2015-2019 Energy and Water Conservation Plan

Department of Public Utilities
Los Alamos County
Approved by the Board of Public Utilities on
March 18, 2015

Acknowledgements

The 2015-2019 Energy and Water Conservation Plan was prepared by Christine Y. Chavez, Energy and Water Conservation Coordinator. The Los Alamos County Department of Public Utilities appreciates the support and contributions of the following persons:

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*photo shown on front cover taken by Joel Pearson

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1 EXECUTIVE SUMMARY

The Board of Public Utilities initially approved six Strategic Objectives on October 17, 2012 to guide the Department of Public Utilities. In August of 2013 the Department of Public Utilities Senior Management Team (DPU SMT) developed the broad Long-Term Department Goals to detail how the department would meet these objectives. These goals are annually reviewed by the DPU SMT, revised if necessary and presented to the BPU for approval. They were most recently approved on October 15, 2014. There were three Long-Term goals that were specific to the DPU Energy and Water Conservation Program. These goals have not changed since their initial approval in 2013.

1. Per capita per day water use is reduced by 12% by 2050.
2. Improve heating efficiency in Los Alamos Customers as measured by therms per capita per heating degree day with an initial goal of a reduction of 3% by 2030.
3. Only have 2% unaccounted for water by 2030.

Fiscal year goals are established in this plan to make progress towards the strategic objectives above within the 4-year planning period. The other goals in this plan were developed by the Conservation Advisory Group, Department of Public Utilities Staff and the Board of Public Utilities.

The Plan expands on the existing DPU Energy and Water Conservation Programs and the development of future programs that support the DPU's objectives.

2 INTRODUCTION

2.1 PURPOSE

The Department of Public Utilities (DPU) operates the county-owned electric, gas, water and wastewater systems servicing the residents, businesses, schools and local government facilities for the communities of Los Alamos and White Rock. The DPU is funded by rates paid for electric, gas, water, wastewater services and auxiliary fees and has provided the community with these services for more than 45 years. The utility is publicly-held and is accountable directly to the citizens of Los Alamos County through the local Board of Public Utilities.

The Board of Public Utilities and the DPU approved a Conservation Plan for Water and Energy in June 2013. This document served as a plan to meet the following objectives:

1. Establish consumption baselines for Water, Electricity and Gas representative of designated customer classes
2. Adopt appropriate and reasonable conservation goals representative of the communities desires
3. Develop cost-effective conservation programs to move the community towards defined conservation goals
4. Develop an implementation plan and measurement metrics of conservation efforts

This revision of the DPU Energy and Water Conservation Plan focuses on conservation goals over the planning period 2015-2019. In addition it was designed to meet the mission, vision and long-term strategic objectives of the DPU and to provide support to the County's Comprehensive Plan and Sustainability initiatives.

The plan also serves two separate compliance requirements 1) to fulfill a state statutory requirement for water conservation planning required by the New Mexico Office of the State Engineer (NMOSE) and 2) to fulfill a federal regulatory requirement to develop and implement an energy and water conservation plan that addresses both supply and demand-side energy and water conservation efforts to be submitted to the Western Area Power Administration (WAPA) annually as part of Los Alamos County's section of the joint Integrated Resource Plan (IRP) with the Department of Energy (DOE).

The DPU Energy and Water Conservation Plan is the result of nearly four years of data-gathering, evaluation and analysis. It follows the recommended guidelines from a variety of resources including the United States Environmental Protection Agency Manuals on Water Conservation Plan Guidelines, Energy Management Guidebook for Wastewater and Water Utilities, American Water Works Association Water Conservation Planning Manual and the New Mexico's Water Conservation Guide For Public Water Suppliers (Technical Report 53 from the New Mexico Office of the State Engineer 2013).

The premise for the DPU Energy and Water Conservation Plan is to maintain an active and responsive approach to our customers' needs, comfort, capabilities, and limitations. Further, the Plan's conservation programs and goals identify and promote conservation as a customer service component primarily through voluntary compliance. Customers can save money and

improve their standard of living through water and energy conservation without making sacrifices in lifestyle or through large monetary investments.

2.2 PUBLIC INPUT

Developed with several means of public input the Plan attempts to meet community defined goals for water and energy conservation. These efforts include 1) a 2011 Customer Survey that surveyed the community on conservation efforts and goals 2) the formation of a conservation advisory group made up of representatives from each of the customer classes and stakeholder groups to assist in the development of conservation goals and 3) a series of public input sessions when the plan was in final draft form to ensure that appropriate opportunities were made for the public to review, comment and prioritize the advisory groups recommended conservations measures. Comments were also gathered using a new on-line public comment forum called "Open Forum" on the County's website. No additional public input was sought out as part of this revision. For more information on the Conservation Advisory Group refer to Appendix 2.

2.3 RELATION TO THE LOS ALAMOS COUNTY SUSTAINABILITY PLAN

The Los Alamos County Environmental Sustainability Plan is a separate plan from the Los Alamos County DPU Energy and Water Conservation Plan. The information presented in the DPU Plan is specific to commodities provided by the DPU; water, natural gas, electricity and wastewater. The DPU Plan is a requirement of operating the utility system and it identifies goals for water, natural gas and electricity usage for utility customers. The DPU Energy and Water Conservation Plan also has compliance components with the Western Area Power Administration and the New Mexico Office of the State Engineer. The Sustainability Plan looks beyond the areas of energy and water usage by establishing goals in other areas crucial to creating a more sustainable community with a focus on Local Government.

2.4 LOS ALAMOS NATIONAL LABORATORY/ DOE

Conservation efforts in this Plan are not directed toward the U.S. Department of Energy (DOE) or to the Los Alamos National Laboratory (LANL). While DPU has a contract to supply DOE with water and DPU is a partner with DOE in the Electric Coordination Agreement, DOE does not fall under DPU jurisdiction. Federal legislation mandates water and energy conservation for all Federal agencies, which may or may not be stricter than DPU goals set forth in this Plan. The DPU, whenever possible, will coordinate and communicate efforts with the DOE.

2.4.1 LANLS's Water and Energy Conservation Efforts

LANL has a site-wide Water Conservation Program Plan in place that maintains a target water consumption goal of 1,662 acre feet per year and now currently uses an average of 73% of that target level. Most of LANL's efforts concentrate on ways of using existing water more efficiently. LANL is committed to working with the DPU on long term conservation goals. More information on LANL's water conservation efforts can be found at http://www.lanl.gov/community-environment/environmental-stewardship/sustainability/goals/index.php

LANL along with Los Alamos County is mandated by the Energy Policy Act of 1992 to work together to submit an Integrated Resource Plan to the Western Area Power Administration (WAPA) as part of their Energy Planning and Management Program. LANL and the DPU manage independent electric production and distribution systems in Los Alamos County. A comprehensive action plan and measurement strategy is submitted to WAPA independently by both entities and a combined annual report is submitted by the DPU reporting any updates.

2.5 LOCAL CONDITIONS

Los Alamos County is located in northern New Mexico and comprises the communities of Los Alamos and White Rock. Los Alamos County is located in a region known as the Pajarito Plateau and is situated at an elevation of 7,320 feet above sea level. The population taken by the US Census Bureau in 2010 was 17,950 for Los Alamos and White Rock combined. Los Alamos County is home to the Los Alamos National Laboratory (LANL) and is surrounded by various surrounding Pueblos including San Ildefonso, Santa Clara and the National Forest Service including Bandelier National Monument. LANL is the largest employer in Los Alamos County and Northern New Mexico. Total employment including students and contract labor was 10,199 in 2014.

Figure 1: Map of Los Alamos Town site

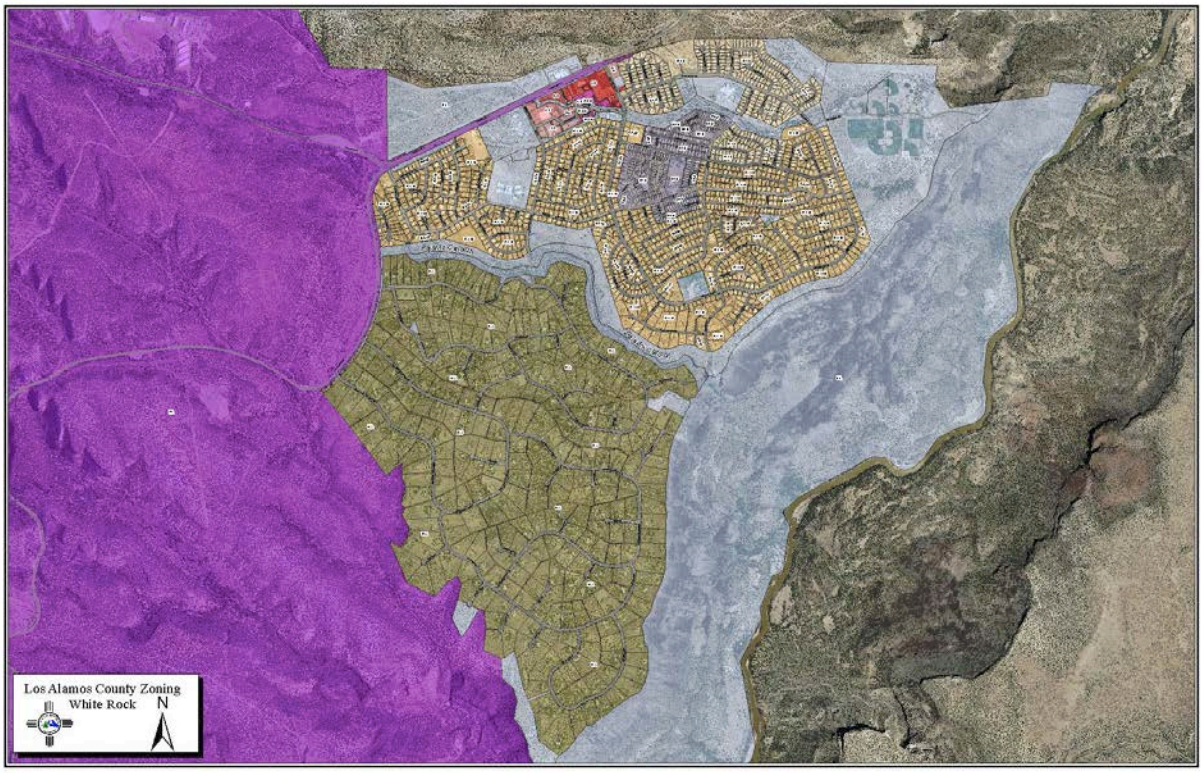


Figure 2: Map of White Rock

2.5.1 Demographic Forecasts

Daniel B. Stephens and Associates, Inc. (DBS&A) completed a Los Alamos County Long-Range Water Supply (LRWS) Plan, and it was approved by the Board of Public Utilities in 2006. The plan focused on long term water planning and projected two possible outcomes as part of its demand forecast. The "High Use" outcome assumed that the ratio of single family and multi-family homes would remain unchanged upon the completion of a full "build out" scenario where it was projected that the population would increase to 25,086 by the year 2020.

An update to the LRWS Plan is currently underway, and the revised plan will be completed by fall 2015. The revision is being completed to update the 2006 LRWS Plan, as well as to address comments received from the New Mexico Office of the State Engineer (OSE). The OSE's comments relate primarily to the demand projections that were used in the 2006 LRWS Plan, which were based on "ambitious economic growth goals". According to the U.S. Census, the population for Los Alamos County actually declined between 2000 and 2010. White Rock experienced more of a decline than Los Alamos and the data seem to indicate a continuing downward trend. Growth is directly related to employment at LANL, making it difficult to estimate what will happen in regard to growth but in all likelihood little or no growth is expected in the near term. The State recently prepared updated population projections as a part of the regional water plan updates that are underway, and these projections are being used in the LRWS Plan update, along with County developed per capita use values, to develop updated Los Alamos County water demand projections.

2.5.2 Differences between White Rock and Los Alamos

Population differences between Los Alamos and White Rock in the Census 2010 data showed that Los Alamos is nearly twice as large in population size than White Rock. More specifically the 2010 Census population for Los Alamos was reported at 12,019 and 5,725 for White Rock.

The Conservation Advisory Group recommended that the residential water consumption be separated out for both Los Alamos and White Rock and their usage be evaluated with climatic differences in mind. That data sort was revealing in the fact that both towns seem to have their own distinct ecosystems with White Rock receiving 20-35% less rainfall during the summer monsoons than Los Alamos. Los Alamos is at a higher elevation and closer to the mountains and therefore has a wetter climate than White Rock. Los Alamos receives about 18" of precipitation per year and White Rock receives about 13" (LANL Weather Machine).

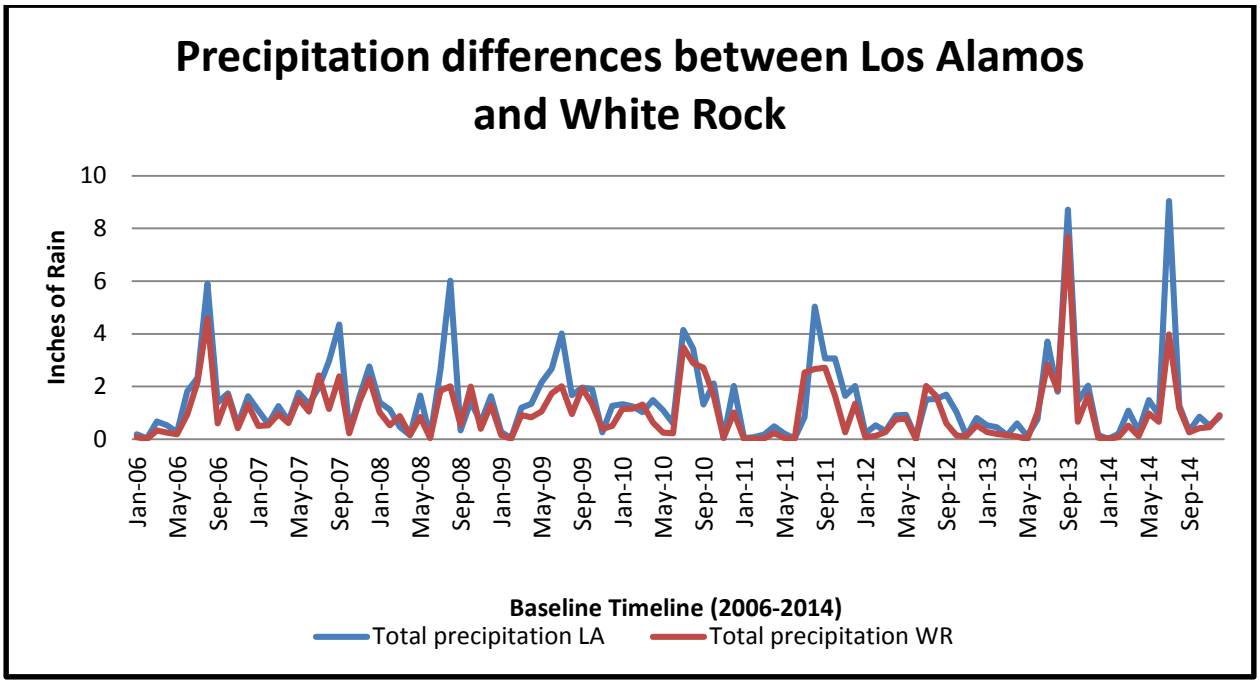
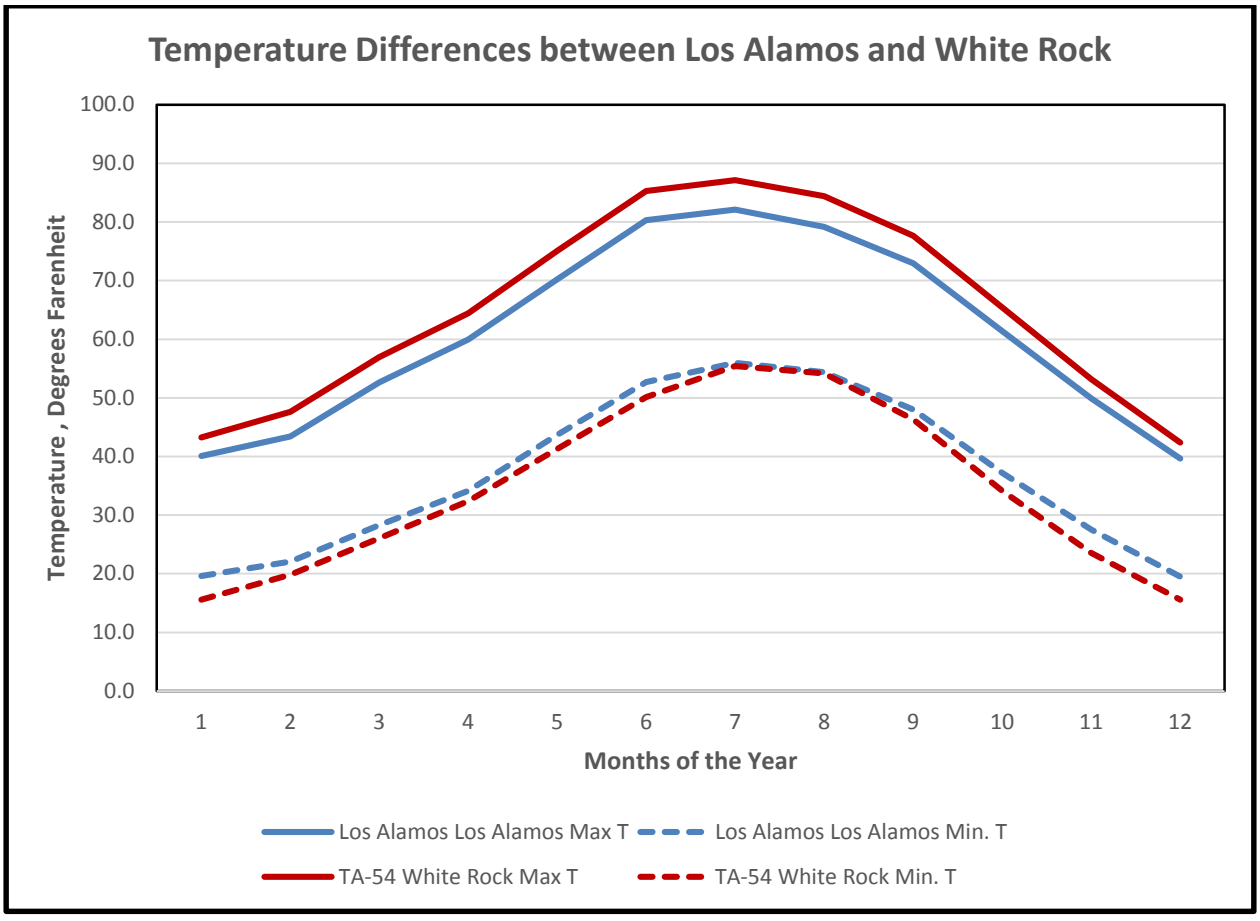


Figure 3 and 4: Precipitation and average temperatures for both White Rock and Los Alamos were collected from LANL weather stations to show climatic differences.



3 WATER SUPPLY OVERVIEW

3.1 WATER RESOURCES

DPU began operating the water system under a lease from the DOE in 1998, however the ownership of the system and associated water rights were not transferred over until 2001. The DPU provides water service to the residents and businesses of Los Alamos, White Rock, LANL and Bandelier National Monument. The DPU has a contract to supply the DOE with water under a service agreement but there is no limit to the water that has to be provided.

Table 1: Summary of Los Alamos County Water Rights	
Water Rights Owned by Los Alamos County	3,878.91 ac-ft (Surface and Groundwater)
Water Rights Owned by LANL	1,662.39 ac-ft (Surface and Groundwater)
San Juan Chama	1,200 ac-ft/ year (not yet developed)
Total Water Rights	**6,741.30 ac-ft/year**

Water rights for Los Alamos County total 5,541.3 acre feet per year and are comprised of a combined right of groundwater and surface water. Los Alamos County also has a contract with the Bureau of Reclamation for an additional 1,200 acre-feet of San Juan Chama surface water. Since the late 1960's to the present, total water consumption hovers between 4,000 and 5,000 acre-feet/year. Two occasions during this time span, annual consumption was above 5,000 acre-feet and encroached upon the permitted water right amount.

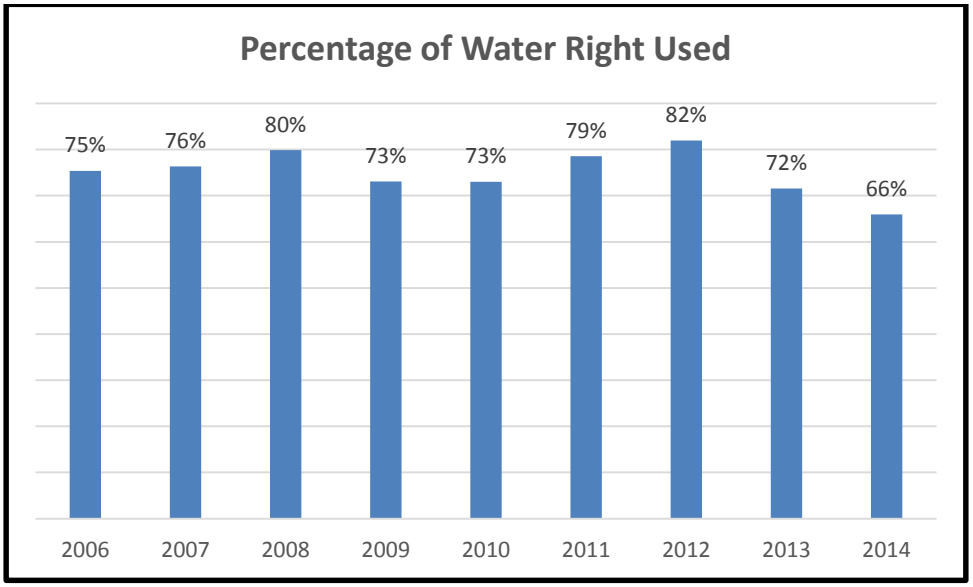


Figure 5: Percentage of total water right that has been used for 2006-2014

3.1.1 Groundwater

Los Alamos County is currently supplied by 12 wells that range in depth from 1,519 feet to 3,092 feet and all draw from the aquifer below the Pajarito Plateau. Currently groundwater from the Guaje, Pajarito and Otowi well fields supply all potable water for the communities of Los Alamos, White Rock, LANL and Bandelier National Monument.

3.1.2 Surface Water

While the County's water rights of 5,541.3 acre feet include both surface water and ground water, the DPU has supplied its customers solely with groundwater for potable use. Prior to the Cerro Grande fire, surface water from the Los Alamos Reservoir was used for irrigation purposes for the Los Alamos Public Schools and the County. As of the date of this Plan the County has not been able to utilize surface water from the Los Alamos reservoir due to the pipeline being damaged by multiple flooding events since 2000. The County also has a contract with the Bureau of Reclamation for another 1,200 acre-feet of surface water as part of the San Juan Chama Project. The DPU completed a preliminary engineering report in 2012 to evaluate alternatives to develop the 1,200 acre-feet. The recommended alternative is to drill up to three wells on the canyon rim in White Rock to intercept groundwater prior to reaching the Rio Grande. Development of the 1,200 acre-feet is on hold pending completion of a revised Long Range Water Supply Plan for Los Alamos County to identify when water demand will warrant developing additional water rights based on population growth and operational expansion at Los Alamos National Laboratories. The Long Range Water Supply Plan will be presented to both the Utility Board and County Council along with a discussion of the timing of the need for the San Juan Chama water.

3.1.2.1 Reservoir Reconstruction

The Los Alamos Reservoir was built in the 1930's and 40's and was the Los Alamos Ranch School and later the Manhattan Project's first supply of potable water. After potable use was discontinued in the early 1960's, it was later used for irrigation of sports fields and community parks until 2000. The Cerro Grande Fire in 2000 severely damaged the reservoir and its watershed. The reservoir was filled in with sediment from post fire flooding and could no longer function as a water supply. Repair and reconstruction of the reservoir was completed in the spring of 2013. A catastrophic flood in September of 2013 however, filled the newly repaired reservoir in with silt again. Dredging of the reservoir and repair of the transmission pipeline is scheduled for 2015 and 2016, after which time it will again be used as a non-potable water resource. It is intended that the low-cost water from this system will provide for irrigation of parks and school grounds.

3.1.2.2 Diamond Drive Phases 1-5

The completed Diamond Drive Phases 1-5 projects have been a cooperative effort between the DPU and the County's Public Works Department to upgrade utilities concurrent with the roadway. The projects included the installation of 2.5 miles of 8" non-potable water lines for irrigation of public parks and schools which will be used for water from the Los Alamos Reservoir as well as expanding the use of reclaimed water from the wastewater treatment plant.

3.1.3 Reclaimed Water

Wastewater is currently treated at the Los Alamos Wastewater Treatment Plant and the treated effluent is used to irrigate four different sites in Los Alamos; North Mesa Soccer Field, North Mesa Ball Fields, Los Alamos Middle School and Los Alamos County Golf Course. Effluent from the White Rock Waste Water Treatment Plant is used to irrigate Overlook Park in White Rock. In total an estimated 112.37 acres are currently irrigated with treated effluent. Los Alamos County has good track record of using reclaimed water from its wastewater plants to irrigate county parks. The DPU has effectively operated effluent distribution facilities, partnered with the county parks division and administered the required permits for decades. Use of reclaimed water began in 1985 in White Rock at Overlook Park and in Los Alamos reclaimed water use began in 1945 when the original golf course was developed. Currently the DPU is pursuing expansion of reclaimed water use per the guidance of a comprehensive Non-Potable Master Plan completed in 2013.

3.1.3.1 Non-Potable Master Plan

Forsgren Associates Inc. prepared a Non-Potable Water System Master Plan as part of the DPU's effort to optimize the use of effluent and surface water for irrigation purposes. The plan was completed in September 2013. The objectives of the Master Plan Study included reviewing existing infrastructure, evaluating existing and potential future irrigated sites, developing realistic demand for system build-out and recommending system improvements. Figures 6 and 7 show the existing and potential non-potable water system in Los Alamos and White Rock as identified in the Non-Potable Water System Water Plan. A capital improvement plan was developed as part of the master plan to expand the non-potable water system to spread the use of non-potable water throughout the Los Alamos and White Rock communities to displace use of potable water for irrigation. Expansion of the non-potable system is funded by loan/grant funding from the New Mexico Finance Authority Water Trust Board (WTB). Grant/loan funding is applied for annually from the WTB. In 2012 the DPU received funding to complete the master plan and design four priority non-potable projects. In 2014, the

DPU received funding to construct the four projects design by 2012 WTB funds. In 2015, the DPU has two applications for consideration by the WTB for pipeline projects.

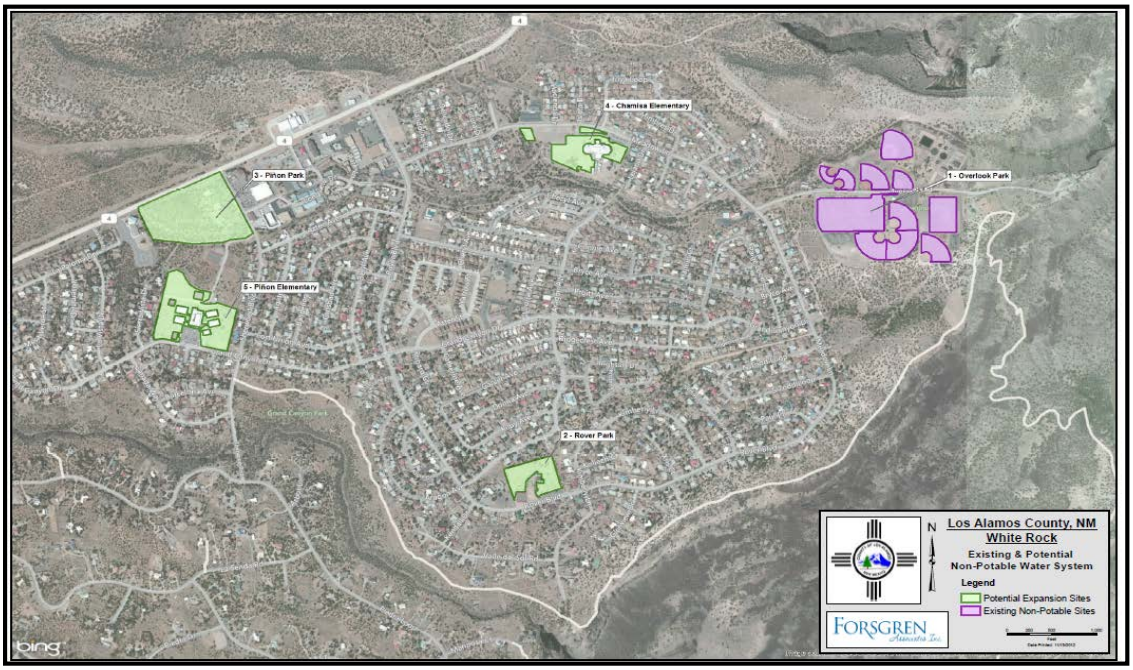


Figure 6: Existing and potential non-potable water irrigation sites in White Rock.

