It was a very informative process that helped us understand how we can better support ICI water conservation efforts with our constituents.

The District would like to thank the PPAB as well as The Brendle Group for making this project possible and bringing the needed momentum to move forward and further the development of an ICI water conservation plan.

Attachment 1 - Mapping of NAICS codes to Categories

NAICS Code (some partial)	NAICS Name	Equivalent sector
111	Crop Production	Omitted
112	Animal Production	Omitted
113	Forestry and Logging	Omitted
114	Fishing, Hunting, and Trapping	Omitted
115	Support Activities for Agriculture and Forestry	Omitted
221	Utilities	Utilities/water districts
233	Construction	Manufacturing/industry
234	Construction	Manufacturing/industry
235	Construction	Manufacturing/industry
311	Food Manufacturing	Food processors
313	Textile Mills	Manufacturing/industry
314	Textile Product Mills	Manufacturing/industry
315	Apparel Manufacturing	Manufacturing/industry
316	Leather and Allied Product Manufacturing	Manufacturing/industry
321	Wood Product Manufacturing	Manufacturing/industry
322	Paper Manufacturing	Manufacturing/industry
323	Printing and Related Support Activities	Manufacturing/industry
324	Petroleum and Coal Products Manufacturing	Manufacturing/industry
325	Chemical Manufacturing	Manufacturing/industry
326	Plastics and Rubber Products Manufacturing	Manufacturing/industry
327	Nonmetallic Mineral Product Manufacturing	Manufacturing/industry
331	Primary Metal Manufacturing	Manufacturing/industry
332	Fabricated Metal Product Manufacturing	Manufacturing/industry
333	Machinery Manufacturing	Manufacturing/industry
334	Computer and Electronic Product Manufacturing	Manufacturing/industry
335	Electrical Equipment, Appliance, and Component Manufacturing	Manufacturing/industry
336	Transportation Equipment Manufacturing	Manufacturing/industry
337	Furniture and Related Product Manufacturing	Manufacturing/industry
339	Miscellaneous Manufacturing	Manufacturing/industry
421	Wholesale Trade	Retail/shopping centers
422	Wholesale Trade	Retail/shopping centers
441	Motor Vehicle and Parts Dealers	Retail/shopping centers
442	Furniture and Home Furnishings Stores	Retail/shopping centers
443	Electronics and Appliance Stores	Retail/shopping centers
444	Building Material and Garden Equipment and Supplies Dealers	Retail/shopping centers
445	Food and Beverage Stores	Grocery/food stores
446	Health and Personal Care Stores	Retail/shopping centers
447	Gasoline Stations	Gas Station
448	Clothing and Clothing Accessories Stores	Retail/shopping centers

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NAICS Code (some partial)	NAICS Name	Equivalent sector
451	Sporting Goods, Hobby, Book, and Music Stores	Retail/shopping centers
452	General Merchandise Stores	Retail/shopping centers
453	Miscellaneous Store Retailers	Retail/shopping centers
454	Nonstore Retailers	Retail/shopping centers
484	Truck Transportation	Manufacturing/industry
485	Transit and Ground Passenger Transportation	Manufacturing/industry
488	Support Activities for Transportation	Manufacturing/industry
492	Couriers and Messengers	Property management/general commercial/office
493	Warehousing and Storage	Manufacturing/industry
511	Publishing Industries (except Internet)	Property management/general commercial/office
512	Motion Picture and Sound Recording Industries	Property management/general commercial/office
513	Information	Property management/general commercial/office
514	Information	Property management/general commercial/office
522	Credit Intermediation and Related Activities	Property management/general commercial/office
523	Securities, Commodity Contracts, and Other Financial Investments and Related Activities	Property management/general commercial/office
524	Insurance Carriers and Related Activities	Property management/general commercial/office
525	Funds, Trusts, and Other Financial Vehicles	Property management/general commercial/office
531	Real Estate	Property management/general commercial/office
532	Rental and Leasing Services	Property management/general commercial/office
541	Professional, Scientific, and Technical Services	Property management/general commercial/office
551	Management of Companies and Enterprises	Property management/general commercial/office
561	Administrative and Support Services	Property management/general commercial/office
562	Waste Management and Remediation Services	Manufacturing/industry
611	Educational Services	Property management/general commercial/office
6111	Elementary and Secondary Schools	Schools and colleges
61111	Elementary and Secondary Schools	Schools and colleges
611110	Elementary and Secondary Schools	Schools and colleges
6112	Junior Colleges	Schools and colleges
61121	Junior Colleges	Schools and colleges
611210	Junior Colleges	Schools and colleges
6113	Colleges, Universities, and Professional Schools	Schools and colleges

