Left Hand Water District

SLOW the FLOW COLORADO

Water Efficiency Grant Report

Final Report - 2013

PO# OE PDA 11000000105

Left Hand Water District

AMERICAN LEAK DETECTION
THE ORIGINAL LEAK SPECIALISTS™

GREAT WESTERN INSTITUTE
Promoting Water Resources Conservation
Through Education, Research and Policy Development

Introduction

This final report summarizes the implementation of the Water Efficiency Grant (PO# OE PDA 11000000105) provided to Left Hand Water District (District) by the Colorado Water Conservation Board - Office of Water Conservation and Drought Planning (CWCB). The grant was provided to the District for the purpose of implementing three of the water conservation measures identified in the District's Water Conservation Plan updated in July, 2008 and reviewed and approved by the CWCB in February, 2009. For this particular grant, the focus of the water conservation measures was on three specific efforts:

- *Residential Indoor Water Audit Program*
- *Improved Leak Detection and Repair Program*
- *Commercial Water Audit Program*

The goal of the District and CWCB was to enhance the District's on-going water conservation programs and to identify which programs piloted through this grant would provide the most efficient means of conserving water within the District service area. Since these were three new programs for the District, certain assumptions were made in order to estimate the number of customers who would participate in the indoor residential and commercial audits. As has been discussed in the 50% and 75% reporting, the District found there to be less than enthusiastic participation in the two audit programs. Actual participation in indoor residential audits performed by the Center for Resource Conservation and the commercial audits performed by Great Western Institutes was much lower than anticipated in the grant application and therefore the entire cost of the grant came in lower to account for this difference. However, this also decreased the water savings recognized from these two programs. The third program, *Improved Leak Detection and Repair Program,* proved to be very worthwhile in identifying non-billed water loss to the District and has since become a standard annual program due to the success of the program piloted through this grant.

Acknowledgements

The District wishes to acknowledge the contributions of the team participants involved in implementing the three piloted conservation programs. Commercial and residential customers allowed team members access to their homes and businesses to perform water usage audits and to replace fixtures including shower heads and faucet aerators. Without the participation and support of these individuals and businesses, none of the data collection or long-term water savings could have been realized. Other than the 35 residential and commercial properties that

participated, other organizations that should be acknowledged for their support and participation include:

- Left Hand Water District Board of Directors and staff members - Betsy Wheeler, Water Projects Specialist; Todd Petry, Distribution Manager and Vicki Santos, Finance Manger.
- American Leak Detection – Michael Parrish
- Center for Resource Conservation – Daniel Stellar & Kate Gardner
- Great Western Institute – Tracy Bouvette

Summary

We feel that our community is already benefitting from the implementation of these new water conservation programs and look forward to continuing to support water conservation efforts by the District and water wise use by all categories of customers. Based on the implementation schedule, the overall grant timeline including the Final Report date of 8/22/2013 has remained unchanged from the approved grant application. The cost of these programs has come in lower than anticipated in the grant application for a total cost to CWCB of $37,197.69 or 81% of the $45,836 originally requested. Appendix C includes a spreadsheet detailing all of the expenditures by LHWD and those costs reimbursed by CWCB under PO# OE PDA 11000000105.

As a result of this grant program, the District has been able to better gauge the feasibility of implementing these three programs initially identified in the 2008 Water Conservation Plan. Because of the low participation rate for the two indoor audit programs, these have been discontinued. The third program, enhanced leak detection, has been adopted as an ongoing distribution system program and appears to be identifying at least 10 acre-feet per year in unaccounted for losses. In addition to the water saved, this program allows the District to better plan long-term capital improvement project by identifying areas with higher than normal losses. The remainder of this report provides a more detailed summary for each of the three programs included in this grant.

Residential Indoor Audit Program

Participant Selection

The District's 2008 Water Conservation Plan included providing a link to a self-guided internet based residential audit program. In order to build on this customer initiated audit program, the District has teamed with the Center for Resource Conservation (CRC) since 2009 by participating in the *Slow the Flow Colorado* for residential irrigation audits including large HOA irrigation customers. A portion of the Water Efficiency Implementation Grant was used to enhance this approach through the addition of *Slow the Flow Indoors* also provided through CRC.

The initial plan was to contact a minimum of 560 homes identified in older subdivisions through a direct mail campaign in order to target those homes most likely to have high water use fixtures. The homes targeted were within subdivisions built from the 1960's through the 1980's. The estimated number of positive responses was approximately 100 homes willing to take part in this program. Response rates from the initial targeting were extremely disappointing in that we mailed out 550 flyers and received no positive response. An additional mailing of 650 flyers as well as hand delivering 140 flyers to the Countryside Condominium Association yielded 36 participants for a total response rate of 2.7% response rate. In addition to the direct mailing campaign, the District advertised the program through our website in our January 2012 newsletter *Tap Water Tribune*.

Audits

A *Slow the Flow Indoor*s audit is an indoor water use inspection program available to residents of participating Colorado water providers. The audits are performed by trained auditors employed directly through Center for Resource Conservation. The fee for each audit was paid for by Left Hand Water District and reimbursed through CWCB as part of this grant. Waterwise shower heads and faucet aerators were purchased by LHWD through the grant and provided to CRC for distribution and installation as part of the program. The benefits provided to the participants by *Slow the Flow Indoors* included:

- Identifying areas of highest use indoors at each participant's location.
- Leak tests on fixtures to find where water is being wasted.
- Learning practical easy ways to make a home more water efficient.
- Receiving personalized cost benefit analysis on switching to lower use appliances.
- Receiving free installations of low-flow shower heads and faucet aerators.

Data Tracking – Results

According to CRC's Slow the Flow Annual Report – 2012, the LHWD participating households averaged 2 full time residents and were constructed in 1983. The final indoor audit was completed on April 16, 2012 and water use data tracking began at that time. Water use for the participating households was measured for winter months (Oct-Feb) in order to measure only indoor use – the focus of this program. An analysis of the water use tracking data for the 36 taps yields an overall *increase* in water used by the 36 residential participants during winter months of 115,000 gallons. However, in reviewing each of the account histories it was discovered that six of the accounts noted significant leaks detected during the reporting period which were skewing the results. For this reason, data from those six accounts (650.01; 722.01; 2625.01; 3912.01; 7376.01; 7421.01) has been excluded from the overall reporting thus yielding a total savings of 120,000 gallons annually (0.37 acre-foot) or an average of approximately 333 gallons per month per tap. CRC provided a section in our annual report related directly to the Slow the Flow Indoors program (See Appendix A) with estimated annual water savings due to the audits based on a water savings calculator. Left Hand Water District usage reports demonstrate a significantly lower level of actual savings as illustrated in the following table:

Audits	36	
Avg. household (persons)	2.7	
Aerators replaced	143	
Showerheads replaced	45	
Est. annual gallons saved (CRC)	223,015	
Actual annual gallons saved (LHWD)	**120,000**	
Est. annual dollars saved/house (CRC)	$43.24	
Actual annual dollars saved/house (LHWD @ $3.15/1000 gal)	**$12.60**	
Avg. cost per house	$223.00	
Total Program Cost	**$8,030.27**	(fixtures & CRC time; no LHWD staff time)
$/acre foot saved	**$21,805.60**	

This relates to a monetary savings of approximately $12.60 per year per tap at the current residential water rate of $3.15/1000 gallons or a 17 year payback. *Table 1* presents the water use data for the reporting period and has been included in *Appendix A* of this report. Due to the lower than anticipated participation the reimbursement for this portion of the grant will be $4,195.15 lower than the approved grant amount.

Electronic Leak Detection

American Leak Detection (ALD) completed all of the field work related to this portion of the program in August, 2011. The District provided 2 distribution technicians to work with American Leak Detection Services so that production was much better than anticipated in the grant application. In addition to the ten (10) subdivisions that were included in the scope of the 10 days of electronic leak detection, the District was able to survey an additional nine (9) subdivisions as well as an additional 3.5 miles of 18 inch transmission line and 1.5 miles of 4 inch main.

In general, ALD found the system to be *"well maintained in all areas...the operating personal assigned exhibited a high level of system knowledge which permitted a faster than estimated completion in the areas tested"*. According to the estimated leak rate prior to repairs reported by American Leak Detection, the Improved Leak Detection resulted in the discovery of:

- 16 service connections at River Valley Village Mobile Home Community ~ 35.2 gpm total
- 2 F.H.'s with leakage ~ 0.60 gpm total
- 10 service line leaks ~ 17.7 gpm total

In the Grant application, repairs to the leaks found through this program were to be done as budget allowed. We received confirmation from River Valley Village that they had completed all of the repairs that were found on their side of the master meter by email on August 17, 2011 and the District's in-house crew made repairs to all other leaks identified by the end of August, 2011. Based on the estimates provided by ALD, the District would see a savings of 86 AF in the first year at a cost of $10K in ALD services and an additional $35,000 in-kind repair work done in-house. This would result in a cost/benefit of $523 per acre foot or $1.61 per 1,000 gallons. Actual data for River Valley Mobile Home Park (the only metered area subject to repairs) showed a total reduction of 2,000,000 gallons of use compared to the 12 month period prior to this program. This represents only about 11% of the savings estimated by ALD. Even assuming that the water savings is only 11% of that estimate, the District yields a cost/benefit of $4,756.87 per acre-foot saved. The budget as approved in the Grant proposal, $10,000, has been unchanged for this program.

Based on the results of the 2011 Enhanced Leak Detection program the District has already adopted this program to be continued at our own cost. The District has continued this program in 2012 and again in 2013 such that the entire District will be covered on a continuous 5-year survey cycle.

Great Western Institute

Terry Bouvette with Great Western Institute has completed all field work and post audit water use analysis related to providing Commercial Water Audits and Fixture Replacements. GWI has provided a Final Report of the work completed and success towards meeting goals and objectives (See Appendix B).

Following an 8 month reporting period, the District provided GWI with all of the post audit water usage data for the businesses that took part in the audits/retrofits. GWI provided the District with individualized reports that were then sent to each participating entity. In order to better understand the usage trend following the audits, GWI and District prepared a questionnaire that was hand delivered to each participant by Left Hand Water District staff in order to assist GWI in measuring the success of the program. Results of these questionnaires are provided in the Final Report.

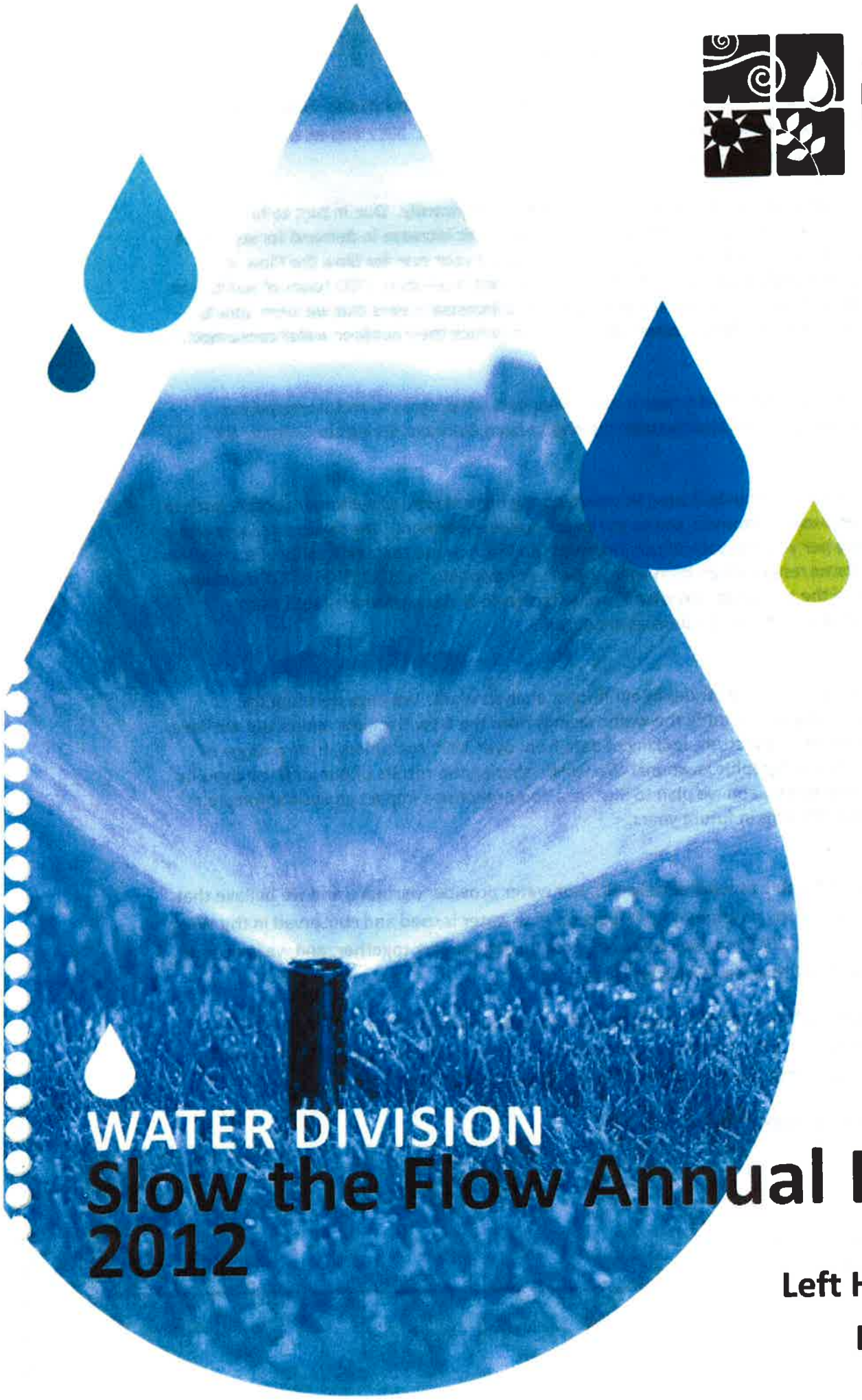
Similarly to the Residential Indoor Audits performed by CRC, it appears as though it is unlikely that the District will achieve the water savings estimated in the grant application. This is as a result of the number of facilities willing to participate in the audits, or from those contacted who would not have benefited from retrofits due to already having replaced fixtures on their own. Based on the analysis performed by Great Western Institute the amount of water savings due to the commercial audit program was 2.36 acre feet at a cost to the grant of $16,945.35 or $7,180.23/acre foot. The overall budget for this program has been reduced by $4,195.15 due to the actual number of audits and retrofits completed.

Appendix B of this Report contains the full 100% Progress Report from GWI.

APPENDIX A

RESIDENTIAL INDOOR WATER AUDIT PROGRAM

CENTER FOR
ReSource
CONSERVATION



WATER DIVISION

Slow the Flow Annual Report 2012

Left Hand Water District

Dear CRC Partners and Friends in the Left Hand Water District,

In the following pages, you will find the Center for Resource Conservation's Water Division's 2012 Annual Report for our work in the Left Hand Water District. 2012 was an exciting year for the Water Division on a number of fronts:

- We expanded our core programs and services significantly. Due in part to hot and dry weather across the Front Range, we saw a dramatic increase in demand for several of our programs. In particular, 2012 was the largest year ever for Slow the Flow, our irrigation audit program. This year we performed more than 6700 hours of audits – an increase of nearly 1800 hours over 2011. This increase means that we were able to work with over 2000 customers to help them reduce their outdoor water consumption.

- In 2012, we welcomed 6 new communities into our programs, and increased our geographic service area to cover the region from Colorado Springs to Gillette, WY.

- We continue to be dedicated to providing the highest level of customer service, both to our end-user customers and to our water provider partners. We conduct at least one survey per year for each of our programs, and I am proud that the quality of each of our programs remains high from year to year. For example, in 2012, 67% of STF customers ranked the service as "excellent" while Garden-In-A-Box customers rated their satisfaction with the gardens as 4.3 out of 5.

- We also made great strides in our impact analysis work. We have developed a methodology to quantify the water savings from the Slow the Flow audits and we have completed a pilot study, looking at data from over 1600 customers, from a range of years and geographic locations. We will be sharing the results of our initial analysis in the near future, and we plan to include a comprehensive impact analysis among our service offerings in future years.

We are proud to be able to work closely with our water provider partners, and we believe that together we are making a tremendous impact on how water is used and conserved in the West. As we move towards 2013, we look forward to continuing to work together, and we welcome your feedback about how we can better serve you.

In closing, I want to thank the CRC's fantastic and deeply committed Water Division: Kate Gardner, Mari Linden, Sara Fairchild and Bryan Baker. I am often amazed that such a small group can accomplish so much, and I'm privileged to work with them.

Thank you for your support and partnership.

Sincerely,

Dan Stellar
CRC Water Division Director
December 2012

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About the Center for ReSource Conservation

Founded in 1976, the Center for ReSource Conservation (CRC) is a Boulder-based 501(c) 3 non-profit organization which empowers our community to conserve natural resources. Each year, the CRC empowers more than 30,000 individuals to live a more sustainable life through programs and services designed to help members of our community conserve water and energy and minimize waste.

Staff and Acknowledgements
Water Division Director: Dan Stellar
Senior Water Programs Manager: Kate Gardner
Water Program Coordinator: Mari Linden
Water Conservation Associate: Sara Fairchild
Report Associates: Ashley Luscan, Josh Kuhn & Cole Anthony

The CRC's 2012 Auditing Team: Bryan Baker, Lauren Ehlers, Amanda Emerson, Tyler Kesler, Peter Niedbalski, Christina Aalto, Alfred Bohlim, Drew Caschcette, Nicole Caveny, Matt Hoenecke, Alex Jacoski, Max Jewett, Matthew Leibel, Kai Linden, Molly McGee, Emily Mitchell, Justin Patrick, Elliot Shugerman, Matt Owen, and Adam Waters

The CRC would like to thank Ron Boyd and the Northern Colorado Water Conservancy District for their help with auditor training.