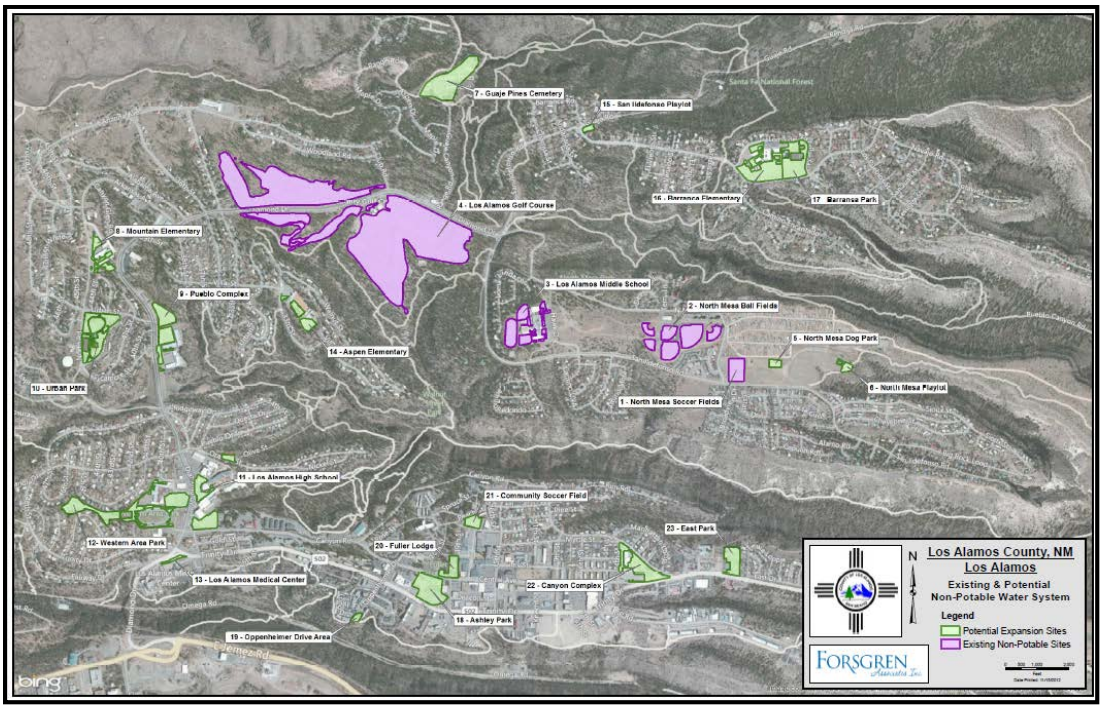


Figure 7: Existing and potential non-potable water irrigation sites in Los Alamos County.

4 ELECTRIC SUPPLY OVERVIEW

The Department of Public Utilities and the Department of Energy are joined in an Electric Coordination Agreement (ECA) to combine their resources for the Los Alamos County Power Pool. The Power Pool purchases, sells and schedules the power requirements for Los Alamos County and LANL. The ECA contract enabled Los Alamos County to purchase fossil-fuel and hydroelectric generation capacity through the sale of tax-exempt municipal revenue bonds in the amount of $110 million dollars which was repaid in July 2014.

Renewable energy for Los Alamos County fluctuates between 20-28% of the total energy used. Renewable Energy is defined as electric energy generated from a renewable source such as wind, solar and qualifying hydroelectric generation. Los Alamos County and LANL/DOE are increasingly seeking opportunities to add renewable energy to its supply portfolio through the coordination of Los Alamos County/DPU and County Council adopted goals as well as federal mandates on LANL/DOE to increase renewable energy use.

The Public Service Company of New Mexico (PNM) provides the transmission service into Los Alamos County and the DOE owns the transmission system within Los Alamos County that serve both Los Alamos County and LANL. Los Alamos County owns and operates the Electric Distribution System in Los Alamos and White Rock. The Los Alamos County distribution system consists of the town site substation which provides power to Los Alamos to approximately 6,100 customers and the White Rock substation which provides power to the White Rock Community to approximately 2,400 customers.

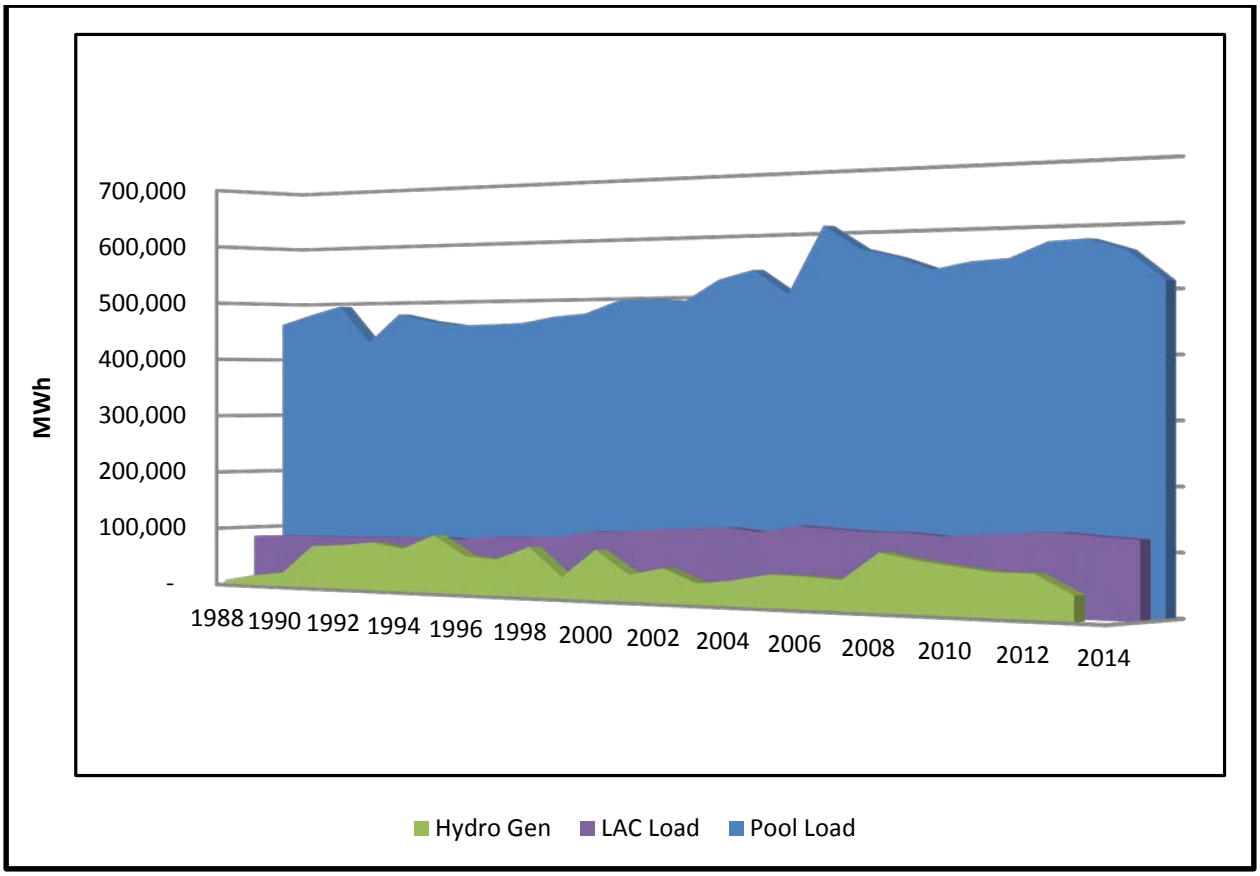
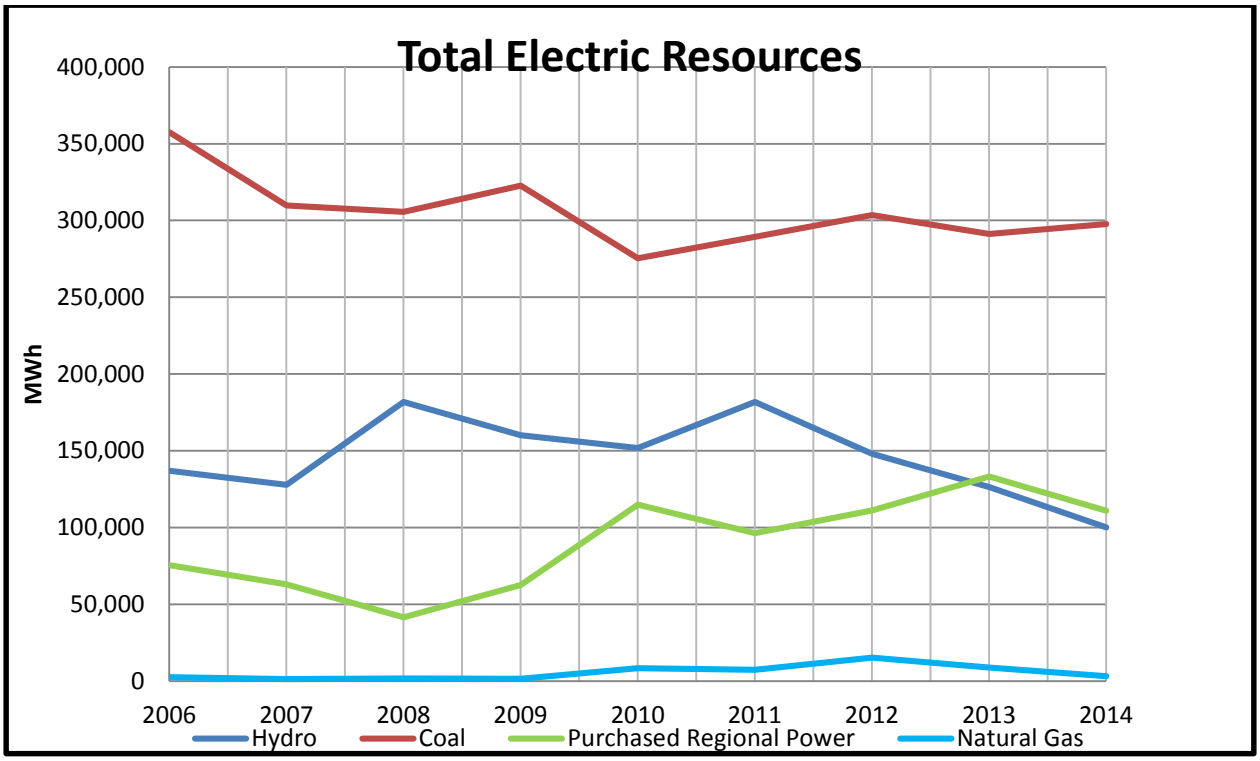


Figure 8: The electric load for the Power Pool (Los Alamos County and LANL) along with the load for Los Alamos County itself and the annual calendar year generation from the hydro sources.

Power Pool resources include:

- San Juan Generating Station Unit 4 (coal, 36 megawatts)
- Laramie River Station entitlement (coal, 10 megawatts)
- El Vado hydroelectric facility (hydropower, 8 megawatts)
- Abiquiu hydroelectric facility (hydropower, 17 megawatts)
- Los Alamos Western Area Power Administration entitlement (hydropower 1MW)
- County transmission agreements
- County purchased power contracts
- Photovoltaic array on the East Jemez landfill site (1 megawatt)



Figures 9: Electric Resources for Los Alamos County

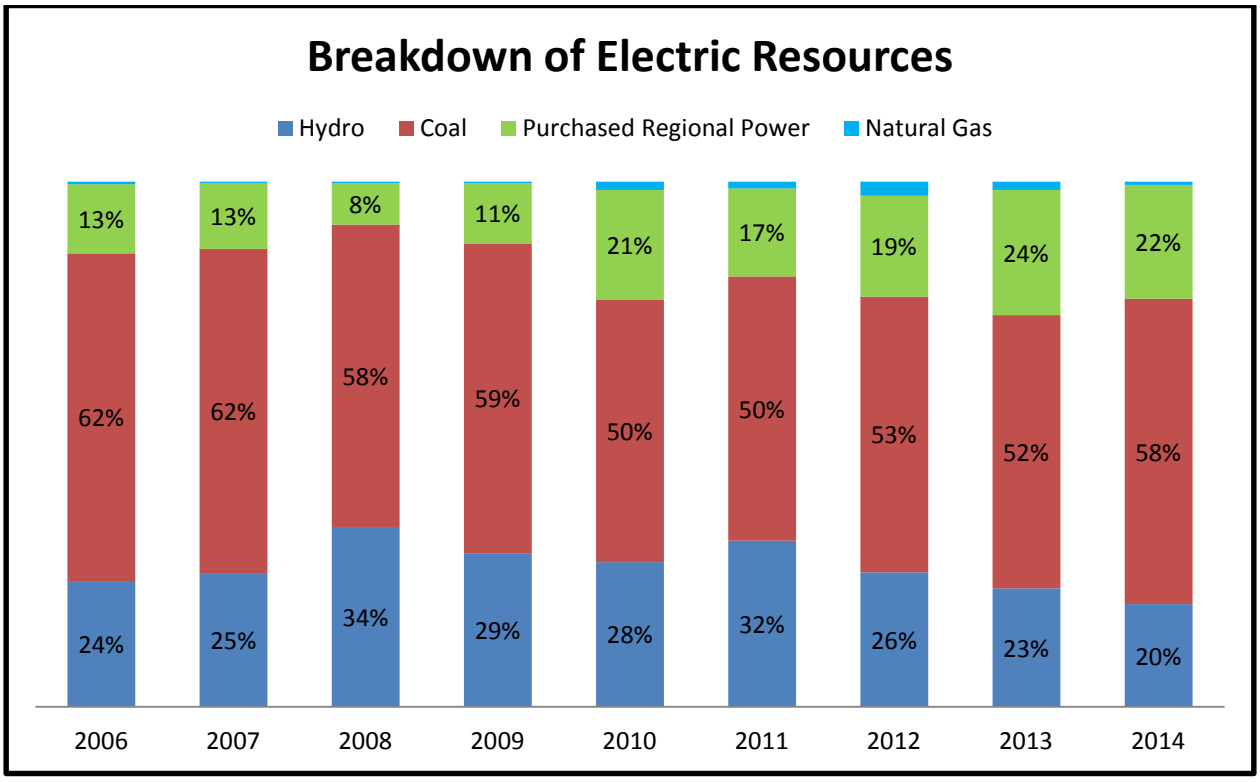
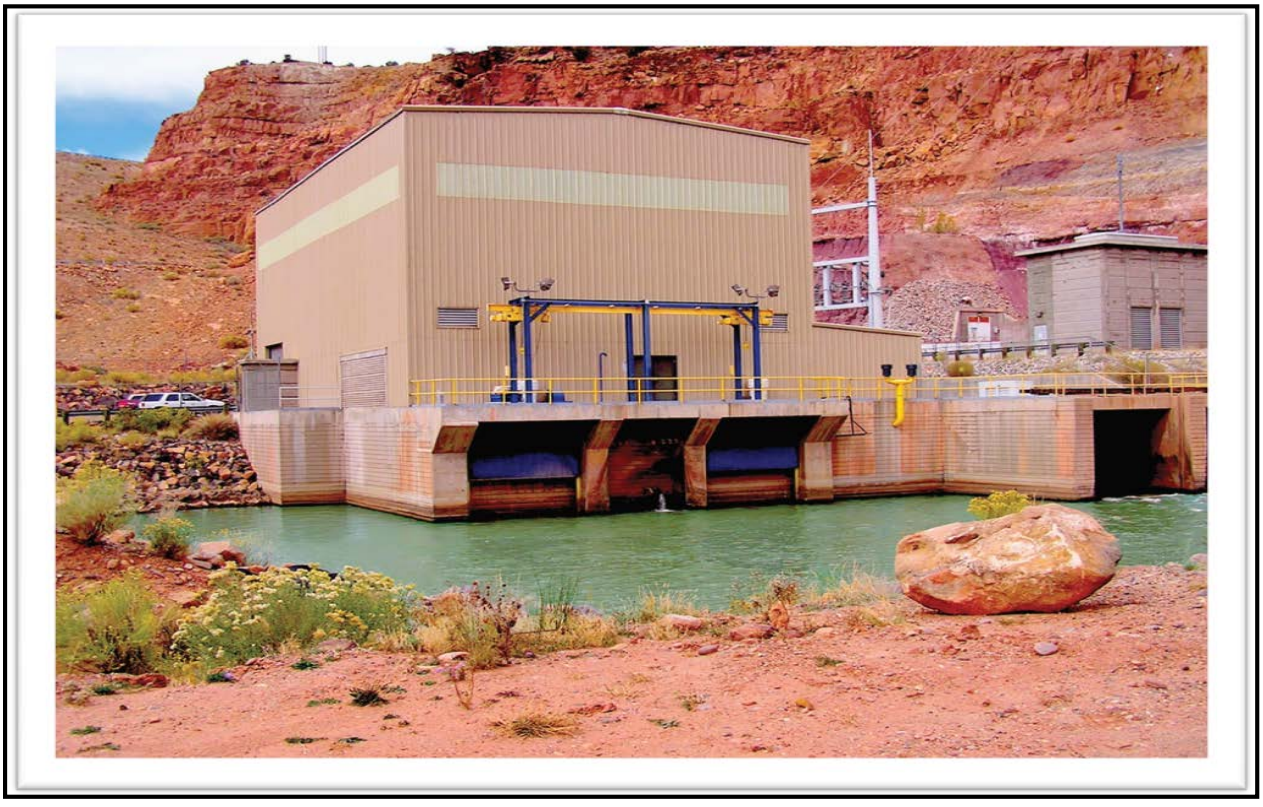


Figure 10: Percentage of each resource that contributes to the overall electric production system.

Figures 11 and 12: El Vado hydroelectric facility is shown in the picture above and the Abiquiu hydroelectric facility in the picture below.



4.1.1 Renewable Energy

One of the Strategic Objectives approved by the BPU was for the DPU to become a carbon neutral electric provider by 2040. An Ad Hoc Citizens Committee for Future Renewable Energy Resources is currently being formed by the BPU to solicit input from the Citizens of Los Alamos County regarding the future of alternative and carbon-free energy resources in the County's energy portfolio. The Committee will work on the following objectives:

1. Discuss the concept of carbon neutrality and agreement on a definition of just what carbon neutrality actually means.
2. A general policy direction on replacement of existing coal-fired generation formulated on the types of replacement energy that the DPU should look at in the future.
3. To research wind and solar generation sources and their implications on the reliability on the grid, quality of power and for the cost structure for infrastructure maintenance and operations.

The committee consists of 7 members representing the Los Alamos Public Schools, Los Alamos National Laboratory, Los Alamos County Environmental Sustainability Board, the business community, a citizen representing those who own rooftop solar generation equipment and two citizens at large. The committee is scheduled to present their final recommendations in July 2015.

In 2008 the DPU collaborated with William H. Jones of the Infrastructure Planning Office at LANL to write a Renewable Energy Feasibility Study under the coordinated efforts of LANL/DOE and the DPU. The purpose of the study was to explore the potential of renewable energy projects for the Power Pool that would meet LANL/DOE and DPU requirements and that would stabilize the future cost of energy. The study is available online at https://www.losalamosnm.us/utilities/DPUDocuments/DPU_BR0904SolarEnFeasStdyApr.pdf

4.1.1.1 Completion of Abiquiu Low Flow Turbine

As part of the research done in the aforementioned Renewable Energy Feasibility Study, installation of a 3 megawatt Low-Flow turbine at the existing Abiquiu hydroelectric facility was identified as a potential project to increase renewable energy for LANL and the DPU. The DPU embarked upon the project in 2009 and completed it in April 2011, Renewable power capacity increased by 22% at the Abiquiu Plant from lower water releases at the Dam that the existing

higher flow turbines were unable to leverage. Because the project qualifies under the federal Energy Policy Act of 2005 as a producer of Renewable Energy Credits (REC's) the DPU is able to provide those REC's to the DOE/LANL to meet their renewable energy goals. The project received 50% funding through a $4.5 million dollar grant from the American Recovery and Reinvestment Act (ARRA) secured by the DPU. It was the first major hydro or wind power ARRA funded project to reach completion in the USA.

4.1.1.2 2MW PV at Landfill – NEDO Demonstration Smart Grid Collaboration

The DPU, Los Alamos National Laboratory and Japan's New Energy and Industrial Technology Development Organization (NEDO) collaborated on a $52 million state-of-the-art international smart grid project to demonstrate how to introduce significant penetrations of intermittent photovoltaic energy onto a residential distribution grid. The project included a 1 megawatt utility scale photovoltaic array, an 8.2 megawatt utility scale battery storage system, a smart house, an energy management system and 1,600 smart meters that serve Los Alamos County residents. Smart grids are new generation electrical power networks that efficiently control and balance the supply and demand of power through digital information that integrates small and large-scale renewable energy sources.

As part of this project a 1 megawatt photovoltaic solar array has been installed at the former landfill on East Jemez Road by NEDO. It includes about 5,000 solar panels with different cell types to evaluate efficiency levels. This is the first PV system to be constructed on a landfill in New Mexico and the DPU is planning on installing a second 1 MW in the near future. Combined, the 2MW photovoltaic array supplies electricity to about 670 homes. The utility scale battery storage systems if fully discharged could power another 600 homes. So combined (PV and batteries) the system could power almost 1270 homes for 6 hours. The "Smart House" is equipped with intelligent appliances and energy systems that will improve the efficiencies of electric consumption. The smart house has the ability to provide power to the grid when utility demand is high, purchase excess power from the grid when utility demand is low; or detach from the grid altogether and power itself during system disturbances. The demonstration period ended in 2014 and the DPU now owns the entire system.

Figure 13: Photovoltaic array on the East Jemez landfill site

4.1.2 Non-Renewable Energy

The DPU is a partial owner of the San Juan Generating station (36MW) which is a coal fired power plant in New Mexico and the DPU has a life-of-plant entitlement of 10 MW from Laramie River Station in Wheatland, Wyoming. Several environmental upgrades have been implemented and additional upgrades are planned for the future.

5 GAS SUPPLY OVERVIEW

The DPU owns and operates its natural gas distribution system which in 2013 provided service to approximately 7,090 residential customers that included multi-family connections and approximately 397 commercial/ municipal customers. The natural gas system is comprised of both steel and plastic distribution mains and service lines ranging in size from ½" to 8" in diameter. The regional transmission pipelines are owned and operated by New Mexico Gas Company (NMGC).

The source of supply for the community of White Rock comes from a 4" steel pipeline owned by the NMGC that begins at the New Mexico 502 and State Road 4 interchange. The White Rock service line's operating pressure is approximately 58 psig (pound per square inch gauge). The White Rock system contains approximately 33 miles of mainline pipe and 18 miles of service lines.

There are two sources of supply available for Los Alamos County. The first is the City Gate Station located directly across from Camino Entrada along State Road 502 and the second City

Gate Station is located in the Quemazon subdivision. The Los Alamos County gas distribution system contains approximately 84 miles of mainline pipe and 41 miles of service lines.

Recent improvements made by the DPU has increased the capability of providing a sustainable supply of natural gas throughout the system by completing a high pressure loop system which provides up to 93.3 psig MAOP (maximum allowable operating pressure) to 18 district regulator stations and which reduces the pressure to 20 psig with an MAOP of 20 psig. In 2011 DPU's Gas, Water and Sewer Crews also started working on the replacement of residential gas risers (portion of gas pipe that rises to meet gas meter) that feed natural gas to several hundred homes throughout Los Alamos and White Rock. Hundreds of homes have had their risers replaced with newer, safer, code compliant risers.

6 ASSESSING PUBLIC WATER SUPPLIER PERFORMANCE

6.1 HISTORICAL WATER USE (2006-2014)

To gain a better understanding of consumption patterns among customer classes extensive work was done amongst DPU staff to extract information from the Cayenta billing system database for the following customer classes:

- Single Family Residential
- Multi-Family residential
- Municipal
- Commercial
- Educational

Utilities staff develops a consumption report each month which breaks down usage by customer class. This breakdown now includes a separate multi-family residential class for each of the three utilities. This data will help in developing continuing trends so that conservation efforts can be developed and directed where they will have the most impact. Graphs 14-17 show that there is large potential in aiming conservation efforts on the single family residential and multi family customer classes while taking into consideration the climatic differences between Los Alamos and White Rock.

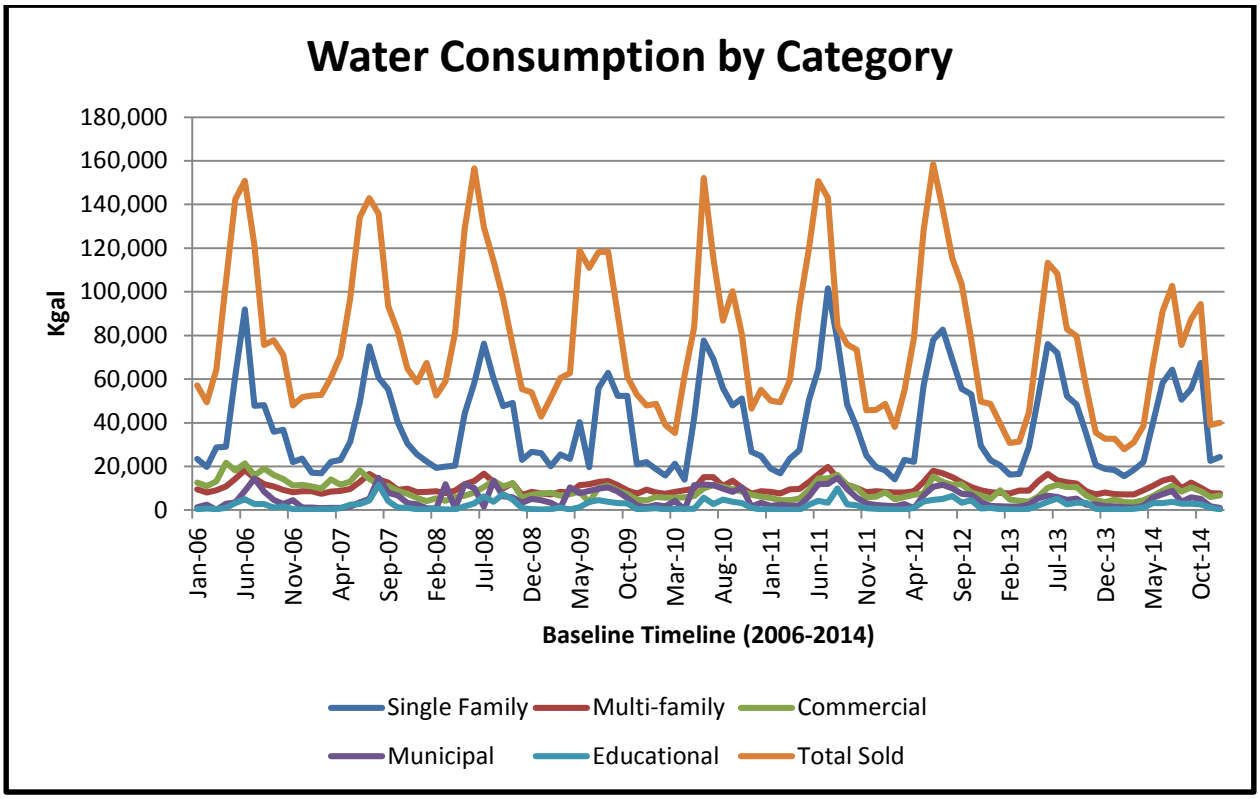
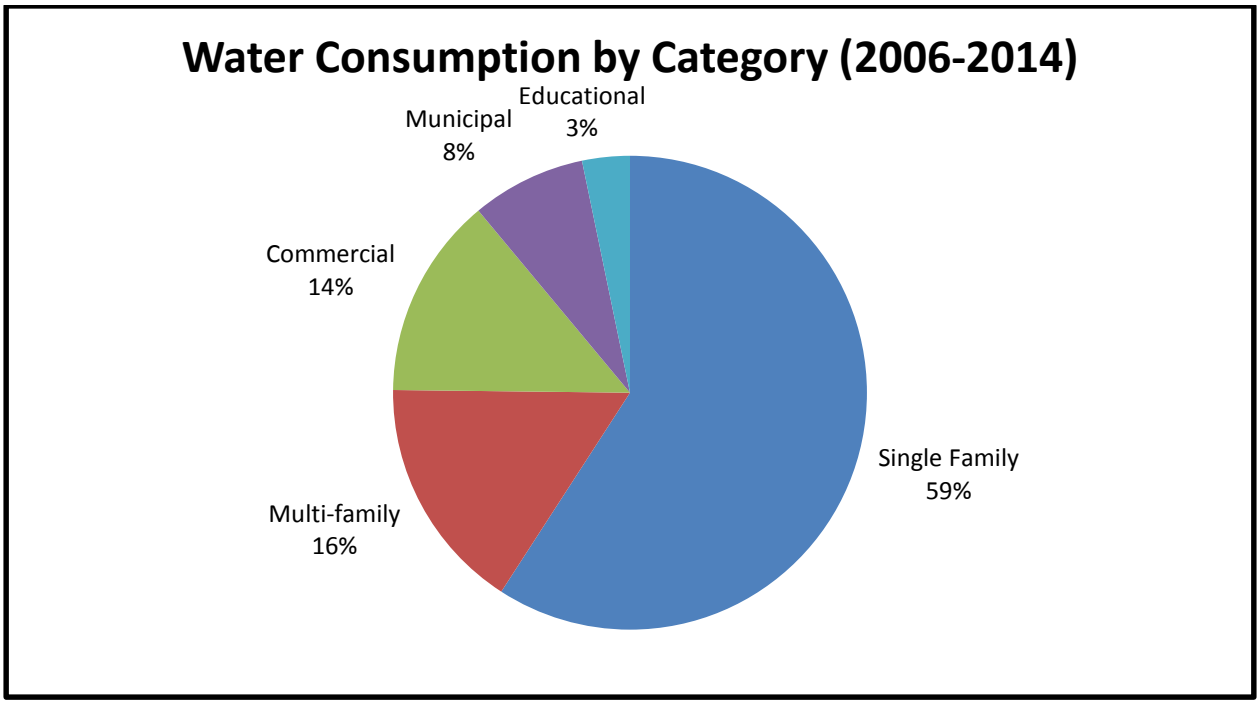


Figure 14: Water Consumption amongst all customer classes against total production data (LANL excluded)



As depicted in Figure 15, single family water consumption exceeds all customer classes in overall usage (LANL excluded).