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NAICS Code (some partial)	NAICS Name	Equivalent sector
61131	Colleges, Universities, and Professional Schools	Schools and colleges
611310	Colleges, Universities, and Professional Schools	Schools and colleges
6114	Business Schools and Computer and Management Training	Schools and colleges
61141	Business and Secretarial Schools	Schools and colleges
611410	Business and Secretarial Schools	Schools and colleges
61142	Computer Training	Schools and colleges
611420	Computer Training	Schools and colleges
61143	Professional and Management Development Training	Schools and colleges
611430	Professional and Management Development Training	Schools and colleges
6115	Technical and Trade Schools	Schools and colleges
61151	Technical and Trade Schools	Schools and colleges
611511	Cosmetology and Barber Schools	Schools and colleges
611512	Flight Training	Schools and colleges
611513	Apprenticeship Training	Schools and colleges
611519	Other Technical and Trade Schools	Schools and colleges
6116	Other Schools and Instruction	Schools and colleges
61161	Fine Arts Schools	Schools and colleges
611610	Fine Arts Schools	Schools and colleges
61162	Sports and Recreation Instruction	Schools and colleges
611620	Sports and Recreation Instruction	Schools and colleges
61163	Language Schools	Schools and colleges
611630	Language Schools	Schools and colleges
61169	All Other Schools and Instruction	Schools and colleges
611691	Exam Preparation and Tutoring	Schools and colleges
611692	Automobile Driving Schools	Schools and colleges
611699	All Other Miscellaneous Schools and Instruction	Schools and colleges
621	Ambulatory Health Care Services	Hospitals and medical offices
622	Hospitals	Hospitals and medical offices
623	Nursing and Residential Care Facilities	Nursing homes, retirement/assisted living complexes
624	Social Assistance	Property management/general commercial/office
62441	Child Day Care Services	Child care
711	Performing Arts, Spectator Sports, and Related Industries	Recreation
713	Amusement, Gambling, and Recreation Industries	Recreation
71394	Fitness and Recreational Sports Centers	Health and fitness clubs
713940	Fitness and Recreational Sports Centers	Health and fitness clubs
721	Accommodation	Hotels/motels
722	Food Services and Drinking Places	Restaurants

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NAICS Code (some partial)	NAICS Name	Equivalent sector
811	Repair and Maintenance	Manufacturing/industry
8111	Automotive Repair and Maintenance	Auto service stations
81111	Automotive Mechanical and Electrical Repair and Maintenance	Auto service stations
811111	General Automotive Repair	Auto service stations
811112	Automotive Exhaust System Repair	Auto service stations
811113	Automotive Transmission Repair	Auto service stations
811118	Other Automotive Mechanical and Electrical Repair and Maintenance	Auto service stations
81112	Automotive Body, Paint, Interior, and Glass Repair	Auto service stations
811121	Automotive Body, Paint, and Interior Repair and Maintenance	Auto service stations
811122	Automotive Glass Replacement Shops	Auto service stations
81119	Other Automotive Repair and Maintenance	Auto service stations
811191	Automotive Oil Change and Lubrication Shops	Auto service stations
811192	Car Washes	Car washes
811198	All Other Automotive Repair and Maintenance	Auto service stations
812	Personal and Laundry Services	Laundromats/laundry facilities
8121	Personal Care Services	Salons
81211	Hair, Nail, and Skin Care Services	Salons
812111	Barber Shops	Salons
812112	Beauty Salons	Salons
812113	Nail Salons	Salons
81219	Other Personal Care Services	Salons
813	Religious, Grantmaking, Civic, Professional, and Similar Organizations	Property management/general commercial/office
81311	Religious Organizations	Churches
814	Private Households	Omitted
921	Executive, Legislative, and Other General Government Support	Government
922	Justice, Public Order, and Safety Activities	Government
923	Administration of Human Resource Programs	Government
924	Administration of Environmental Quality Programs	Government
926	Administration of Economic Programs	Government

Attachment 2- Commercial Water Audit Survey

I. General Facility Information

Name of Facility _____ Date _____

Address _____

Contact Person _____ Title _____

Phone Number(s) _____ E-Mail Address _____

Business Type _____ Account Number _____

Brief description of facility (e.g. facility, processes, products, etc.)

Number of FTE Employees _____

Average number of visitors, guests or tenants _____ Occupancy rate _____

Days of Operation M T W Th F Sa Su Annual Hours _____

Buildings _____ # Levels per Building _____ Age of Buildings _____

Size of the site (acres or sq ft): _____ Sq. ft. of the building(s) _____

Own or lease? _____ Are you sole proprietor of the building? Y N

List any other businesses _____

Can you provide plan drawings and site layout? Y N

Size and location of meter(s) _____

Is irrigation metered separately from building use? Y N

Does the building have submetered water uses (e.g. specialty processes, cooling tower, boiler, etc.)? _____

II. Water Use Data

High Water Use

Month _____ Gallons _____ Bill amount _____

Months typically with higher use _____

Low Water Use

Month _____ Gallons _____ Bill amount _____

Months typically with lower use _____

Annual Use

Total _____ Cost _____

III. Indoor Water Use

1. Manufacturing Processes

Description of water uses in processing _____

Is any process water reused or recirculated? _____

Comments _____

2. Mechanical Consumption

Are cooling towers in use? Y N If yes, model and serial numbers:

How much makeup water is needed to replace blowdown, evaporation, etc. _____

Are boilers in use? Y N If yes, model and serial numbers: _____

How much makeup water is needed to replace blowdown, evaporation, etc. _____

Is evaporative cooling (e.g. swamp coolers) used? Y N If yes, model and serial numbers: _____

Are water-cooled compressors used? Y N

Are water-cooled pumps used? Y N

How much water is used in once-through cooling? _____

Comments _____

3. Heating and Cooling

Type of HVAC system _____

Is HVAC system: Air-cooled Water-cooled

If water-cooled, is it: Open loop Closed loop

Comments _____

4. Lavatories

Older toilets usually can be identified by the date stamped on the underside of the toilet tank lid. Some toilets will be identified by gallons per flush stamped on the bowl rim.

Toilet Date	Gallons per Flush
1980 and earlier	5 - 6 gpf
1980 - 1992	3.5 gpf
1992 - present	1.6 gpf

Faucet Drip	Gallons per Day
Slow drip	5 - 10 gal./day
Fast drip	20 - 30 gal./day
Steady stream	40 - 55 gal. day

Location	Number	Gallons/Flush or Gallons/Minute	Infrared Controls?	Leaking?
#1				
Toilets				
Urinals				
Faucets				
Showerheads				
#2				
Toilets				
Urinals				
Faucets				
Showerheads				
#3				
Toilets				
Urinals				
Faucets				
Showerheads				
#4				
Toilets				
Urinals				
Faucets				
Showerheads				

Comments _____

5. Kitchen/Cafeteria

Number of kitchen areas _____ Average meals served per day _____

Location	Flow Rate	Controls (knee or foot)	Leaking?
Kitchen #1			

Faucet			
Pre-rinse spray nozzle			
Pre-rinse spray nozzle			
Kitchen #2			
Faucet			
Pre-rinse spray nozzle			
Pre-rinse spray nozzle			

	Make	Model	Gallons/Load	#Loads/Week	Rinse Water Reused?
Dishwasher #1					
Dishwasher #2					

(estimate 15 gallons per load for a residential-style dishwasher)

Number of ice makers _____ Are they: Air-cooled Water-cooled

Number of refrigerators _____ Use water coolant system? Y N

Garbage disposals in use? Y N How many? _____

Comments _____

6. Laundry

Washer Date	Gallons per Load
1980 and earlier	56 gal.
1980 - 1990	50 gal.
After 1990	40 gal.
High efficiency	27 gal.

	Make	Model	Gallons/Load	#Loads/Week	Rinse Water Reused?
Washer #1					
Washer #2					

Comments _____

7. Other Indoor Uses

List any leaks and estimate rates _____

Other indoor water uses (air washers, wet scrubbers) _____

Comments _____

IV. Outdoor Water Use

1. Landscape and Lawn Watering

Acreage/square footage of lawn area _____ of other landscaping _____

Lawn type _____ Type of other landscaping _____

Watering/irrigation system Automatic Manual Separate irrigation tap? Y N

Raw water used for irrigation? Y N

Controller: Make _____ Model _____

Days system runs M T W Th F Sa Su

Types of sprinklers for lawn area _____ for landscaping _____

Rotor Zones _____ Runtime for rotors _____

Sprayhead Zones _____ Runtime for sprayheads _____

Is the schedule adjusted for the time of the year? Y N

Is a rain shutoff sensor installed? Y N

Is the system run once a month to look for maintenance issues? Y N

Decorative water feature? Y N If yes, is the water recirculating? Y N

Is system maintenance done by onsite staff or contractor? Onsite Contractor

List leaks or other problems _____

Comments _____

2. Vehicle Washing

Any vehicle washing at the facility? Y N Type: _____

Comments _____

3. Evaporation Ponds

Do you have any evaporation ponds, tanks, or lagoons? Y N

Are the ponds lined? Y N Type of lining: _____ Are they covered? Y N

4. Swimming Pools

How much water is used to fill the pool? _____ How often is water added? _____

Is the pool covered when not in use? Y N

Comments _____

5. Other Outdoor Uses

Do you have an ornamental water feature? Y N Does water recirculate? Y N

Other outdoor uses (pond, dust suppression, etc.) _____

Comments _____

V. Maintenance

Are sprinkler heads, faucets, pipes, and plumbing checked regularly for leaks? Y N

Is regularly scheduled preventative maintenance performed? Y N

Is maintenance documented with standard records or inspection logs? Y N

Are employees aware of water conservation practices? Y N

Are procedures for equipment posted? Y N

Comments _____

VI. Facility Water Conservation Measures

Explain any water conservation measures used at the facility _____

VII. Other Information

Are any building/site expansions/renovations or equipment replacements planned in the next 1-3 years? _____

Any other information that would be helpful for the water audit? _____