For correspondence related to this report, please contact Kate Gardner at 303-999-3820 x 210 or KGardner@ConservationCenter.org

2012 Partner Utilities

Aurora Water
Castle Pines North Metropolitan District
Centennial Water & Sanitation District
City of Boulder
City of Broomfield
City of Golden
City of Lafayette
City of Longmont
City of Loveland
City of Louisville
City of Northglenn
City of Thornton
City of Westminster
Left Hand Water District
Willow Water District
North Table Mountain Water & Sanitation District
Parker Water & Sanitation District
South Adams County Water & Sanitation
Town of Castle Rock
Town of Erie
Town of Superior

Executive Summary

The Center for ReSource Conservation's (CRC) Water Division coordinates a suite of programs designed to help people irrigate efficiently and implement water-wise landscaping. The WaterWise Landscape Seminars, Garden-in-a-Box Xeriscape Program, Slow the Flow Colorado Irrigation Inspection Program and Slow the Flow Indoor Audit Program are complementary services, each of which provides local residents with tools they need to use water more efficiently. CRC's water programs are designed to help utilities meet water conservation goals. In 2012, CRC offered the Slow the Flow Colorado Irrigation Inspection Program to residents in the Left Hand Water District service area.

Slow the Flow Colorado Irrigation Inspection Program

Slow the Flow Colorado Irrigation Inspection Program is the water division's flagship program. Through Slow the Flow, a trained auditor goes to a residential or large property, performs a thorough inspection of the sprinkler system, and spends time educating homeowners or property managers about what to fix on their sprinkler system and how to water more efficiently. The inspection includes concrete recommendations of steps that can be taken to improve the efficiency of watering systems, as well as the development of a customized watering scheduling.

Each inspection provides customized, pragmatic advice and one-on-one education for homeowners or property managers. Inspections are free to customers of participating water providers who sign up voluntarily through the CRC. In 2012, the CRC performed 43 inspections on residential properties and 3 inspections on large properties in the Left Hand Water District service area.

For each audit performed, CRC collected a wealth of data, including information related to property size and characteristics, water conservation features, sprinkler system use and problems, and current watering practices. As part of each audit, CRC staff conducted tests of sprinkler system precipitation rates, efficiency and pressure, and made a customized watering schedule for each home. For spray zones (the majority of zones tested) the **auditors recommended that customers reduce their watering time by an average of 6%.**

In 2012, program participant evaluations were very positive. The CRC received 6 survey responses from Left Hand customers. 100% of respondents rated the program as either excellent or satisfactory; 83 percent rated the program excellent and 17 percent rated it satisfactory. Across the CRC's service area, 67% of respondents rated the program as excellent, and 29% as satisfactory.

Slow the Flow Indoor Water Audit Program

Background

Slow the Flow Indoor was a new program for CRC, debuted in the winter of 2010 and 2011. Start-up of the program was generously sponsored by the Colorado Water Conservation Board and the Cities of Thornton and Lafayette. Through this program, CRC sends trained technicians to area residences to conduct complete indoor water audits. The service consists of flow tests of fixtures, checks for leaks and other common problems, and the installation of low-flow showerheads and aerators. At the conclusion of the audit, CRC's technician presents the resident with a prioritized list of recommended changes to improve water efficiency. The priorities factor in both water saving potential and economic costs and benefits.

The indoor audit program runs from September – May and is inactive during the summer months. This annual report includes data from September 2011 through May 2012. In that timeframe, 454 audits were completed, of which 46 were in Left Hand. As a direct result of these audits, a total of approximately 2,848,538 gallons of water will be saved per year due to the installation of 1363 faucet aerators and 502 low-flow showerheads. In addition to the direct savings, the project had large potential savings, since auditors made recommendations for additional steps homeowners could take to conserve water. The total potential savings of the project (if every customer made every recommended change) is 5,658,683 gallons. Our surveys indicated that over 60% of respondents had made at least one recommended change within 6 months following the audit.

Slow the Flow Indoor customers were asked to rate their overall satisfaction with the audit, on a scale of 1 -5, as well as their overall satisfaction with any retrofits or installations performed by the audit. In both cases, customers rated the service very highly, with average responses of 4.81 and 4.62 respectively.

Analysis

In the section below, the data presented is specific to the indoor audits completed in the Left Hand Water District during the 2011 – 2012 season (fall 2011 – spring 2012) as well as any additional data collected from audits performed in the fall of 2012 A summary of this data can be found at the end of this section.

Methodology

Data for the analysis was compiled in several ways. Prior to the audit being performed, we attempted to retrieve the past water records for the customers, which we were able to do in many cases. During the audit, the auditor asked the homeowner questions about their level of usage of different fixtures. The auditor conducted a range of tests to determine flow rates of faucets and showerheads, and also catalogued the amount of water used by appliances such as dishwashers and washing machines. Finally, information was captured during the follow-up phone survey.

A key step in the project was determining the water saving potential of different water conservation options and presenting this information to the customer. Water savings were calculated using a methodology developed by other indoor water audit programs, which was then modified to meet CRC's needs. The first step in determining the water savings for a particular household was analyzing their past water usage, and comparing this to the average usage for a similar size household. This allowed us to determine a behavioral multiplier. During the site visit, the auditor made an estimation of the usage of different fixtures, based on information from the homeowner. For example, the auditor would find out which bathroom was the primary, secondary and so on, and use this information to estimate the percentage of time each bathroom was used. The auditor would then determine the flow rate of the fixtures through flow rate tests. By putting all this information together, along with the number of people in the house and national averages of individual water use, the auditor was able to make an assessment of how much water a given fixture used.

For example, if a homeowner had two bathrooms, and stated that one of them was the primary one, the auditor would assume this bathroom was used 70% of the time. The auditor would then conduct a flow rate test on the faucets in this bathroom. Using information about national averages, the auditor would note that the average per person faucet usage was 4.86 minutes per day. The auditor would then multiply this number, the number of people in the house, the flow rate of the faucet, the percentage the faucet was used and the behavioral multiplier. This would generate an estimate of the total amount of gallons used by a given faucet over a year. Potential savings were calculated in a similar manner, simply substituting the water usage of the changed fixture (in this case, a faucet with an aerator) for the actual flow rate. This new figure would be the number of gallons per year used if the change was made. By comparing the actual usage with the potential usage, the auditor could make an accurate estimation of potential savings. Determining the economic impact of this change was done by inputting the local marginal price of water and multiplying this by the gallons saved. The calculator could easily be changed for different municipalities and different pricing structures.

Demographic Data

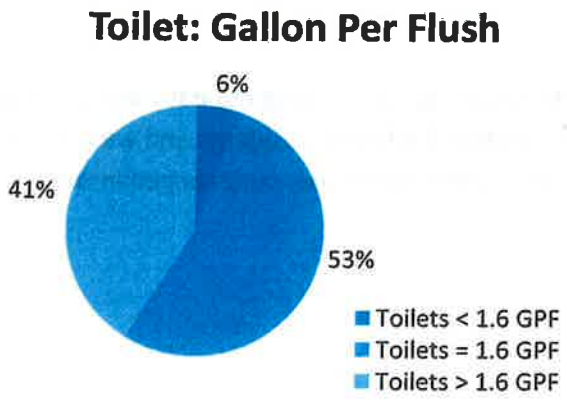
Audits were performed at 46 houses in which complete data was gathered. Analysis of the data indicates that the median home had 2 full-time residents and was constructed in 1983. A range of data was collected regarding indoor water use, summarized in the table below.

	Mean	Median	Min	Max

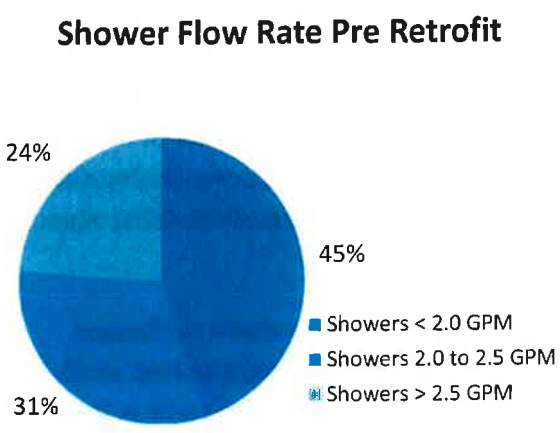
Number of People in the Home	2.72	2	1	6
Year the House Was Built	1980	1983	1920	2001
Number of Bathrooms	3.39	3	2	6
Toilet Usage	2.77 gpf	1.60 gpf	1.28 gpf	5.00 gpf
Number of Faucets (Bathrooms)	1.25	1	0	2
Faucet Usage (Bathrooms)	1.90 gpm	1.80 gpm	0.96 gpm	5.40 gpm
Number of Faucets (Other)	1.30	1	1	3
Faucet Usage (Other)	1.97 gpm	1.86 gpm	1.20 gpm	5.16 gpm
Number of Showers	2.76	3	1	5
Shower Usage	2.18 gpm	2.04 gpm	0.44 gpm	4.68 gpm
Washing Machine Usage	33 gpl	39 gpl	20 gpl	51 gpl
Dish Washer Usage	8 gpl	7 gpl	6 gpl	14 gpl

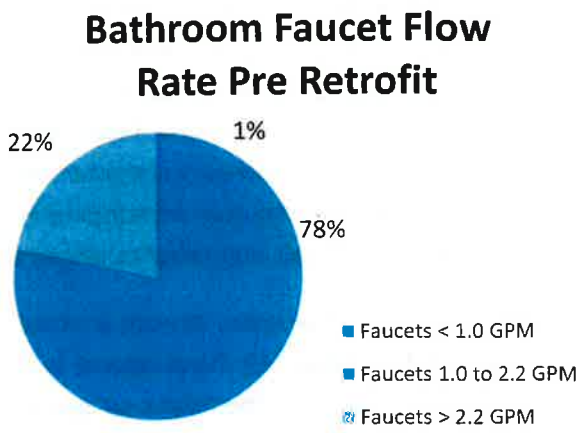
Toilets

During the STFI audit the auditor recorded the gallon per flush of all the toilets in a home. The majority of toilets that were found in homes were 1.6 gallon per flush. This would make sense given that a significant percentage of houses were built after 1994, when 1.6 gallon toilets became the industry standard. Given that the program only found 6% of toilets with usages below 1.6 there is an opportunity for our municipal partners to give rebates and incentives for 1.28 toilets.



Showerheads and Faucets





The pre-retrofit flow rates of showerheads were much closer to the post-retrofit rate for showerheads than for bathroom faucets. The largest grouping of showerheads was those with a measured flow rate of 2.0 GPM or less. During the inspection the auditor installed a showerhead with a rating of 2.0 GPM; therefore the auditor installed less of these fixtures than faucet aerators which had an average measured flow of 1.90 GPM compared to the 1.0 GPM rated aerators that were installed.

Installations

The STFI audit included installation of water saving fixtures, primarily low-flow showerheads and faucet aerators. As part of the project, 45 showerheads and 143 faucet aerators were retrofitted.

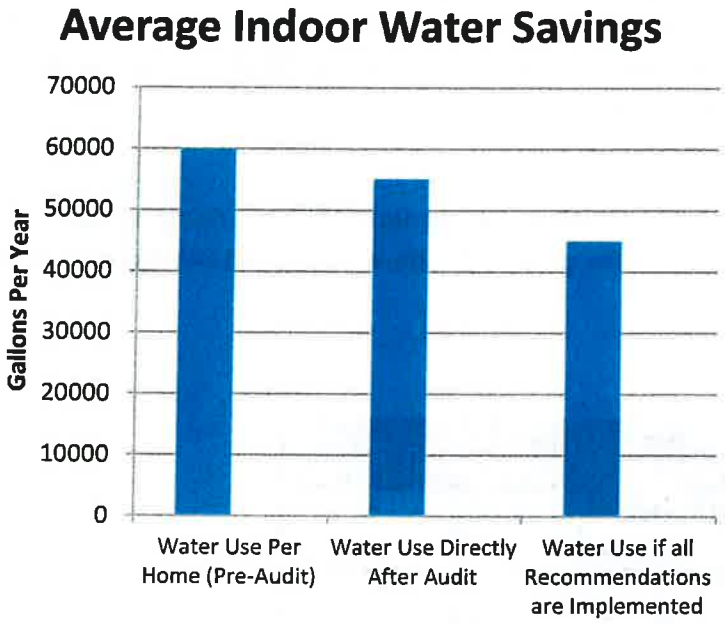
Retrofit Data	
Total Showerheads Retrofitted	45
% of Showerheads Retrofitted	35.43%
Avg. Showerheads Retrofitted per House	1.09
Total Aerators Retrofitted	143
% of Aerators Retrofitted	76.47%
Avg Aerators Retrofitted / House	2.62

Water savings

Direct water savings were achieved as a result of the installations of showerheads and faucet aerators. As a direct result of this work, approximately 223,015 gallons of water will be saved by year, which computes to $1,989.04 dollars being saved by customers.

Water savings are also achieved as a result of customers making the changes recommended (but not actually completed) by the auditors. As part of the service, the auditors gave customers a prioritized list of recommended changes, which would lead to water and financial savings. Changes were only recommended if they would lead to significant water savings as well as have a short financial payback (less than 5 years). Without long-term follow-up, we do not know to what extent individual customers will make these changes. However, survey results indicate that even within a six month time frame following the audit, many customers (62%) made some of the changes and retrofits recommended by the auditors.

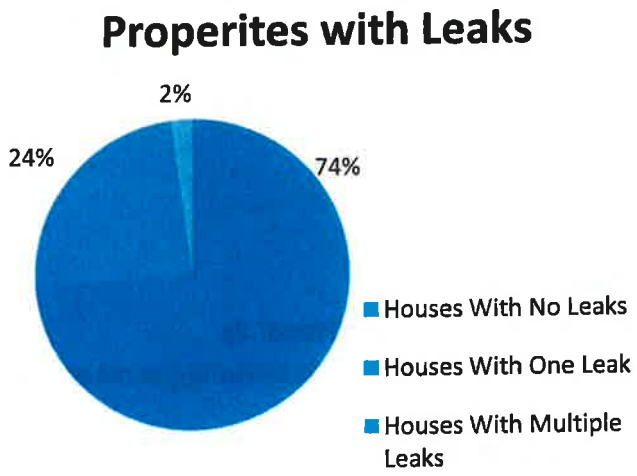
The potential water savings enabled by this program (if all customers made all changes recommended by the program) is 463,368 gallons per year, representing a savings of $3,599.14 per year. Since the follow-up surveys indicated that 62% of the customers made at least one change recommended by the audit within 6 months, it is reasonable to assume that some factor of these potential savings will be achieved over time, as more and more customers make some of the changes recommended by the auditors. This can best be tested by a long-term survey.



At the individual customer level the savings are significant. The direct savings are an average of 4,848 gallons of water per household per audit, and potential savings of 10073 gallons per household per audit. This computes to 8.1% and 16.8% respectively.

Water saving data

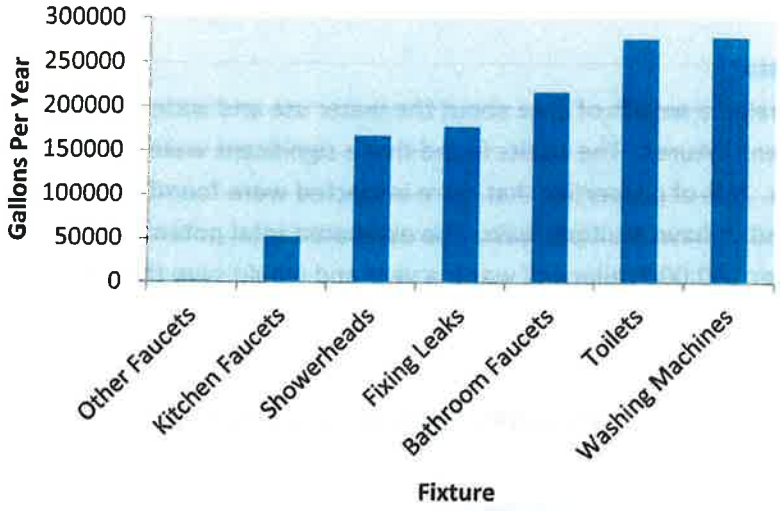
The project revealed a wealth of data about the water use and water saving potential of a variety of different fixtures. The audits found that a significant water saving potential comes from fixing leaks. 26% of properties that were inspected were found to have leaks and 2% of which were found to have multiple leaks. The estimated total potential of water savings from fixing leaks is over 140,000 gallons of water a year and would save the average homeowner with a leak $76 per year.



Other sources of significant potential water savings are toilet and washing machine replacements. On the other hand, the project found that dishwasher replacements are not a good source of potential water savings, due to their relatively low water use and high cost. Our auditors did not recommend dish washer replacements in any instances. The table below shows the water saving potential of different fixture replacement options.

It should be noted that this information is quite dependent upon location. For example, in the communities we served where the median year of home construction was 1994 or newer, many houses had relatively new toilets (over 90% of homeowners had 1.6 gpf toilets). While toilet replacements were still often recommended in this case, the water savings are not as significant as they would be with regard to older toilets. In different communities with older houses, we found significantly greater potential savings from toilet replacements.

Potential Water Savings By Fixture



Summary of Left Hand Specific Data

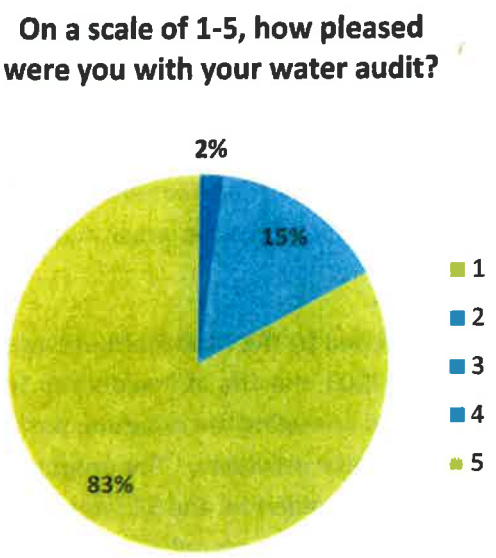
- Number of audits performed in Left Hand: 46
- Amount charged per audit: $64.06 (not including aerators and showerheads purchased directly by CWCB)
- Total showerheads retrofitted: 45
- Total aerators retrofitted: 143
- Total annual gallons saved as a result of retrofits: 223,015 (all figures estimated from a water use calculator)
- Per household annual gallons saved as a result of retrofits: 4,848
- Per household annual dollars saved as a result of retrofits: $43.24
- Total annual potential gallons saved (if all households make all changes recommended by auditor): 463,368
- Per household annual potential gallons saved: 10,073
- Per household annual potential dollars saved: $78.24

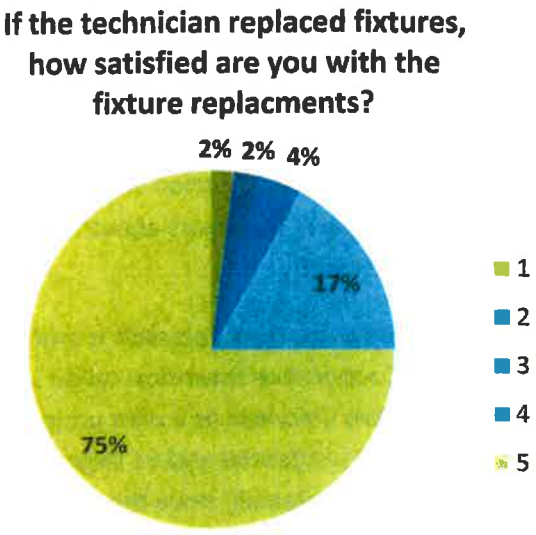
Customer survey

Of the 228 audits completed, 195 customers were placed in the call list for follow-up surveys. Customers were left off the call-list either at their request or due to a lack of complete information. Of the 195 customer contacts, surveys were completed with 60 of them, for a response rate of 31%.