6.1.1.1 White Rock vs. Los Alamos

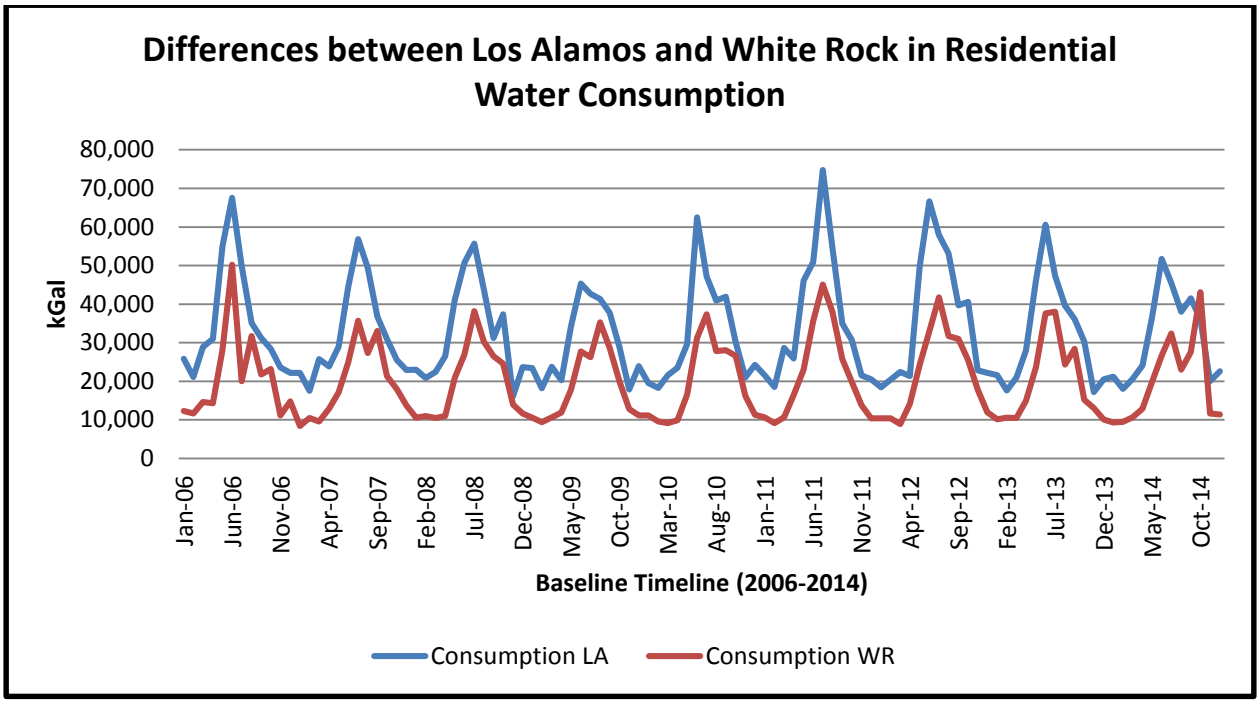


Figure 16: Differences between Los Alamos and White Rock in residential water consumption with Los Alamos population being nearly double the size of White Rock.

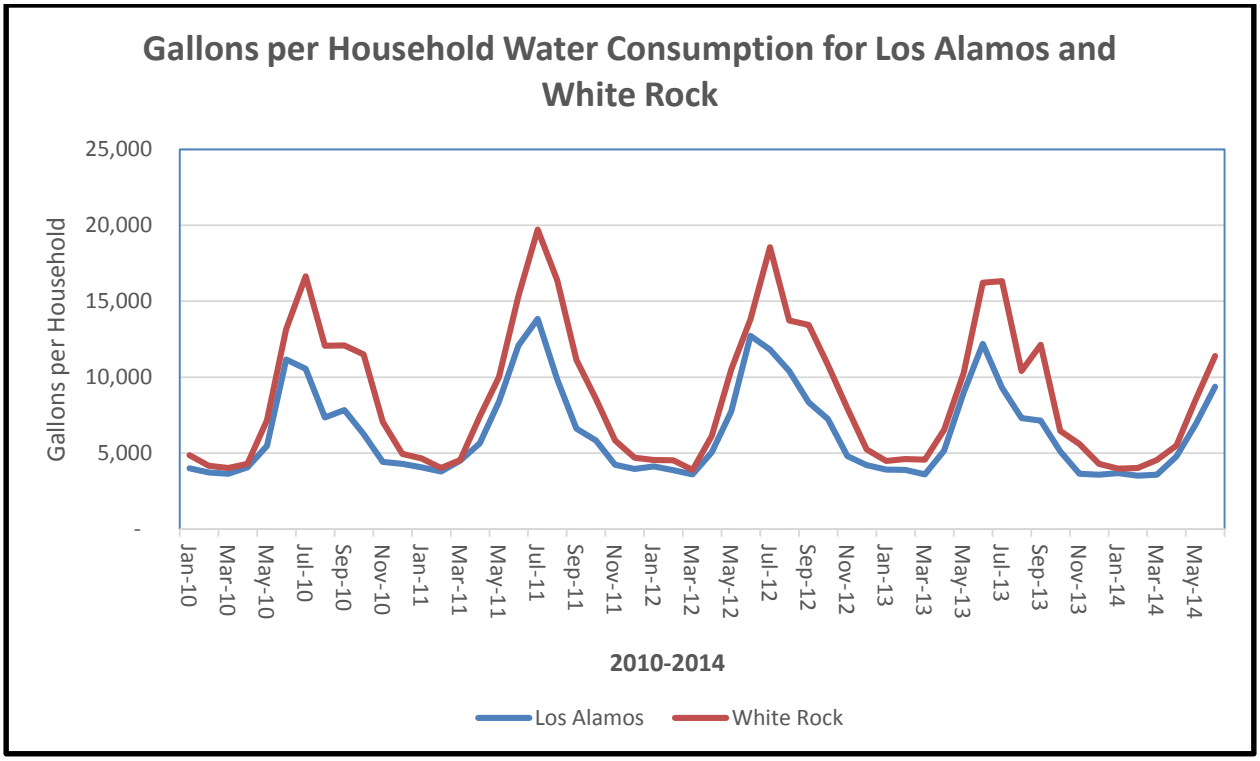


Figure 17 shows Gallons per Household for Los Alamos and White Rock calculated by dividing the total consumption for each community by the customer count.

6.2 DATA RESULTS AND ANALYSIS, AMERICAN WATER WORKS ASSOCIATION (AWWA) WATER LOSS CONTROL COMMITTEE (WLCC) FREE WATER AUDIT SOFTWARE REPORTING WORKSHEET

The AWWA Water Audit is being utilized as a standardized method of auditing water utilities and is a requirement of the NMOSE and of Technical Report 53 as a means to compare communities using the same methodology to obtain their percentage of unaccounted for water. This is the first year that Los Alamos County DPU has completed the audit and used the manual titled "Water Audits and Loss Control Programs, Manual 36" published by the American Water Works Association as a guide to organizing and collecting the data necessary for its completion. The Water Audit was completed for Fiscal Year 2014. The Water Audit will be completed each fiscal year and submitted to the NMOSE.

The Water Audit is defined by the AWWA as "an examination of records of financial accounts to check their accuracy". The Water audit traces the flow of water from the site of withdrawal, or treatment, through the water distribution system, and into customer properties. The resulting set of spreadsheets details the variety of consumption and losses that exist in a community water system. According to the AWWA strong water loss control programs produces benefits in four primary manners:

1. Water resources management, by limiting unnecessary or wasteful source water withdrawals
2. Financially, by optimizing revenue recovery and promoting equity among ratepayers
3. Operationally, by minimizing distribution system disruptions, optimizing supply efficiency, and generating reliable performance data.
4. System integrity, by reduction of potential for contamination

There are two focuses of the Water Audit that are of importance to the DPU. One is the reduction of apparent losses which is defined by the AWWA as "losses in customer consumption attributed to inaccuracies associated with customer metering, systematic data handling error, plus unauthorized consumption (theft or illegal use of water)". The other focus is the reduction of real losses which is defined by the AWWA as "the physical loss of water from the pressurized system and the utilities storage tanks, up to the point of customer consumption". Total water losses would be the addition of both apparent and real losses. Total water loss was calculated to be 76.739 million gallons which is 10.0% of the 770.000 million gallons of water supplied to the County Water Distribution system. Bulk water supplied to LANL is not included in the water loss calculation because Los Alamos County does not operate or maintain the LANL distribution system and because weaknesses in the distribution system components are the most significant contributors to water loss.

According to the AWWA the national average for total water losses is 12.4% which indicates that the DPU beats the national average but still has room for improvement.

The Water Audit also calculates a water audit data validity score based on data provided. The DPU scored a 72%. The software indicates that the DPU's audit accuracy can be improved by improving the following areas:

1. Refine data collection practices and establish as routine business process
2. Refine, enhance or expand ongoing programs based upon economic justification
3. Conduct detailed planning, budgeting and launch of comprehensive improvements for metering, billing or infrastructure management.
4. Establish mid-range (5 year horizon) apparent and real loss reduction goals
5. Performance benchmarking

The DPU has a Long Term Strategic Goal of reducing unaccounted for water to 2% by 2030. Now that the Water Audit is completed the goal will have to be revisited to determine whether this 2% will be specific to total water loss, apparent loss or real loss as defined by the AWWA. For the detailed analysis please refer to Appendix 5.

6.3 DATA RESULTS AND ANALYSIS, GPCD CALCULATOR TABLE

The New Mexico Office of the State Engineer designed a gallons per capita per day (NMOSE GPCD) calculator that allows New Mexico communities to compare their water consumption across different customer classes. A Microsoft excel spreadsheet is populated using utility billing data to calculate GPCD for residential, multi-family and a combined class of municipal, educational and commercial categories. The spreadsheet allows for the DPU to remove from the calculation wholesale water sold to LANL. This allows the DPU to make a more accurate calculation of the County's total water consumption. This allows for more appropriate goal development and conservation planning initiatives with regard to water consumption for the County. For the detailed analysis refer to Appendix 4.

6.3.1 Period of Study

The period of study for the GPCD Calculator was 2007-2014.

6.3.2 Average Size of Household

The 2010 Census reports the following information on total housing units in Los Alamos County and when they were built.

Table 2: Total Housing Units	**8,332**
Built 2010 or later	3
Built 2000-2009	997
Built 1990 to 1999	601
Built 1980 to 1989	960
Built 1970 to 1979	1,594
Built 1960 to 1969	1,543
Built 1950 to 1959	1,829
Built 1940 to 1949	793
Built 1939 or earlier	12

Landscape preferences and the age of indoor appliances and fixtures are the biggest contributors to water use. The Energy Policy Act began enforcement in 1994 allowing only low-volume toilets, urinals, faucets and showerheads that could be installed in most facilities. We could assume that from this information about 7,000 homes in Los Alamos County were built prior to 1994 which would open up a large customer base from which appliances or fixtures could be updated which would have a significant impact on their water and energy use.

6.3.3 Annual Single-Family Residential (SFR) Gallons per Capita per Day (GPCD)

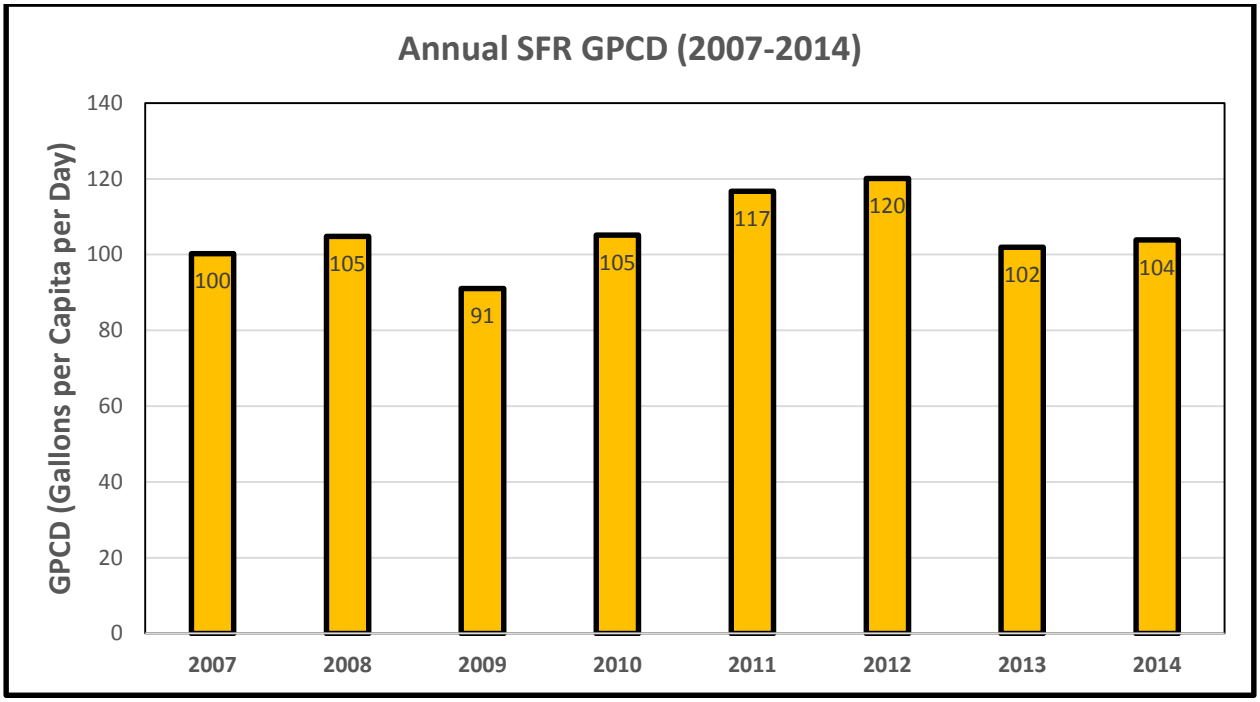


Figure 18: Annual Single Family Residential GPCD (excluding LANL)

6.3.4 Monthly SFR GPCD

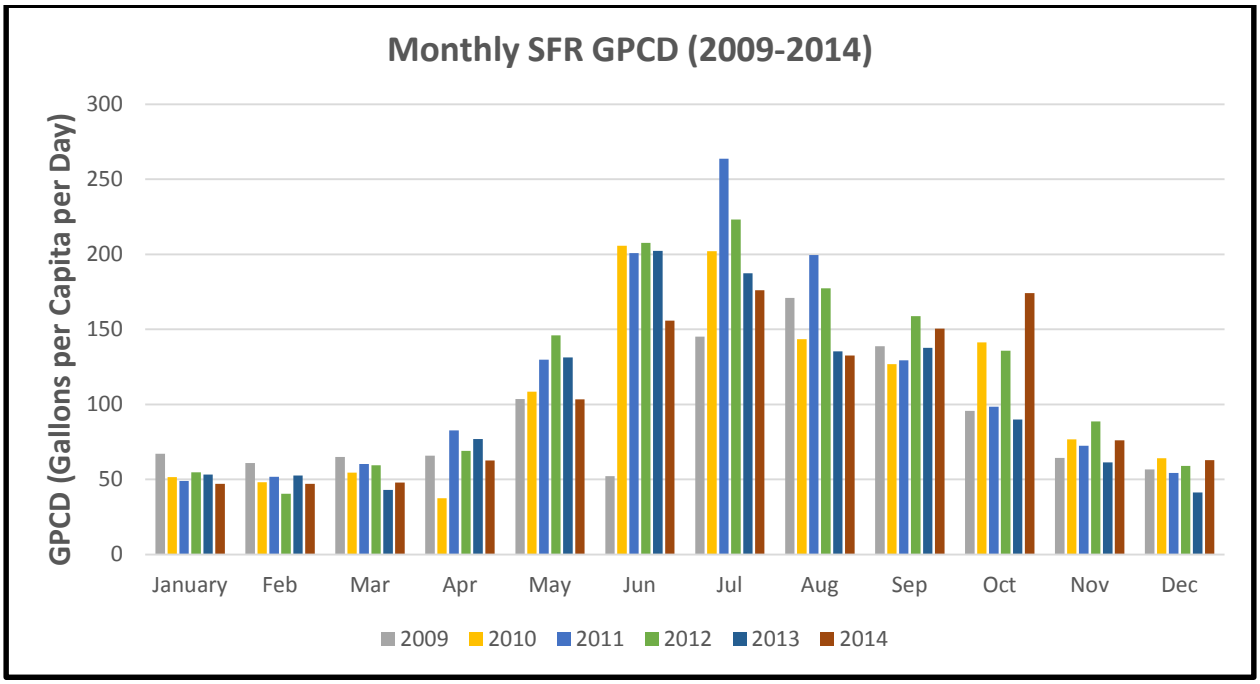


Figure 20: Monthly Single Family Residential GPCD (Excluding LANL)

6.3.5 Estimated SFR Indoor Water Use

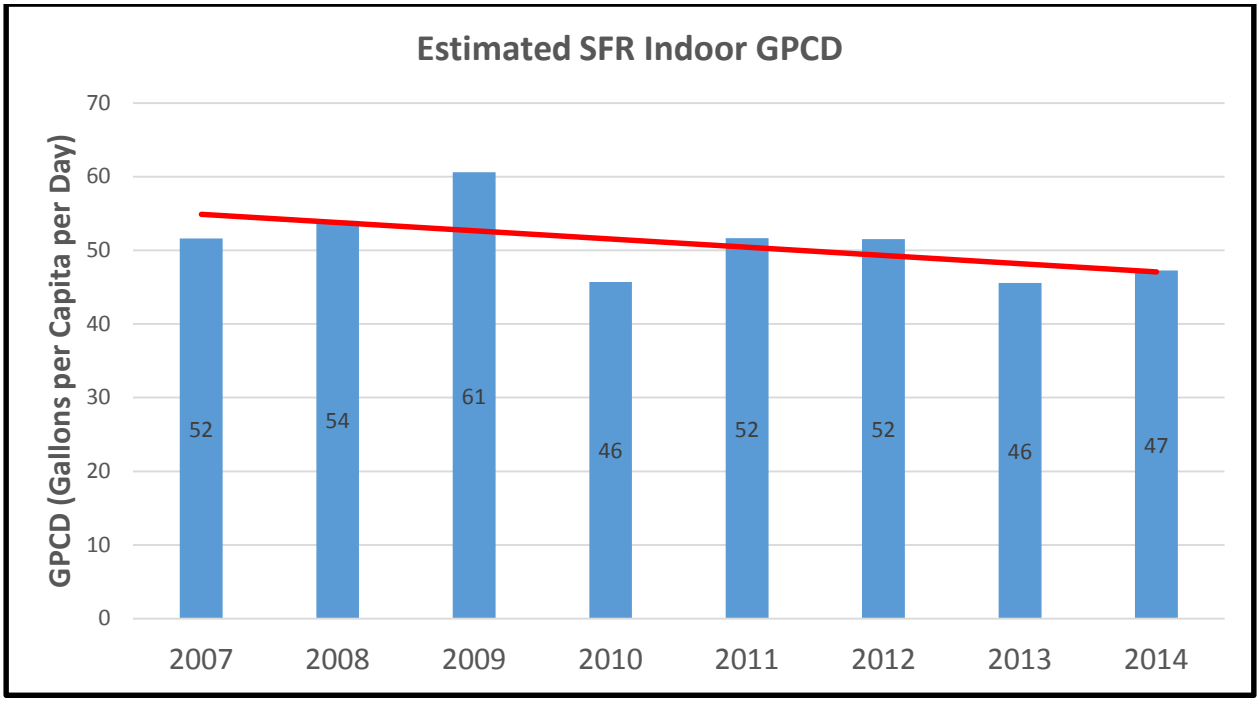


Figure 21: Single Family Residential indoor usage was calculated by averaging the three lowest winter months.

6.3.6 Estimated SFR Outdoor Water Use

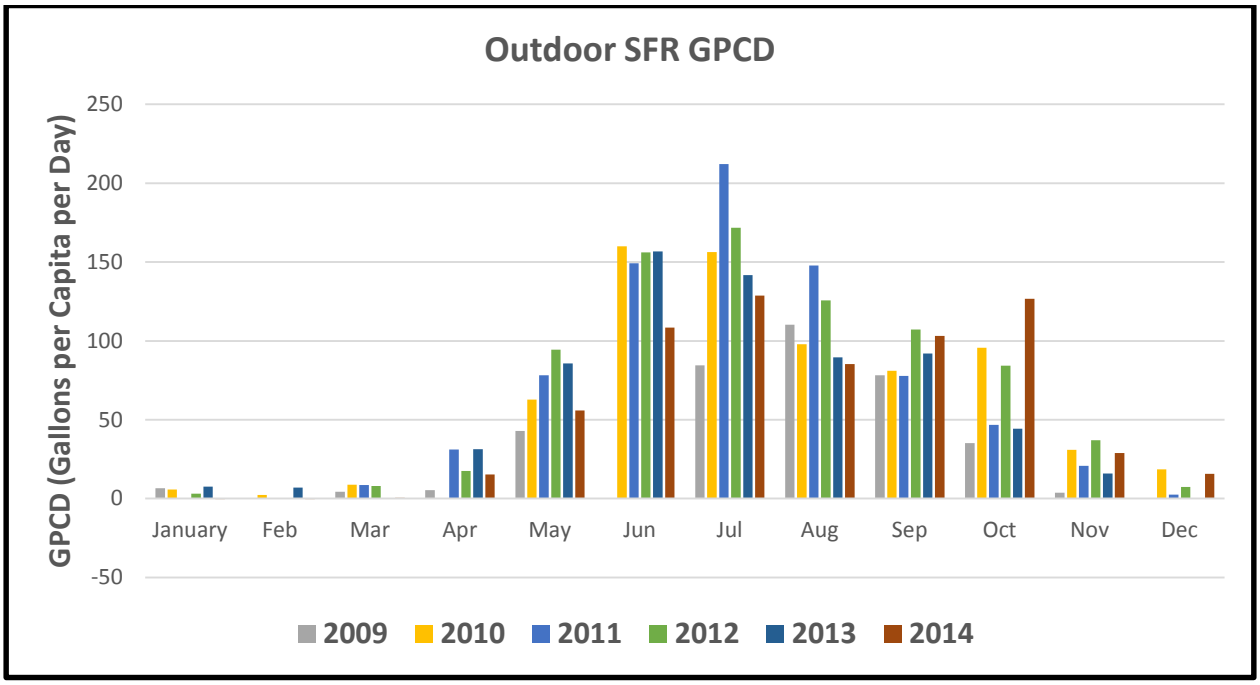


Figure 23: Single Family Residential outdoor usage was calculated by subtracting the average of the three lowest winter months from the monthly GPCD.

6.3.7 Annual Multi-Family Residential (MFR) GPCD

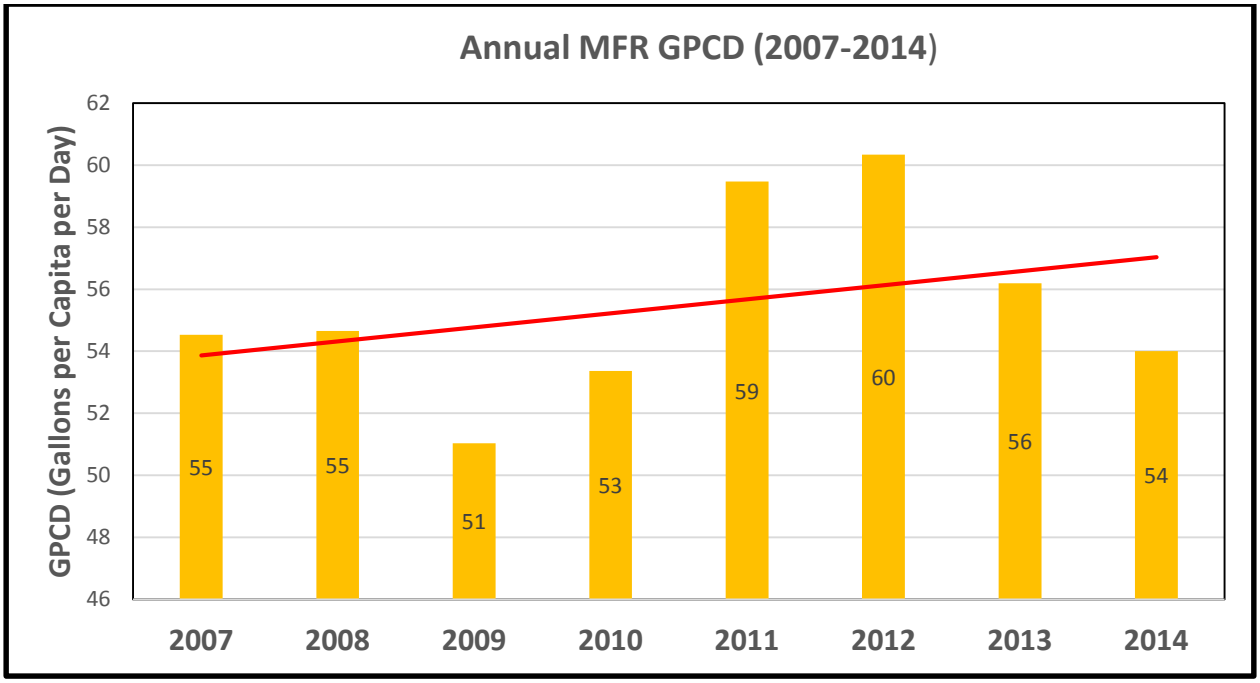


Figure 24: Annual Multi-Family Residential GPCD (excluding LANL)

6.3.8 Estimated MFR Indoor Water Use

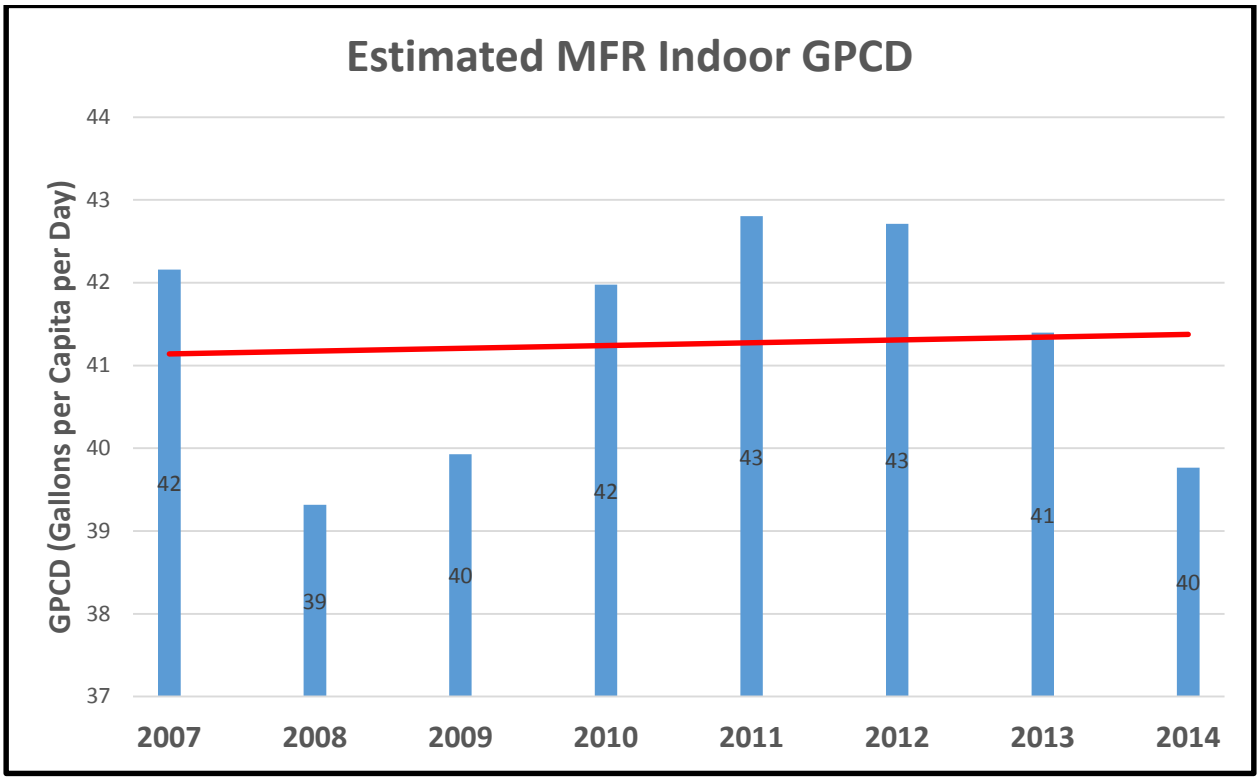


Figure 25: Multi-Family Residential indoor usage was calculated by averaging the three winter months with the lowest water use.