Customer satisfaction

Customers were asked to rate their overall satisfaction with the audit, on a scale of 1 -5, as well as their overall satisfaction with any retrofits or installations performed by the audit. In both cases, customers rated the service very highly, with average responses of 4.81 and 4.62 respectively.





Changes to water fixtures

Customers were asked whether they had made any changes to their water fixtures as a result of the audit, or whether they planned to make any changes. In both cases, responses were positive. Of the 60 customers who responded to the survey, 37, or 62%, indicated they had already made some change, while 23 customers, or 38%, indicated they intended to make changes in the future. Popular changes included replacement of leaking toilet flappers, replacement of toilets, and installation of kitchen sink aerators. Several respondents also reported having already replaced, or planning to replace, washing machines.

Water use

Survey respondents were asked whether their water use had increased or decreased. While only observational, this provides additional evident of the water savings achieved by the program. Of the 60 survey respondents, 20 reported that their water use had decreased, while the remainder was unsure or hadn't yet compared. No one reported an increase.

Table 1
Residential Audit Data Tracking
Oct-Feb 2012 vs Oct-Feb 2013

Account Number	Usage 2011/12	Usage 2012/13	Water Savings	Notes
47.01	27,000	15,000	12,000	
59.01	15,000	12,000	3,000	
141.08	21,000	17,000	4,000	
147.02	23,000	23,000	0	
188.01	25,000	20,000	5,000	
245.01	20,000	24,000	(4,000)	
327.01	23,000	21,000	2,000	
448.01	58,000	45,000	13,000	
480.01	6,000	4,000	2,000	
535.02	21,000	61,000	(40,000)	
544.01	13,000	16,000	(3,000)	
591.01	14,000	12,000	2,000	
641.02	12,000	21,000	(9,000)	
650.01	85,000	52,000	33,000	Leak detected 12/23/2011
715.02	26,000	25,000	1,000	
722.01	43,000	67,000	(24,000)	Customer turned off water 1/13-2/13
968.01	11,000	10,000	1,000	
1416.01	22,000	32,000	(10,000)	
1516.01	169,000	132,000	37,000	10 Unit Condoplex
2128.01	16,000	11,000	5,000	
2625.02	27,000	61,000	(34,000)	Numerous leaks detected 8/11 - 4/13
2907.01	15,000	29,000	(14,000)	
3322.02	24,000	18,000	6,000	
3849.01	18,000	19,000	(1,000)	
3901.01	22,000	22,000	0	
3912.01	19,000	118,000	(99,000)	Leak detected 11/20/12
4130.02	14,000	13,000	1,000	
4540.02	20,000	19,000	1,000	
4607.01	64,000	36,000	28,000	
4723.02	27,000	25,000	2,000	
4924.03	35,000	38,000	(3,000)	
5202.02	41,000	46,000	(5,000)	
5334.01	27,000	18,000	9,000	
6073.01	25,000	20,000	5,000	
7376.01	15,000	23,000	(8,000)	New account 1/2012
7421.01	48,000	81,000	(33,000)	Leak detected 2/25/13
Subtotal:	1,091,000	1,206,000	(115,000)	Avg. increase: 639 gallons per month/tap
Excluding known leaks:			**50,000**	**Avg. savings: 333 gallons per month/tap**

APPENDIX B

COMMERCIAL WATER AUDIT PROGRAM

Water Efficiency Grant Report

Commercial Water Audits

conducted for the

Left Hand Water District

Niwot, Colorado

May 2013

GREAT WESTERN INSTITUTE

Introduction

This Report summarizes the project conducted as a portion of the Water Efficiency Grant provided to Left Hand Water District (hereafter the "LHWD") by the Office of Water Conservation and Drought Planning (hereafter the "Office") of the Colorado Water Conservation Board (CWCB) in 2011. This portion of the grant was provided to LHWD for the specific purpose to pilot test one component of LHWD's Water Conservation Plan – conduct water audits for LHWD's large commercial customers. The project involved the following tasks:

- Prepare for and conduct commercial water audits at selected facilities served by the LHWD
- Replace inefficient fixtures (e.g., showerheads and faucet aerators) in those commercial facilities that would permit the retrofit
- Collect data on water use after the audit was performed
- Prepare a written report

Each of these specific activities is discussed in the report that follows; as is a presentation of key findings and recommendations.

Please note that it is the intention of both the LHWD and the CWCB to support the implementation of meaningful water conservation in the LHWD's service area. For this reason, this project was conducted as a pilot to determine the efficacy and value of a commercial water audit program to the overall water conservation efforts of LHWD.

To this point, the project was focused on characterizing the costs and benefits of sustainable water demand reductions in some of the largest commercial facilities within the LHWD service area. Fixture replacements and data collection tasks were therefore executed to achieve and verify permanent water savings in those facilities where retrofits were permitted to be installed by the owner/operator. Insomuch as this project was only one part of the overall scope for the grant awarded by the CWCB to LHWD, evaluations were made by LHWD under separate cover evaluating and comparing the costs and benefits of each of the different water conservation programs piloted through this process by LHWD. This report therefore was developed to provide LHWD with information on the costs and the benefits of the audit program from the perspective of both the LHWD and the LHWD's customers.

It should be noted that conditions for a direct comparison of water use behaviors before and after the audits and retrofits occurred was complicated by the LHWD raising water rates about 6% within 6 months of when retrofits were installed. The increase in water pricing may have influenced the perceptions of the recipients of the retrofits with regard to the cost benefit of the new, more efficient fixtures. It is also possible that the water rate increase influenced water use behaviors at the commercial facilities. In addition, the use of the commercial facilities, and the motels in particular, appears to have changed substantially between the period prior to the installation of the retrofits (i.e., when the baseline water use was characterized) and after the installations occurred. For this reason,

the analyses conducted herein had to be developed in accordance with this understanding to account for these two external interferences[1].

Acknowledgements

The LHWD and the project team wish to acknowledge the contributions of the owners and staff of all the businesses that allowed the audit and fixture replacement teams to visit, collect data and install new fixtures. Without the support and cooperation of these individuals, none of the permanent water savings associated with this project could be realized. Those organizations and institutions that supported this project include the following:

- Motels – America's Best Value Motel, Days Inn, and First Interstate Inn
- Restaurants – Ajuua, Colterra (Table 210), Greenbriar, and Niwot Market

Modifications to the Scope

As indicated in the progress status reports, the scope of work contained in the grant application included estimates on the number of audits, and the number of replacement fixtures that would be installed as a result of conducting the audits. However, conditions predicted at the time of the application were not entirely consistent with the conditions found during project execution. For these reasons, some of the original scope was revised to account for conditions encountered during execution of the project.

To begin with, LHWD does not service many large commercial water customers that would benefit from fixture retrofits. Therefore, only a dozen or so customers were targeted as potential beneficiaries of the commercial audit program. In addition, many of LHWD's restaurants and motels are new construction housing franchises for large commercial organizations (e.g., McDonalds, Taco Bell, Super 8 Motels, etc.). These organizations have specific plumbing fixture requirements dictated to them by corporate offices. Therefore, local facility managers and owners do not have the authority to conduct and implement water audits that are not corporate sponsored.

Given the number of organizations that were targeted for audits, but declined to participate; the overall success of the commercial audit program was limited to older facilities and privately owned facilities. Although the commercial audit program cost less to implement than was budgeted, smaller water use demand reductions were realized than predicted, making the average price per acre-foot of demand reduction somewhat higher than anticipated (this point is discussed in more detail in the summary and conclusions). Although the overall project costs did not require the expenditure of the entire grant monies award to LHWD by the CWCB; the overall effectiveness of the program in this setting was smaller and less cost-effective than initially anticipated.

[1] The federal government ("Measurement and Verification for Federal Energy Projects," U.S. Department of Energy Office of Energy Efficiency and Renewable Energy, 2000) provides specific guidelines related to estimating water savings in situations with changing facility use. For these circumstances, the guidelines suggest that water demand reductions be estimated using a comparison of water use associated with past fixture consumption and manufacturer estimates of new fixture consumption – based on daily use of fixtures developed through water use modeling.

Specific Tasks Performed

Each of the tasks identified in the grant application are discussed below. The tasks include:

- Prepare for and conduct the audits
- Install retrofits
- Develop water use model
- Conduct customer surveys
- Prepare report

Audits

The LHWD conducted a commercial water audit program in August 2011[2] in an effort to further support customer wise water use and water use efficiency. Audits were performed at a total of 3 motels, one state park and 4 local restaurants. An additional six restaurants including two McDonalds, a Taco Bell, Subway, Arby's and Pepper Jacks were visited, however, these facilities were not formally audited and did not receive retrofits based on the direction given by local owners and operators.

The water audit involved reviewing past and current water use data for each audited facility, and collecting site-specific data characterizing facility-specific water use. Data that was collected during the audits included:

- Number, use and flow rate from each sink faucet
- Number and flow rate from each showerhead, where appropriate
- Number and estimated flush volume for each toilet and urinal
- Number and serial number of all kitchen and laundry facility appliances that use water (e.g., washing machines, laundry extractors, ice machines, steam tables, dish washing machines, etc.)
- Swimming pool, hot tub and Jacuzzi use and water replacement rates, where appropriate
- Outdoor irrigation uses (e.g., irrigated area, sprinkler system timing)
- Other water uses

Fixture Replacements

Based on the observed need, facility manager participation, the availability of fixtures, and the coordination of facility needs by the local installation team, replacement fixtures were installed in a total of five City facilities. A summary of the installed fixtures by facility is provided in Table 1.

The specific fixtures that were used to replace the inefficient old fixtures are as follows:

- Showerheads- A total of 106 Caroma 1.5 gallons per minute (gpm) stainless steel, vacuum assisted low-flow showerhead fixtures were installed. Extra showerheads (39) were provided to

[2] All audits and retrofits were conducted in August 2011, except for the audit and retrofit for First Interstate Inn which took place in October 2011.

the facility managers for installation in occupied rooms, in showers that required additional plumbing to allow for installation and for replacement purposes.

- Faucet aerators- A total of 158 USA Landlords dual-threaded 0.5 gallon per minute (gpm) stainless steel, low-flow faucet aerator were installed in bathroom and kitchen hand-wash sinks. These faucet aerators were not deemed suitable for other applications (e.g., pot and pan sinks, kitchen gallery sinks, etc.). An extra 34 aerators were provided to the facility managers for additional replacement efforts.

Table 1 - Water Fixture Retrofits per Facility

Location	**Fixture Type**		
Motels	Showerheads*	Bathroom Sink Aerator*	Bar Sink/Kitchen Hand Wash Sink Aerator*
Americas Best Value Inn	72 (installed 49)	74 (installed 67)	2 (installed 1)
Days Inn	39 (33)	40 (35)	0
First Interstate Inn	32 (23)	33 (27)	0
Restaurants			
Ajuua	0	3 (2)	3 (2)
Colterra (Table 210)	1 (1)	7 (6)	3 (2)
Greenbriar Inn	1 (0)	9 (9)	6 (3)
Niwot Market	0	2 (2)	3 (2)
	145 (106)	168 (148)	17 (9)

* GWI installed 158 faucet aerators and 106 showerheads, and the facilities were provided with the balance (for a total of 192 faucet aerators and 147 showerheads) to install in occupied rooms, in showers that required additional plumbing changes and for replacement parts. Note that handicapped rooms that were present at Americas Best Value Inn and Days Inn could not be retrofit with high efficiency showerheads due to the configuration of the shower. The retrofits included 10 faucet aerators at the City of Boulder Reservoir State Park.

Develop Water Use Model

For indoor water uses, data collected from each facility was compared and contrasted with monthly, seasonal and annual water rates to configure and calibrate a facility-specific water model which was used to estimate water use for each subject fixture that may be a candidate for replacement. In this way, an estimate of water savings and costs for each candidate fixture could be developed to support decision-making by the LHWD and the CWCB in the allocation of potential future Grant supported replacement fixtures.

Appendix A contains the results of the individual commercial facility audits conducted as part of the grant funding, including the location, the data collected, and the water model developed to evaluate site-specific water use and identify candidates for fixture replacement.

Note that a water model, and subsequent estimates of future water savings, was not developed for the City of Boulder Reservoir Park since water use at this location included numerous large, poorly characterized water uses (e.g., water use during special events, water use in outdoor facilities, etc.). Indoor water use was therefore substantially overshadowed by the large outdoor water uses, such that

estimates of individual faucet use was stymied and considered unreliable. For this reason, an estimate of water use reduction based on the retrofit of 10 faucet aerators in the indoor bathroom facilities was not prepared.

Estimates of Potential Water Savings

The installation of the high-efficiency fixtures in the facilities listed in Table 1 have unquestionably reduced current water use demand for those uses impacted by the retrofitting. All new showerheads allow less water to flow in a minute than the older, less efficient showerheads – using 60% less water on average. This is also true for the new faucet aerators, which use on average about 25% less water than their predecessors. For this reason, real water savings must be occurring at each facility that received new, more efficient fixtures assuming that fixtures are still in place. The estimates that were made related to expected water use reductions assume that the same water use behaviors are taking place as were observed during the audit.

Unfortunately, measuring the actual water use reduction is not as simple as might otherwise be expected, for at each facility the replacement fixtures represent only a fraction of current water use. In addition, there may be other water uses at each facility that were not reported or captured within the audit framework. Finally, water use behaviors may not be truly constant, therefore, a comparison of expected water saved (based on the facility-specific water models developed) and the actual measured water savings is not necessarily congruent. Nonetheless, it is clear that water use reductions have occurred at every facility with installed retrofits.

Tables 2 and 3 present the water-model based estimated water savings for each of the facilities that received replacement fixtures, for motels and restaurants, respectively based on the water model presented in Appendix A. The potential water savings presented in these tables were developed based on the replacement of all indoor fixtures and appliances that may be more water efficient than current equipment.

Actual water savings at each of the facilities that received more efficient fixtures may be different than the estimates provided in these tables due to a number of factors including:

- Differences in the number of facility users (e.g., motel occupancy rate).
- Differences in the normal uses of water within a facility.[3]
- Differences between past and future water use behaviors[4].

[3] Based on the monthly wintertime water use data provided for the audited facilities, it appears that leaks are occurring at each location related to leaking toilets, faucets, or other unknown sources. The nature of water loss at each facility may change over time, as well as the nature of water use behavior, influencing the amount of water used and masking the effect of the retrofits and audit upgrades. Nonetheless, water use reductions will occur as long as the high efficiency showerheads and faucet aerators remain in place.

[4] It is assumed that the facility will maintain its current water use behavior, and that future water use will be utilized in a manner consistent with past water use. For example, no new water features or uses such as outdoor irrigation and/or pools and spas will be installed in the future with the exception of those uses that were observed during the audit.

The LHWD does not have access to records regarding visits and/or occupancy rates for its customer facilities. It is not anticipated that this data can be easily collected by the LHWD in the future, therefore estimates of water savings will have to be based on an understanding of changes between current and future use given the change between the deliveries and/or use of water by more efficient fixtures and appliances.

Surveys

Follow-up surveys were prepared and conducted by LHWD staff (see Appendix B) with each of the commercial facility owners/operators that participated in the project. The surveys focused on collecting opinion data related to the perceived benefit of the audits and related retrofits on facility operations. Questions included in the survey were associated with:

- Impact of audits and retrofits on facility water use
- Benefit of the audits and retrofits on facility operations

Results from these surveys were mixed and at times conflicting. For example, some owners/operators indicated that the audits were not beneficial to their operations (scoring 1 out of 5)[5] yet the field work and the retrofits were scored as excellent (4 out of 5). In addition, some of the survey responses were inconsistent with the work conducted during the audits or the site conditions. For example, one location indicated that portions of the audit were poor (1 of 5) for lawn irrigation, kitchen use, and pool and spa water use when none of these water uses occur at this particular facility. In other surveys, it did not appear that the owner/operator that participated in the surveys was familiar with what retrofits were installed.

In spite of the issues with the accuracy of the survey responses, the surveys indicated that the audits had a fair to good impact on facility operations, and that the owners/operators would likely recommend the audits to other businesses.

[5] Note that the water and energy savings estimated for the 7 facilities receiving the benefits of the audits and retrofits reduced operating cost by over $11,000 annually (see Table 4) at no cost to the facilities.

Table 2 – Estimated Water Use Reductions for Motels

Motel/Fixtures (Number of Fixtures)	Cost of Implementation[6]	Estimated Potential Savings For Average Conditions				Costs to District	
		Water (gallons/year)	Energy (kWHr/year)	Cost Savings to Customer[7] ($/year)	Rate of Return[8] (years)	Installation[9] ($)	Replacement Water[10] ($)
Americas Best Inn							
Toilets (75)	320.00	27,862	0	242	99	3,750	1,710
Showers heads (72)	47.25	151,014	20,301	2,633	1.3	3,402	9,269
Bath Faucets (74)	12.44	173,250	14,556	2,453	0.4	921	10,634
Urinals (1)	320.00	6,570	0	57	6	50	403
Clothes Washers (3)	625.00	56,064	7,280	961	2.0	300	3,441
Pre-Rinse Spray (1)	120.00	43,800	5,687	751	0.2	120	2,688
Hand Wash Sinks (3)	12.44	8,687	730	123	0.2	37	533
				7,221		8,580	28,679
Days Inn							
Toilets (40)	320.00	9,552	0	83	154	2,000	586
Showers heads (39)	47.25	64,058	8,611	1,117	1.7	1,843	3,932
Bath Faucets (40)	12.44	69,612	5,849	986	0.5	498	4,273
				2,186		4,341	8,791
First Interstate Inn							
Toilets (33)	$ 320.00	67,391	0	586	18	1,650	4,136
Showers heads (32)	47.25	64,380	8,655	1,123	1.4	1,512	3,952
Bath Faucets (33)	12.44	70,265	5,904	995	0.4	411	4,313
Clothes Washers (4)	625.00	53,655	9,016	1,053	2.4	400	3,293
				3,757		3,973	15,694

[6] Includes cost of materials and labor per fixture/appliance

[7] Assuming water is $3.70 per 1000 gallons; sewer connection is $5 per 1000 gallons; and energy costs are $0.065/kWHr.

[8] Based on costs for equipment and installation versus cost savings to customer.

[9] Assumes LHWD pays for materials and labor to install showerheads, faucet aerators and pre-rinse spray aerators; and provides $50, $50, and $100 rebates for toilets, urinals, and clothes washers, respectively.

[10] Assuming cost for equivalent replacement water ($20,000) includes water rights acquisition, transmission, treatment and distribution.

Table 3 – Estimated Water Use Reductions for Restaurants

		Estimated Potential Savings Under Average Conditions				Costs to District	
Restaurants/Fixtures (Number of Fixtures)	Cost of Implementation [11]	Water (gallons/year)	Energy (kWHr/year)	Cost Savings to Customer [12] ($/year)	Rate of Return [13] (years)	Installation [14] ($)	Replacement Water [15] ($)
Ajuua							
Toilets (4)	$ 320.00	21,842	0	$ 190	33	$ 200	$ 1,314
Bath Faucets (3)	12.44	30,839	2,591	1,437	0.3	37	1,893
Kitchen/Bar Sinks (3)	12.44	36,113	3,034	511	0.3	37	2,217
				1,138		274	5,450
Colterra							
Toilets (5)	$ 320.00	14,016	0	$ 122	13	$ 250	$ 860
Showers heads (1)	47.25	13,140	1,766	229	0.2	48	1807
Bath Faucets (7)	12.44	64,386	5,410	912	0.1	87	3,952
Kitchen/Bar Sinks (3)	12.44	11,680	981	165	0.2	37	717
				1,328		422	6,336
Greenbriar							
Toilets (pre 1994)(2)	$ 320.00	21,068	0	$ 183	3.5	$ 100	$ 1,293
Toilets (post 1994)(5)	320.00	10,833	0	94	20	250	665
Showers heads (1)	47.25	4,964	667	87	0.6	48	305
Bath Faucets (9)	12.44	48,895	4,108	692	0.2	112	3,001
Urinals (4)	320.00	9,490	0	83	16	200	582
Kitchen/Bar Sinks (6)	12.44	170,820	14,352	2,419	0.03	75	10,485
				3,558		785	16,331
Niwot Market							
Toilets (2)	$ 320.00	32,412	0	$ 282	2.3	$ 100	$ 1,989
Bath Faucets (2)	12.44	17,374	1,460	246	0.1	25	1,066
Urinals (1)	320.00	3,650	0	32	10	50	224
Kitchen/Bar Sinks (3)	12.44	11,169	938	158	0.2	37	686
				718		212	3,965

[11] Includes cost of materials and labor per fixture/appliance

[12] Assuming water is $3.70 per 1000 gallons; sewer connection is $5 per 1000 gallons; and energy costs are $0.065/kWHr.

[13] Based on cost of retrofit for customer to cost savings in water and power utility billing

[14] Assumes LHWD pays for materials and labor to install showerheads, faucet aerators and pre-rinse spray aerators; and provides $50, $50, and $100 rebates for toilets, urinals, and clothes washers, respectively.

[15] Assuming cost for equivalent replacement water ($20,000) includes water rights acquisition, transmission, treatment and distribution.

Conclusions and Recommendations

The Water Efficiency Grant awarded to LHWD was put to use to implement components of the District's approved Water Conservation Plan. As a result of the grant funded project, LHWD was able to decrease water demand associated with specific water uses in seven commercial facilities within the LHWD service area.

Total estimated water savings on average over a single year associated with the installed replacement fixtures are expected to be about 2.4 acre-feet, with a replacement value of about $47,000 as shown in Table 4 (based on a replacement water cost of $20,000 per acre foot including water acquisition, transportation, treatment and distribution). The cost of installing the retrofits at each of the facilities (independent of other project costs) was about $7,000 such that retrofit program allowed for water demand reduction at a rate of about $2,920 per acre foot[16]. This value compares favorably with many other water conservation measures and programs implemented by other Colorado water utilities.

The cost of the water savings varied in each retrofit facility dependant on a number of factors, including the number and type of fixtures replaced, the number of times each fixture was used, and the number of facility visits. In particular, those facilities that received showerhead and faucet aerators were typically the most cost effective retrofits, especially in those facilities with shared use showers and sinks (i.e., motels). This is evident in the estimated percent of total water demand reduction (or water saved) as presented in Table 4. For example, water demand reduction at the motels and the one restaurant with a showerhead replacement (i.e., Colterra) ranged from 10 to 15 % of total annual water use, whereas water demand reduction at the remaining restaurants ranged from 3 to 7%.

Table 4 – Summary of Costs and Benefits of the Pilot Commercial Water Audit and Retrofits

Location	Average Water Savings for Installed Retrofit Fixtures (as a percent of total annual water use)	Average Yearly Reduction in Facility Utility Bills (power plus water)	Cost of Retrofits (equipment and labor)	Average Water Demand Reduction with Retrofits	Cost of Replacement Water to LHWD
Motels					
Americans Best Value Inn	10 %	$ 4,100	$ 3,161	0.81	$ 16,200
Days Inn	15	1,800	1,995	0.35	7,070
First Interstate Inn	14	1,600	1,423	0.32	6,370
Restaurants					
Ajuua	3	630	50	0.14	2,740
Colterra (Table 210)	12	1,120	147	0.23	4,670
Greenbriar Inn	7	1,990	149	0.43	8,550
Niwot Market	3	350	50	0.08	1,520
		11,590	**6,975**	**2.36**	**47,120**

[16] Including total project costs, which include the cost of data collection and assessment both prior to and after the audits, coordinating and scheduling the audits and preparing project reports, the per acre foot cost of water savings was about $5,500. In the future, LHWD could continue this program without some of the project costs inherent to a pilot program.

Also note that the water demand reductions at Niwot Market and Ajuua, which were the lowest percentages projected, were likely impacted by the fact that both of these businesses share a tap with another business, such that the retrofits only impacted a portion of the water use for that tap.

In general, these results indicate that water use reductions will and can occur independent of water use practices and behaviors at any particular facility as long as the fixtures remain in place. Reductions are expected to remain fairly consistent as a percentage of total water use over the course of a full year since most facilities do not have appreciable outdoor irrigation practices with the exceptions of Colterra and Greenbriar Inn, which both have garden areas. This means that as motel occupancy increases, total water demand reductions increase as showers and sink faucets receive more use, and vice-versa, such that the percentage remains roughly the same.

It is possible that the percent of water demand reduction may change in the future. Circumstances related to changing leak rates (see footnote 3) and/or changing water use behaviors (such as initiating outdoor irrigation practices or adding water features) may impact the estimated percent of water demand reductions.

Overall, the value of the commercial water audit program to LHWD in the future may be limited given the following observations:

- There are only a limited number of commercial facilities within the District's service area that would benefit from the fixture retrofits (beyond those that participated in this pilot project), given the types of facilities (e.g., the presence of nurseries, dairies, and other agricultural based businesses), the age of facilities (e.g., many of the commercial facilities within the District's service area are less than 15 years old), and the number of facilities.
- Water demand reductions from other water conservation measures and programs that LHWD have piloted may provide for more cost effective savings.
- The administrative costs of conducting audits and retrofit may be greater than costs for other incentive programs (e.g., rebate programs) that LHWD may choose to conduct.

Appendix A

Commercial Facility Water Audit Reports and Water Models

Left Hand Water District

look for WaterSense Meets EPA Criteria

SMART WATER Audit Facility Report

Ajuua's Restaurant

Overview

Great Western Institute (GWI) conducted a SMART WATER Audit at 7960 Niwot Road in Niwot, Colorado in August 2011. The SMART WATER Audit was conducted as part of Left Hand Water District's (LHWD) efforts to implement its Water Conservation Plan. To implement this program, LHWD working with GWI, selected and contacted a group of local businesses to participate in the audits. Those businesses that chose to participate received water audits to better understand their water uses and to identify methods to improve their efficiency. Participants also received retrofits of high efficiency showerheads and faucet aerators, when appropriate.

Water Use Summary

Ajuua Restaurant began operations in the 1990's as part of the strip mall that houses Winot Coffee and Sugar Beet Station (which share the water tap with Ajuua's). Construction occurred after the national plumbing code was developed such that the facility contains low flow faucet aerators (2.2 gallons per minute (gpm)) and toilets (1.6 gallons per flush (gpf)). Similar to many facilities built since 1994, this restaurant has plumbing fixtures that could be updated to improve water use efficiency using those fixtures that are US EPA Water Sense approved, thus saving water and energy expenses. For example, the toilets that were found during the audit could be made more efficient by installing 1.28 gpf models. Similarly, the bathroom fixtures (e.g., faucet aerators) use more water than is needed to support hand washing and other personal needs.

An inventory of Ajuua's water using fixtures and appliances is provided in Table 1 along with a water use model configured[1] and calibrated based on the observed monthly water use and the inventory of site specific appliances and fixtures. Table 1 also presents a summary of potential water and energy savings that the facility could realize through the replacement of existing fixtures and appliances with more water efficient fixtures and appliances.

Figure 1 presents the monthly water use at the facility from January 2009 to February 2013 (which includes a depiction of water use for the period preceding and after the SMART WATER Audit was performed).

Note that based on the water model developed for Ajuua's, it appears that under normal conditions a significant portion of the facility's water use may be attributed to toilets leak or malfunctions, wasting an estimated 600-800 gallons of water a day. This water waste may be associated with more than toilets, including but not limited to dripping sinks, kitchen fixtures, and/or mop sinks, etc.

[1] The water model includes estimates of water use for the two other storefronts that share the tap – Sugar Beet Station and Winot Coffee.

including those that may be in the other storefronts that share this water tap. It appears that the water waste occurs year round.

Based on the result of the SMART WATER Audit, it was estimated that on average about 0.14 acre-feet of water would be saved (as a result of demand reduction) at this location, based solely on the retrofits which were installed. This is equivalent to about 120 gallons of water a day due to more efficient kitchen (hand wash) and bathroom faucets or about 3% of the water use associated with this tap that is shared with Winot Coffee and Sugar Beet Station. If these savings are realized, it would reduce the facility water and energy costs by about $ 620 over a one year period at a cost to the LHWD of about $50 in replacement fixtures and labor.

Additional water efficiencies could be realized at the Ajuua's. For example, the facility manager may want to evaluate the benefits of replacing the 1.6 gpf toilets, and the faucet aerators that could not be installed during the audit. If all the toilets and faucet aerators were replaced with more efficient models, the facility may observe water use demand reductions close to 0.27 acre feet, or about 240 gallons per day.

Summary of Options for Improved Indoor Water Efficiency at the Ajuua Restaurant

Fixture/Appliance (number)	Estimated Cost to Install (per fixture/appliance)	Potential Annual Cost Savings (per fixture/appliance)	Installed as Part of Audit	Available Rebate from Left Hand Water District
Toilets (4)	$ 320	$ 48	No	Yes
Bathroom Sink Faucet Aerators (3)	12	145	Yes (2)	No
Kitchen Hand Wash Sinks (3)	12	170	Yes (2)	No

Table 1 - Summary of Current Water Use and Potential Water Savings
Ajuua's Restaurant

Maximum Use Calculation

	number	per use hot	per use cold	per use total		uses/day		subtotal gpd hot	subtotal gpd cold	subtotal gpd total	
Common Bathrooms	2										
Toilet	3			1.6	1.6 gpf	60.0	flushes	-	288	288	
Urinal	1			1	1 gpf	50.0	flushes	-	50	50	
Sink	2	1.1		1.1	2.2 gpm	38.5	minutes	85	85	169	
Kitchen											
Handwash Sinks	2	1.1		1.1	2.2 gpm	15.0	minutes	33	33	66	
Dishwasher (NSF)	1	0		2	2 gpl	220.0	loads	-	440	440	
Pots and Pans Sinks	2	2.5		2.5	5 gpm	200.0	minutes	1,000	1,000	2,000	
Ice Machine (Scotsman CM3)	1	0		18	18 gp100#	4.0	loads	-	72	72	
Pre-Rinse Spray Nozzle	1	0.75		0.75	1.5 gpm	180.0	minutes	135	135	270	
Sugar Beet Station/Winot Coffee (call on 9/10/12)											
Toilets	1			1.6	1.6 gpf	75.0	flushes	-	120	120	
Sink	1	1.1		1.1	2.2 gpm	26.3	minutes	29	29	58	
Handwash Sink	1	1.1		1.1	2.2 gpm	26.3	minutes	29	29	58	
Dishwasher	1	0		2	2 gpl	60.0	loads	-	120	120	
Ice Machine	1	0		18	18 gp100#	4.0	loads	-	72	72	
Estimated Leak	1			0.55	0.55 gpm	1,440.0	minutes	-	792	792	
											calculated max month
								1,310	**3,264**	**4,575**	**average day**
									observed	138,000	max month
									observed	4,600	max month average day

Average Winter Use Calculation

	number	per use hot	per use cold	per use total		uses/day		subtotal gpd hot	subtotal gpd cold	subtotal gpd total	
Common Bathrooms	2										
Toilet	3			1.6	1.6 gpf	45.0	flushes	-	216	216	
Urinal	1			1	1 gpf	36.0	flushes	-	36	36	
Sink	2	1.1		1.1	2.2 gpm	15.8	minutes	35	35	69	
Kitchen											
Handwash Sinks	2	1.1		1.1	2.2 gpm	20.0	minutes	44	44	88	
Dishwasher (NSF)	1	0		2	2 gpl	150.0	loads	-	300	300	
Pots and Pans Sinks	2	2.5		2.5	5 gpm	150.0	minutes	750	750	1,500	
Ice Machine (Scotsman CM3)	1	0		18	18 gp100#	2.0	loads	-	36	36	
Pre-Rinse Spray Nozzle	1	0.75		0.75	1.5 gpm	150.0	minutes	113	113	225	
Sugar Beet Station/Winot Coffee (call on 9/10/12)											
Toilets	1			1.6	1.6 gpf	52.0	flushes	-	83	83	
Sink	1	1.1		1.1	2.2 gpm	18.2	minutes	20	20	40	
Handwash Sink	1	1.1		1.1	2.2 gpm	18.2	minutes	20	20	40	
Dishwasher	1	0		2	2 gpl	35.0	loads	-	70	70	
Ice Machine	1	0		18	18 gp100#	2.0	loads	-	36	36	
Estimated Leak	1			0.45	0.45 gpm	1,440.0	minutes	-	648	648	
											calculated average
								981	**2,406**	**3,388**	**winter day**
									observed	102,333	average winter month
									observed	3,411	average winter day

Maximum Use Savings Calculation

	number	per use hot	per use cold	per use total		uses/day		subtotal gpd hot	subtotal gpd cold	subtotal gpd total		Potential Savings hot	Potential Savings cold	Potential Savings total
Common Bathrooms	2													
Toilet	3			1.28	1.28 gpf	60.0	flushes	-	230	230		-	58	58
Urinal	1			1	1 gpf	50.0	flushes	-	50	50		-	-	-
Sink	2	0.25		0.25	0.5 gpm	38.5	minutes	19	19	39		65	65	131
Kitchen														
Handwash Sinks	2	0.25		0.25	0.5 gpm	15.0	minutes	8	8	15		26	26	51
Dishwasher (NSF)	1	0		2	2 gpl	220.0	loads	-	440	440		-	-	-
Pots and Pans Sinks	2	2.5		2.5	5 gpm	200.0	minutes	1,000	1,000	2,000		-	-	-

Table 1 - Summary of Current Water Use and Potential Water Savings
Ajuua's Restaurant

Ice Machine (Scotsman CM3)	1	0	18	18	gp100#	4.0	loads	-	72	72					
Pre-Rinse Spray Nozzle	1	0.75	0.75	1.5	gpm	180.0	minutes	135	135	270					
												-	-	-	
												-	-	-	
Sugar Beet Station/Winot Coffee (call on 9/10/12)															
Toilets	1		1.28	1.28	gpf	75.0	flushes	-	96	96					
Sink	1	0.25	0.25	0.5	gpm	26.3	minutes	7	7	13		-	24	24	
Handwash Sink	1	0.25	0.25	0.5	gpm	26.3	minutes	7	7	13		22	22	45	
Dishwasher	1	0	2	2	gpl	60.0	loads	-	120	120		22	22	45	
Ice Machine	1	0	18	18	gp100#	4.0	loads	-	72	72		-	-	-	
												-	-	-	
Estimated Leak	1		0.55	0.55	gpm	1,440.0	minutes	-	792	792		-	-	-	
											calculated efficient				
								1,175	**3,047**	**4,222**	**average maximum month day**	**136**	**217**	**353**	
									observed	4,600	average max month day				
										8%	reduction				
									water savings	$ 39.16	per month				