6.3.9 Estimated MFR Outdoor Water Use

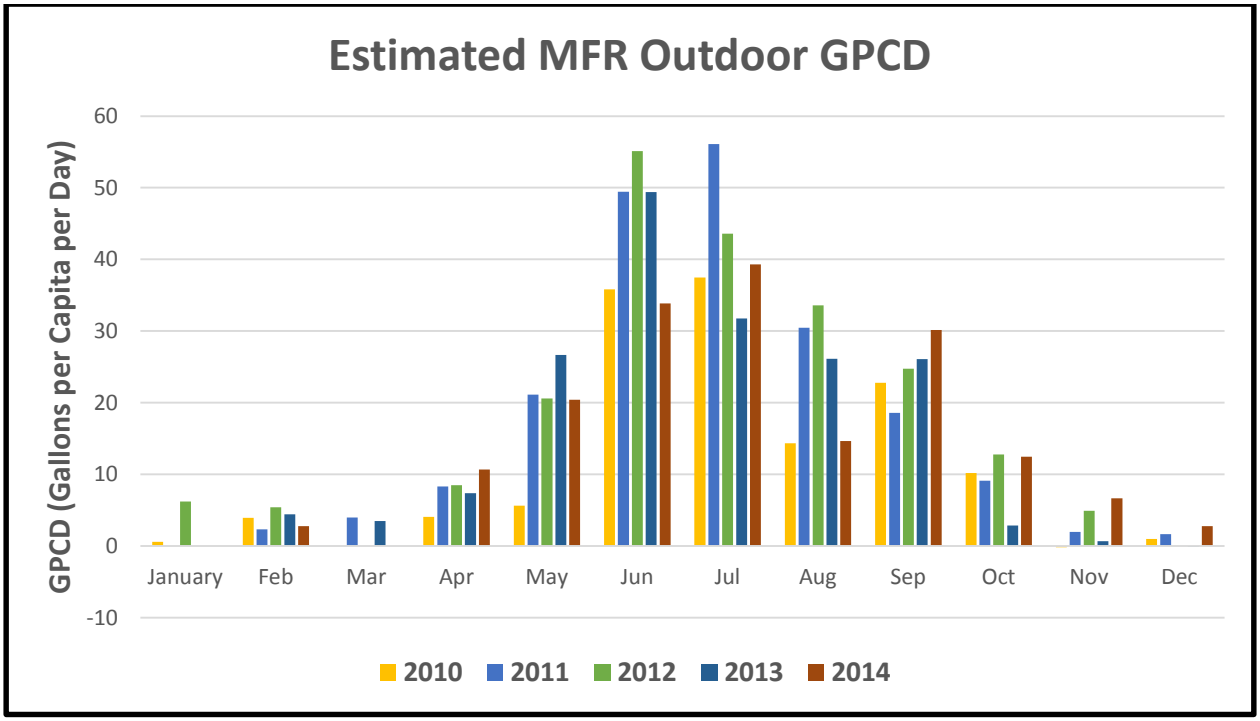


Figure 26: Multi-Family Residential outdoor usage was calculated by subtracting the average of the three lowest winter months from the monthly GPCD.

6.3.10 Monthly MFR GPCD

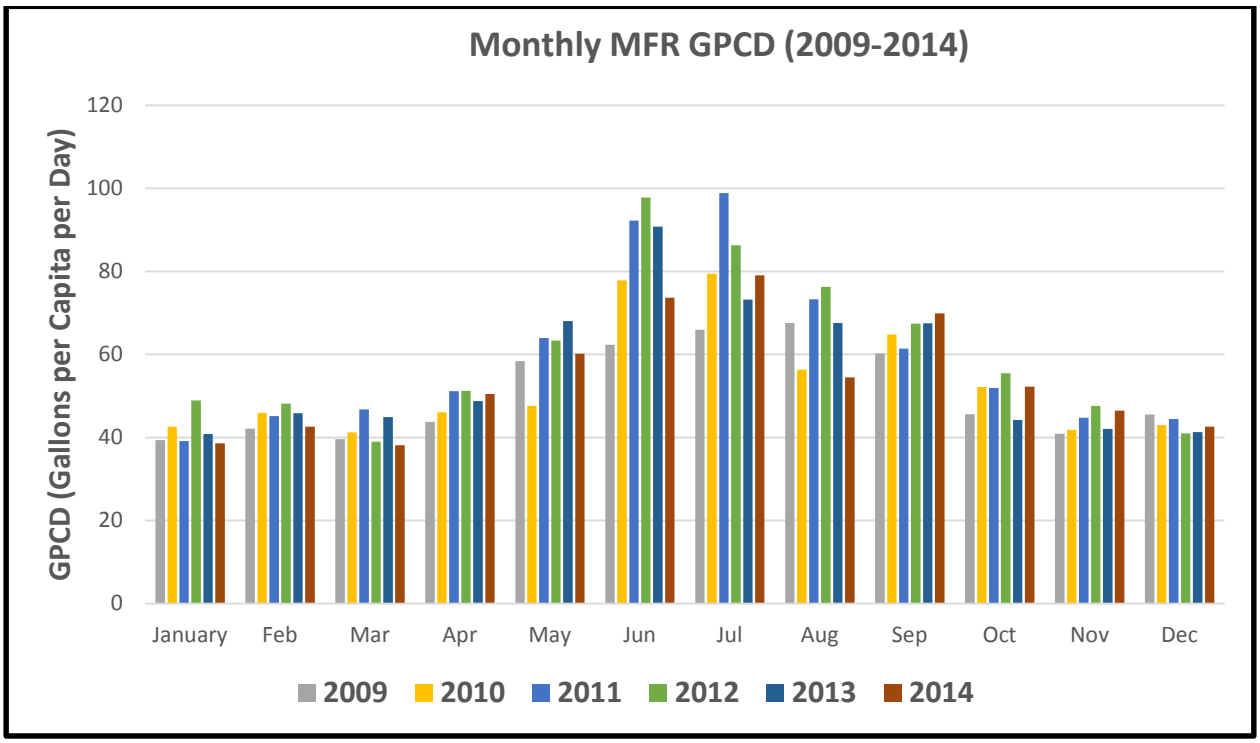


Figure 28: Monthly Multi-Family GPCD (excluding LANL)

6.3.11 Industrial, Commercial, Industrial (ICI) and Other Metered.

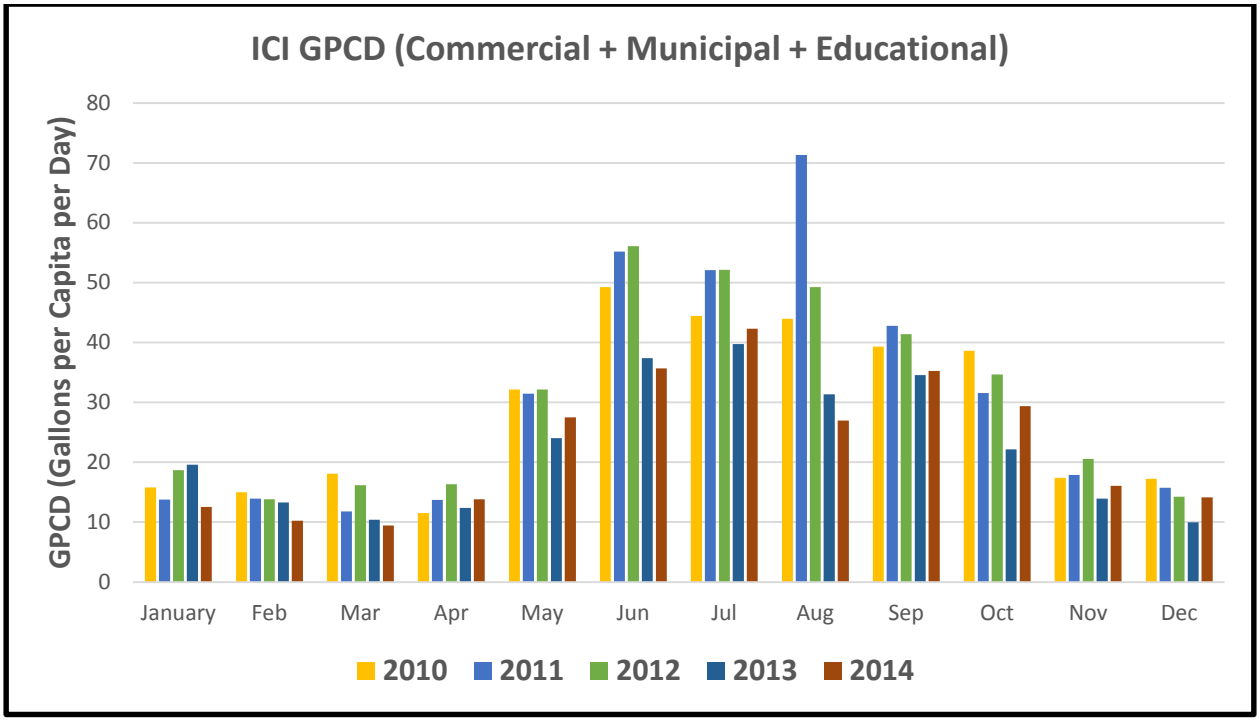


Figure 29: GPCD for Commercial, Educational and Municipal Combined (ICI calculation) that excludes LANL

6.3.12 Annual System Total GPCD

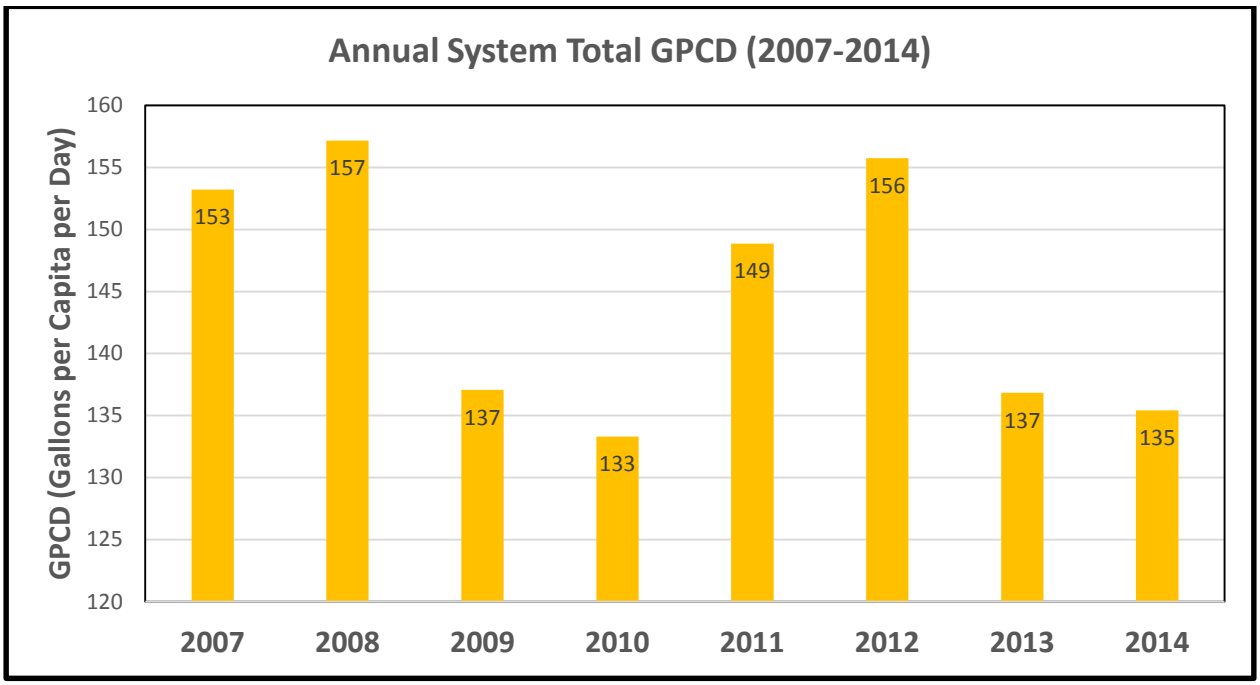


Figure 30: Annual System Total GPCD (excluding LANL)

6.3.13 Monthly System Total GPCD

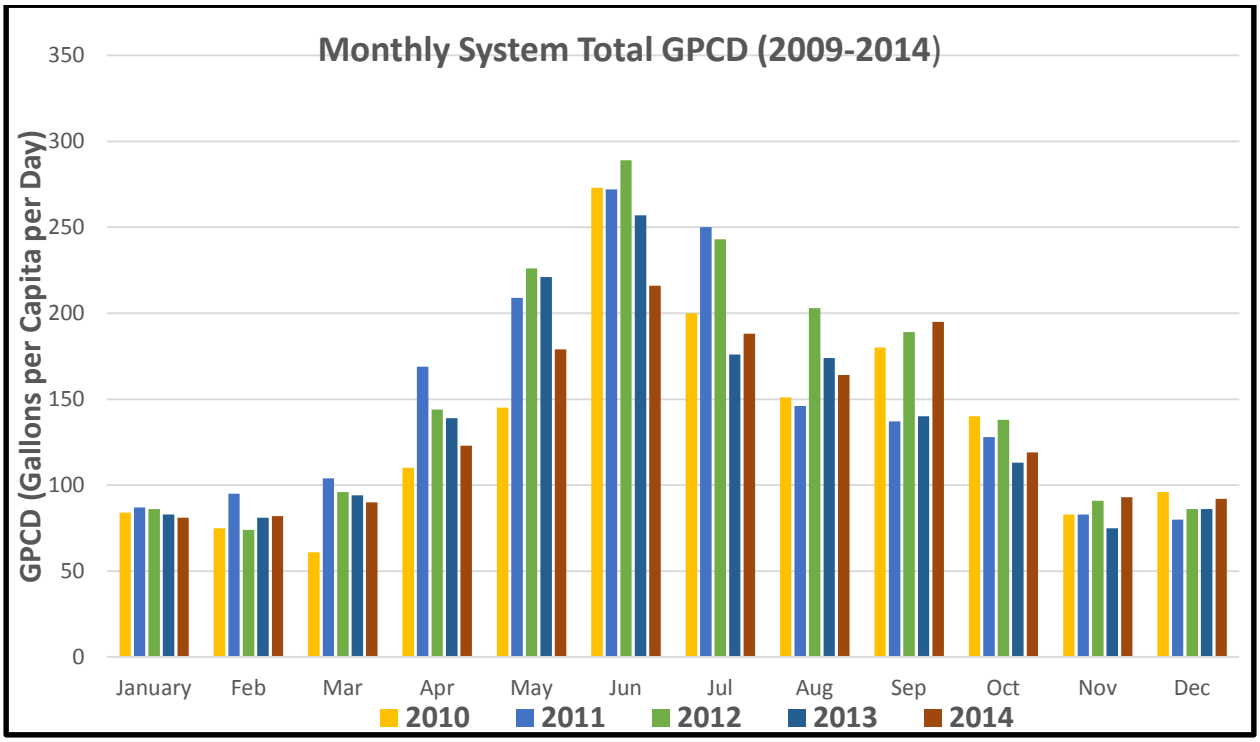


Figure 31: Monthly System Total GPCD (excluding LANL)

7 Assessing Public Electric Supplier Performance

7.1 Historical Electric Use (2006-2014)

Electric consumption varies from season to season. Electric consumption increases in the summer are being driven by municipal water pumping while electric increases during the winter are driven by residential heating, additional lighting and electronics, etc. Commercial and private area lights may be a secondary focus for conservation programs.

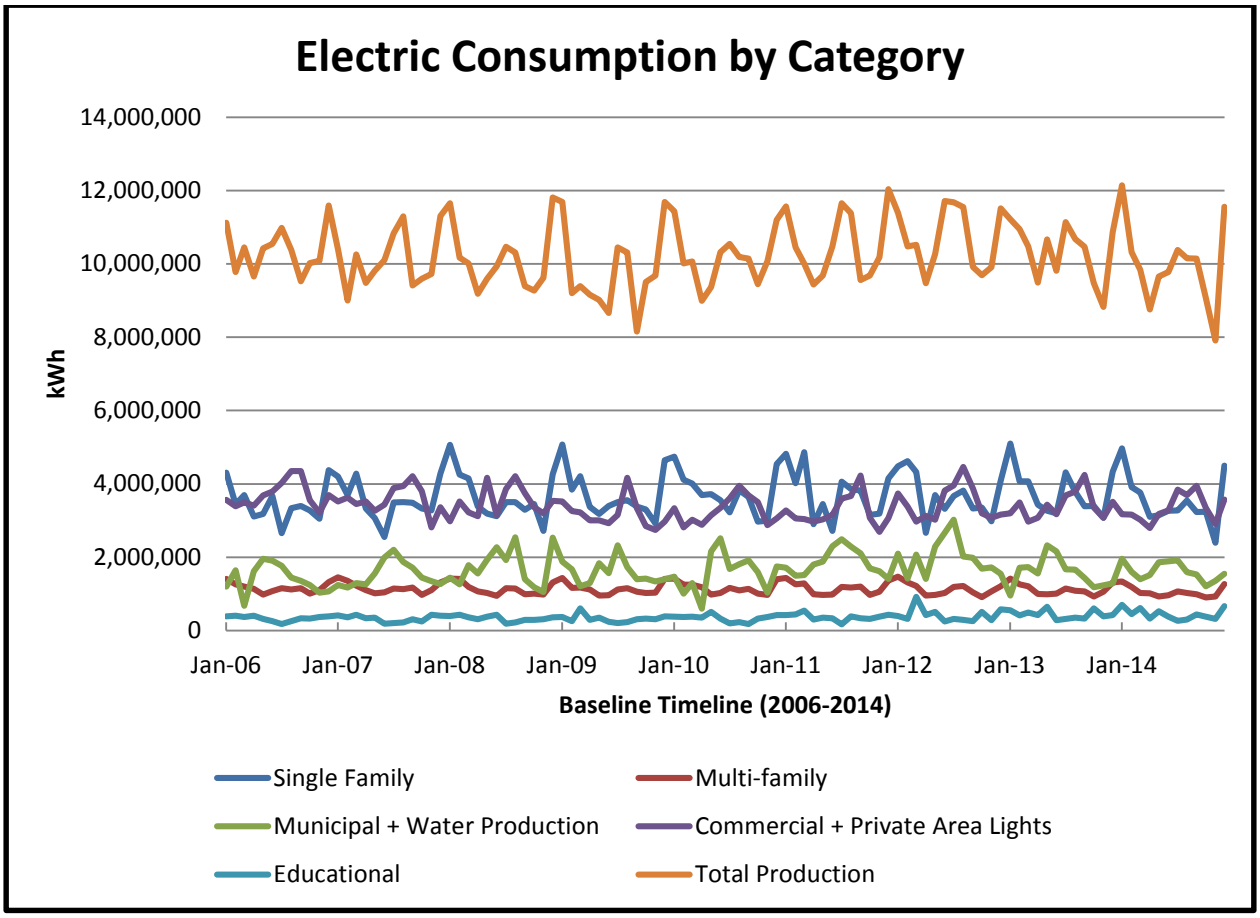


Figure 33: Electric consumption across all customer classes including the County's total production (LANL excluded).

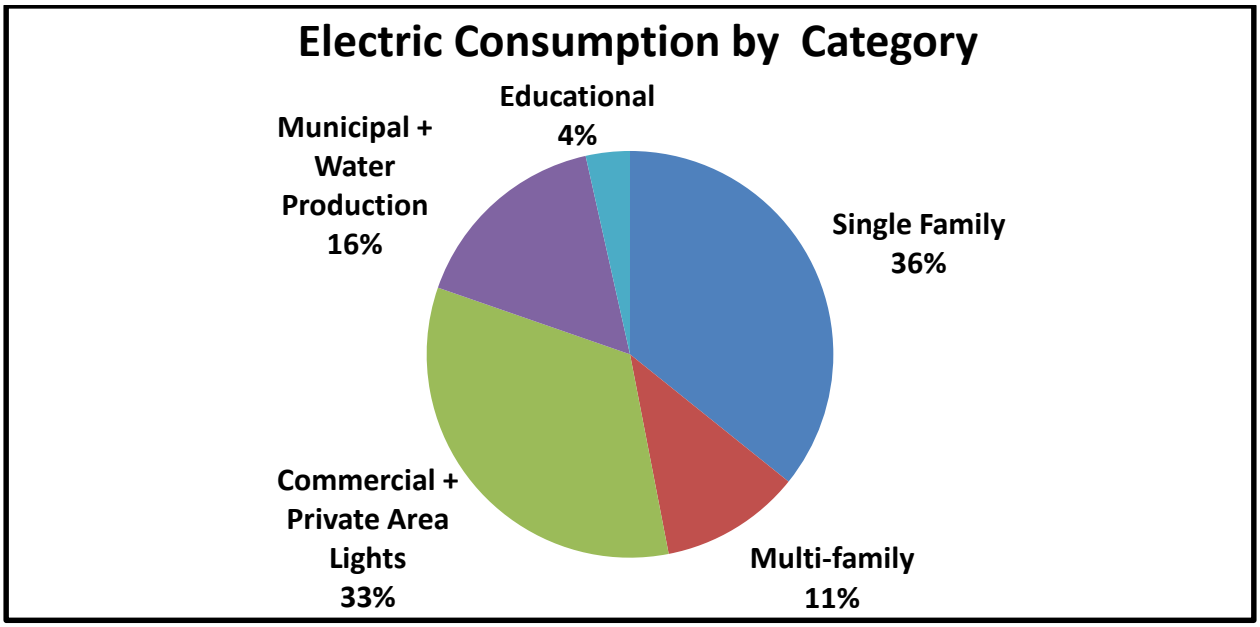


Figure 35: Electric Consumption by Category (LANL excluded)

8 ASSESSING PUBLIC SUPPLIER GAS PERFORMANCE

8.1 HISTORICAL USE OF NATURAL GAS (2006-2014)

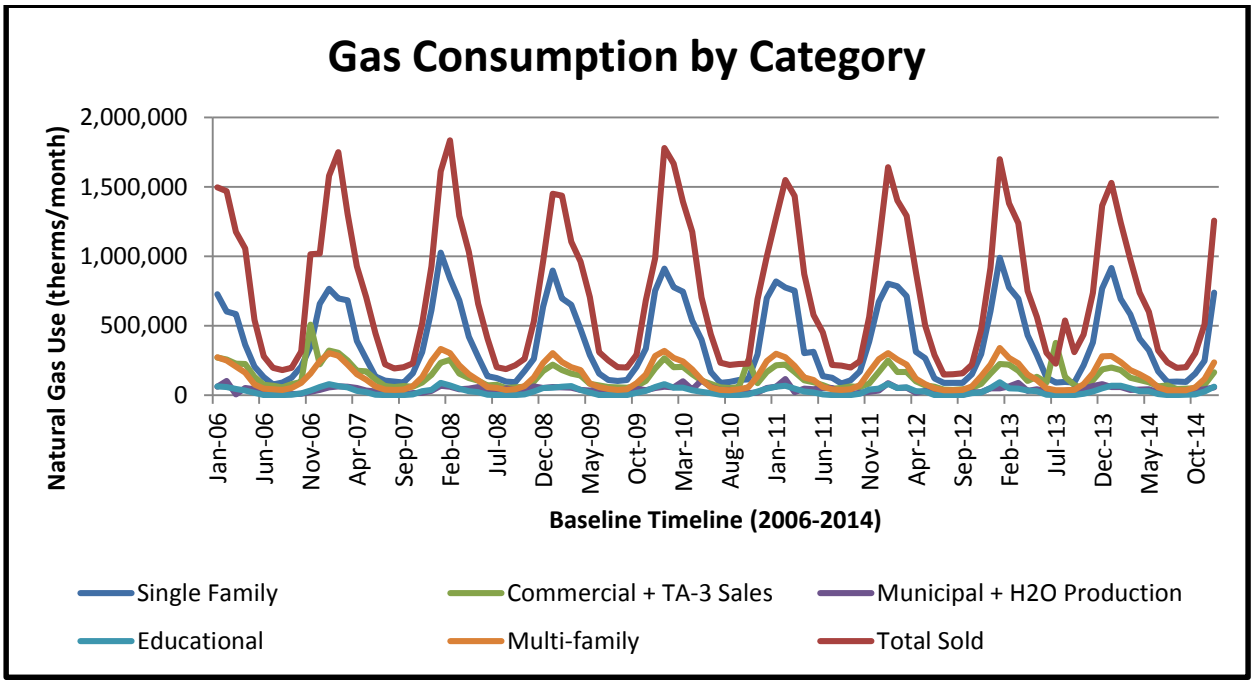


Figure 36: Gas consumption across all customer classes including total production data (LANL excluded)

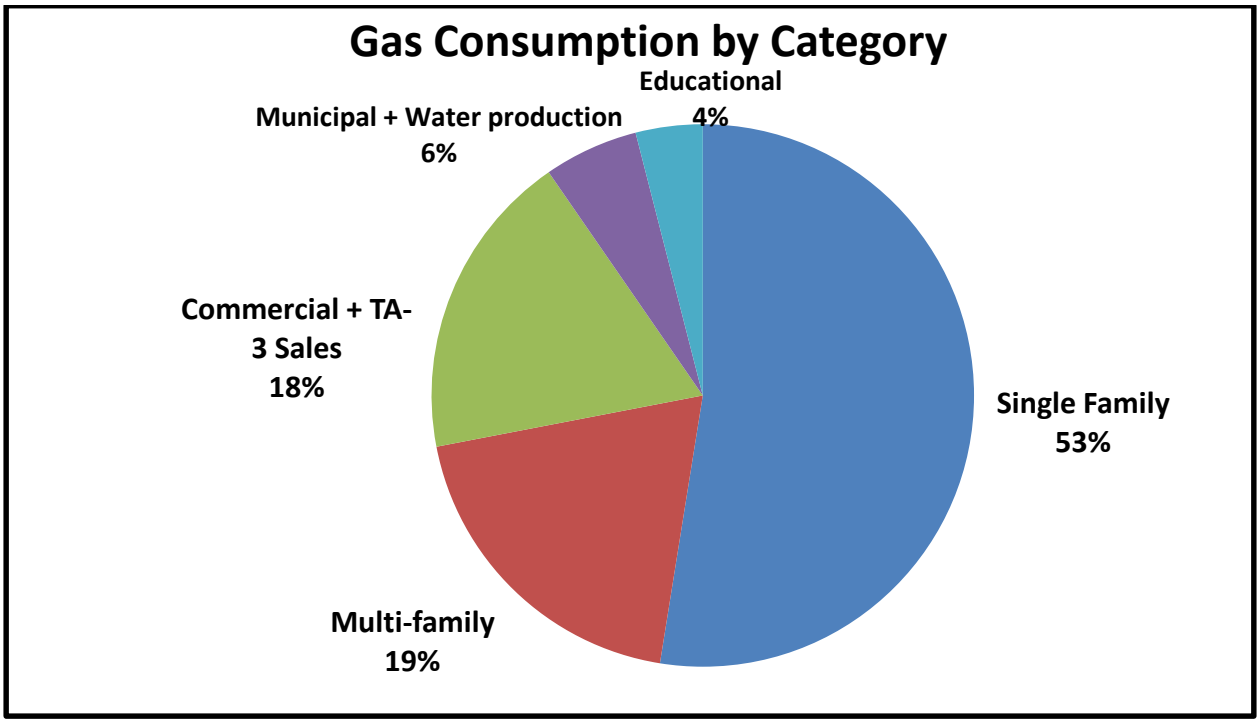


Figure 37: Gas consumption by category (LANL excluded)

8.1.1.1 Baseline with heating degree days

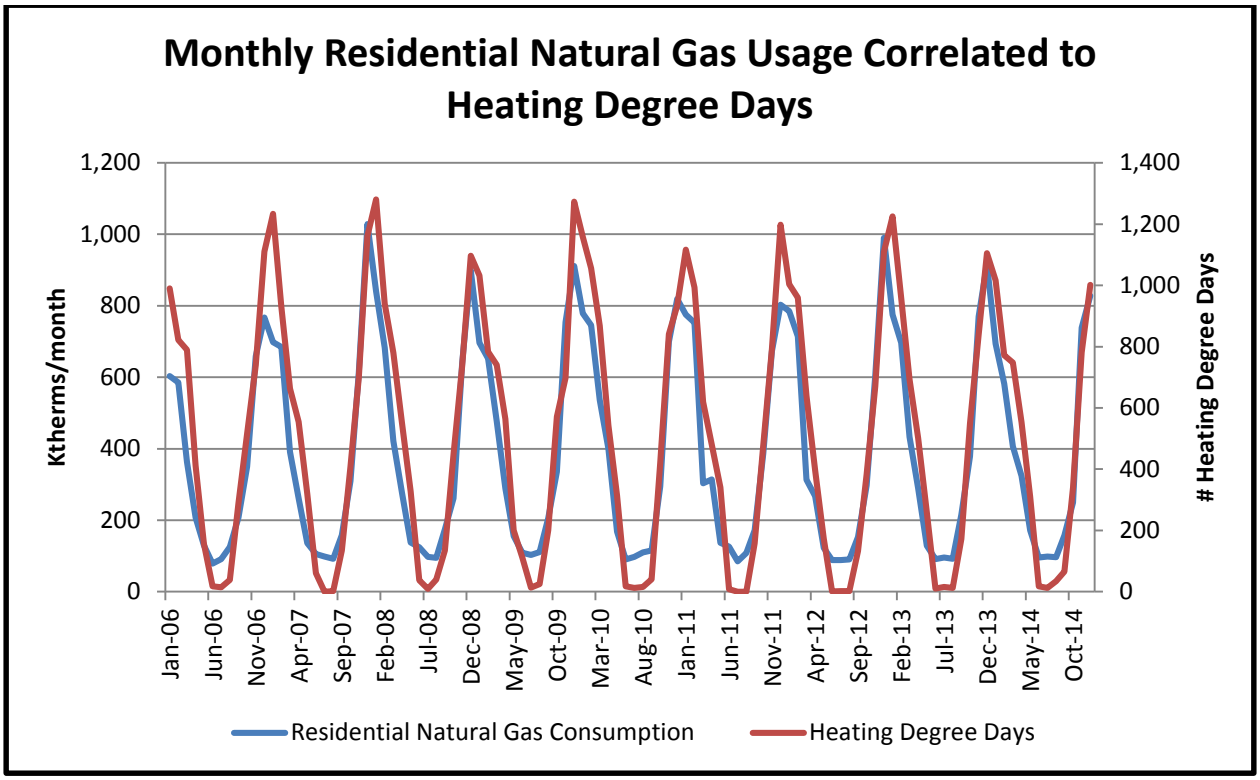


Figure 38: Residential gas consumption against heating degree days for 2006-2014

Figure 38 depicts residential natural gas usage (1000's of therms) as it correlates to heating demand which is shown by heating degree days. A heating degree day is defined as the number of degrees that a day's average temperature is below 65° Fahrenheit, the temperature below which buildings need to be heated.

The County's average gas usage in the summer months is approximately 24 therms per month primarily used for heating water, cooking and pilot lights. The County's highest average consumption in the winter months is about 195 therms per month of gas which includes all of the above uses, as well as heating. The average consumption for Los Alamos County is about 74 therms per household per month. The AGA states that the typical American household in the West uses approximately 165 therms/month.

9 CURRENT WATER AND ENERGY CONSERVATION PROGRAM

The conservation programs included in this Plan target both the supply and demand side for each utility. The DPU Energy and Water Conservation Program is facilitated by a full-time staff member who is responsible for implementing and monitoring all aspects of the Plan. All developments of the program are coordinated with DPU staff and the Board of Public Utilities.

9.1 SYSTEM EFFICIENCY IMPROVEMENTS

9.1.1 Water

9.1.1.1 Meter Testing and Replacement

Maintenance, testing and replacement of water meters is a critical component of the DPU's water utility operation since it is recognized that meters lose accuracy with age. The DPU has an existing program to test on a scheduled interval and replace water meters that are found to be inaccurate. There is also a FY2015 goal to replace 350 residential water meters with new magnetic flow meters.

9.1.1.2 Large Water Customer Usage and Account Review

The Cayenta database system is currently used by the DPU to record utility meter information, consumption billing and meter maintenance activity for each utility. Currently the system only tracks the potable water system. The non-potable system for irrigation of County properties is handled outside of the Cayenta billing system due to unique operational characteristics.

A Large Water Meter Review Project Report was completed in August 2011 by DPU staff that addressed discrepancies in the metering or in the billing of large water customers so that corrections could be made to the billing system or out in the field that would increase accuracy and efficiency in the water system. As part of the recommendations from this report efforts were made to identify every potable water meter's location using GIS technology and in the field data collection by summer intern staff. These locations were then matched with actual addresses in the Cayenta Billing system to ensure account/meter accuracy.

9.1.1.3 System Leak Detection Survey

A System Leak Detection Survey is conducted annually on 20% of the total system. Each year a different part of the system is surveyed and the leaks are classified into 3 different categories. Class 1 is a leak deemed hazardous to the utility which could result in damage to the utilities, surface collapse or severe enough to warrant immediate repair. Class 2 are leaks that display water losses significant enough to be monitored on a regular repair schedule. Class 3 leaks are relatively small leaks that should be repaired as workload permits. Class 1 and Class 2 leaks are repaired immediately.

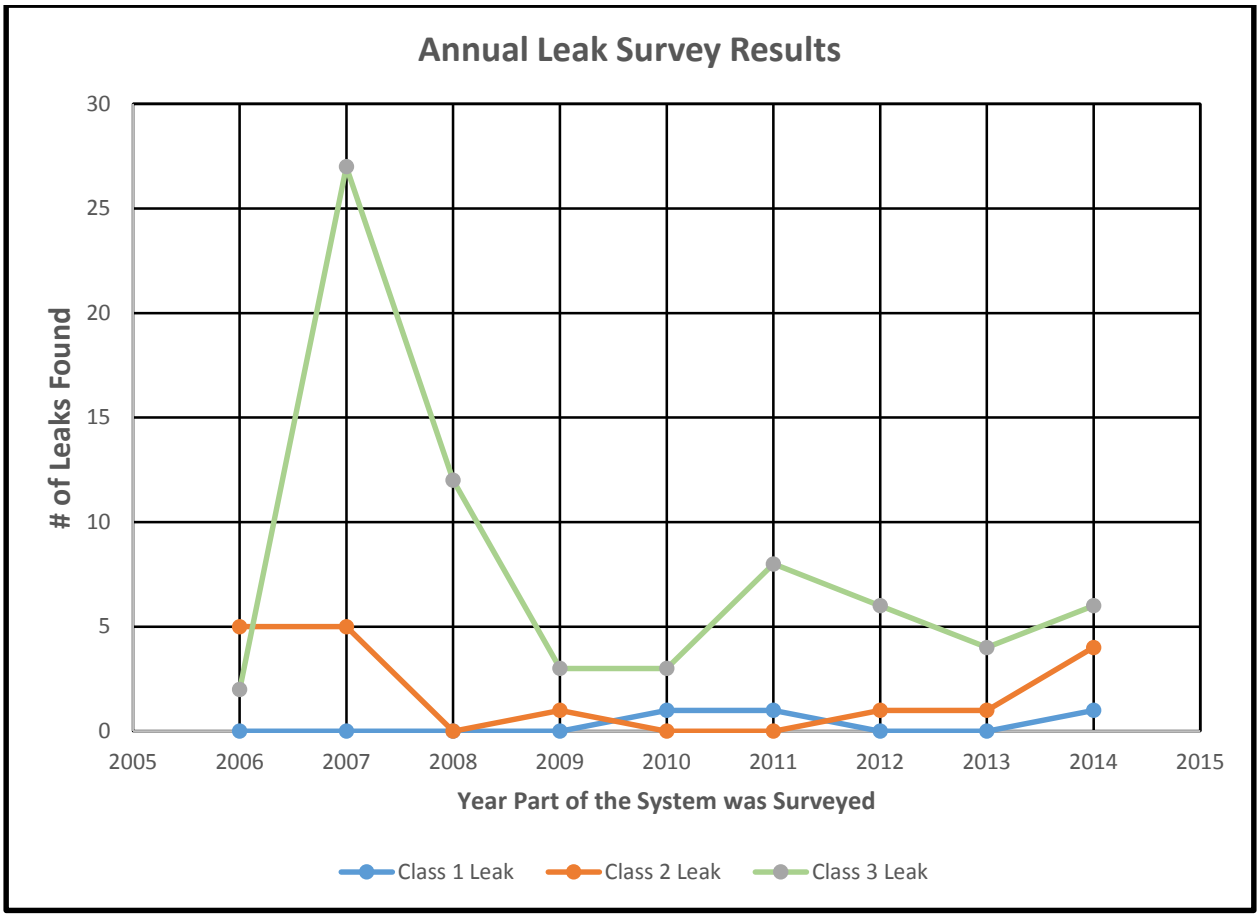


Figure 39: Annual survey results by classification of leak type

9.1.1.4 Regulatory Measures

Water Rule W-8 was adopted by the Board of Public Utilities in July 2005 as part of the Rules and Regulations of the Water Utility Department. Provisions include:

- Water Waste is prohibited
- Irrigation Water Runoff is prohibited
- Even/Odd Address Watering Schedule (May 1 – Sept. 30)
- Daytime Watering Restriction
- Leak Repair Requirement

Water Rule W-8 has no punitive consequences for customers not in compliance. This rule is voluntary and seeks to encourage customers to conserve through best management practices for outdoor water use.

The Los Alamos County Council approved a tiered water rate on July 8, 2014 for residential and multi-family customers only. The three tiers are structured as follows:

- Tier one - $4.19 per 1,000 gallons for the first 8,999 gallons consumed
- Tier two - $4.45 per 1,000 gallons for consumption between 9,000 and 15,000 gallons
- Tier three - $5.32 per 1,000 gallons for all consumption above 15,000 gallons

This rate structure was designed to better assign the costs of water delivery to the consumption patterns driving those costs. Implementing a tiered water rate for Los Alamos County was listed as the first recommendation from the Conservation Advisory Group and public input sessions.

9.1.1.5 Conservation Incentives

9.1.1.5.1 Irrigation Audits

The DPU Conservation Coordinator is a certified landscape irrigation auditor (CLIA) through the Irrigation Association as well as a certified Qualified Water Efficient Landscaper (QWEL) through the EPA WaterSense program. Work has been done to coordinate with County Parks to conduct irrigation audits that result in recommendations to their irrigation schedules and maintenance on the existing irrigations systems. Several of the Parks staff has also received the QWEL training and certification. Fuller Lodge Park was audited in spring 2011 and initiated the cooperative work between DPU staff and County parks to identify leaks or problems and in the development of a report to help guide parks staff in the recommended irrigation schedule that resulted from the performed audit. Parks staff was represented in the conservation advisory group and a developed goal of collaborative work between the two entities to reduce summer time irrigation of parks in Los Alamos County and to promote a strong “lead by example” component from the County. Additionally the Los Alamos County Sustainability Plan has identified a goal of reducing water usage in Los Alamos County parks to 25% below 2012 levels by 2020.

9.1.1.5.2 Commercial Water Conservation Audits

The DPU Conservation Coordinator gained an invaluable training experience in July 2012 to train with Lonnie Burke who is co-owner of Resource Wise Consulting and who works as a consultant with the City of Rio Rancho conducting all of their residential and commercial water conservation audits. His work with the Community Water Conservation Project funded by the Bureau of Reclamation to assist New Mexico communities with water conservation programs allowed him to train the DPU Conservation Coordinator in commercial water audits for an entire week in Los Alamos County. Overall 7 comprehensive water conservation audits were

performed including a large grocery store, a hotel and a school campus. Some of the participants were featured in the monthly bill insert as encouragement for other businesses to follow. Each participant was given a detailed report on the findings as well as recommendations that were based on nationwide standards for similar businesses across the country.

9.1.1.5.3 Residential Water Conservation Outreach

General conservation education measures for residential customers will continue to expand under the conservation plan. A number of educational materials have been distributed to our customers including bill inserts, feature articles and announcements in the news media, workshops and booklets.

The DPU co-sponsored a free public lecture given by Jeffrey Adams on Integrated Rainwater Harvesting Systems that was attended by over 35 participants on August 19, 2012. The course introduced the basics of site assessment, designing, implementing and maintaining multi-functional rainwater harvesting systems. This lecture was so well received in the community that an expansion on this lecture is being considered to include additional follow-up lectures including active or passive systems, soils and plants and permaculture. A FAQ sheet is being developed on permitting requirements specific to Los Alamos County for the installation of rainwater harvesting systems. Additionally a demonstration project is being considered that will be a host site for future workshops including hands on installation and maintenance of rain water harvesting systems.

"Waterwise" bill inserts are also an integral part of the residential water conservation program. The DPU Conservation Coordinator has the opportunity to use the bill inserts as a way to communicate program events, and topics of interest in energy and water conservation. In the winter months the focus is usually on energy conservation and in the spring and summer the focus is on water conservation. Some of the bill inserts have included information written by the DPU conservation coordinator who collaborates with several local experts to distribute information on:

- Gray water residential use
- Rainwater harvesting
- Winter irrigation system preparation
- Fix a Leak campaign and local efforts

9.1.2 Electric and Natural Gas

9.1.2.1 Meter testing and replacement

Maintenance, testing and replacement of electric, water and gas meters are a critical component of a utility operation since meters can lose accuracy. Therefore the DPU has an existing program to test meters on a scheduled interval and replace meters that are found to be inaccurate.

9.1.2.1.1 Installation of Smart Meters

The DPU has completed work with NEDO to develop a smart meter demonstration project for a sample size of 1,800 customers. The smart meters were installed to test a consumer's likelihood to alter consumption behavior based on a demand response program. Demand response allowed for electric demand in the home to be responsive to real-time or block interval price signals from the utility, which could minimize potential costs and preserve the comfort of normal residential usage patterns. A Request for Proposals (RFP) closed in January 2015 to select a consultant to evaluate the existing system and develop a business case analysis for full deployment of a smart metering program for electric, gas, and water throughout Los Alamos County.

9.1.2.2 Loss Evaluated Transformers

Four years ago, the DPU started purchasing transformers based on loss evaluation which takes into consideration the initial cost of the transformer and its losses (in dollars) over its useful life (transformer life cycle). This means that the DPU may purchase a higher cost transformer if it saves a significant amount of money on losses over its useful life. The DPU anticipates replacing almost 1,000 of its older transformers in the next 10-15 years.

9.1.2.3 Annual Gas Leak Survey- unaccounted for gas

Surveys for gas leaks using highly sensitive detection equipment are conducted annually for business districts and high pressure pipe lines and every three years for residential areas. Key valves and gas regulator stations are inspected annually to ensure that they are working properly and aging infrastructure is replaced as needed. Steel gas pipe lines are protected by cathodic protection to reduce corrosion and cathodic protection levels are surveyed annually with deficiencies promptly corrected. All leaks are evaluated and fixed as soon as possible or immediately if necessary or the line is scheduled for replacement. Leaks are reviewed annually

by the DPU Engineering Division for possible system problems and compared to past leak history for trends needing corrective action.

Annual unaccounted for gas is low. The annual unaccounted-for-gas for the last six fiscal years is listed below:

- 2013 5.44%
- 2012 3.08%
- 2011 -3.32%
- 2010 2.03%
- 2009 -1.30%
- 2008 4.50%

One reason for the fluctuation of unaccounted-for-gas is the time differences in the city gate station measurement readings and the meter reading billing cycles.

9.1.2.4 Large Gas Customer Usage and Account Review

In 2005, the condition of meters and regulators for 100 of the top gas commercial customers were evaluated by the DPU. Several meters were found to be hardly registering. As a result of the evaluation over 40 meters and regulators were judged to be older and possibly in poor condition. In 2006 they were replaced with new rotary meters and new regulators. Rotary meters are very durable and remain accurate for a longer period of time. In 2010, the condition of meters and regulators for 252 commercial customers were reviewed by the DPU. Only a few meters and associated equipment needed attention.

A new meter testing and replacement schedule was recently introduced. Large gas meters are tested or replaced on a more frequent schedule than residential meters. Rotary meters less than 5M cubic feet are to be tested every 5 years by differential testing and 5M cubic feet and larger rotary meters are to be tested every 3 years. Large diaphragm meters 400-1000 cubic feet capacity are to be replaced every 20 years.

9.1.2.5 Customer Service High Low Automatic Review

The DPU meter reading system has a high low automatic review check in the system that will kick out meter readings that are too high or too low based on past year meter consumption for the same period and set parameters, 25% for low and 200% for high. The system flags these

accounts for customer service representatives and the accounts are not billed until action is taken by the customer service representative. The DPU Conservation Coordinator also assists in reviewing these accounts and making recommendations. After the accounts are reviewed an action to call for a reread or write a work order for operations to investigate may follow which would also include checking for any leaks. The high low system check allows meter reading and consumption problems to be caught in a timely manner. This high low automatic review check is done for electric, water and gas accounts.

9.1.3 Conservation Incentives

9.1.3.1 Energy Conservation Audits

Currently a comprehensive energy conservation audit is offered to utility customers free of charge. The audit consists of a 5 year utility bill analysis which shows consumption trends for water, electric and gas. A complete walk-through of the home is done using an infrared imager to identify and locate system inefficiencies. A detailed report is provided to the homeowner with recommendations based on the walk-through as well as specific recommendations as requested by the home owner that may include appliance upgrades or paybacks on retrofits. Each of these audits is tracked in Cayenta on the completion date and each is mapped in a GIS database. From January 2011 through December 2014 there were 158 energy audits conducted in both Los Alamos and White Rock. Out of the 158 audits, 27 of them included a blower door test which aids the homeowner in identifying potential leakage in the home using blower door technology and an infrared camera.

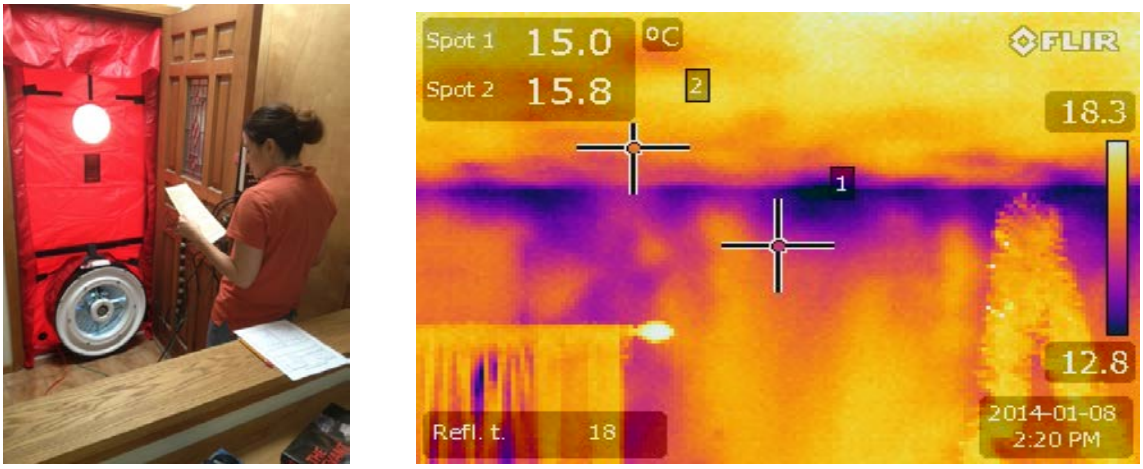


Figure 40: Blower door set up to the left and an example of leakage shown through the infrared camera on the right.

9.1.3.2 LA Green

LA Green is a program that allows customers to contribute to the County's renewable and carbon neutral energy goals by signing up to pay a small surcharge for their energy consumption to be used for "green" initiatives. Originally the funds were being used to purchase "Renewable Energy Credits", or "RECS", to offset the County's carbon based generation for the selected increment of the customer's consumption. Los Alamos County now owns considerable renewable and carbon neutral generation capacity at its El Vado and Abiquiu hydroelectric plants, and the solar/battery array on the retired landfill, and thus no longer purchases RECs to meet our subscribed renewable energy requirements. The funds derived through LA Green are currently used to offset the additional operating costs of these owned renewable and carbon free resources.

9.1.4 Educational and Training Measures

9.1.4.1 Outreach in Public Schools

In August 2008, the DPU entered into a contractual agreement with the Pajarito Environmental and Education Center (PEEC) to provide energy conservation services to the DPU's customers. Several task orders have been implemented as part of this agreement and are described in detail below. A significant effort was made by the new DPU Conservation Coordinator upon hire in January 2011 to begin to measure the amount and effect of the outreach conducted by PEEC and to provide a more coordinated approach from the DPU and PEEC in the development of materials for actual instruction in the classroom.

An annual report is now submitted to the DPU quantifying the amount of outreach conducted under the contract including teacher contact names, number of students, materials and resources used to conduct the lesson and feedback from the teachers. The tasks established under Task Orders 1-6 which have been implemented by PEEC and developed with the coordination of the DPU Conservation Coordinator are as follows:

- CFL Light bulb exchange – The DPU provided CFL light bulbs for distribution by PEEC to utility customers exchanging 60 watt or greater incandescent light bulbs with a maximum of 6 bulbs per customer. Promotion of LED light bulbs will now be included.

- LA Green Membership Campaign – An outreach plan designed to increase community participation in the LA Green program for all customer classes with a heavy emphasis on increased commercial participation.

- Energy Trunk – Classroom instruction activity to educate students on energy and the importance of energy conservation through instruction with hands-on activities through a portable "Energy Trunk" lesson plan. Some curriculum goals and standards include describing the DPU's energy resources and how they are used, understanding greenhouse effect and carbon emissions and defining ways to conserve energy. The students are also given instruction on how to conduct an energy audit on their own home. Activities are different for each grade level.

- Cool the Earth – This activity has been done with two Los Alamos County Elementary Schools to do an energy conservation lesson through a school wide assembly. Energy saving actions were incentivized through individual "coupon booklets", classroom activities and school-wide actions. Extensions of this activity included the development of school "green teams" and activities promoted throughout the school year that could earn the title of an individual or school-wide "action".

- Water Conservation Trunk – Elementary and middle school students are educated on water and the importance of water conservation with hands on activities through a portable "Water Conservation Trunk" lesson plan. Some of the concepts used in this lesson included describing drinking water resources and infrastructure for Los Alamos County, effluent re-use within the County, the water-energy nexus and a water footprint exercise that the students could use at home to measure their families' daily water consumption.

- Water and Energy Conservation Trunk – Middle school students are educated on water and energy conservation opportunities with hands-on activities through a portable "Water and Energy Conservation Trunk" curriculum. The curriculum incorporates the Los Alamos County Youth Food Project Garden located at Los Alamos Middle School. Implementation of this activity will begin in the spring of 2015.

Table 3: Outreach Results				
Timeframe	**Task Order Title**	**Brief Description**	**Age Group**	**Outreach Results**
2010	Light Bulb Exchange	Energy Conservation	General Public	6,962 exchanges
2010	LA Green Membership	Energy Conservation	Utility Customers	30 residential 2 small commercial
2011-2012	Energy Trunk	Energy Conservation	3rd - 8th grade students	2011-460 students 2012-402 students
2011-2012	Cool the Earth	Energy Conservation	3rd- 6th grade students	2011-233 students and 10 staff (2,999 actions) 2012-360 students and 36 staff (1,549 actions)
2012	Water Trunk	Water Conservation	3rd -5th and 7th grade students	185 students in grades 3-5
2013-2014	Water and Energy Conservation Trunk	Water and Energy Conservation	7th- 8th grade students	456 students
2013-2014	Energy Sources Trunk	Energy and Water Conservation	3rd - 5th grade	1,338 Students
2013-2014	Water Trunk	Water Conservation	3rd- 5th grade	228 students
2013	High School Energy and Water Management Outreach	Smart House Tour	10th – 12th grade	14 students
2014	Energy and Water School Outreach	Fix-a-leak week and school/public outreach programs (Science Night, Earth Day, Discover E event)	4th and 5th grade	896 students

The current four year contract awarded to PEEC for conservation outreach will continue until December 2016. The services provided by PEEC within the contract include all previous task orders for both elementary and secondary grades. The outreach will consist of specific energy

and water conservation lessons developed in coordination with Los Alamos Public School staff, PEEC and the DPU Conservation Coordinator and in meeting with the New Mexico Science Standards. Any staff involved in outreach will be subject to reference checks and background checks. Also as part of the new contract all activities will be labeled with the DPU logo and all activities will be tied to actual DPU projects and infrastructure.

9.1.4.2 Conservation Partnerships

The DPU recognized the importance of regional and nationwide conservation partnerships to continue to share ideas, gain resources and learn valuable lessons from other communities, state and federal agencies. The DPU is currently partnered in the following conservation programs:

- ✓ **WaterSense (EPA) Promotional Partner**
  The DPU became an official WaterSense Promotional Partner in March of 2008. WaterSense seeks to protect the future of our nation's water supply by promoting water efficiency and enhancing the market for water-efficient products, programs, and practices. WaterSense will help consumers identify water-efficient products and programs. The WaterSense label will indicate that these products and programs meet water efficiency and performance criteria. WaterSense-labeled products perform well, help save money, and encourage innovation in manufacturing.

- ✓ **Alliance for Water Efficiency Charter Member**
  In July 2008, the DPU became a charter member of the Alliance for Water Efficiency "AWE", which provides comprehensive information about water-efficient products, practices, and programs. Additional services include the development of conservation codes and standards, coordination with green building initiatives, training for conservation professionals, and general water use education.

- ✓ **New Mexico Water Conservation Alliance**
  2008 was a continuation of the DPU's membership with the New Mexico Water Conservation Alliance. The alliance is a non-profit organization dedicated to water conservation issues. Many communities from

around the state meet regularly to exchange information, provide education, and work towards a water-secure future for New Mexico.

- ✓ **Energy Star (EPA) Promotional Partner**
  In September of 2008, the DPU became a promotional partner with the Environmental Protection Agency's Energy Star Program. Partnership offers a unique opportunity to leverage ENERGY STAR and receive free energy efficiency updates designed for customer education. The ENERGY STAR label appears on over 50 different product categories as well as new homes, commercial buildings and industrial plants.

- ✓ **Alliance to Save Energy Member**
  In 2008 the DPU became a member of the Alliance to Save Energy. Well known for their National Energy Hog Campaign, "the mission of the Alliance to Save Energy is to promote energy efficiency worldwide to achieve a healthier economy, a cleaner environme and greater energy security" by Kateri Callahan, President. Founded in 1977, the Alliance to Save Energy is a non-profit coalition of business, government, environmental and consumer leaders.

ALLIANCE TO SAVE ENERGY
Creating an Energy-Efficient World

- ✓ **Los Alamos County Sustainability Program**
  The DPU's Energy and Water Conservation Program is tied closely to the efforts of the County's Sustainability program and the intent is that if the County "leads by example" then the rest of the community is likely to follow. Los Alamos County's sustainability initiative is guided by County Council, Environmental Sustainability Board, County Green Team and the County Fleet team. Baselines are developed and used by both the DPU and Los Alamos County to proceed forward with the analysis of consumption and development of energy and water conservation goals. While the main goal of the DPU Energy and Water Conservation program is to establish goals for utility customers the County's sustainability program focuses mainly on County goals and measures.

10 Water and Energy Conservation Goals

10.1 Advisory Group, Public Input and Utility Board Review

A Conservation Advisory Group was formed in December 2011 to assist the DPU Conservation Coordinator with the development of conservation goals and measures that best fit the unique community of Los Alamos County. Members of the group were chosen to represent stakeholder groups such as Los Alamos Public Schools, Los Alamos County Parks, Los Alamos County Environmental Services, small commercial customers and general homeowners. Eight members were chosen and given a specific designation based on their experience and stakeholder resemblance. After research had been conducted by all members, conservation goals for water and energy were brought back to the DPU for discussion and then brought before the Utility Board for review. These selected goals were then presented at two public input sessions in both White Rock and Los Alamos. Participants were asked to rate each goal or program on the priority they should be given based on what they believed would work best in the community and the ones they were more likely to implement as residents of Los Alamos County. For more information refer to Appendix 2.

10.1.1 Water Consumption

Los Alamos County currently relies on existing ground water rights of 5,541 acre-feet /year to supply its customers' water demands and is currently pursuing the development of an additional 1,200 ac-ft/yr of San Juan Chama Project surface water rights. In August 2006 the Utilities Board and the County Council adopted the Long Range Water Supply Plan (LRWS) thereby implementing recommendation to decrease water consumption by 12% by 2050.

The LRWS needs to be updated and submitted to the NMOSE for review and approval. When the plan was written Los Alamos County was anticipating future growth and increased demands that were projected to exceed existing water rights. The growth anticipated has not occurred nor have the population projections been realized indicating that a new direction needs to be taken to account for present population statistics and realistic growth expectations.

10.1.1.1 OSE GPCD (gallons per capita per day) Spreadsheet

The NMOSE GPCD methodology analyzed for the purposes of this plan demonstrate that conservation efforts should be focused on single family residential homes and multi-family customer class. Using this methodology will allow us to compare ourselves against other communities and adjust goals accordingly on an annual basis as this reporting occurs. In Figure 41 all of the cities in New Mexico are using the same NMOSE methodology to calculate and report their GPCD.

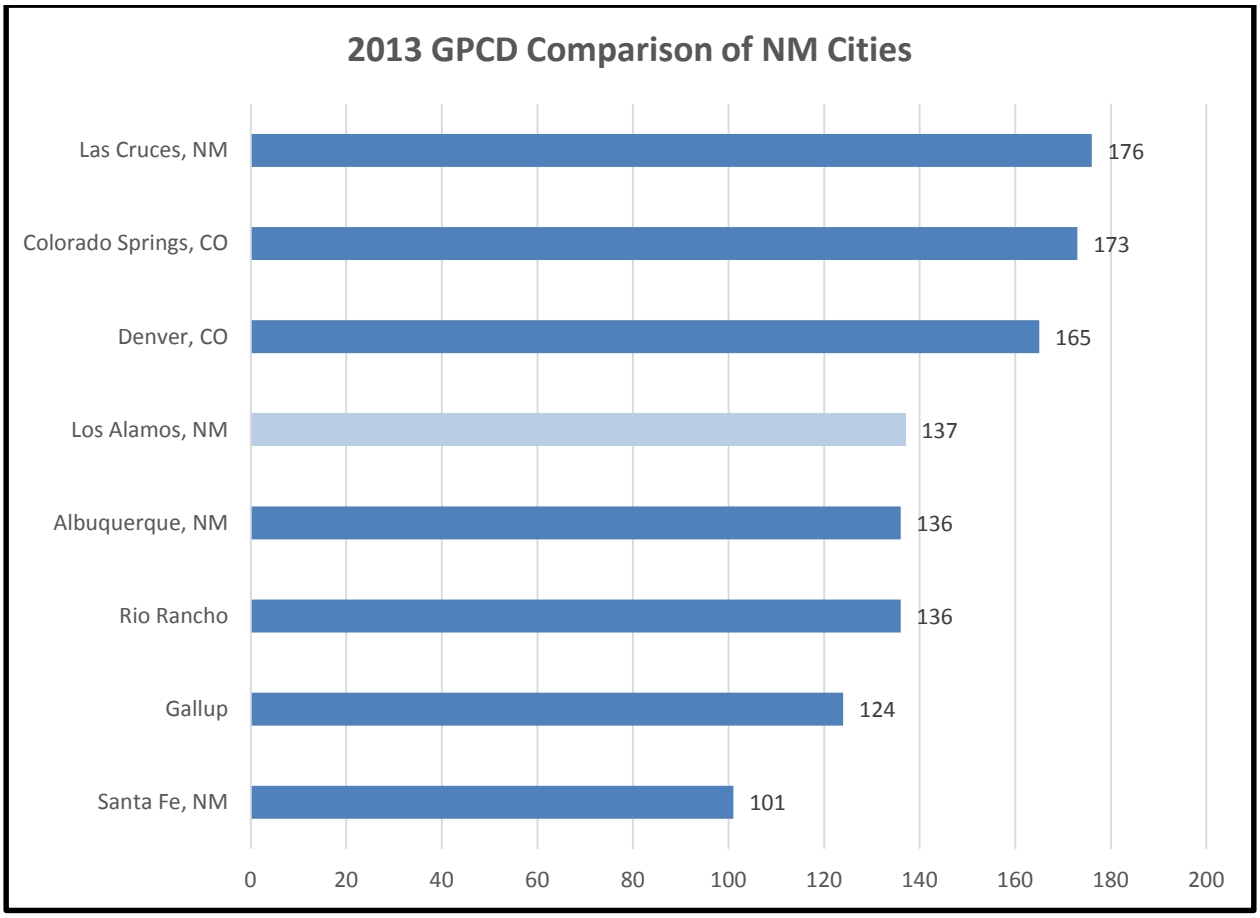


Figure 41: Comparative graph of total gallons-per-capita-per-day amounts for western cities for 2013.