Average Winter Use Savings Calculation

	number	hot	per use cold	total		uses/day		subtotal gpd hot	cold	total		Potential Savings hot	cold	total
Common Bathrooms	2													
Toilet	3		1.28	1.28	gpf	45.0	flushes	-	173	173				
Urinal	1		1	1	gpf	36.0	flushes	-	36	36		-	43	43
Sink	2	0.25	0.25	0.5	gpm	15.8	minutes	8	8	16		-	-	-
												27	27	54
Kitchen														
Handwash Sinks	2	0.25	0.25	0.5	gpm	20.0	minutes	10	10	20				
Dishwasher (NSF)	1	0	2	2	gpl	150.0	loads	-	300	300		34	34	68
Pots and Pans Sinks	2	2.5	2.5	5	gpm	150.0	minutes	750	750	1,500		-	-	-
Ice Machine (Scotsman CM3)	1	0	18	18	gp100#	2.0	loads	-	36	36		-	-	-
Pre-Rinse Spray Nozzle	1	0.75	0.75	1.5	gpm	150.0	minutes	113	113	225		-	-	-
												-	-	-
Sugar Beet Station/Winot Coffee (call on 9/10/12)														
Toilets	1		1.28	1.28	gpf	52.0	flushes	-	67	67				
Sink	1	0.25	0.25	0.5	gpm	18.2	minutes	5	5	9		-	17	17
Handwash Sink	1	0.25	0.25	0.5	gpm	18.2	minutes	5	5	9		15	15	31
Dishwasher	1	0	2	2	gpl	35.0	loads	-	70	70		15	15	31
Ice Machine	1	0	18	18	gp100#	2.0	loads	-	36	36		-	-	-
												-	-	-
Estimated Leak	1		0.45	0.45	gpm	1,440.0	minutes	-	648	648		-	-	-
											calculated efficient			
								889	**2,255**	**3,144**	**average winter day**	**92**	**152**	**243**
									observed	3,411	average winter day			
										7%	reduction			
									water savings	$ 27.00	per month			

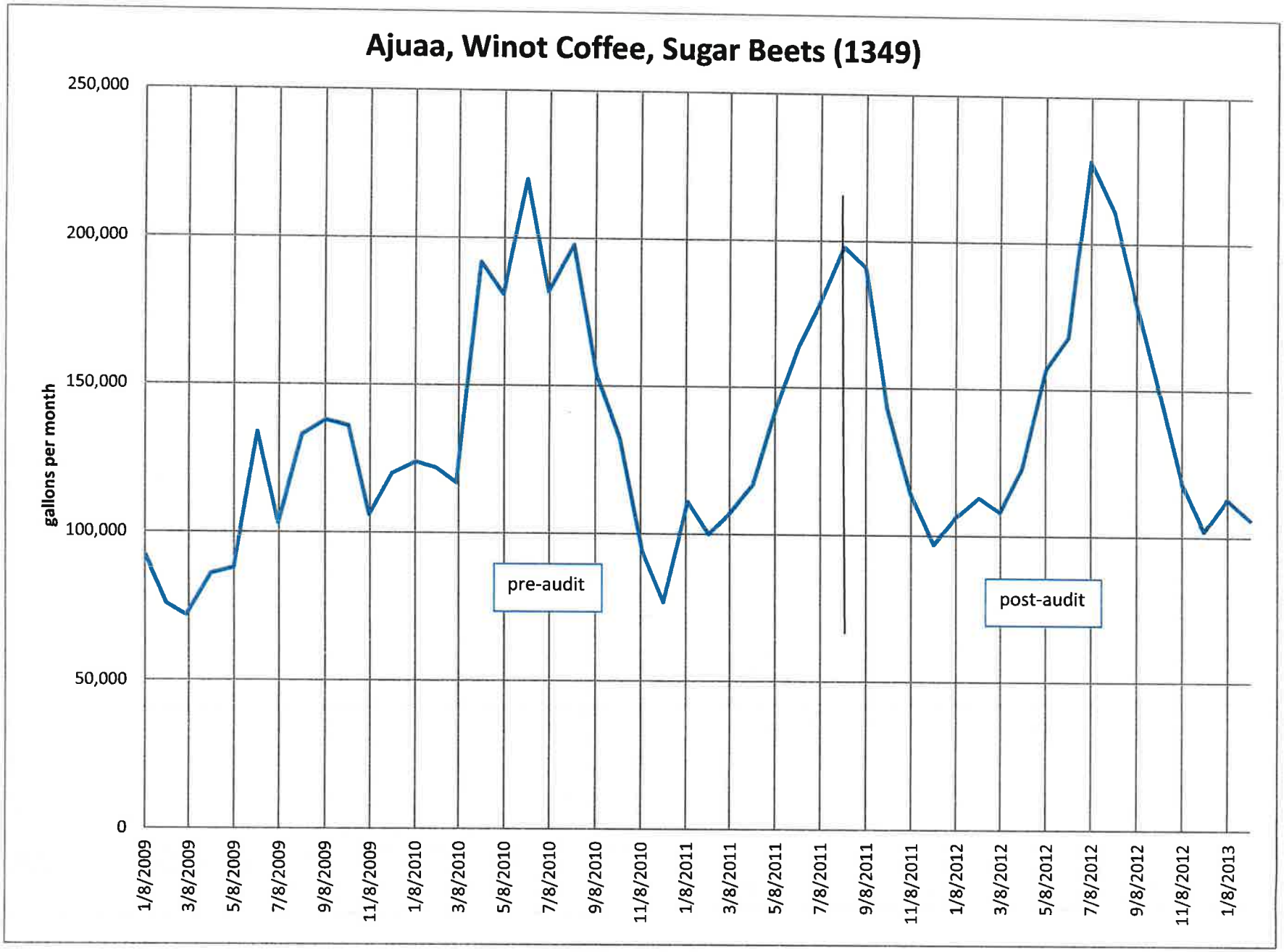
Costs to Implement

Potential Savings (if 100% of High Efficiency Fixtures/Appliance are installed)	number	Costs hardware	installation	total	Pay Back Period	Average Conditions Water Savings (gpy)	Energy Savings (kWhr)	Replacement Water Costs	Total Customer Cost Savings/yr	Total Cost Savings/yr/fixture
Toilet	4	$ 225	$ 95	$ 1,280	6.74 yrs	21,842	-	$ 1,341	$ 190	$ 47.51
Showerheads	0	$ 37.25	$ 10	$ -	yrs	-	-	$ -	$ -	
Bathroom Sinks	3	$ 2.44	$ 10	$ 37	0.09 yrs	30,839	2,591	$ 1,893	$ 437	$ 145.57
Kitchen and Bar Sinks	3	$ 2.44	$ 10	$ 37	0.07 yrs	36,113	3,034	$ 2,217	$ 511	$ 170.47
Urinals	0	$ 225.00	$ 95	$ -	yrs	-	-	$ -	$ -	
Clothes Washers	0	$ 550.00	$ 75	$ -	yrs	-	-	$ -	$ -	
Pre-Rinse Spray Aerator	0	$ 95.00	$ 25	$ -	yrs	-	-	$ -	$ -	
				$ 1,355	total costs for retrofits	88,794	5,625	$ 5,450	$ 1,138	
						0.27 AF Saved				

Table 1 - Summary of Current Water Use and Potential Water Savings
Ajuua's Restaurant

Estimated Savings from Retrofits (installed during SMART Water Audit)	Costs number	hardware	installation	total	Pay Back Period	Average Conditions Water Savings (gpy)	Energy Savings (kWhr)	Total Customer Cost Savings/yr	Total Cost Savings/yr/fixture
Toilet (1996)	0	$ 225	$ 95	$ -	yrs	-	-	$ -	
Showerheads	0	$ 37.25	$ 10	$ -	yrs	-	-	$ -	
Bathroom Sinks	2	$ 2.44	$ 10	$ 25	0.09 yrs	20,559	1,727	$ 291	$ 145.57
Kitchen and Bar Sinks	2	$ 2.44	$ 10	$ 25	0.07 yrs	24,075	2,023	$ 341	$ 170.47
Urinals	0	$ 225.00	$ 95	$ -	yrs	-	-	$ -	
Clothes Washers	0	$ 550.00	$ 75	$ -	yrs	-	-	$ -	
Pre-Rinse Spray Aerator	0	$ 95.00	$ 25	$ -	yrs	-	-	$ -	
				$ 50	total costs for retrofits	44,635	3,750	$ 632	
				$ 2,740	replacement water cost	0.14	AF Saved		

Annual Water Use
4.85
2.8%


Ajuaa, Winot Coffee, Sugar Beets (1349)
250,000
200,000
150,000
100,000
50,000
0
gallons per month
pre-audit
post-audit
1/8/2009
3/8/2009
5/8/2009
7/8/2009
9/8/2009
11/8/2009
1/8/2010
3/8/2010
5/8/2010
7/8/2010
9/8/2010
11/8/2010
1/8/2011
3/8/2011
5/8/2011
7/8/2011
9/8/2011
11/8/2011
1/8/2012
3/8/2012
5/8/2012
7/8/2012
9/8/2012
11/8/2012
1/8/2013

Left Hand Water District

SMART WATER Audit Facility Report

Colterra Restaurant

look for WaterSense Meets EPA Criteria

Overview

Great Western Institute (GWI) conducted a SMART WATER Audit at 210 Franklin Street in Niwot, Colorado in August 2011. The SMART WATER Audit was conducted as part of Left Hand Water District's (LHWD) efforts to implement its Water Conservation Plan. To implement this program, LHWD working with GWI, selected and contacted a group of local businesses to participate in the audits. Those businesses that chose to participate received water audits to better understand their water uses and to identify methods to improve their efficiency. Participants also received retrofits of high efficiency showerheads and faucet aerators, when appropriate.

Water Use Summary

Colterra Restaurant began operations in the 1990's. Construction occurred after the national plumbing code was developed such that the facility contains low flow faucet aerators (2.2 gallons per minute (gpm)) and toilets (1.6 gallons per flush (gpf)). Similar to many facilities built since 1994, this restaurant has plumbing fixtures that could be updated to improve water use efficiency using those fixtures that are US EPA Water Sense approved, thus saving water and energy expenses. For example, the toilets that were found during the audit could be made more efficient by installing 1.28 gpf models. Similarly, the bathroom fixtures (showerheads and faucet aerators) use more water than is needed to support bathing, cleaning and other personal needs.

An inventory of Colterra's water using fixtures and appliances is provided in Table 1 along with a water use model configured and calibrated based on the observed monthly water use and the inventory of site specific appliances and fixtures. Table 1 also presents a summary of potential water and energy savings that the facility could realize through the replacement of existing fixtures and appliances with more water efficient fixtures and appliances.

Figure 1 presents the monthly water use at the facility from January 2009 to February 2013 (which includes a depiction of water use for the period preceding and after the SMART WATER Audit was performed).

Note that based on the water model developed for Colterra's, it appears that under normal conditions a small portion of the facility's water use may be attributed to toilets leak or malfunctions, wasting an estimated 90 gallons of water a day (which is about 7% of the restaurant's average wintertime daily water use). This water waste may be associated with more than toilets, including but not limited to dripping sinks and showers, kitchen fixtures, and/or mop sinks, etc. It appears that the water waste occurs year round.

Based on the result of the SMART WATER Audit, it was estimated that on average about 0.23 acre-feet of water would be saved (as a result of demand reduction) at this location, based solely on the

retrofits which were installed. This is equivalent to about 210 gallons of water a day due to more efficient kitchen (hand wash) and bathroom faucets. If these savings are realized, it would reduce the facility water and energy costs by about $1,120 over a one year period at a cost to the LHWD of about $150 in replacement fixtures and labor.

Actual water use reductions observed during the winter months following the audit were estimated to be at a rate of about 17%, or about 200 gallons per day. Note that the actual performance of the retrofits may be greater than this given that water use at Colterra has trended upward for each of the last three years (see Figure 1). Adjusting for this upward trend, water savings may be as high as about 400 gallons per day.

Additional water efficiencies could be realized at the Colterra's. For example, the facility manager may want to evaluate the benefits of replacing the 1.6 gpf toilets, and the faucet aerators that could not be installed during the audit. If all the toilets and faucet aerators were replaced with more efficient models, the facility may observe water use demand reductions close to 0.32 acre feet, or about 280 gallons per day.

Summary of Options for Improved Indoor Water Efficiency at the Colterra Restaurant

Fixture/Appliance (number)	Estimated Cost to Install (per fixture/appliance)	Potential Annual Cost Savings (per fixture/appliance)	Installed as Part of Audit	Available Rebate from Left Hand Water District
Toilets (5)	$ 320	$ 24	No	Yes
Showerheads (1)	47	229	Yes (1)	No
Bathroom Sink Faucet Aerators (7)	12	130	Yes (6)	No
Kitchen Hand Wash Sinks (3)	12	55	Yes (2)	No

Table 1 - Summary of Current Water Use and Potential Water Savings
Colterra Restaurant

Maximum Use Calculation

		number	per use hot	per use cold	per use total		uses/day		subtotal gpd hot	subtotal gpd cold	subtotal gpd total	
Common Bathrooms		4										
	Toilet (1999)	5		1.6	1.6	gpf	35.0	flushes	-	280	280	
	Urinal	1		1	1	gpf	35.0	flushes	-	35	35	
	Sink	7	1	1	2	gpm	24.5	minutes	172	172	343	
	Shower	1	3.6	0.9	4.5	gpm	12.0	minutes	43	11	54	
Kitchen												
Handwash Sinks		2	1.25	1.25	2.5	gpm	10.0	minutes	25	25	50	
Dishwasher (Autochlor)		1	0	2	2	gpl	90.0	loads	-	180	180	
Pots and Pans Sinks		1	1.5	1.5	3	gpm	120.0	minutes	180	180	360	
Ice Machine (Hoshizaki)		1	0	18	18	gp100#	4.0	loads	-	72	72	
Pre-Rinse Spray Nozzle		2	0.75	0.75	1.5	gpm	120.0	minutes	180	180	360	
Bar Sink		1	1.25	1.25	2.5	gpm	75.0	minutes	94	94	188	
Mop Closet		1	2.5	2.5	5	gpm	30.0	minutes	75	75	150	
Other												
Leaking Toilets/Sinks		0.5	0	0.12	0.12	gpm	1,440.0	minutes	-	86	86	
Washing Machine (stackable Maytag)		1	7.5	7.5	15	gpl	1.0	loads	8	8	15	
Outdoor Irrigation		1	0	319	319	g/day	1.0	days	-	319	319	
												calculated max month
									776	**1,716**	**2,492**	**average day**
										observed	75,000	max month
										observed	2,500	max month average day

Average Winter Use Calculation

		number	per use hot	per use cold	per use total		uses/day		subtotal gpd hot	subtotal gpd cold	subtotal gpd total	
Common Bathrooms		4										
	Toilet (1999)	5		1.6	1.6	gpf	24.0	flushes	-	192	192	
	Urinal	1		1	1	gpf	24.0	flushes	-	24	24	
	Sink	7	1	1	2	gpm	16.8	minutes	118	118	235	
	Shower	1	3.6	0.9	4.5	gpm	12.0	minutes	43	11	54	
Kitchen												
Handwash Sinks		2	1.25	1.25	2.5	gpm	8.0	minutes	20	20	40	
Dishwasher (Autochlor)		1	0	2	2	gpl	80.0	loads	-	160	160	
Pots and Pans Sinks		1	1.5	1.5	3	gpm	80.0	minutes	120	120	240	
Ice Machine (Hoshizaki)		1	0	18	18	gp100#	1.0	loads	-	18	18	
Pre-Rinse Spray Nozzle		2	0.75	0.75	1.5	gpm	25.0	minutes	38	38	75	
Bar Sink		1	1.25	1.25	2.5	gpm	20.0	minutes	25	25	50	
Mop Closet		1	2.5	2.5	5	gpm	15.0	minutes	38	38	75	
Other												
Leaking Toilets/Sinks		0.5	0	0.12	0.12	gpm	1,440.0	minutes	-	86	86	
Washing Machine (stackable Maytag)		1	7.5	7.5	15	gpl	0.8	loads	6	6	11	
Outdoor Irrigation		1	0	319	319	g/day	-	days	-	-	-	
												calculated average
									406	**854**	**1,261**	**winter day**
										observed	38,000	average winter month
										observed	1,267	average winter day

Maximum Use Savings Calculation

		number	per use hot	per use cold	per use total		uses/day		subtotal gpd hot	subtotal gpd cold	subtotal gpd total	Potential Savings hot	Potential Savings cold	Potential Savings total
Common Bathrooms		4												
	Toilet (1999)	5		1.28	1.28	gpf	35.0	flushes	-	224	224	-	56	56
	Urinal	1		1	1	gpf	35.0	flushes	-	35	35	-	-	-
	Sink	7	0.25	0.25	0.5	gpm	24.5	minutes	43	43	86	129	129	257
	Shower	1	1.2	0.3	1.5	gpm	12.0	minutes	14	4	18	29	7	36
Kitchen														
Handwash Sinks		2	0.25	0.25	0.5	gpm	10.0	minutes	5	5	10	20	20	40

Table 1 - Summary of Current Water Use and Potential Water Savings
Colterra Restaurant

Dishwasher (Autochlor)	1	0	2	2 gpl	90.0	loads	-	180	180		-	-	-
Pots and Pans Sinks	1	1.5	1.5	3 gpm	120.0	minutes	180	180	360		-	-	-
Ice Machine (Hoshizaki)	1	0	18	18 gp100#	4.0	loads	-	72	72		-	-	-
Pre-Rinse Spray Nozzle	2	0.75	0.75	1.5 gpm	120.0	minutes	180	180	360		-	-	-
Bar Sink	1	1.25	1.25	2.5 gpm	75.0	minutes	94	94	188		-	-	-
Mop Closet	1	2.5	2.5	5 gpm	30.0	minutes	75	75	150		-	-	-
Other													
Leaking Toilets/Sinks	0.5	0	0.12	0.12 gpm	1,440.0	minutes	-	86	86		-	-	-
Washing Machine (stackable Maytag)	1	7.5	7.5	15 gpl	1.0	loads	8	8	15		-	-	-
Outdoor Irrigation	1	0	319	319 g/day	1.0	days	-	319	319		-	-	-
										calculated efficient average maximum			
							599	**1,504**	**2,103**	**month day**	**177**	**212**	**389**
								observed	2,500	average max month day			
									16%	reduction			
								water savings	$ 536.39	per month			