10.1.2 Electric Production

The DPU along with the Conservation Advisory Group and through received public input established a conservation goal to reduce the CO_2e emissions for each kilowatt of electricity produced. This reduction should be achieved by reducing overall electrical energy use and increased use of non-hydrocarbon electric generation sources. In Figure 42 the increase in emissions in 2014 was due to the El Vado Hydroelectric plant being out of service and an increase from usage at LANL that resulted in more open market purchases.

As part of the joint integrated resource plan submitted on behalf of LANL and Los Alamos County these emissions can be tracked and joint goals can be established.

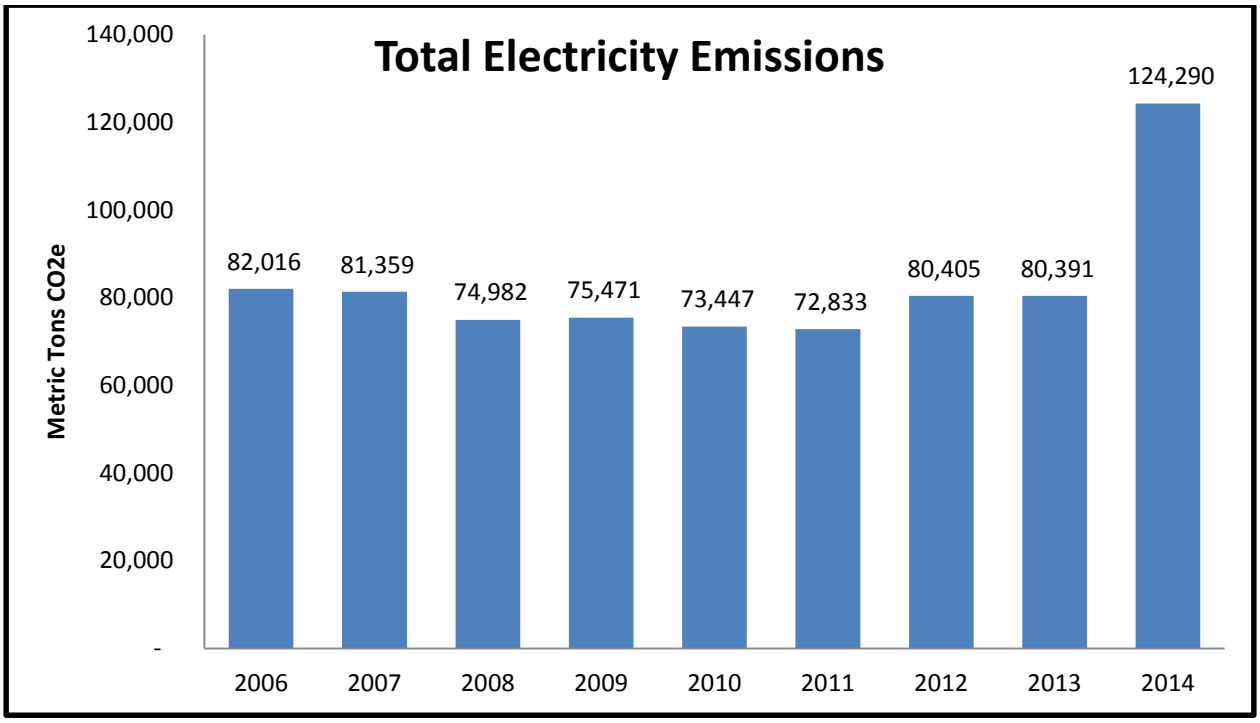


Figure 42 shows the total CO2e emissions calculated using the from EPA eGRID tool 2007 Plant Data (Appendix 1)

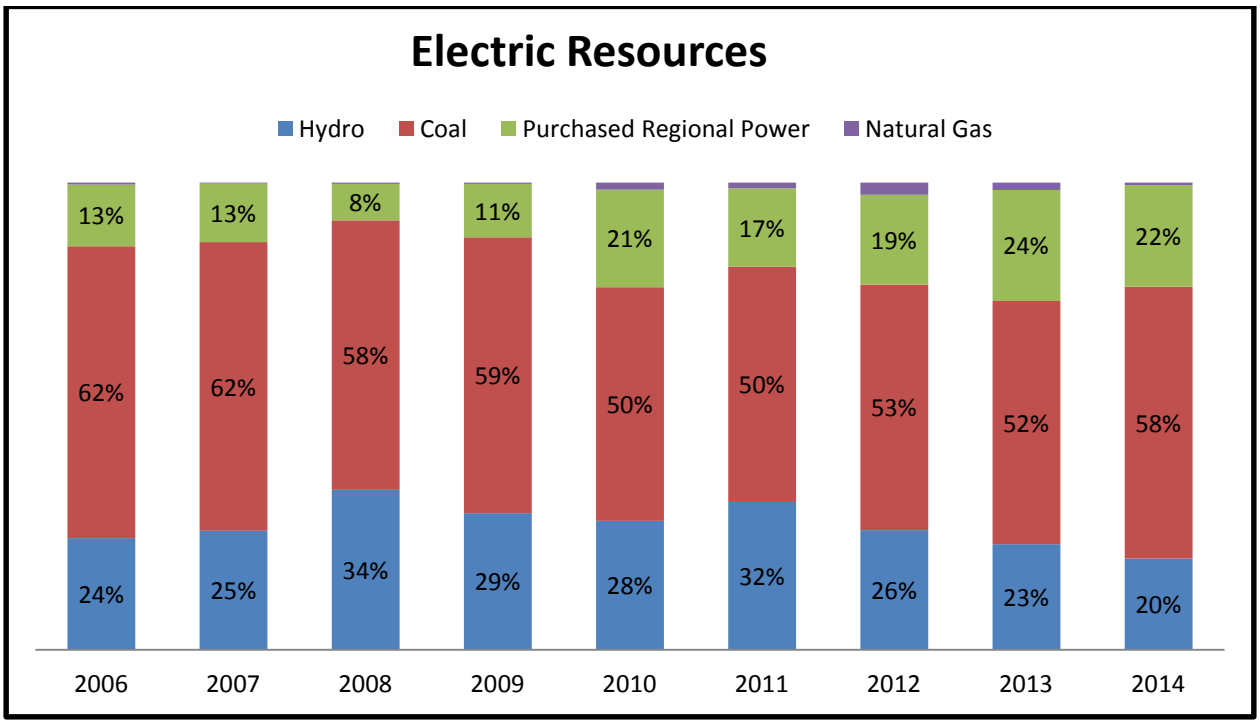


Figure 43 shows scheduling data for the Power Pool as a whole which includes both LANL and Los Alamos County.

10.1.3 Natural Gas Consumption

The DPU along with the Conservation Advisory Group established a conservation goal to improve natural gas efficiencies relative to the 2006-2011 baseline beginning in 2014. Figure 44 shows single family residential use as it compares to heating degree days for Los Alamos County. The single family residential class had been identified as a target class for conservation and additional analysis was done to determine what the residential natural gas usage per degree day per household was to determine efficiency levels in residential homes (Appendix 1). Since the efficiencies that we wanted to concentrate on were in the winter months when residential gas consumption would be at its highest we took the consumption for the months of May-September out of the analysis. Figure 45 shows the winter residential natural gas consumption in therms per degree day per household. This graph will allow us to measure efficiencies in relation to weather on an annual basis. The DPU's has a Long Term Departmental Goal of improving heating efficiency in Los Alamos County customers as measured by therms per capita per heating degree day with an initial goal of a reduction of 3% by 2030.

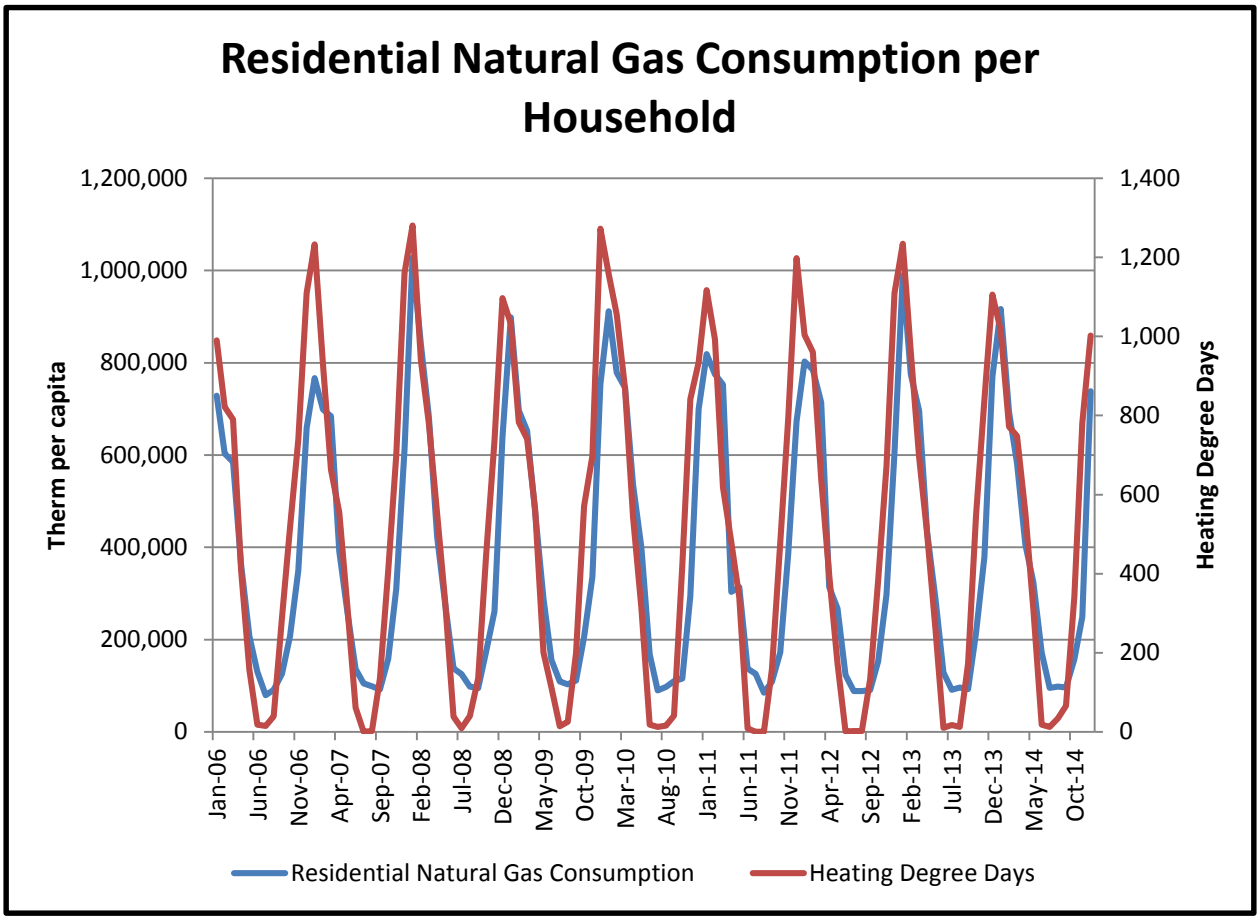


Figure 44 shows residential natural gas consumption per household for 2006-2014.

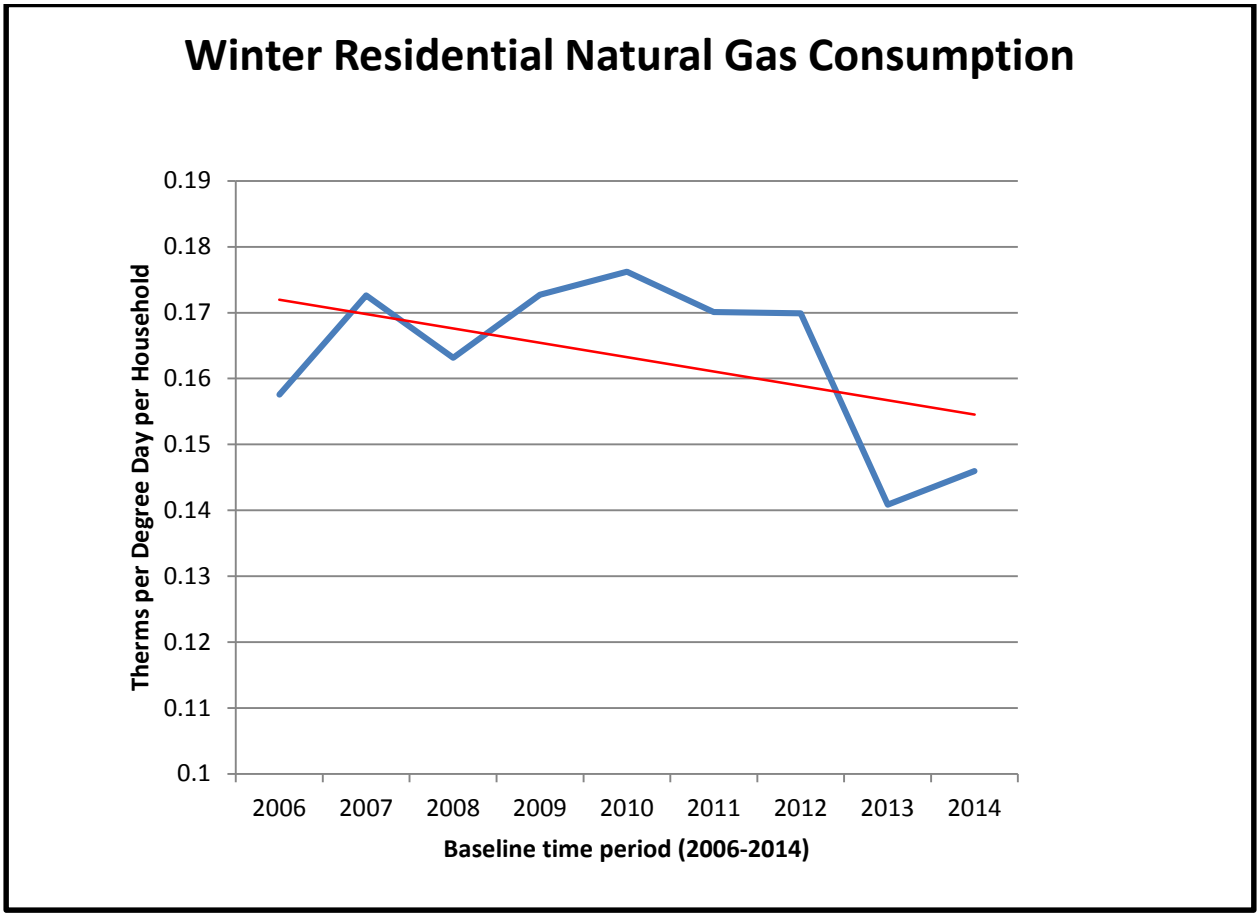


Figure 45 shows the winter residential natural gas consumption per degree day per household for Los Alamos County.

10.2 Residential Goals

The following implementation schedule was developed in following the direction received from the public input process and the Conservation Advisory Group. All proposed strategies will require the approval of the Board of Public Utilities and may be dependent upon available funding. A program for each developed strategy will be established based on prioritization.

Table 4: Water Conservation Residential Goals from Public Input			
Long Term Departmental Goal – Reduce water usage by 12% by the year 2050			
Goal	Activity / Monitoring/ Results	Staff / Resources Involved	Timeline
Increase Water Conservation Education and Outreach	Increase water conservation education in public schools (Task Orders and Water Festival)	PEEC DPU Conservation Coordinator WaterSense Program	Ongoing throughout 4 year Plan period
	Adult education efforts including annual home energy showcase and Outreach lectures and demonstration workshops	PEEC DPU Conservation Coordinator	Ongoing throughout 4 year Plan Period
Residential Irrigation Audits	Focus on irrigation audits to assist customers with tiered rate structure in peak summer months	DPU Conservation Coordinator QWEL BPI	Ongoing throughout 4 year Plan Period
Improve Water Rule W-8 with enforcement	Investigate effectiveness of rule as it exists and propose changes	Public Input DPU Conservation Coordinator BPU approval needed	1-2 years
Incentives for lawn replacement	Program would include landscape assistance, rebates for plant purchases and technical assistance with gray water systems or rain harvesting	DPU Conservation Coordinator Deputy of Finance BPU approval needed	2-4 years

Table 5: Energy Conservation Residential Goals from Public Input			
Long Term Departmental Goal – Improve heating efficiency in Los Alamos County Customers as measured by therms per capita per heating degree day with an initial goal of a reduction of 3% by 2030.			
Goal	Activity / Monitoring/ Results	Staff / Resources Involved	Timeline
Incentives for high efficiency washing machines and refrigerators	Develop a program and determine effect on revenue for both water and electric	DPU Conservation Coordinator Deputy of Finance BPU approval needed	2-4 years
Enhanced home energy audits	Continue blower door testing and expand to multi-family units	DPU Conservation Coordinator	Ongoing throughout 4 year Plan period
Neighborhood Audit program	Offer audit with energy efficiency experts and demonstrations for entire neighborhood with similar housing styles	DPU Conservation Coordinator BPI Santa Fe Community College	1-3 years
Increase energy conservation education and outreach	Increase energy conservation in schools and include as part of that annual water and energy festival	PEEC DPU Conservation Coordinator	Ongoing throughout 4 year Plan Period
	Increase adult education efforts with ongoing lectures/ demonstrations and annual home energy showcase	PEEC DPU Conservation Coordinator	Ongoing throughout 4 year Plan Period

10.2.1 Customer Billing

As a recommendation from the Conservation Advisory Group an effort was made to improve residential billing to include historical usage data. The customer billing changes were implemented in fall 2012 to include 13 months of usage for each utility including the current month so that consumption levels could be compared to the previous year. There was also a meter reading detail included to inform customers on their meter's multiplier, previous and current read and total consumption. Work is now being done to discuss changes that can be made for the e-bill customers that would extend customer access data for a longer time period.

10.2.2 Outdoor Water Use

The DPU has partnered with the New Mexico Water Conservation Alliance, the New Mexico Office of the State Engineer and the EPA to participate in "Fix a Leak" week which usually occurs in March. Work will be done to use this event which is nationally advertised to promote fix a leak demonstrations and targeted audits for high water users in the community. Resources and guides will also be developed to assist home owners on finding leaks in their homes and recommendations on how to fix them.

The current Water Rule-8 will be revisited to consider enforcement per recommendation from the Conservation Advisory Group. Other outdoor irrigation schedules will also be researched.

10.2.3 Audit improvements

Comprehensive energy and water conservation audits conducted by the DPU conservation staff continue to be in high demand and are popular among utility customers. The DPU invested recently in the acquisition of a blower door kit for use in the energy audits. A blower door is a tool that depressurizes a home which exaggerates the home's air leaks making the leaks easier to measure and locate. To encourage energy efficiencies in a home recommendations to make it most airtight are of utmost importance due to heat loss that occurs from air leaks most especially in older homes. The blower door kit comes with software that measures a home's leakage rate. As the test occurs a walkthrough with the homeowner allows for specific recommendations to be made based on the leaks that can be observed through the use of smoke indicators near a suspected leak and by viewing potential leaks through a thermographic imager camera. The blower door analysis will accomplish two things; demonstrate how leaky a home is and to locate leaks that are occurring. A detailed review of the home owner's consumption history will also continue along with analysis and targeted conservation suggestions.

Now that the audits have been recorded and mapped using GIS work will be done with PEEC to implement a Community Conservation Program that will include the development of customer friendly Best Energy Management Practices modeled for the different era homes in Los Alamos County. The model will offer utility customers cost/benefit information on how to best retrofit and upgrade their homes to increase energy efficiency.

Another program is being developed in which "neighborhood audits" will be conducted in areas of town with similar home structures. The conservation audit will be conducted in one

neighborhood home with a group of homeowners and then some “fixes” will be demonstrated such as sealing up an identified leak or replacing a broken sprinkler head, etc. The homeowners will then share the information with other homeowners or friends in their neighborhood, etc. Because the audits are very time consuming for the one person conservation staff the implementation of a community based outreach program in which homeowners educate one another is an effort to improve overall program efficiency.

The DPU Conservation Coordinator has also been trained to conduct commercial water audits and those will continue to be offered to small commercial customers as part of their commitment to reducing water consumption in their business practices as another “lead by example” component in Los Alamos County.

10.2.4 Outreach

General outreach to the public will continue to educate the public on subjects of interest. Public input thus far as well as recommendations from the Conservation Advisory Group has set forth some subjects of interest that include the following.

- ✓ Gray water use in the landscape
- ✓ Rainwater harvesting
- ✓ Xeriscaping and permaculture
- ✓ Energy efficiency upgrades

There are several demonstration gardens in the County and committed homeowners who have opened up their gardens and homes for educational purposes. Collaboration will continue between DPU conservation staff, PEEC, NMSU Master Gardener program and NMSU extension staff to bring in guest speakers and to implement outreach programs of specific interest to utility customers promoting energy and water conservation.

10.3 Multi-family goals

Now that the multi-family customer class has been developed and will be tracked independently specific goals for multi-family complexes will be developed. Because summer time irrigation will be less of a concern for multi-family complexes due to less landscaped areas more emphasis will be placed on water conservation retrofits in the form of toilets, showerheads, faucets and aerators. Home owner associations, apartment complex

newsletters, etc. will also be an avenue to distribute information. An audit process for multi-family complexes is in development and the data gathered from this process will be evaluated to develop strong multi-family water and energy conservation goals specific for Los Alamos County.

10.4 Commercial

Water Conservation Audits will now be offered to small commercial utility customers however the DPU does not have the resources to conduct audits for large facilities.

Focus will continue on the testing and replacement of large commercial meters on a scheduled basis and as identified in the continued large meter surveys.

The commercial consumption baseline will be further developed to look at small and large gas and electric customer classes independently. In addition energy sales will be broken down by rate class and large and small categories so that energy efficiency programs can target customer classes more appropriately.

10.5 Municipal

10.5.1 Coordination with the Los Alamos County Sustainability Program

The DPU Energy and Water Conservation Program will continue to work closely with the Los Alamos County Sustainability Program to develop goals for the community. The Los Alamos County Sustainability Program will focus on County initiatives and the DPU will focus on utility customers. Both programs will work together to promote sustainability initiatives for Los Alamos County.

10.5.2 County Lead by Example

The DPU's conservation program will provide technical assistance and expertise in the development of a strong "Lead by Example" component from Los Alamos County. A goal is in place currently to continue to provide assistance to Los Alamos County parks staff to support continued training for Parks staff and to continue to provide assistance on irrigation audits for Los Alamos County parks to identify water conservation savings opportunities and to reduce the amount of water used through a recommended irrigation schedule following the audit. A separate baseline for each park is being developed so that park managers can analyze the water

consumption for each park separately and so that a maintenance schedule can be put in place in coordination with these trends.

The County's Non-Potable Master Plan has already developed water use criteria that will be used to evaluate the efficiency of the existing systems and project water needs of new areas that are irrigated using treated effluent or non-potable water from the Los Alamos reservoir.

10.6 Educational

A school representative on the Conservation Advisory Group had several recommendations on how the DPU's conservation program could assist them with their water and energy conservation goals. It was recommended that a baseline be created for each campus outlining water and energy conservation trends. A school representative focusing on conservation would be assigned to collaborate with the conservation coordinator to ensure that educational teaching standards were being met with the outreach being conducted in the schools as well as to help develop new task orders and activities for faculty and students. For the time being water conservation audits will be conducted on each campus that will result in recommendations for each campus that the students and faculty can focus on and outreach on energy conservation measures will continue as well.

11 Conservation Plan Tracking Methods and Metrics

A significant aspect of the Department of Public Utilities Water and Energy Conservation Program includes the monitoring plan. Measurement and verification of the various programs are to be conducted on an annual basis and will include evaluations using multiple methods. The DPU currently collects and reports data using the Cayenta billing system. The DPU Conservation Coordinator will work in cooperation with other DPU staff to develop the means for measurement and verification functions.

11.1 OSE GPCD

The OSE GPCD spreadsheet will be completed annually and submitted to the Office of the State Engineer as a compliance requirement on water rights for Los Alamos County. This spreadsheet will be used to compare the County's water consumption with other communities in the southwest to help in development of water conservation goals.

11.2 AWE Tracking Tool

The AWE (Alliance for Water Efficiency) tracking tool is a resource to help water utilities in the planning and evaluation of conservation programs through analysis of water savings, costs and other benefits. This software will be used to track the efficiency of the water conservation program and similar tracking will take place to measure the efficiency of the energy conservation measures being implemented as part of the program.

11.3 ECoBa Study

The ECoBa (Evaluation and Cost Benefit Analysis) of municipal water conservation programs is a study that measured direct costs and benefits to evaluate the effectiveness of several types of conservation programs. The study is meant to provide water conservation programs a thorough analysis of conservation measures which have been or are currently being implemented to ascertain the actual water savings and the direct costs and benefits related to each program's implementation. Each conservation measure in place now will be compared against similar program measures in the study to evaluate its effectiveness. The study will also be used to measure the energy efficiency goals being implemented by the program.

11.4 Cayenta Billing System

Extensive work has been done with the Cayenta Billing system to ensure that the data needed by the DPU Energy and Water Conservation Program will be available. A new customer class has been established for multi-family and that consumption will be reported in the DPU's published consumption report. This customer class separation will make it easier for the DPU Conservation Coordinator to populate the OSE GPCD spreadsheet annually and to analyze customer class consumption trends in a timely manner.

11.5 EPA Energy Portfolio

The EPA Portfolio Manager is an interactive energy management tool that allows its customers to track and assess energy and water consumption across all its buildings in a secure online environment. Our access to EPA portfolio manager will allow us to support the Los Alamos County Sustainability Program in comparing all county owned buildings to other similar structures in the system to gain energy efficiency data.

11.6 Program Evaluation and Plan Revision Process

The DPU Conservation Coordinator will update the Board of Public Utilities quarterly on program activities and developments. The DPU Conservation program will also continue to work with the general public and county staff to continue to receive input necessary for successful implementation of conservation work in the community.

12 Appendix 1: Methodology for emissions and natural gas calculations

Methodology for Determining Greenhouse Gas Emissions from Electricity

The national standard for calculating greenhouse gas emissions from purchased electricity is to utilize the EPA eGRID tool. The eGRID tool utilizes regional emission factors to estimate emissions from electricity usage. A cost component summary is compiled monthly by Utilities staff which shows power purchased for the local power pool which is used by the community and by LANL. The County utilizes four sources of power: coal, natural gas, hydroelectric, and power purchased from the regional grid. The County is partial owner of the San Juan Generation station, a coal-fired power plant in New Mexico and has a life-of-plant entitlement of 10MW from another coal plant in Wyoming. The County owns two hydroelectric facilities (Abiquiu and El Vado) and also receives hydropower from federally owned facilities.

Emission factors for each source of electricity were taken from the 2009 EPA eGRID tool. Electricity generated from the San Juan plant resulted in emissions of 0.93 metric tons of CO_2 per megawatt hour. Electricity generated from the Wyoming plant resulted in 1.11 metric tons of CO_2 per megawatt hour. New Mexico is located in the WECC Southwest subregion and has an emission factor of 1,196.58 lbs of CO_2e per MWH which converts into 0.54 metric tons of CO_2e per MWH.

The emission factor for electricity from natural gas was taken from the World Resource Institute (2008) GHG protocol tool for stationary combustion version 4.0. The emission factor calculated was 0.2311 lbs of CO_2e per MWH. CO_2e is a measure for describing how much global warming a given type and amount of greenhouse gas may cause using the functionally equivalent concentration of carbon dioxide CO_2 as the reference.

The total emissions from purchased electricity for Los Alamos was determined by multiplying the electricity usage by the percentage generated from each source and then by the emission factor for each source.

Calculations for Natural gas Consumption per household

Residential natural gas consumption and number of households was taken from the Utility Consumption report. Heating degree days for Los Alamos County were taken from the LANL weather machine. The therms used were then divided by degree day and then divided by number of customers (households). The concentration was on the winter months so the months of May-September were taken out of the analysis.

13 Appendix 2: Conservation Advisory Group Recommendations

Advisory Group Recommendation Summary

Group Members were given the specific areas of development below:

2011 Conservation Advisory Group		
Participant	**Association**	**Designation**
Megan Lee	LAPS	LAPS
Rebecca Stradling	Homeowner-White Rock	Residential
Jeff Humpton	LAC Parks	Parks
Tom Nagawieki	LAC Environmental Services	Municipal
Mike Steinzig	Homeowner-Los Alamos	Residential
Steve Watts	Los Alamos Co-op	Commercial/Businesses
Suzie Havemann	Realtor	Residential
Robert Gibson	Homeowner-Los Alamos	Overall goals/baselines

Overall Goals – Robert Gibson

- Reduce natural gas use by at least 2% per year (adjusted for annual temperature variations)
- Reduce consumption of coal produced electricity by at least 3% per year
- System goal reduction of 12% for water as identified in our 40-year water plan over the next 40 years
- Reference the OSE review of our 40 year water plan document and Energy Usage report by Robert Gibson

Residential

- Provide quantifiable conservation targets for customers home type
- Use the Monitor to provide a monthly conservation column
- Increase conservation education and outreach
- Light bulb exchange program
- Increase compliance and awareness of Water Rule W-8
- Work with realtors/ Chamber of Commerce to include welcome packets for new homeowners that promote the audits and highlight conservation measures in the community
- Use door hangers to communicate with homeowners
- Provide energy retrofit recommendations based on housing type
- Incentives for high efficiency heating/cooling systems and water heaters
- How-to water conservation workshops
- Incentives for toilet replacement

Audits

- Offer the blower door test along with the thermographic imager
- Residential outdoor irrigation audit expansion

- Advertise audits through local media which emphasize potential savings and then conservation
- Target top consumers for a potential audit
- Increase number of audits performed each month
- Neighborhood audit program
- Neighborhood energy competition/education campaign

Billing

- Provide a 5-10 year consumption history for customers for gas, electricity and water consumption online and on their paper bill
    - Give customers the choice of enrolling in the online billing process
    - Provide room on the bill for important utility messages (conservation)
- Provide a comparison of other consumption patterns in the community
    - Number of people in the household
    - Average county values
    - Information gathered from energy / irrigation audits
    - When data becomes available from smart metering
    - Consider other contractors such as Opower (see attached article)

Landscaping

- Make landscaping materials more accessible to public
    - Helping with initial costs for landscaping materials
        - Gravel buys
        - Soil amendments
        - Plants and trees
    - Rain barrels at discounted prices
- Highlighting xeric yards in the community
- Bringing in guest speakers to offer information to homeowners
- Incentives for lawn removal

Rates

- Consider rate increase options beyond tiered rates

Municipal

- Use consistent data for the county's sustainability plan and the utility conservation plan and emphasize overlapping efforts as way for the County to Lead by Example
- Reference the County's sustainability Plan
- Use xeric landscaping on all municipal buildings as an educational example

Parks

- Give Parks their own baseline from which to work on for selected parks

- Educate park staff on new irrigation system installation and retrofits
- Install ET stations or moisture sensors on all new systems
- Work with Utility Conservation staff to audit high irrigation sites and implement irrigation scheduling strategies
- Provide more in-house or local training for parks staff

Los Alamos Public Schools

- Continue to work with local groups such as PEEC to provide educational outreach in water and energy conservation in the public schools targeting all age groups
    - Work with curriculum developers to ensure that outreach also highlights benchmark standards in place in various subjects
    - Provide opportunities for students to work at home with their families on conservation activities
    - Use the schools communication systems as a way for students to take the information home or to advertise the message to parents
        - Electronic message boards or use of the bridge for signs or promotional messages
- Work with LAPS Building maintenance and administrative staff to conserve and monitor energy and water usage in the LAPS buildings
    - Work with facilities coordinator on replacement for more efficient equipment
    - Assist current energy savings program staff in the schools
    - Offer campuses their own baseline data so that individual goals can be made for each campus
    - Meet with staff to develop activities for conservation events such as Earth Day, Fix A Leak Week, etc

Commercial/Businesses

- Offer free energy and water audits to establish baselines for commercial utility customers using the EPA's Portfolio Manager
    - Will give the commercial building the opportunity to earn an EPA energy star rating
- Work with Local Businesses to promote Conservation measures
- Have hotels/restaurants participate in public conservation outreach efforts (signs at tables/ in rooms)

14 Appendix 3: Summarization of feedback/ comments from Public Input Sessions

Energy

Draft Goal: Reduce usage of electricity by 3% & natural gas by 2% per year using the average 2006-2011 use as the baseline.

Rank the Following Programs*:

Enhanced home energy audits – Enhance existing free home energy audits provided by the County to offer more valuable information to the resident. Plans include adding a blower door test to the audit process and improving the final report provided at the end of the audit.

Household energy retrofit recommendations: Provide energy retrofit recommendations based on housing type, as the majority of the housing stock in Los Alamos County fits into certain classifications. Create written handouts to provide in-depth cost-benefit information for energy retrofits to specific housing types. Written materials to include successful retrofits made in the community. Provide average neighborhood usage data for comparison purposes.

Incentives for high efficiency heating/cooling systems & water heaters: Offer incentives for residents to replace outdated and inefficient appliances with highly efficient models. Space heating/cooling and water heating make up around 60% of the total energy usage of a household. Increasing the efficiency of these devices can have a significant impact upon household energy usage.

Increase energy conservation education and outreach: Develop specific events that would increase residents' access and exposure to energy conservation information. One potential program is an energy fair that would provide residents with educational information on energy conservation, and serve as a venue for renewable energy and energy conservation contractors to share information about their services.

Light bulb exchange program: Offer residents the opportunity to swap out old inefficient incandescent light bulbs for efficient compact fluorescent bulbs. Lighting accounts for 5 to 10% of the total usage in a household. Trading in inefficient light bulbs for efficient models can go a long way in reducing energy usage.

Neighborhood audit program: Provide an in-depth audit to a neighborhood group in a style home common in the area. The audit would include a handful of specific suggestions with potential energy savings and cost data. Attendees would then be tasked with sharing the information with neighbors. By engaging local community members the message could spread further and gain more community support.

Neighborhood energy competition/education campaign– Appoint an energy conservation leader for each neighborhood and have neighborhoods compete over a set time period to see which could save the most energy. Utilizing local community members as energy conservation advocates to create a healthy competitive atmosphere has been shown to be effective in changing behavior. These individuals would be responsible for hosting fun events to discuss energy conservation ideas.

**Note: Adoption of any of the above-mentioned Programs are dependent upon available funding and approval by pertinent governing bodies.*

Water

Draft Goal: Reduce water usage 12% by the year 2040 using the 2006 usage as the baseline.

Rank the Following Programs*:

How-to water conservation workshops: Implement how-to workshops that focus on water conservation practices. Free hands-on sessions taught by subject-area specialists on different methodologies to help reduce water usage. Specific subjects would include xeriscaping, composting, rainwater harvesting and the use of gray water systems.

Improve Water Rule W-8 with enforcement: Add enforcement measures to Water Rule W-8. The current rule states that water shall not be wasted, sets a watering schedule based on residential address, and forbids watering between 10 am and 5 pm from May 1st to September 30th. There is no enforcement associated with this rule, and there is a low level of participation. Increasing awareness of this rule and adding repercussions for violating the rule could help reduce water usage.

Incentives for lawn removal: Provide incentives for residents to remove their lawn and replace it with xeric/native plants and materials. Removing water thirsty lawns with plants that require less water will help reduce water usage.

Incentives for toilet replacement: Provide incentives for residents to replace inefficient toilets. Toilets are the king of indoor water usage, accounting for up to 30% of total water usage. Toilets made prior to 1994 use as much as 5 gallons per flush. Replacing an old toilet with a new water efficient model can save up to 10,000 gallons per year.

Increase conservation education and outreach: Create new education programs and outreach materials that will further promote understanding of water conservation methods by residents, businesses and schools.

Residential irrigation audits: Offer free audits of residential irrigation systems to identify potential water conservation measures that could be taken.

Tiered water rate structure: Propose a tiered water rate ordinance. Tiered rates are designed to reward customers who use less water by charging the lower rates for water used in the lower tiers. The more water a customer uses, the higher the tier(s), resulting in higher charges for water use. This approach is used extensively throughout the country and is an effective means to reduce water usage.

**Note: Adoption of any of the above-mentioned Programs are dependent upon available funding and approval by pertinent governing bodies.*

Waste and Recycling

Draft Goal: Reach 40% recycling rate by 2020 (current recycling rate is 24%)

Rank the Following Programs*:

Commercial glass recycling pickup: Offer a fee based service for businesses to recycle glass. This could increase business participation in the glass recycling program.

County reuse center: Establish a reuse center in the County to help extend the life of useful products. Reuse centers are effective at diverting household items and clothing from being sent to the landfill. Reuse centers also provide affordable goods to the community.

Curbside organic waste collection: Provide customers a third roll cart for food and yard waste that would be collected every other week. Organic waste makes up 27% of the waste stream. It is estimated that residents are currently throwing away approximately 2,000 tons of organic waste annually, a large percentage of which could be captured through a successful curbside organic waste collection program.

Increase materials accepted in curbside mixed recycling: Expand the curbside mixed recycling program to include materials currently not accepted. Materials to be included are #1-#7 plastics and paperboard. This would help the community capture more recyclable materials. About 80% of all plastic containers are #1 or #2, whereas only about 20% are #3 - #7.

Landfill ban: Ban certain recyclable materials from being disposed of as trash. Common materials that would be banned are cardboard, white goods (refrigerators) and green waste.

Mandatory commercial recycling: Require commercial entities such as restaurants, churches, businesses and apartment complexes to recycle. This tactic is commonly used across the Country in cities like New York City and Minneapolis to name a few. Los Alamos County has an opportunity to significantly expand recycling in the commercial sector.

Pay-As-You-Throw (PAYT): Propose a rate structure to enable residents to pay for trash services based on the amount of waste they generate. PAYT rate structures are in place in more than 7,000 communities across the U.S. and have been found to be extremely effective in reducing waste generation and increasing recycling.

**Note: Adoption of any of the above-mentioned Programs are dependent upon available funding and approval by pertinent governing bodies.*

Additional Comments from Public Input Sessions	
General Comments	Develop strategies to reduce carbon fuel energy and CO2 in transportation and land use
	Start land grading practices to reduce erosion and protect watershed, critical since fires have affected forest. Erosion on trails and roads (Pipeline road is a good example) has worsened due to increased runoff.
	Most of the proposals above would make an excellent start, our materialistic public has to be educated first. Sadly all they really understand is the cost of their desires. Therefore raise the price of non-sustainable resources.
	Preserving open space is vital to sustainability
	You probably know about this, but here are links of reuse-stores/information on them: http://the-idea-store.org/ http://www.reusealliance.org/wp-content/uploads/RA-Creative-Reuse-Centers-Overview-8-11.pdf http://www.scrap-sf.org/ I think, making people pay more money usually gets them to listen. Not even the schools or churches followed the water rule w-8 from what I have seen last summer. House audits with suggestions/incentives to change something might not work whenever a place is rented and not used by the owner himself/herself.
	I would like to rate all of the items for water and recycling as #1-they all sound great
	The golf course is not sustainable-get rid of it.
	Am wondering what is being done to monitor where we stared from and where we are going to. What has the County done to monitor our use? I am also wondering if we are going to be working on education, change of behaviors, etc.
	There are some excellent ideas here and I hope we are able to implement some of them. I am enthusiastically in support of anything that provides an economic incentive to people to change their behaviors.
	If Los Alamos County is wanting to be sustainable they should encourage the ownership of chickens by its residents. This would eliminate the 24% food waste from that household and from the county's waste stream. No pick up required. - Sustainability should also be encouraged in the area of households raising their own food. The Community garden is way too small to have any impact. There are large plots of county land that go untouched. Why not allow its residents to put this land to use? Horse waste and tree/brush waste could be recycled and put to use to build the soil on this large plot of land while also growing local food for the community.
	As a Los Alamos resident, I support the efforts of the County and DPU to achieve these goals. It will require changing the way we live in mainly minor ways; it is reasonable to expect that we must do so given the environmental issues we face. Thank you for moving this forward.
	Keep up the good work. The fact that LA county has an Environmental Sustainability board at all is great.

	You are doing very well considering the commercial and social forces you are having to contend with.
Energy Conservation Strategies	Provide incentives to install and USE programmable thermostats in commercial and residential occupancies. Provide incentives to install occupancy-sensing lighting controls in commercial occupancies. Provide incentives to install timers on electric heat lamps in residential bathrooms. Provide Incentives/requirements to install flow-restrictors on all shower heads and lavatory faucets.. Reduce/eliminate the street lighting in most residential areas. Eliminate the wasteful and redundant decorative street lights in downtown Los Alamos. Encourage replacement of inefficient windows in existing homes by eliminating strict enforcement of current building code requirements for window size and sill height.
	Could we encourage more distributed power generation in LA? There has been quite a bit of interest in solar electrical power gen in the past. Many folk here do indeed have the bucks to install alternative power gen systems. Maybe more info on the current status of such systems: re performance and cost and return on investment, Some input from locals with experience installing and owning.
	Encourage the use of more solar energy for water use.
	Would like to see incentives to add solar panels/sky lights at houses. Also, automatic light switches that go off /on by motion detection at houses and throughout the town.
	County wide update/upgrade of water and electrical meters.
	If compostable trash is chosen as a recycling strategy, please consider a natural gas harvesting program. Methane can be harvested from compost.
	Identified some households that will serve as good examples on how to reduce energy use by using different doors, winters, temperature control, or save waters by collecting water for re-use.
	More advertising about these energy audits. I have lived here for 16 years and attend fairs and have never heard of an energy audit. Set different rates for different times of the day. 8AM - 5PM is higher cost than at night to encourage people to lower their heating during the day and to turn off appliances / lights / computers during the day when they are gone.
	Make LA Green an opt out program instead of an opt in program. Provide county installed solar on the landfill for purchase by county residents to offset purchased electricity
	In Israel new or replaced hot water heaters are required to be solar. This is something that seems like a prudent thing to do. If not solar at least consider on demand hot water heaters. Most of this town is gone all day and yet we have hot water heaters keeping water hot for no one to use. I have heard it said that our houses are like two idling cars 24/7.
	Mandatory energy audit for public buildings - Schools, UNM-LA etc.
	Promote Photovoltaic systems through additional tax incentives. Start program

	"A PV on Every Roof." FDR had "a chicken in every pot." Distributed electric generation benefits user by reduction in electric bill, and power into the grid in the day provides energy to commercial and LANL operations.
	Incentives for residential solar electricity
	The green energy program could be advertised more. Also, why is it limited to 90% of my energy consumption? I would like Los Alamos to get out of its San Juan Generating Station contract and stop using electricity produced from burning fossil fuels.
	Less restrictions from the permit department when it comes to energy efficiency. I am in a Group 11 Duplex. Last time I tried to change a toilet, they said I'd have to redo my whole bathroom to meet new standards. Then when I wanted to replace windows, I was going to have to actually cut the walls and add bigger windows, and if I did that in the bathroom I'd have to again remodel the whole thing to meet new codes. So, I did both on my own without permits and had to feel sneaky and bad when I was trying to do the right thing saving energy and money. It sucks.
	I am opposed to the County's proposal to install smart meters at residential and commercial structures. I believe the County can implement effective energy conservation strategies without "upgrading" technology. An intelligent community like Los Alamos should be provided the opportunity to choose whether or not smart meters belong in our utility grid, and all residents must be allowed the option to opt-out of having a smart meter attached to their homes. Additionally, residents must be informed when smart meters are attached to homes within at least a 300 meter radius.
	I like the introduction of solar generation that I see around town and would encourage the expansion of this for rooftops on municipal buildings and garages.
Water Conservation Strategies	Also, water collecting systems to collect rain water at individual homes and re-use it in the garden.
	County wide update/upgrade of water and electrical meters.
	Rebate for water collection barrels as was done in SF County
	Aquifer height should be monitored and large scale aquifer recharge plans implemented
	education/workshops on grey water vs effluent water drip irrigation workshops
	Incentives for water catchment and grey water re-use systems. - Building the soil using horse manure and mulch from the transfer station leads to garden beds that retain moisture which leads to up to a 75% reduction in water usage in gardens. Permaculture techniques should be encouraged and rewarded. I place lawn replacement with natural grasses and wild flowers in the same category.
	incentives/education for residential grey water capture/use

	Do not want pay as you throw , tiered water rates. Use gentle approaches
	Water conservation is critical to our future. Thanks for addressing it.
	I think promotion of grey water for landscaping is a great idea.

15 Appendix 4: New Mexico Office of the State Engineer GPCD Spreadsheets

NMOSE GPCD CALCULATOR

Gallons per Capita - v2.04 Beta

Release Date: Mar, 16, 2009

This spreadsheet-based GPCD calculator is designed to help quantify and track water uses associated with water distribution systems. The spreadsheet contains several separate worksheets. Sheets can be accessed using the tabs towards the bottom of the screen, or by clicking the buttons on the left below. Descriptions of each sheet are also given below.

It should be noted that all the recorded data should be from actual metered results and should not include any estimates.

THE FOLLOWING KEY APPLIES THROUGHOUT:

- Value to be entered by user
- Dropdown box, pick from list
- Value calculated based on input data
- No longer available for input

Look for the following boxes that provide additi
Instructions Info

Please begin by providing the following information, then proceed through each sheet:

NAME OF CITY OR UTILITY: Los Alamos County — New Mexico

REPORTING YEARS: Enter the most recent reporting year: 2013 — Data can be entered back to: 2007

NAME OF CONTACT PERSON: Christine Y. Chavez — **E-MAIL:** cy.chavez@lacnm.us — **TELEPHONE:** 505-662-8147 **Ext.**

SELECT THE REPORTING UNITS FOR VOLUME DATA: Gallons (US) — Gallons per Capita - v2.04 Beta

Instructions & Utility	This sheet
Census Data	Census data and the portal to get the data from the Census website
Single-Family	Single-Family residential gallons and population
Multi-Family	Multi-Family residential gallons and population
ICI & Other Metered	Other data including Commercial, Industrial and Institutional [1.3] and Other metered [1.4] categories
Reuse	Data related to water reuse projects
Total Diverted	Total Production and Diverted Water
Reported Data	The calculated data graphical review of most common performance indicators
Annual Performance	The calculated data graphical review of **annual** performance indicators
Monthly Performance	The calculated data graphical review of **monthly** performance indicators
Definitions	Use this sheet to understand terms used in the audit process

All parties reserve the right to validate the data recorded in this document. This does not bind the OSE or the Utility to the results. It is a tool used for planning purposes.

If you have questions or comments regarding the software please contact us at: waternm@state.nm.us

Census Information Data Table 2.1

Info

Click here to access the Census Web site

OR

Click here for instructions on how to find the data on the Census website

2013 TO 2007

Use the most recent census data

Return to Instructions

DATA

US Census Table	Description		INPUT
		CENSUS YEAR	2010
P37	Group Quarters Population	Total	**124**
H3	Occupancy Status	Total	**8,354**
from H3		Occupied	**7,663**
from H3		Vacant	**691**
H12	Ave. Household Size of Occupied Housing Units	Total	**2.33**

Formula: Household Size = Total Population / Total Number of Housing Units

Vacancy Rate %	8.3%

COMMENTS:

DATA INPUT SHEET

Los Alamos County

Instructions

3. SINGLE-FAMILY RESIDENTIAL (SFR)

Return to Instructions

MONTHLY DATA

TABLE 3.1 Info

2013 TO 2007

SFR BILLED WATER CONSUMPTION (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2013	20,496,000	16,225,000	16,579,000	28,921,000	51,390,000	76,121,000	71,977,000	52,219,000	48,435,000	35,013,000	20,597,000	15,939,000
2012	18,147,000	14,030,000	23,042,000	22,091,000	57,004,000	78,009,000	82,714,000	68,750,000	55,520,000	53,003,000	29,417,800	22,877,590
2011	19,011,000	16,908,000	23,571,000	27,385,000	50,605,000	64,440,000	101,524,000	77,689,000	48,319,000	37,970,000	25,065,000	19,800,000
2010	18,752,000	15,770,000	21,188,000	13,929,000	42,197,000	77,716,000	69,237,000	55,788,000	47,968,000	51,155,000	26,682,000	24,830,000
2009	26,162,000	20,087,000	25,550,000	23,389,000	40,307,000	19,698,000	55,850,000	62,896,000	52,327,000	37,313,000	21,009,000	22,024,000
2008	22,274,000	19,348,000	19,994,000	20,436,000	44,328,000	58,415,000	76,283,000	60,401,000	47,679,000	49,167,000	23,065,000	26,684,000
2007	17,206,000	16,816,000	22,077,000	22,977,000	31,204,000	49,325,000	75,086,000	60,663,000	55,232,000	40,174,000	30,497,000	25,433,000

TABLE 3.2 Info

Active Connections Only

You have chosen to enter Active Connections Only, enter the monthly values below, or enter annual values in table 3.8 Check message above Table 3.3 to see if additional data is required.

NUMBER OF SFR CONNECTIONS (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2013	5,338	4,727	5,352	5,379	5,423	5,384	5,321	5,346	5,034	5,387	4,798	5,354
2012	4,595	5,310	5,366	4,578	5,409	5,376	5,130	5,369	5,000	5,405	4,749	5,370
2011	5,369	5,016	5,418	4,738	5,400	4,590	5,329	5,392	5,343	5,346	4,948	5,054
2010	5,041	5,025	5,389	5,316	5,387	5,404	4,743	5,382	5,412	5,011	4,976	5,358
2009	5,395	5,056	5,445	5,079	5,392	5,398	5,328	5,097	5,397	5,396	4,679	5,383
2008	5,441	5,087	5,421	5,384	5,384	5,374	5,374	5,378	5,043	5,402	4,323	5,414
2007	4,921	5,287	5,298	5,280	5,287	5,291	5,355	5,392	5,001	5,340	5,019	5,389

TABLE 3.3 Info

You have entered Active Connections Only in Table 3.2; leave the cells below blank

INACTIVE (ZERO USE) SFR CONNECTIONS (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2013												
2012												
2011												
2010												
2009												
2008												
2007												

TABLE 3.4

Formula = (No. of Connections - No. of Zero Use Accounts) * Ave. Household Size

SFR POPULATION (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2013	12,438	11,014	12,470	12,533	12,636	12,545	12,398	12,456	11,729	12,552	11,179	12,475
2012	10,706	12,372	12,503	10,667	12,603	12,526	11,953	12,510	11,650	12,594	11,065	12,512
2011	12,510	11,687	12,624	11,040	12,582	10,695	12,417	12,563	12,449	12,456	11,529	11,776
2010	11,746	11,708	12,556	12,386	12,552	12,591	11,051	12,540	12,610	11,676	11,594	12,484
2009	12,570	11,780	12,687	11,834	12,563	12,577	12,414	11,876	12,575	12,573	10,902	12,542
2008	12,678	11,853	12,631	12,545	12,545	12,521	12,521	12,531	11,750	12,587	10,073	12,615
2007	11,466	12,319	12,344	12,302	12,319	12,328	12,477	12,563	11,652	12,442	11,694	12,556

TABLE 3.5

Formula = Billed Water Consumption (SFR only) / Calculated Population (SFR only)

SFR GPCD CALCULATION (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2013	53.16	52.61	42.89	76.92	131.20	202.27	187.28	135.23	137.65	89.98	61.41	41.22
2012	54.68	40.50	59.45	69.03	145.91	207.59	223.23	177.28	158.86	135.76	88.62	58.98
2011	49.02	51.67	60.23	82.69	129.74	200.85	263.76	199.48	129.38	98.33	72.47	54.24
2010	51.50	48.10	54.43	37.49	108.45	205.74	202.10	143.51	126.80	141.33	76.71	64.16
2009	67.14	60.90	64.96	65.88	103.49	52.20	145.12	170.84	138.71	95.73	64.24	56.64
2008	56.68	58.30	51.06	54.30	113.99	155.51	196.52	155.49	135.26	126.01	76.33	68.24
2007	48.41	48.75	57.69	62.26	81.71	133.37	194.13	155.76	158.00	104.16	86.93	65.34

COMMENTS:

ANNUAL DATA

TABLE 3.6

ANNUAL CONSUMPTION

TABLE 3.7

ANNUAL CALCULATION
453,912,000
524,605,390
512,287,000
465,212,000
406,612,000
468,074,000
446,690,000

TABLE 3.8

AVG. ANNUAL CONNECTIONS

TABLE 3.9

AVG CONN. CALCULATION
5,237
5,138
5,162
5,204
5,254
5,252
5,238

TABLE 3.10 Info

CALCULATED GROWTH RATE
1.92%
-0.46%
-0.80%
-0.95%
0.03%
0.26%

TABLE 3.11

No. VACANT SFR CONNECTIONS

TABLE 3.12 Info

SIZE OF HOUSEHOLD
2.33
2.33
2.33
2.33
2.33
2.33
2.33

TABLE 3.13 Info

SFR POPULATION
12,202
11,972
12,027
12,125
12,241
12,237
12,205

TABLE 3.14 Info

ANNUAL SFR GPCD
101.92
120.06
116.70
105.12
91.00
104.79
100.27

DATA INPUT SHEET

Los Alamos County

Instructions

4. MULTI-FAMILY RESIDENTIAL (MFR)

Return to Instructions

MONTHLY DATA

2013 TO 2007

TABLE 4.1 Info

MFR BILLED WATER CONSUMPTION (Monthly) (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2013	7,974,000	7,681,000	8,887,000	8,942,000	13,204,000	16,515,000	13,641,000	12,688,000	12,201,000	8,710,000	7,141,000	8,099,000
2012	8,299,000	8,073,000	8,067,000	8,719,000	12,862,000	18,041,000	16,927,000	15,062,000	12,787,000	10,517,000	9,102,000	8,181,000
2011	8,290,000	7,558,000	9,499,000	9,634,000	12,940,000	16,456,000	19,854,000	14,812,000	11,611,000	10,142,000	8,216,000	8,600,000
2010	8,024,000	7,433,000	8,360,000	9,019,000	9,868,000	15,101,000	15,132,000	11,015,000	13,423,000	10,220,000	7,499,000	8,641,000
2009	7,594,000	7,208,000	8,389,000	8,075,000	11,411,000	11,942,000	12,958,000	13,292,000	11,476,000	9,050,000	7,424,000	9,332,000
2008	8,363,000	8,601,000	7,816,000	8,919,000	11,837,000	13,295,000	16,716,000	12,956,000	10,038,000	12,285,000	6,857,000	8,285,000
2007	8,585,000	7,442,000	8,468,000	8,827,000	9,667,000	12,892,000	16,500,000	14,137,000	12,673,000	9,261,000	9,861,000	8,186,000

TABLE 4.2

If only Current Number of Units is Known, put this number in Table 4.7

NUMBER OF MFR UNITS (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2013	2,941	2,807	2,977	2,859	2,923	2,839	2,818	2,838	2,823	2,962	2,666	2,952
2012	2,588	2,810	3,103	2,675	3,053	2,879	2,956	2,973	2,952	2,864	2,974	3,004
2011	3,176	2,811	3,057	2,941	3,048	2,798	3,025	3,045	2,951	2,950	2,870	2,923
2010	2,855	2,726	3,057	3,047	3,114	3,022	2,883	2,953	3,211	2,959	2,813	3,030
2009	2,919	2,868	3,179	2,888	2,952	2,988	2,964	2,970	2,971	2,991	2,844	3,081
2008	2,977	2,973	2,974	2,963	2,966	2,960	2,971	2,977	2,795	2,985	2,806	3,111
2007	2,964	2,932	2,999	2,938	3,014	2,977	2,966	2,985	2,975	2,978	2,976	2,982

TABLE 4.3

Formula = (Number of Units - Vacant MFR Connections) * Ave. Household Size

MFR POPULATION (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2013	6,300	5,988	6,384	6,109	6,258	6,062	6,013	6,060	6,025	6,349	5,659	6,326
2012	5,471	5,988	6,671	5,673	6,554	6,149	6,328	6,368	6,319	6,114	6,370	6,440
2011	6,828	5,978	6,551	6,281	6,530	5,948	6,477	6,523	6,304	6,302	6,115	6,239
2010	6,079	5,779	6,550	6,527	6,683	6,468	6,145	6,308	6,909	6,322	5,981	6,487
2009	6,229	6,110	6,835	6,157	6,306	6,390	6,334	6,348	6,350	6,397	6,055	6,607
2008	6,367	6,358	6,360	6,334	6,341	6,327	6,353	6,367	5,943	6,386	5,969	6,679
2007	6,333	6,258	6,415	6,272	6,449	6,363	6,338	6,382	6,359	6,366	6,361	6,375

TABLE 4.4

Formula = MFR Billed Water Consumption (Monthly) / MFR Population (Monthly)