Average Winter Use Savings Calculation

		number	hot	per use cold	total		uses/day	subtotal gpd hot	cold	total		Potential Savings hot	cold	total
Common Bathrooms		4												
	Toilet (1999)	5		1.28	1.28	gpf	24.0 flushes	-	154	154		-	38	38
	Urinal	1		1	1	gpf	24.0 flushes	-	24	24		-	-	-
	Sink	7	0.25	0.25	0.5	gpm	16.8 minutes	29	29	59		88	88	176
	Shower	1	1.2	0.3	1.5	gpm	12.0 minutes	14	4	18		29	7	36
Kitchen														
Handwash Sinks		2	0.25	0.25	0.5	gpm	8.0 minutes	4	4	8		16	16	32
Dishwasher (Autochlor)		1	0	2	2	gpl	80.0 loads	-	160	160		-	-	-
Pots and Pans Sinks		1	1.5	1.5	3	gpm	80.0 minutes	120	120	240		-	-	-
Ice Machine (Hoshizaki)		1	0	18	18	gp100#	1.0 loads	-	18	18		-	-	-
Pre-Rinse Spray Nozzle		2	0.75	0.75	1.5	gpm	25.0 minutes	38	38	75		-	-	-
Bar Sink		1	1.25	1.25	2.5	gpm	20.0 minutes	25	25	50		-	-	-
Mop Closet		1	2.5	2.5	5	gpm	15.0 minutes	38	38	75		-	-	-
Other														
Leaking Toilets/Sinks		0.5	0	0.12	0.12	gpm	1,440.0 minutes	-	86	86		-	-	-
Washing Machine (stackable Maytag)		1	7.5	7.5	15	gpl	0.8 loads	6	6	11		-	-	-
Outdoor Irrigation		1	0	319	319	g/day	- days	-	-	-		-	-	-
											calculated efficient			
								273	**705**	**978**	**average winter day**	**133**	**150**	**283**
									observed	1,267	average winter day			
										23%	reduction			
									water savings	$ 389.78	per month			

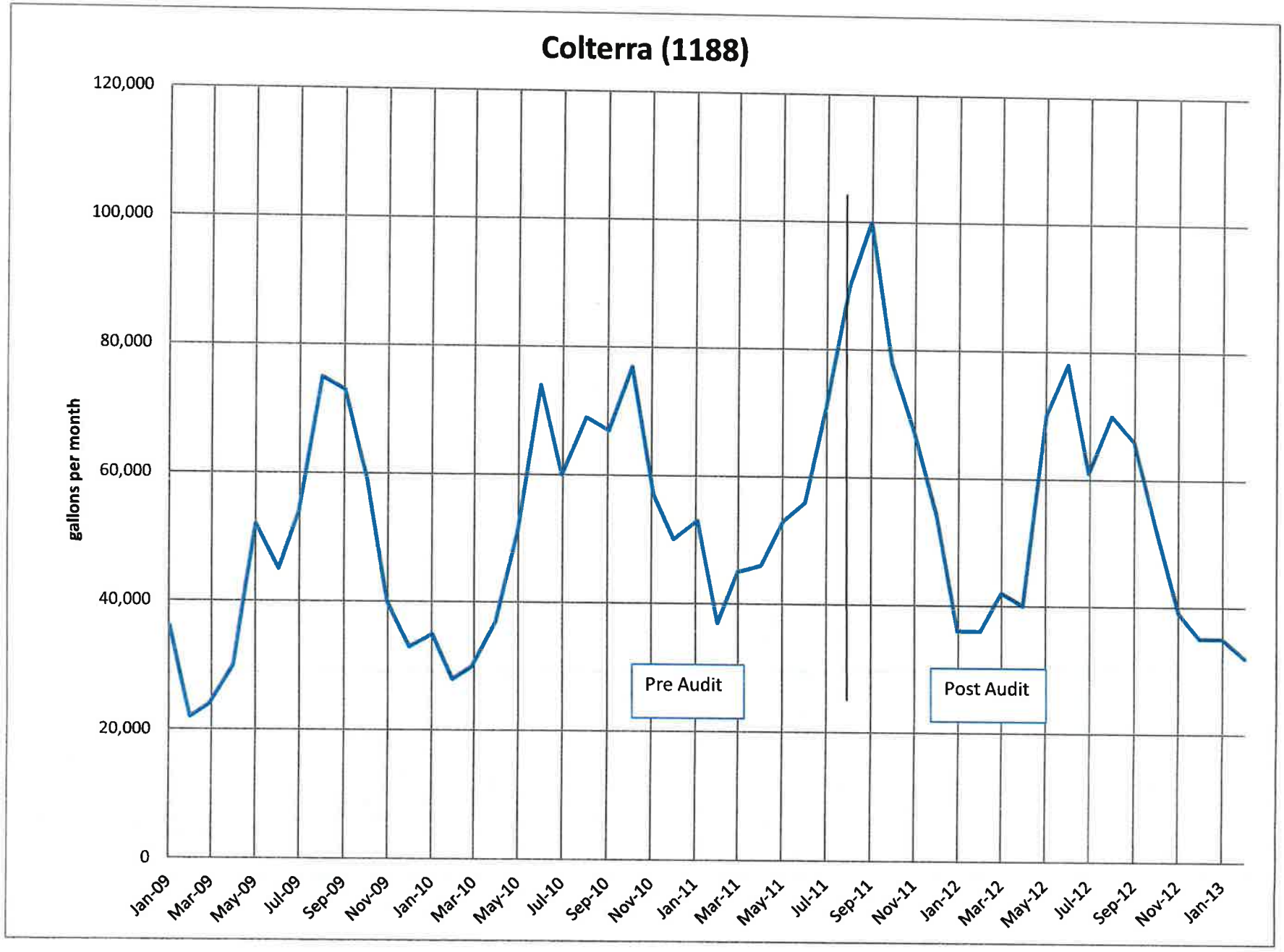
Costs to Implement

Potential Savings (if 100% of High Efficiency Fixtures/Appliance are installed)	number	Costs hardware	installation	total	Pay Back Period	Average Conditions Water Savings (gpy)	Energy Savings (kWhr)	Replacement Water Costs	Total Customer Cost Savings/yr	Total Cost Savings/yr/fixture
Toilet	5	$ 225	$ 95	$ 1,600	13.12 yrs	14,016	-	$ 860	$ 122	$ 24.39
Showerheads	1	$ 37.25	$ 10	$ 47	0.21 yrs	13,140	1,766	$ 807	$ 229	$ 229.13
Bathroom Sinks	7	$ 2.44	$ 10	$ 87	0.10 yrs	64,386	5,410	$ 3,952	$ 912	$ 130.25
Kitchen and Bar Sinks	3	$ 2.44	$ 10	$ 37	0.23 yrs	11,680	981	$ 717	$ 165	$ 55.13
Urinals	0	$ 225.00	$ 95	$ -	yrs	-	-	$ -	$ -	$ -
Clothes Washers	0	$ 550.00	$ 75	$ -	yrs	-	-	$ -	$ -	$ -
Pre-Rinse Spray Aerator	0	$ 95.00	$ 25	$ -	yrs	-	-	$ -	$ -	$ -
				$ 1,772	total costs for retrofits	103,222	8,157	$ 6,336	$ 1,428	
						0.32 AF Saved				

Table 1 - Summary of Current Water Use and Potential Water Savings
Colterra Restaurant

Estimated Savings from Retrofits (installed during SMART Water Audit)	Costs					Average Conditions		Total Customer Cost Savings/yr	Total Cost Savings/yr/fixture
	number	hardware	installation	total	Pay Back Period	Water Savings (gpy)	Energy Savings (kWhr)		
Toilet	0	$ 225	$ 95	$ -	yrs	-	-	$ -	$ -
Showerheads	1	$ 37.25	$ 10	$ 47	0.21 yrs	13,140	1,766	$ 229	$ 229.13
Bathroom Sinks	6	$ 2.44	$ 10	$ 75	0.10 yrs	55,188	4,637	$ 782	$ 130.25
Kitchen and Bar Sinks	2	$ 2.44	$ 10	$ 25	0.23 yrs	7,787	654	$ 110	$ 55.13
Urinals	0	$ 225.00	$ 95	$ -	yrs	-	-	$ -	$ -
Clothes Washers	0	$ 550.00	$ 75	$ -	yrs	-	-	$ -	
Pre-Rinse Spray Aerator	0	$ 95.00	$ 25	$ -	yrs	-	-	$ -	
				$ 147	total costs for retrofits	76,115	7,057	$ 1,121	
				$ 4,672	replacement water cost	0.23	AF Saved		

Average Annual Water Use
1.97
0.118435685


Colterra (1188)
gallons per month
120,000
100,000
80,000
60,000
40,000
20,000
0
Jan-09
Mar-09
May-09
Jul-09
Sep-09
Nov-09
Jan-10
Mar-10
May-10
Jul-10
Sep-10
Nov-10
Jan-11
Mar-11
May-11
Jul-11
Sep-11
Nov-11
Jan-12
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Pre Audit
Post Audit

Left Hand Water District

SMART WATER Audit Facility Report

Greenbriar Inn

look for WaterSense Meets EPA Criteria

Overview

Great Western Institute (GWI) conducted a SMART WATER Audit at 8735 N. Foothills Highway in Boulder, Colorado in August 2011. The SMART WATER Audit was conducted as part of Left Hand Water District's (LHWD) efforts to implement its Water Conservation Plan. To implement this program, LHWD working with GWI, selected and contacted a group of local businesses to participate in the audits. Those businesses that chose to participate received water audits to better understand their water uses and to identify methods to improve their efficiency. Participants also received retrofits of high efficiency showerheads and faucet aerators, when appropriate.

Water Use Summary

The Greenbriar Inn was built in various stages beginning in the 1920's, and continuing into the 1990's. Most construction occurred before the national plumbing code was developed such that the facility and the adjacent cabin contain high flow showerheads (2.5+ gallons per minute (gpm)), faucet aerators (2.2 gpm) and toilets (3.5+ gallons per flush (gpf)). Similar to many facilities built since 1994, this restaurant has plumbing fixtures that could be updated to improve water use efficiency using those fixtures that are US EPA Water Sense approved, thus saving water and energy expenses. For example, the toilets that were found during the audit could be made more efficient by installing 1.28 gpf models. Similarly, the bathroom fixtures (showerheads and faucet aerators) use more water than is needed to support bathing, cleaning and other personal needs.

An inventory of the Greenbriar Inn's water using fixtures and appliances is provided in Table 1 along with a water use model configured and calibrated based on the observed monthly water use and the inventory of site specific appliances and fixtures. Table 1 also presents a summary of potential water and energy savings that the facility could realize through the replacement of existing fixtures and appliances with more water efficient fixtures and appliances.

Figure 1 presents the monthly water use at the facility from January 2009 to February 2013 (which includes a depiction of water use for the period preceding and after the SMART WATER Audit was performed).

Note that based on the water model developed for the Greenbriar Inn, it appears that under normal conditions a portion of the facility's water use may be attributed to toilets leak or malfunctions, wasting an estimated 190 gallons of water a day (or about 7% of an average winter day demand). This water waste may be associated with more than toilets, including but not limited to dripping sinks and showers, kitchen fixtures, and/or mop sinks, and/or leaks in the laundry facility. It appears that the water waste occurs year round.

Based on the result of the SMART WATER Audit, it was estimated that on average about 0.43 acre-feet of water would be saved (as a result of demand reduction) at this location, based solely on the retrofits which were installed. This is equivalent to about 380 gallons of water a day due to more efficient shower and bathroom faucets. If these savings are realized, it would reduce the facility water and energy costs by about $2,000 over a one year period at a cost to the LHWD of about $200 in replacement fixtures and labor.

Actual water use reductions observed during the winter months following the audit were estimated to be at a rate of about 18%, or about 460 gallons per day.

Additional water efficiencies could be realized at the Greenbriar Inn. For example, the facility manager may want to evaluate the benefits of replacing the 3.5 gpf toilets, and the faucet aerators that could not be installed during the audit. If all the older toilets, and bar faucet aerators were replaced with more efficient models, the facility may observe water use demand reductions close to 0.82 acre feet, or about 730 gallons per day.

Summary of Options for Improved Indoor Water Efficiency at the Greenbriar Inn

Fixture/Appliance (number)	Estimated Cost to Install (per fixture/appliance)	Potential Annual Cost Savings (per fixture/appliance)	Installed as Part of Audit (number)	Available Rebate from Left Hand Water District
Toilets (pre-1994) (2)	$ 320	$ 92	No	Yes
Toilets (post-1994) (5)	320	16	No	Yes
Showerheads (1)*	47	87	Yes (1)	No
Bathroom Sink Faucet Aerators (9)*	12	77	Yes (9)	No
Urinals (4)	320	21	No	No
Kitchen Hand Wash/Bar Sinks (6)	12	403	Yes (3)	No

*Includes care keeper cabin on premises.

Table 1 - Summary of Current Water Use and Potential Water Savings
Greenbriar Inn

Maximum Use Calculation

		number	per use hot	per use cold	per use total		uses/day		subtotal gpd hot	subtotal gpd cold	subtotal gpd total	
Common Bathrooms		4										
	Toilet (1996)	5		1.6	1.6	gpf	60.0	flushes	-	480	480	
	Toilet (1978)	2		3.5	3.5	gpf	60.0	flushes	-	420	420	
	Urinal	4		1.5	1.5	gpf	60.0	flushes	-	360	360	
	Sink	8	1.1	1.1	2.2	gpm	42.0	minutes	370	370	739	
Cabin												
	Toilet	1		3.5	3.5	gpf	4.0	flushes	-	14	14	
	Shower	1	2.4	0.6	3.0	gpm	12.0	minutes	29	7	36	
	Sink	1	1.1	1.1	2.2	gpm	8.0	minutes	9	9	18	
	Kitchen	1	3.6	0.9	4.5	gpm	12.0	minutes	43	11	54	
	Washing Machine	1	21	21	42	gpl	1.0	loads	21	21	42	
Kitchen												
Handwash Sinks		3	1.25	1.25	3	gpm	5.0	minutes	19	19	38	
Dishwasher (NSF)		2	0	2	2	gpl	165.0	loads	-	660	660	
Pots and Pans Sinks		6	1.5	1.5	3	gpm	165.0	minutes	1,485	1,485	2,970	
Steam Table		2		18	18	gpd	1.0	days	-	36	36	
Ice Machine (Manitowoc CY 0605W)		2	0	18	18	gp100#	8.0	loads	-	288	288	
Pre-Rinse Spray Nozzle		2	0.75	0.75	1.5	gpm	165.0	minutes	248	248	495	
Bar Sink		3	1.6	1.6	3.2	gpm	120.0	minutes	582	582	1,164	
Mop Closet		1	2.5	2.5	5	gpm	45.0	minutes	113	113	225	
Other												
Leaking Toilets/Sinks		1	0	0.13	0.13	gpm	1,440.0	minutes	-	187	187	
Swamp Coolers		2	0	280	280	gpd	1.0	days	-	560	560	
Outdoor Water Feature		1	0	160	160	g/day	1.0	days	-	160	160	
Outdoor Irrigation		1	0	2026	2,026	g/day	1.0	days	-	2,026	2,026	
												calculated max month
									2,917	**8,054**	**10,971**	**average day**
										observed	329,000	max month
										observed	10,967	max month average day

Average Winter Use Calculation

		number	per use hot	per use cold	per use total		uses/day		subtotal gpd hot	subtotal gpd cold	subtotal gpd total
Common Bathrooms		4									
	Toilet (1996)	5		1.6	1.6	gpf	13.0	flushes	-	104	104
	Toilet (1978)	2		3.5	3.5	gpf	13.0	flushes	-	91	91
	Urinal	4		1.5	1.5	gpf	13.0	flushes	-	78	78
	Sink	8	1.1	1.1	2.2	gpm	9.1	minutes	80	80	160
Cabin											
	Toilet	1		3.5	3.5	gpf	4.0	flushes	-	14	14
	Shower	1	2.4	0.6	3	gpm	8.0	minutes	19	5	24
	Sink	1	1.1	1.1	2.2	gpm	6.0	minutes	7	7	13
	Kitchen	1	3.6	0.9	4.5	gpm	12.0	minutes	43	11	54
	Washing Machine	1	21	21	42	gpl	0.5	loads	11	11	21
Kitchen											
Handwash Sinks		3	1.25	1.25	2.5	gpm	3.0	minutes	11	11	23
Dishwasher (NSF)		2	0	2	2	gpl	40.0	loads	-	160	160
Pots and Pans Sinks		6	1.5	1.5	3	gpm	40.0	minutes	360	360	720
Steam Table		2		18	18	gpd	1.0	days	-	36	36
Ice Machine (Manitowoc CY 0605W)		2	0	18	18	gp100#	2.0	loads	-	72	72
Pre-Rinse Spray Nozzle		2	0.75	0.75	1.5	gpm	60.0	minutes	90	90	180
Bar Sink		3	1.5	1.5	3	gpm	60.0	minutes	270	270	540
Mop Closet		1	2.5	2.5	5	gpm	25.0	minutes	63	63	125
Other											
Leaking Toilets/Sinks		1	0	0.13	0.13	gpm	1,440.0	minutes	-	187	187
Swamp Coolers		2	0	280	280	gpd	-	minutes	-	-	-

Table 1 - Summary of Current Water Use and Potential Water Savings
Greenbriar Inn

Outdoor Water Feature	1	0	160	160 g/day	-	days	-	-	-			
Outdoor Irrigation	1	0	2026	2,026 g/day	-	days	-	-	-			
							953	**1,649**	**2,602**	**calculated average winter day**		
								observed	78,111	average winter month		
								observed	2,604	average winter day		

Maximum Use Savings Calculation

		number	per use hot	per use cold	total		uses/day		subtotal gpd hot	subtotal gpd cold	subtotal gpd total		Potential Savigns hot	Potential Savigns cold	Potential Savigns total
Common Bathrooms		4													
	Toilet (1996)	5		1.28	1.28	gpf	60.0	flushes	-	384	384		-	96	96
	Toilet (1978)	2		1.28	1.28	gpf	60.0	flushes	-	154	154		-	266	266
	Urinal	4		1	1	gpf	60.0	flushes	-	240	240		-	120	120
	Sink	8	0.25	0.25	0.5	gpm	42.0	minutes	84	84	168		286	286	571
Cabin															
	Toilet	1		1.28	1.28	gpf	4.0	flushes	-	5	5		-	9	9
	Shower	1	1.04	0.26	1.3	gpm	12.0	minutes	12	3	16		16	4	20
	Sink	1	0.25	0.25	0.5	gpm	8.0	minutes	2	2	4		7	7	14
	Kitchen	1	3.6	0.9	4.5	gpm	12.0	minutes	43	11	54		-	-	-
	Washing Machine	1	21	21	42	gpl	1.0	loads	21	21	42		-	-	-
Kitchen															
Handwash Sinks		3	1.00	1.00	2.00	gpm	5.0	minutes	15	15	30		4	4	8
Dishwasher (NSF)		2	0	2	2	gpl	165.0	loads	-	660	660		-	-	-
Pots and Pans Sinks		6	1.5	1.5	3	gpm	165.0	minutes	1,485	1,485	2,970		-	-	-
Steam Table		2		18	18	gpd	1.0	days	-	36	36		-	-	-
Ice Machine (Manitowoc CY 0605W)		2	0	18	18	gp100#	8.0	loads	-	288	288		-	-	-
Pre-Rinse Spray Nozzle		2	0.75	0.75	1.5	gpm	165.0	minutes	248	248	495		-	-	-
Bar Sink		3	1.0	1.0	2.0	gpm	120.0	minutes	360	360	720		222	222	444
Mop Closet		1	2.5	2.5	5	gpm	45.0	minutes	113	113	225		-	-	-
Other															
Leaking Toilets/Sinks		1	0	0.13	0.13	gpm	1,440.0	minutes	-	187	187				
Swamp Coolers		2	0	280	280	gpd	1.0	minutes	-	560	560		-	-	-
Outdoor Water Feature		1	0	160	160	g/day	1.0	days	-	160	160		-	-	-
Outdoor Irrigation		1	0	2026	2,026	g/day	1.0	days	-	2,026	2,026		-	-	-
									2,383	**7,040**	**9,423**	**calculated efficient average maximum month day**	**534**	**1,014**	**1,548**
										observed	10,967	average max month day			
											14%	reduction			
										water savings	$ 171.83	per month			

Average Winter Use Savings Calculation

		number	per use hot	per use cold	total		uses/day		subtotal gpd hot	subtotal gpd cold	subtotal gpd total		Potential Savigns hot	Potential Savigns cold	Potential Savigns total
Common Bathrooms		4													
	Toilet (1996)	5		1.28	1.28	gpf	13.0	flushes	-	83	83		-	21	21
	Toilet (1978)	2		1.28	1.28	gpf	13.0	flushes	-	33	33		-	58	58
	Urinal	4		1	1	gpf	13.0	flushes	-	52	52		-	26	26
	Sink	8	0.25	0.25	0.5	gpm	9.1	minutes	18	18	36		62	62	124
Cabin															
	Toilet (1996)	1		1.28	1.28	gpf	4.0	flushes	-	5	5		-	9	9
	Shower	1	1.04	0.26	1.3	gpm	8.0	minutes	8	2	10		11	3	14
	Sink	1	0.25	0.25	0.5	gpm	6.0	minutes	2	2	3		5	5	10
	Kitchen	1	3.6	0.9	4.5	gpm	12.0	minutes	43	11	54		-	-	-
	Washing Machine	1	21	21	42	gpl	0.5	loads	11	11	21		-	-	-
Kitchen															
Handwash Sinks		3	0.25	0.25	0.50	gpm	3.0	minutes	2	2	5		9	9	18
Dishwasher (NSF)		2	0	2	2	gpl	40.0	loads	-	160	160		-	-	-
Pots and Pans Sinks		6	1.5	1.5	3	gpm	40.0	minutes	360	360	720		-	-	-

Table 1 - Summary of Current Water Use and Potential Water Savings
Greenbriar Inn

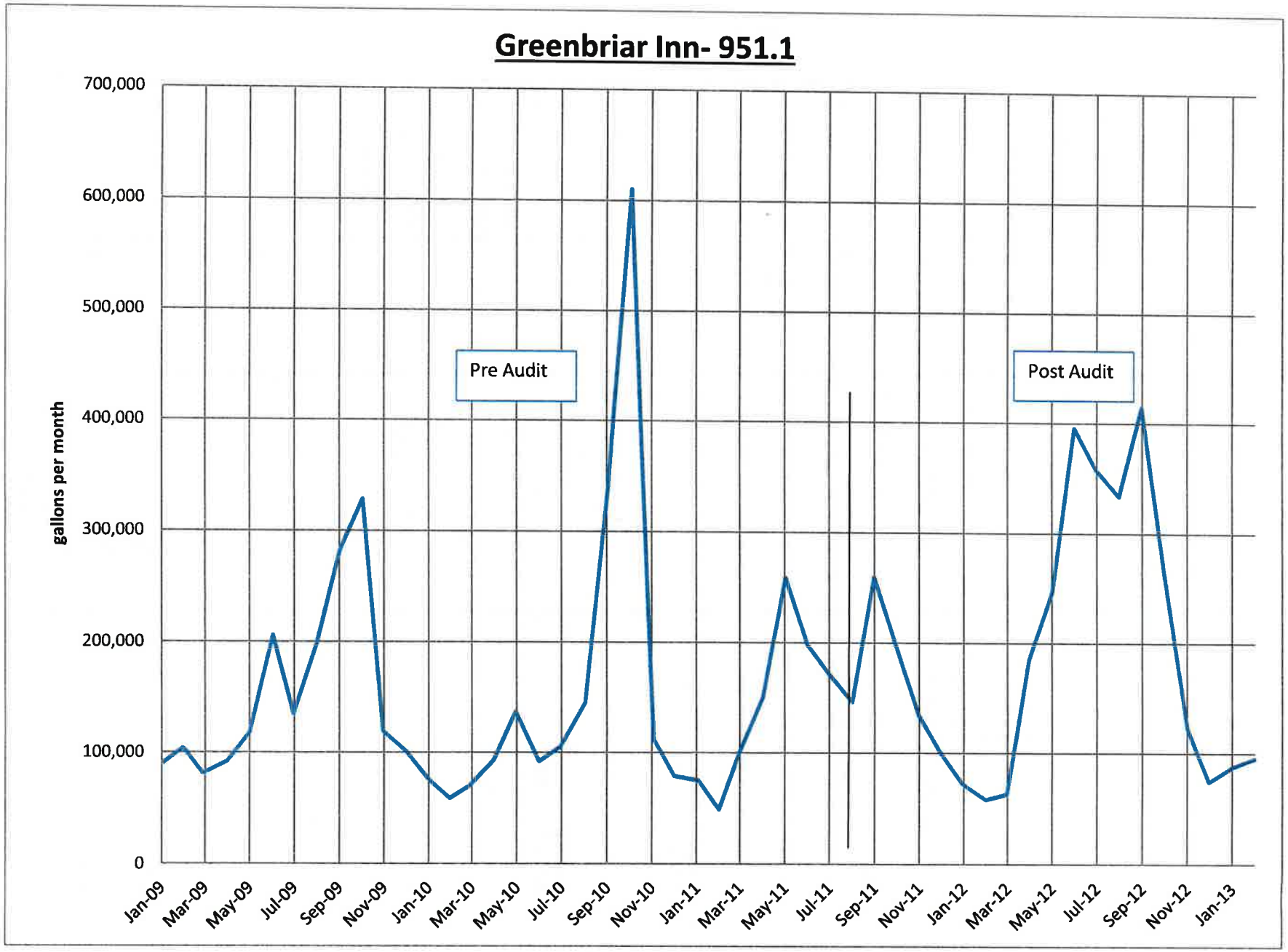
Steam Table	2		18	18	gpd	1.0	days	-	36	36		-	-	-
Ice Machine (Manitowoc CY 0605W)	2	0	18	18	gp100#	2.0	loads	-	72	72		-	-	-
Pre-Rinse Spray Nozzle	2	0.75	0.75	1.5	gpm	60.0	minutes	90	90	180		-	-	-
Bar Sink	3	0.25	0.25	0.50	gpm	60.0	minutes	45	45	90		225	225	450
Mop Closet	1	2.5	2.5	5	gpm	25.0	minutes	63	63	125		-	-	-
Other														
Leaking Toilets/Sinks	1	0	0.13	0.13	gpm	1,440.0	minutes	-	187	187		-	-	-
Swamp Coolers	2	0	280	280	gpd	-	minutes	-	-	-		-	-	-
Outdoor Water Feature	1	0	160	160	g/day	-	days	-	-	-		-	-	-
Outdoor Irrigation	1	0	2026	2,026	g/day	-	days	-	-	-		-	-	-
								641	**1,232**	**1,873**	**calculated efficient average winter day**	**312**	**417**	**729**
									observed	2,604	average winter day			
										28%	reduction			
									water savings	$ 80.91	per month			

Costs to Implement

Potential Savings (If 100% of High Efficiency Fixtures/Appliance are Installed)	number	Costs hardware	Costs installation	Costs total	Pay Back Period	Average Conditions Water Savings (gpy)	Average Conditions Energy Savings (kWhr)	Average Conditions Replacement Water Costs	Total Customer Cost Savings/yr	Total Cost Savings/yr/fixture
Toilet (1996)	6	$ 225	$ 95	$ 1,920	20.37 yrs	10,833	-	$ 665	$ 94	$ 15.71
Toilet (1978)	2	$ 225	$ 95	$ 640	3.49 yrs	21,068	-	$ 1,293	$ 183	$ 91.64
Showerheads	1	$ 37.25	$ 10	$ 47	0.55 yrs	4,964	667	$ 305	$ 87	$ 86.56
Bathroom Sinks	9	$ 2.44	$ 10	$ 112	0.16 yrs	48,895	4,108	$ 3,001	$ 692	$ 76.94
Kitchen and Bar Sinks	6	$ 2.44	$ 10	$ 75	0.03 yrs	170,820	14,352	$ 10,485	$ 2,419	$ 403.17
Urinals	4	$ 225.00	$ 95	$ 1,280	15.50 yrs	9,490	-	$ 582	$ 83	$ 20.64
Clothes Washers	0	$ 550.00	$ 75	$ -	yrs	-	-	$ -	$ -	
Pre-Rinse Spray Aerator	0	$ 95.00	$ 25	$ -	yrs	-	-	$ -	$ -	
				$ 4,074	total costs for retrofits	266,070	19,127	$ 16,331	$ 3,558	
						0.82 AF Saved				

Estimated Savings from Retrofits (installed during SMART Water Audit)	number	Costs hardware	Costs installation	Costs total	Pay Back Period	Average Conditions Water Savings (gpy)	Average Conditions Energy Savings (kWhr)	Total Customer Cost Savings/yr	Total Cost Savings/yr/fixture
Toilet (1996)	0	$ 225	$ 95	$ -	yrs	-	-	$ -	$ -
Toilet (1978)	0	$ 225	$ 95	$ -	yrs	-	-	$ -	$ -
Showerheads	1	$ 37.25	$ 10	$ 47	0.55 yrs	4,964	667	$ 87	$ 86.56
Bathroom Sinks	9	$ 2.44	$ 10	$ 112	0.16 yrs	48,895	4,108	$ 692	$ 76.94
Kitchen and Bar Sinks	3	$ 2.44	$ 10	$ 37	0.03 yrs	85,410	7,176	$ 1,210	$ 403.17
Urinals	0	$ 225.00	$ 95	$ -	yrs	-	-	$ -	$ -
Clothes Washers	0	$ 550.00	$ 75	$ -	yrs	-	-	$ -	
Pre-Rinse Spray Aerator	0	$ 95.00	$ 25	$ -	yrs	-	-	$ -	
				$ 197	total costs for retrofits	139,269	11,951	$ 1,988	
				$ 8,548	replacement water cost	0.43 AF Saved			

Average Annual Water Use
5.74
0.07443581


Greenbriar Inn- 951.1
gallons per month
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
Pre Audit
Post Audit
Jan-09
Mar-09
May-09
Jul-09
Sep-09
Nov-09
Jan-10
Mar-10
May-10
Jul-10
Sep-10
Nov-10
Jan-11
Mar-11
May-11
Jul-11
Sep-11
Nov-11
Jan-12
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13

Left Hand Water District

SMART WATER Audit Facility Report

Niwot Market

look for WaterSense

Overview

Great Western Institute (GWI) conducted a SMART WATER Audit at 7980 Niwot Road in Niwot, Colorado in August 2011. The SMART WATER Audit was conducted as part of Left Hand Water District's (LHWD) efforts to implement its Water Conservation Plan. To implement this program, LHWD working with GWI, selected and contacted a group of local businesses to participate in the audits. Those businesses that chose to participate received water audits to better understand their water uses and to identify methods to improve their efficiency. Participants also received retrofits of high efficiency showerheads and faucet aerators, when appropriate.

Water Use Summary

Niwot Market began operations in the 1990's as part of the strip mall (which shares the water tap with other storefronts). Construction occurred after the national plumbing code was developed such that the facility contains low flow faucet aerators (2.2 gallons per minute (gpm)) and toilets (1.6 gallons per flush (gpf)). Similar to many facilities built since 1994, this restaurant has plumbing fixtures that could be updated to improve water use efficiency using those fixtures that are US EPA Water Sense approved, thus saving water and energy expenses. For example, the toilets that were found during the audit could be made more efficient by installing 1.28 gpf models. Similarly, the bathroom fixtures (e.g., faucet aerators) use more water than is needed to support hand washing and other personal needs.

An inventory of the Market's water using fixtures and appliances is provided in Table 1 along with a water use model configured[1] and calibrated based on the observed monthly water use and the inventory of site specific appliances and fixtures. Table 1 also presents a summary of potential water and energy savings that the facility could realize through the replacement of existing fixtures and appliances with more water efficient fixtures and appliances.

Figure 1 presents the monthly water use at the facility from January 2009 to February 2012 (which includes a depiction of water use for the period preceding and after the SMART WATER Audit was performed).

Note that based on the water model developed for the Niwot Market, it appears that under normal conditions a significant portion of the facility's water use may be attributed to toilets leak or malfunctions, wasting an estimated 260 gallons of water a day (which is over 20% of the building's average wintertime daily water use). This water waste may be associated with more than toilets, including but not limited to dripping sinks, kitchen fixtures, and/or mop sinks, etc. including those

[1] The water model includes estimates of water use for the two other storefronts that share the tap – a bank and the Sashi Sushi Restaurant.

that may be in the other storefronts that share this water tap. It appears that the water waste occurs year round.

Based on the result of the SMART WATER Audit, it was estimated that on average about 0.08 acre-feet of water would be saved (as a result of demand reduction) at this location, based solely on the retrofits which were installed. This is equivalent to about 70 gallons of water a day due to more efficient kitchen (hand wash) and bathroom faucets. If these savings are realized, it would reduce the facility water and energy costs by about $350 over a one year period at a cost to the LHWD of about $50 in replacement fixtures and labor.

Actual water use reductions observed during the winter months following the audit were estimated to be at a rate of about 13%, or about 150 gallons per day. The underestimation of actual water savings may be the result of a higher use of the bathroom than estimated based on the audit and the calibration of the water model. It may also be a result of a lower number of customer visits in 2012 as compared to prior years. It may also be the result of a leak being fixed at the facility.

Additional water efficiencies could be realized at the Niwot Market. For example, the facility manager may want to evaluate the benefits of replacing the 1.6 gpf toilets, and the faucet aerators that could not be installed during the audit. If all the toilets and faucet aerators were replaced with more efficient models, the facility may observe water use demand reductions close to 0.2 acre feet, or about 175 gallons per day.

Summary of Options for Improved Indoor Water Efficiency at the Niwot Market

Fixture/Appliance (number)	Estimated Cost to Install (per fixture/appliance)	Potential Annual Cost Savings (per fixture/appliance)	Installed as Part of Audit	Available Rebate from Left Hand Water District
Toilets (2)	$ 320	$ 141	No	Yes
Bathroom Sink Faucet Aerators (2)	12	123	Yes (2)	No
Urinals (1)	320	53	No	No
Kitchen Hand Wash Sinks (3)	12	32	Yes (2)	No

Table 1 - Summary of Current Water Use and Potential Water Savings
Niwot Market/Sashi Sushi

Maximum Use Calculation

	number	per use hot	per use cold	per use total		uses/day		subtotal gpd hot	subtotal gpd cold	subtotal gpd total	
Common Bathrooms	2										
Toilet	2			3.5	3.5 gpf	35.0	flushes	-	245	245	
Urinal	1			1.5	1.5 gpf	35.0	flushes	-	53	53	
Sink	2		1.1	1.1	2.2 gpm	24.5	minutes	54	54	108	
Kitchen											
Handwash Sinks	3		1.1	1.1	2.2 gpm	10.0	minutes	33	33	66	
Dishwasher (NSF plus small one in sushi bar)	2		0	2.2	2.2 gpl	75.0	loads	-	330	330	
Pots and Pans Sinks	5		2.5	2.5	5 gpm	77.0	minutes	963	963	1,925	
Ice Machine (Scotsman CM3)	1		0	18	18 gp100#	2.0	loads	-	36	36	
Pre-Rinse Spray Nozzle	2		0.5	0.5	1 gpm	75.0	minutes	75	75	150	
Other											
Leak(s)	1		0	0.18	0.18 gpm	1,440.0	minutes	-	259	259	
Outdoor Irrigation	1		0	935	935 g/day	1.0	days	-	935	935	
											calculated max month
								1,124	**2,982**	**4,107**	**average day**
									observed	123,000	max month
									observed	4,100	max month average day

Average Winter Use Calculation

	number	per use hot	per use cold	per use total		uses/day		subtotal gpd hot	subtotal gpd cold	subtotal gpd total	
Common Bathrooms	2										
Toilet	2			3.5	3.5 gpf	20.0	flushes	-	140	140	
Urinal	1			1.5	1.5 gpf	20.0	flushes	-	30	30	
Sink	2		1.1	1.1	2.2 gpm	14.0	minutes	31	31	62	
Kitchen											
Handwash Sinks	3		1.1	1.1	2.2 gpm	6.0	minutes	20	20	40	
Dishwasher (NSF plus small one in sushi bar)	2		0	2.2	2.2 gpl	20.0	loads	-	88	88	
Pots and Pans Sinks	5		2.5	2.5	5 gpm	20.0	minutes	250	250	500	
Ice Machine (Scotsman CM3)	1		0	18	18 gp100#	1.0	loads	-	18	18	
Pre-Rinse Spray Nozzle	2		0.5	0.5	1 gpm	20.0	minutes	20	20	40	
Other											
Leak(s)	1		0	0.18	0.18 gpm	1,440.0	minutes	-	259	259	
Outdoor Irrigation	1		0	361	361 g/day	-	days	-	-	-	
											calculated average
								321	**856**	**1,176**	**winter day**
									observed	35,333	average winter month
									observed	1,178	average winter day

Maximum Use Savings Calculation

	number	per use hot	per use cold	per use total		uses/day		subtotal gpd hot	subtotal gpd cold	subtotal gpd total		Potential Savings hot	Potential Savings cold	Potential Savings total
Common Bathrooms	2													
Toilet	2			1.28	1.28 gpf	35.0	flushes	-	90	90		-	155	155
Urinal	1			1	1 gpf	35.0	flushes	-	35	35		-	18	18
Sink	2		0.25	0.25	0.5 gpm	24.5	minutes	12	12	25		42	42	83
Kitchen														
Handwash Sinks	3		0.25	0.25	0.5 gpm	10.0	minutes	8	8	15		26	26	51
Dishwasher (NSF plus small one in sushi bar)	2		0	2.2	2.2 gpl	75.0	loads	-	330	330		-	-	-
Pots and Pans Sinks	5		2.5	2.5	5 gpm	77.0	minutes	963	963	1,925		-	-	-
Ice Machine (Scotsman CM3)	1		0	18	18 gp100#	2.0	loads	-	36	36		-	-	-
Pre-Rinse Spray Nozzle	2		0.5	0.5	1 gpm	75.0	minutes	75	75	150		-	-	-
Other														
Leak(s)	1		0	0.18	0.18 gpm	1,440.0	minutes	-	259	259		-	-	-
Outdoor Irrigation	1		0	935	935 g/day	1.0	days	-	935	935		-	-	-
											calculated efficient average maximum			
								1,057	**2,742**	**3,799**	**month day**	67	240	307
									observed	4,100	average max month day			
										7%	reduction			

Table 1 - Summary of Current Water Use and Potential Water Savings
Niwot Market/Sashi Sushi

water savings $ 34.10 per month

Average Winter Use Savings Calculation

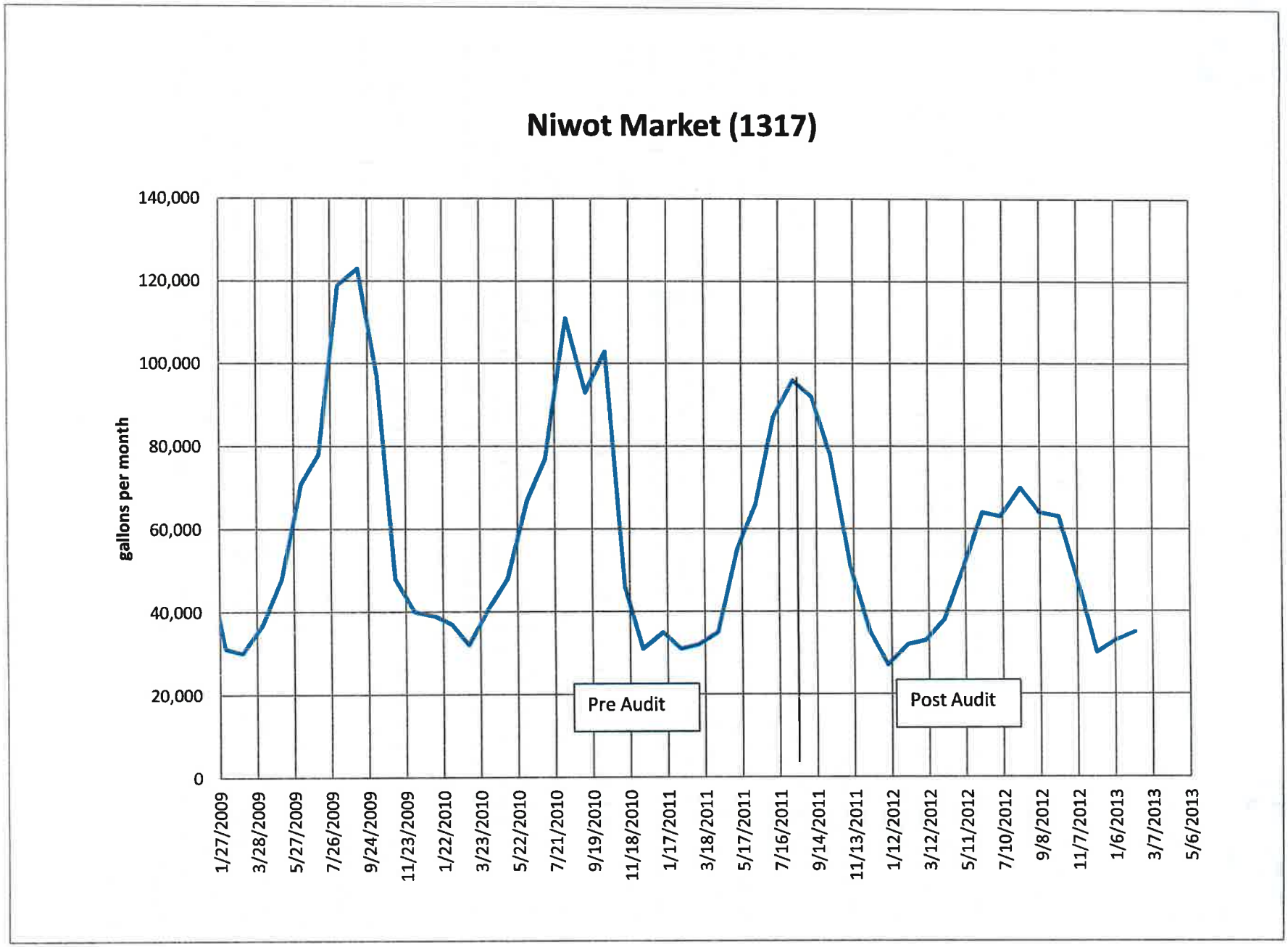
Common Bathrooms	number	hot	per use cold	total		uses/day		subtotal gpd hot	cold	total		Potential Savings hot	cold	total
	2													
Toilet	2		1.28	1.28	gpf	20.0	flushes	-	51	51		-	89	89
Urinal	1		1	1	gpf	20.0	flushes	-	20	20		-	10	10
Sink	2	0.25	0.25	0.5	gpm	14.0	minutes	7	7	14		24	24	48
Kitchen														
Handwash Sinks	3	0.25	0.25	0.5	gpm	6.0	minutes	5	5	9		15	15	31
Dishwasher (NSF plus small one in sushi bar)	2	0	2.2	2.2	gpl	20.0	loads	-	88	88		-	-	-
Pots and Pans Sinks	5	2.5	2.5	5	gpm	20.0	minutes	250	250	500		-	-	-
Ice Machine (Scotsman CM3)	1	0	18	18	gp100#	1.0	loads	-	18	18		-	-	-
Pre-Rinse Spray Nozzle	2	0.5	0.5	1	gpm	20.0	minutes	20	20	40		-	-	-
Other														
Leak(s)	1	0	0.18	0.18	gpm	1,440.0	minutes	-	259	259		-	-	-
Outdoor Irrigation	1	0	361	361	g/day	-	days	-	-	-		-	-	-
								282	**718**	**999**	**calculated efficient average winter day**	39	138	177
									observed	1,178	average winter day			
										15%	reduction			
									water savings	$ 19.65	per month			

Costs to Implement

Potential Savings (if 100% of High Efficiency Fixtures/Appliance are installed)	number	Costs hardware	installation	total	Pay Back Period	Average Conditions Water Savings (gpy)	Energy Savings (kWhr)	Replacement Water Costs	Total Customer Cost Savings/yr	Total Cost Savings/yr/fixture
Toilets	2	$ 225	$ 95	$ 640	2.27 yrs	32,412	-	$ 1,989	$ 282	$ 140.99
Showerheads	0	$ 37.25	$ 10	$ -	yrs	-	-	$ -	$ -	
Bathroom Sinks	2	$ 2.44	$ 10	$ 25	0.10 yrs	17,374	1,460	$ 1,066	$ 246	$ 123.02
Kitchen and Bar Sinks	3	$ 2.44	$ 10	$ 37	0.24 yrs	11,169	938	$ 686	$ 158	$ 52.72
Urinals	1	$ 225.00	$ 95	$ 320	10.08 yrs	3,650	-	$ 224	$ 32	$ 31.76
Clothes Washers	0	$ 550.00	$ 75	$ -	yrs	-	-	$ -	$ -	
Pre-Rinse Spray Aerator	0	$ 95.00	$ 25	$ -	yrs	-	-	$ -	$ -	
				$ 1,022	total costs for retrofits	64,605	2,398	$ 3,965	$ 718	
						0.20 AF Saved				

Estimated Savings from Retrofits (installed during SMART Water Audit)	number	Costs hardware	installation	total	Pay Back Period	Average Conditions Water Savings (gpy)	Energy Savings (kWhr)	Total Customer Cost Savings/yr	Total Cost Savings/yr/fixture
Toilets	0	$ 225	$ 95	$ -	yrs	-	-	$ -	$ -
Showerheads	0	$ 37.25	$ 10	$ -	yrs	-	-	$ -	$ -
Bathroom Sinks	2	$ 2.44	$ 10	$ 25	0.10 yrs	17,374	1,460	$ 246	$ 123.02
Kitchen and Bar Sinks	2	$ 2.44	$ 10	$ 25	0.24 yrs	7,446	626	$ 105	$ 52.72
Urinals	0	$ 225.00	$ 95	$ -	yrs	-	-	$ -	$ -
Clothes Washers	0	$ 550.00	$ 75	$ -	yrs	-	-	$ -	$ -
Pre-Rinse Spray Aerator	0	$ 95.00	$ 25	$ -	yrs	-	-	$ -	$ -
				$ 50	total costs for retrofits	24,820	2,085	$ 351	
				$ 1,523	replacement water cost	0.08 AF Saved			

Average Annual Water Use
2.24131359
3.4%


Niwot Market (1317)
gallons per month
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
1/27/2009
3/28/2009
5/27/2009
7/26/2009
9/24/2009
11/23/2009
1/22/2010
3/23/2010
5/22/2010
7/21/2010
9/19/2010
11/18/2010
1/17/2011
3/18/2011
5/17/2011
7/16/2011
9/14/2011
11/13/2011
1/12/2012
3/12/2012
5/11/2012
7/10/2012
9/8/2012
11/7/2012
1/6/2013
3/7/2013
5/6/2013
Pre Audit
Post Audit

Left Hand Water District

SMART WATER Audit Facility Report

America's Best Value Motel

look for WaterSense Meets EPA Criteria

Overview

Great Western Institute (GWI) conducted a SMART WATER Audit at 3815 Colorado State Highway 119 in Longmont, Colorado in August 2011. The SMART WATER Audit was conducted as part of Left Hand Water District's (LHWD) efforts to implement its Water Conservation Plan. To implement this program, LHWD working with GWI, selected and contacted a group of local businesses to participate in the audits. Those businesses that chose to participate received water audits to better understand their water uses and identify methods to improve their efficiency. Participants also received retrofits of high efficiency showerheads and faucet aerators.

Water Use Summary

The America's Best Value Motel was built in the 1990's after the 1994 national plumbing code was developed such that the facility contains low flow showerheads (2.5 gallons per minute (gpm)), faucets aerators (2.2 gpm) and toilets (1.6 gallons per flush (gpf)). Similar to many facilities built since 1994, this motel has plumbing fixtures that could be updated to improve water use efficiency using those fixtures that are US EPA Water Sense approved, thus saving water and energy expenses. For example, the toilets that were found during the audit could be made more efficient by installing 1.28 gpf models. Similarly, the dish washers and bathroom fixtures (showerheads and faucet aerators) use more water than is needed to support bathing, cleaning and other personal needs.

The inventory of America's Best Value water using fixtures and appliances is provided in Table 1 along with a water use model configured and calibrated based on the observed monthly water use and the inventory of site specific appliances and fixtures. Table 1 also presents a summary of potential water and energy savings that the facility could realize through the replacement of existing fixtures and appliances with more water efficient fixtures and appliances.

Figure 1 presents the monthly water use at the facility from January 2009 to February 2013 (which includes a depiction of water use for the period preceding and after the SMART WATER Audit was performed).

Note that based on the water model developed for America's Best Value Motel, it appears that under normal conditions perhaps as much as 10% of the facilities toilets leak or malfunction, wasting an estimated 650 gallons of water a day. This water waste may be associated with more than toilets, including but not limited to dripping sinks and showers, kitchen fixtures, and/or mop sinks, and/or leaks in the laundry facility or in the pool area. It appears that the water waste occurs year round so it is not necessarily associated with the facility's irrigation system.

Based on the result of the SMART WATER Audit, it was estimated that on average about 0.8 acre-feet of water would be saved (as a result of demand reduction) at this location, based solely on the

APPENDIX C

Water Efficiency Grant Program
Expenditures and Reimbursements

LEFT HAND WATER DISTRICT
WATER EFFICIENCY GRANT

TASK	DESCRIPTION	CWCB GRANT REQUEST	TOTAL LHWD PMTS LABOR	TOTAL LHWD PMTS NON-LABOR COSTS	TOTAL LHWD PMTS TOTAL LHWD PAYMENTS	TOTAL STATE REIMBURSEMENTS LABOR	TOTAL STATE REIMBURSEMENTS NON-LABOR COSTS	TOTAL STATE REIMBURSEMENTS TOTAL STATE REIMB	GRANT FUNDS REMAINING
APPENDIX A - COMMERCIAL WATER AUDIT PROGRAM									
1.1	Obtain and Review Water Use Data	$ 440	$ 275.00	$ -	$ 275.00	$ 275.00	$ -	$ 275.00	$ 165.00
1.2	Commercial Water Audit Website Update	-	-	-	-	-	-	-	-
1.3	Contact Commercial Water Customers - Schedule Visits	275	312.50	-	312.50	275.00	-	275.00	-
1.4	Order High Efficiency Water Fixtures	540	540.00	-	540.00	540.00	-	540.00	-
1.5	Conduct Site Visits	3,500	3,820.00	344.10	4,164.10	2,020.00	344.10	2,364.10	1,135.90
1.6	Replace Fixtures	10,978	200.00	6,243.75	6,443.75	2,000.00	6,243.75	8,243.75	2,734.25
1.7	Collection and Analysis of Pre- and Post-Water Use Data	3,610	3,610.00	-	3,610.00	3,610.00	-	3,610.00	-
1.8	Follow-up to Site Visits	1,760	1,600.00	-	1,600.00	1,600.00	-	1,600.00	160.00
	SUB-TOTAL	**$ 21,103**	**$ 10,357.50**	**$ 6,587.85**	**$ 16,945.35**	**$ 10,320.00**	**$ 6,587.85**	**$ 16,907.85**	**$ 4,195.15**
APPENDIX B - RESIDENTIAL INDOOR WATER AUDIT PROGRAM									
1.1	Development of Indoor Water Audit Program Promotional Materials	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
1.1 & 1.2	Printing and Production- brochures, promo materials etc.	-	-	-	-	-	-	-	-
1.1 & 1.2	Mailings to Selected Subdivisions for Indoor Water Audit Program	-	-	-	-	-	-	-	-
1.3	Indoor Water Audit Website Update	-	-	-	-	-	-	-	-
1.4 & 1.5	Indoor Water Audit Participant Management and Historic Data Compilation	-	-	-	-	-	-	-	-
2.1	Pre-Audit Meeting with CRC for Indoor Audit Program	-	-	-	-	-	-	-	-
2.2	Assemble Indoor Audit Program Participation Packet	-	-	-	-	-	-	-	-
2.3	Purchase faucet aerators and showerheads for Indoor Audit Program Retrofit	3,783	-	3,618.00	3,618.00	-	3,618.00	3,618.00	165.00
2.4, 2.5, 3.2	Indoor Audit (performed by CRC)	6,550	2,491.84	-	2,491.84	2,491.84	-	2,491.84	4,058.16
2.6	Post-Audit Meeting with CRC for Indoor Audit Program	-	-	-	-	-	-	-	-
3.1	Indoor Audit follow-up survey	-	-	-	-	-	-	-	-
3.3 & 3.4	Indoor Audit water use data tracking and analysis	-	-	-	-	-	-	-	-
	SUB-TOTAL	**$ 10,333**	**$ 2,491.84**	**$ 3,618.00**	**$ 6,109.84**	**$ 2,491.84**	**$ 3,618.00**	**$ 6,109.84**	**$ 4,223.16**
APPENDIX C - IMPROVED LEAK DETECTION AND REPAIR PROGRAM									
1.2	Pre-Survey Meeting with ALD	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
1.3	ALD Assistance (before and during survey)	-	-	-	-	-	-	-	-
1.4	Leak Detection Survey (performed by ALD)	10,000	10,000.00	-	10,000.00	10,000.00	-	10,000.00	-
1.5 & 2.1	Leak Detection Survey Data Analysis	-	-	-	-	-	-	-	-
	SUB-TOTAL	**$ 10,000**	**$ 10,000.00**	**$ -**	**$ 10,000.00**	**$ 10,000.00**	**$ -**	**$ 10,000.00**	**$ -**
APPENDIX D - PROGRAM REPORTING									
1.1	50% progress report	$ 220	$ -	$ -	$ -	$ -	$ -	$ -	$ 220.00
2.1	75% progress report	220	220.00	-	220.00	220.00	-	220.00	-
3.1	Prepare the Final Report	3,960	3,960.00	-	3,960.00	3,960.00	-	3,960.00	-
	SUB-TOTAL	**$ 4,400**	**$ 4,180.00**	**$ -**	**$ 4,180.00**	**$ 4,180.00**	**$ -**	**$ 4,180.00**	**$ 220.00**
	TOTAL	**$ 45,836**	**$ 27,029.34**	**$ 10,205.85**	**$ 37,235.19**	**$ 26,991.84**	**$ 10,205.85**	**$ 37,197.69**	**$ 8,638.31**