MFR GPCD CALCULATION (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2013	40.83	45.81	44.91	48.79	68.06	90.81	73.18	67.54	67.50	44.25	42.06	41.30
2012	48.94	48.15	39.01	51.23	63.30	97.80	86.29	76.30	67.46	55.49	47.63	40.98
2011	39.16	45.15	46.77	51.13	63.92	92.23	98.89	73.25	61.39	51.92	44.78	44.47
2010	42.58	45.94	41.17	46.06	47.63	77.82	79.44	56.33	64.76	52.15	41.79	42.97
2009	39.33	42.13	39.59	43.72	58.37	62.29	65.99	67.54	60.24	45.64	40.87	45.56
2008	42.37	48.32	39.64	46.93	60.21	70.04	84.88	65.64	56.30	62.06	38.30	40.01
2007	43.73	42.47	42.58	46.91	48.35	67.53	83.98	71.46	66.43	46.93	51.67	41.42

ANNUAL DATA

TABLE 4.5

ANNUAL CONSUMPTION

TABLE 4.6

ANNUAL CALCULATION
125,683,000
136,637,000
137,612,000
123,735,000
118,151,000
125,968,000
126,499,000

TABLE 4.7

No. CURRENT UNITS

TABLE 4.8

ANNUAL UNIT CALCULATION
2,867
2,903
2,966
2,973
2,968
2,955
2,974

TABLE 4.9 Info

MFR POPULATION
6,128
6,204
6,340
6,353
6,343
6,315
6,356

TABLE 4.10

VACANT MFR CONNECTIONS
237
240
245
246
245
244
246

TABLE 4.11 Info

ANNUAL MFR GPCD
56.19
60.34
59.47
53.36
51.03
54.65
54.53

DATA INPUT SHEET

5. INDUSTRIAL, COMMERCIAL & INSTITUTIONAL (ICI) AND OTHER METERED

Return to Instructions

Info

Los Alamos County

Instructions

MONTHLY DATA

2013 TO 2007

TABLE 5.1

ICI WATER CONSUMPTION (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2013	11,195,000	6,861,000	5,947,000	6,842,000	13,745,000	20,696,000	22,750,000	17,920,000	19,144,000	12,683,000	7,706,000	5,703,000
2012	10,593,833	7,076,400	9,187,400	8,954,700	18,249,900	30,796,500	29,577,700	27,941,000	22,721,700	19,666,183	11,291,717	8,067,200
2011	7,881,000	7,201,000	6,768,000	7,613,000	18,041,000	30,624,000	29,846,000	40,891,000	23,745,000	18,087,000	9,923,000	9,024,000
2010	9,104,000	7,799,000	10,450,000	6,432,000	18,551,000	27,480,000	25,641,000	25,345,000	21,939,000	22,262,000	9,698,000	9,943,000
2009	12,393,000	11,592,800	8,679,900	18,181,480	17,509,370	6,651,650	24,686,160	25,559,240	20,668,990	15,984,910	7,446,000	4,816,020
2008	5,278,626	6,874,000	16,397,000	7,069,200	20,130,200	21,353,600	18,503,400	30,775,600	24,551,200	23,092,900	9,989,100	12,534,300
2007	12,124,834	11,153,014	15,459,592	13,530,700	17,215,700	24,335,000	23,923,774	38,029,626	22,988,000	16,713,300	11,684,700	8,501,474

TABLE 5.2

OTHER METERED (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2013												
2012												
2011												
2010												
2009												
2008												
2007												

COMMENTS:

Commercial + Municipal + Educational

ANNUAL DATA

TABLE 5.3 ICI ANNUAL CONSUMPTION	TABLE 5.4 ICI GPCD	TABLE 5.5 ICI ANNUAL CALCULATED
	22.45	**151,192,000**
	30.56	**204,124,233**
	31.06	**209,644,000**
	28.67	**194,644,000**
	25.51	**174,169,520**
	28.83	**196,549,126**
	31.62	**215,659,714**

TABLE 5.6 OTHER ANNUAL CONSUMPTION	TABLE 5.7 OTHER METERED GPCD	TABLE 5.8 OTHER ANNUAL CALCULATED
	N/A	**N/A**
	N/A	**N/A**
	N/A	**N/A**
	N/A	**N/A**
	N/A	**N/A**
	N/A	**N/A**
	N/A	**N/A**

DATA INPUT SHEET | Info

Los Alamos County

6. REUSE

Return to Instructions

Instructions

MONTHLY DATA

2013 TO 2007

TABLE 6.1

REUSE DIVERSIONS (Monthly) (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2013	1	1	3,867,063	11,552,192	20,165,106	21,739,135	9,850,279	10,504,260	7,470,298	6,106,035	876,738	1
2012	1	1	5,638,165	9,032,844	17,904,886	24,743,657	16,050,773	18,097,000	13,174,880	11,028,777	4,256,322	1
2011	104,800	96,900	7,369,900	14,612,700	19,023,600	22,388,800	21,091,000	7,950,983	4,660,344	6,392,581	1,293,627	1
2010	81,600	107,100	145,200	11,178,612	11,427,200	23,262,400	12,140,000	5,531,600	18,847,100	8,367,300	249,300	126,800
2009	17,500	41,300	67,000	6,697,500	8,119,700	11,247,200	15,859,700	18,253,100	8,672,800	9,549,500	4,133,600	106,400
2008	20,900	40,800	3,232,600	8,366,100	12,907,100	21,961,600	15,917,500	10,432,700	12,902,000	8,505,700	1,490,900	40,900
2007	103,400	140,100	6,964,300	12,236,800	8,810,900	21,080,900	16,384,200	23,650,900	8,005,000	9,609,000	3,639,000	31,000

COMMENTS:

A one was entered for the zero values for the months of Jan/Feb 2012, December 2012 and December 2011 so that the spreadsheet could cacluate GPCD

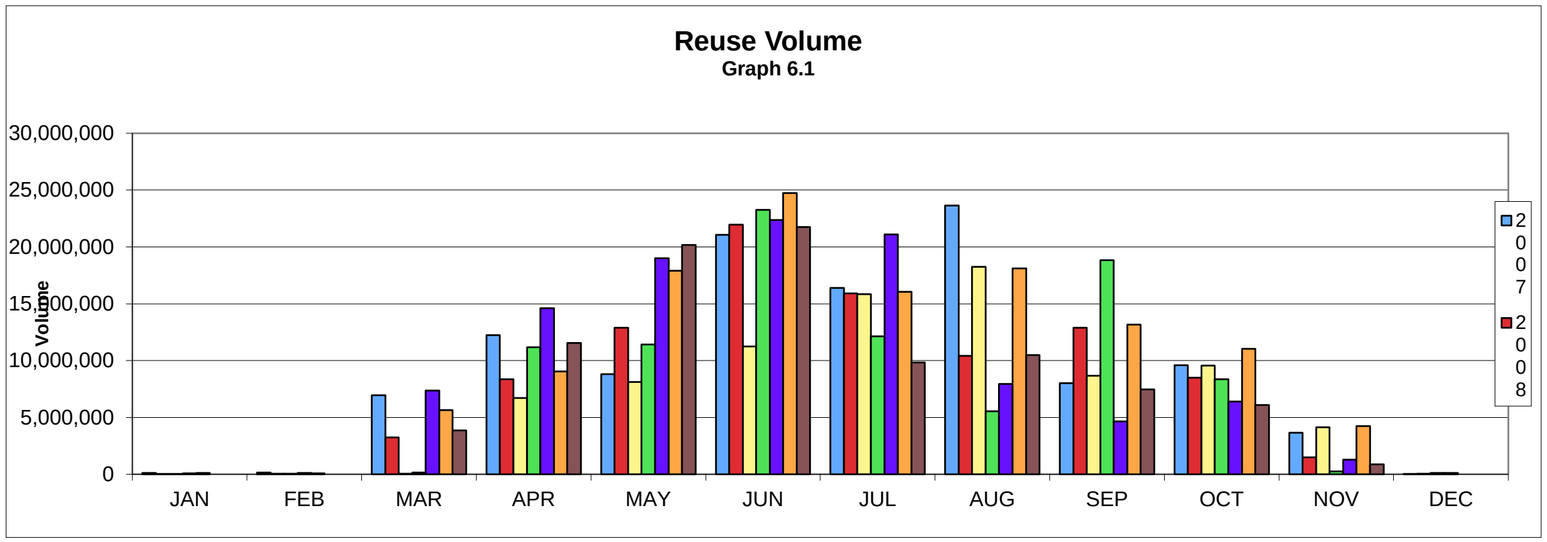
ANNUAL DATA

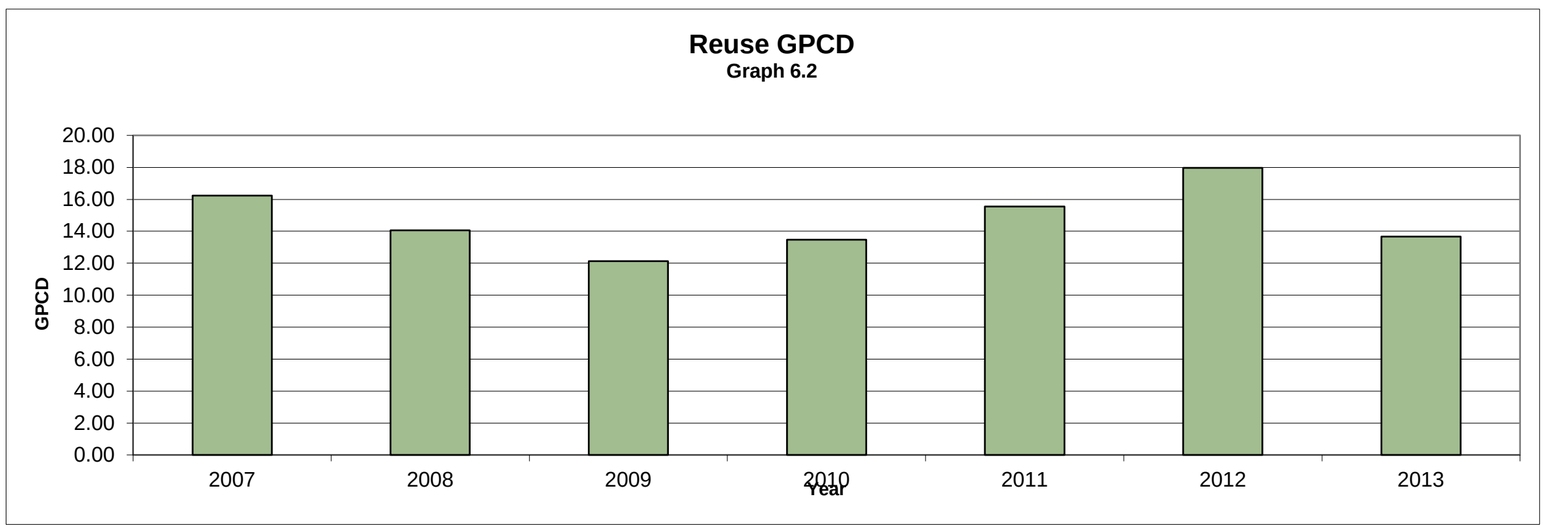
TABLE 6.2

REUSE ANNUAL DIVERSIONS

TABLE 6.3

REUSE GPCD
13.68
17.96
15.56
13.47
12.12
14.06
16.22





NMOSE GPCD Calculator v2.02

DATA INPUT SHEET

Los Alamos County

7. TOTAL WATER DIVERTED AND SUPPLIED

Return to Instructions

MONTHLY DATA

TABLE 7.1 2013 TO 2007

TOTAL WATER DIVERTED (Monthly) (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2013	81,917,000	71,595,000	83,973,000	102,579,000	152,608,000	170,767,000	136,921,000	135,066,000	109,160,000	95,329,000	72,536,000	78,945,000
2012	82,661,700	69,190,300	85,670,000	109,318,000	163,812,000	197,997,000	179,776,000	159,637,000	144,913,000	122,192,000	80,718,000	83,439,000
2011	81,004,000	81,482,000	90,902,000	126,012,000	161,799,000	198,406,000	184,457,000	123,317,000	110,506,000	104,596,000	78,570,000	76,860,000
2010	76,333,000	70,749,000	82,755,000	81,326,000	133,757,000	180,164,000	156,474,000	126,177,000	133,013,000	111,545,000	77,451,329	88,229,000
2009	81,361,000	76,543,000	87,361,000	88,798,000	151,694,000	140,193,000	161,093,000	155,633,000	120,918,000	92,067,000	78,247,000	85,929,000
2008	93,243,000	79,487,000	85,840,000	107,486,000	160,462,000	192,944,000	169,289,000	148,537,000	129,824,000	106,548,000	85,380,725	82,785,000
2007	80,544,000	76,685,000	87,016,000	95,260,000	125,084,000	162,839,000	172,484,000	167,272,000	118,568,000	114,678,000	91,380,000	86,023,000

TABLE 7.2

IMPORTED WATER (Monthly)(Gallons (US)) Info

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2013												
2012												
2011												
2010												
2009												
2008												
2007												

TABLE 7.3

EXPORTED WATER (Monthly) (Gallons (US)) Info

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2013	34,157,620	29,673,620	30,484,280	25,629,270	26,420,100	28,455,360	36,036,030	35,773,540	31,803,760	30,889,410	30,907,190	29,549,140
2012	33,976,790	31,111,040	30,945,380	30,361,480	35,650,090	39,560,560	41,969,120	44,359,720	41,365,310	43,986,330	31,005,310	34,763,240
2011	30,941,680	32,069,010	31,559,390	32,417,950	41,797,130	47,764,100	41,386,960	39,369,280	34,507,460	31,195,970	32,784,870	30,914,740
2010	27,669,780	31,723,200	47,397,810	19,740,800	50,069,470	27,979,260	41,127,820	39,362,040	32,726,930	30,883,230	30,988,209	33,087,840
2009	38,622,440	25,067,360	26,753,190	26,021,190	32,701,620	29,221,980	42,961,460	37,185,000	31,008,880	30,911,340	25,372,820	37,988,830
2008	25,857,380	26,950,490	26,869,660	26,147,380	31,507,520	36,311,820	39,721,410	34,304,380	32,794,680	31,242,470	29,942,810	28,840,030
2007	28,059,910	23,929,970	26,373,510	24,420,760	28,218,810	28,683,970	29,557,910	31,483,700	25,203,640	32,891,200	26,637,950	27,405,950

TABLE 7.4 **Formula = Total Water Diverted + Imported water - Exported Water**

TOTAL WATER SUPPLY (Monthly) (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2013	47,759,380	41,921,380	53,488,720	76,949,730	126,187,900	142,311,640	100,884,970	99,292,460	77,356,240	64,439,590	41,628,810	49,395,860
2012	48,684,910	38,079,260	54,724,620	78,956,520	128,161,910	158,436,440	137,806,880	115,277,280	103,547,690	78,205,670	49,712,690	48,675,760
2011	50,062,320	49,412,990	59,342,610	93,594,050	120,001,870	150,641,900	143,070,040	83,947,720	75,998,540	73,400,030	45,785,130	45,945,260
2010	48,663,220	39,025,800	35,357,190	61,585,200	83,687,530	152,184,740	115,346,180	86,814,960	100,286,070	80,661,770	46,463,120	55,141,160
2009	42,738,560	51,475,640	60,607,810	62,776,810	118,992,380	110,971,020	118,131,540	118,448,000	89,909,120	61,155,660	52,874,180	47,940,170
2008	67,385,620	52,536,510	58,970,340	81,338,620	128,954,480	156,632,180	129,567,590	114,232,620	97,029,320	75,305,530	55,437,915	53,944,970
2007	52,484,090	52,755,030	60,642,490	70,839,240	96,865,190	134,155,030	142,926,090	135,788,300	93,364,360	81,786,800	64,742,050	58,617,050

Table 7.5

SYSTEM TOTAL GPCD (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2013	83	81	94	139	221	257	176	174	140	113	75	86
2012	86	74	96	144	226	289	243	203	189	138	91	86
2011	87	95	104	169	209	272	250	146	137	128	83	80
2010	84	75	61	110	145	273	200	151	180	140	83	96
2009	74	98	105	112	205	198	204	204	160	105	94	83
2008	116	100	102	145	223	280	224	197	173	130	99	93
2007	91	101	105	126	167	239	247	234	167	141	115	101

COMMENTS:

Exported Water = LANL sales This spreadsheet uses total water delivered to the system for total water diverted table 7.1

ANNUAL DATA

TABLE 7.6

ANNUAL TOTAL DIVERTED

TABLE 7.7

ANNUAL TOTAL DIVERTED CALC
1,291,396,000
1,479,324,000
1,417,911,000
1,317,973,329
1,319,837,000
1,441,825,725
1,377,833,000

TABLE 7.8

ANNUAL TOTAL IMPORTED

TABLE 7.9

ANNUAL TOTAL IMPORT CALC
N/A
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 7.10

ANNUAL TOTAL EXPORTED

TABLE 7.11

ANNUAL TOTAL EXPORT CALC
369,779,320
439,054,370
426,708,540
412,756,389
383,816,110
370,490,030
332,867,280

TABLE 7.12

ANNUAL TOTAL WATER SUPPLY
921,616,680
1,040,269,630
991,202,460
905,216,940
936,020,890
1,071,335,695
1,044,965,720

Info

TABLE 7.13

TOTAL POP. EST.
18,454
18,299
18,491
18,602
18,708
18,677
18,685

TABLE 7.14

Info

Year	SYSTEM TOTAL GPCD
2013	**136.83**
2012	**155.75**
2011	**146.86**
2010	**133.32**
2009	**137.07**
2008	**157.16**
2007	**153.22**

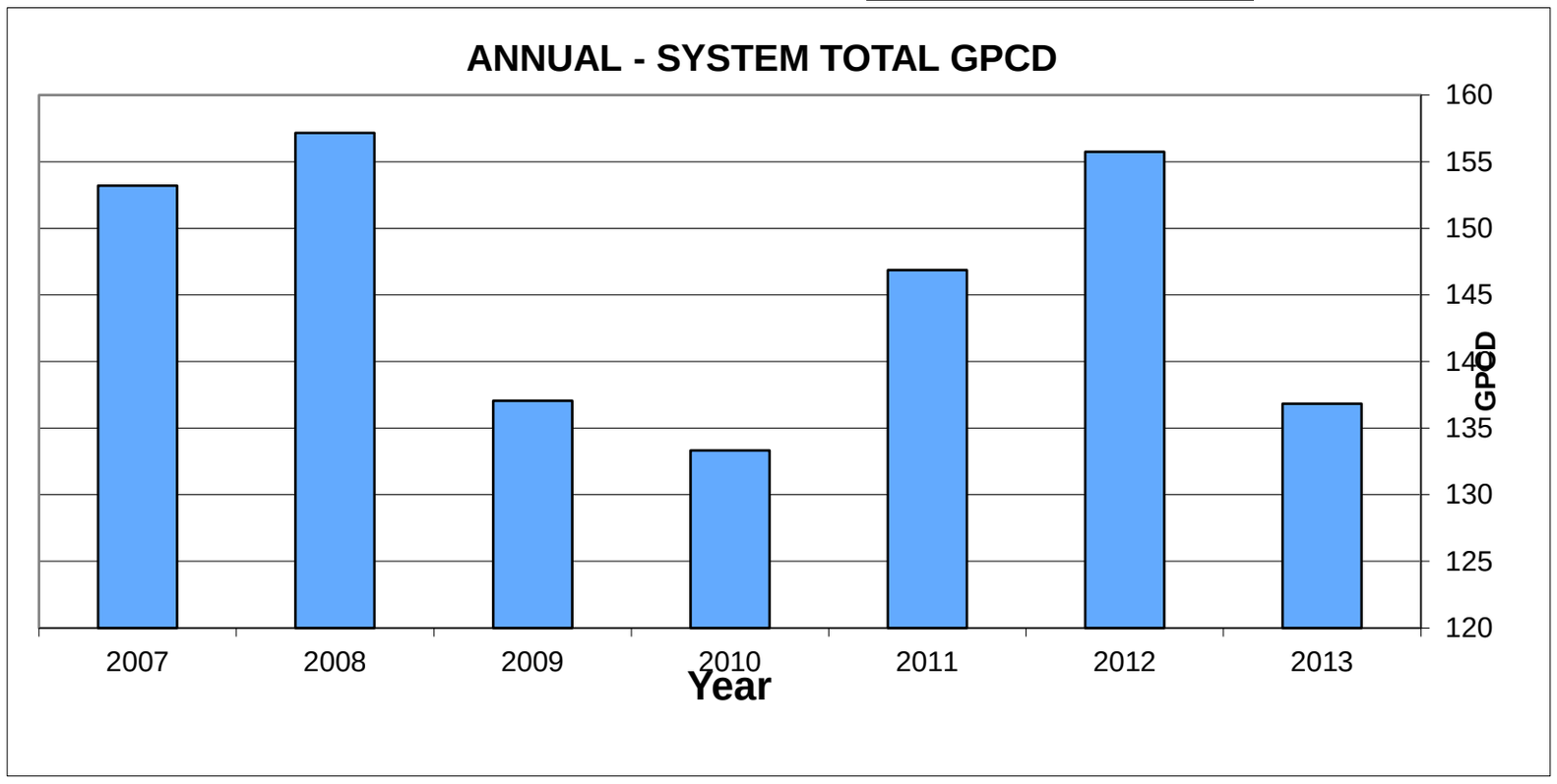
8. GPCD REPORTED DATA

Los Alamos County		
2013	To:	2007

Return to Instructions

ANNUAL

Year	SYSTEM GPCD
2013	136.83
2012	155.75
2011	146.86
2010	133.32
2009	137.07
2008	157.16
2007	153.22

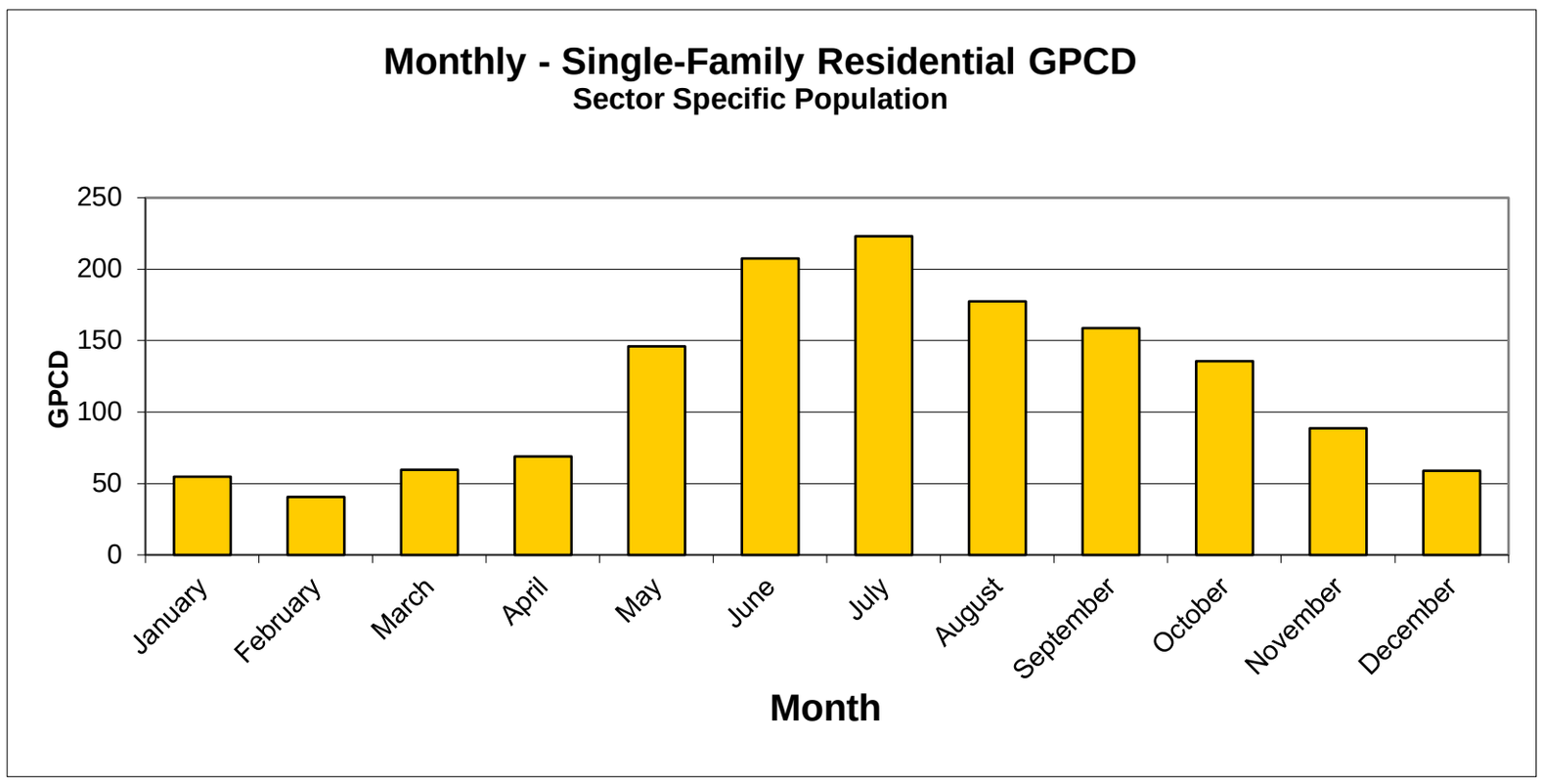


MONTHLY

Month	SFR GPCD
January	54.68
February	40.50
March	59.45
April	69.03
May	145.91
June	207.59
July	223.23
August	177.28
September	158.86
October	135.76
November	88.62
December	58.98

Year	2012

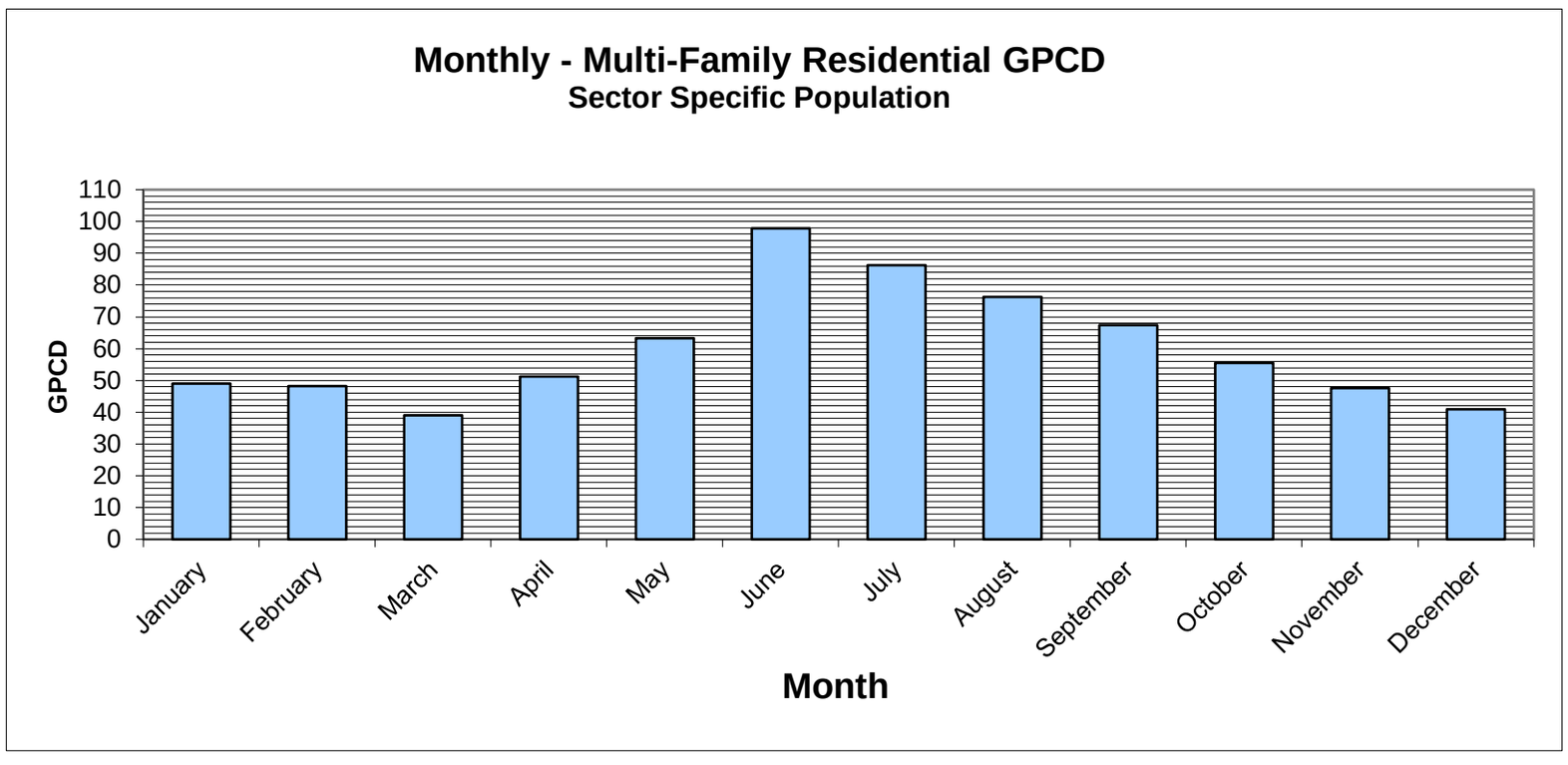
Peak/Ave	1.89



YEAR 2012

Month	MFR GPCD
January	48.94
February	48.15
March	39.01
April	51.23
May	63.30
June	97.80
July	86.29
August	76.30
September	67.46
October	55.49
November	47.63
December	40.98

Peak/Ave	1.62



YEAR 2012

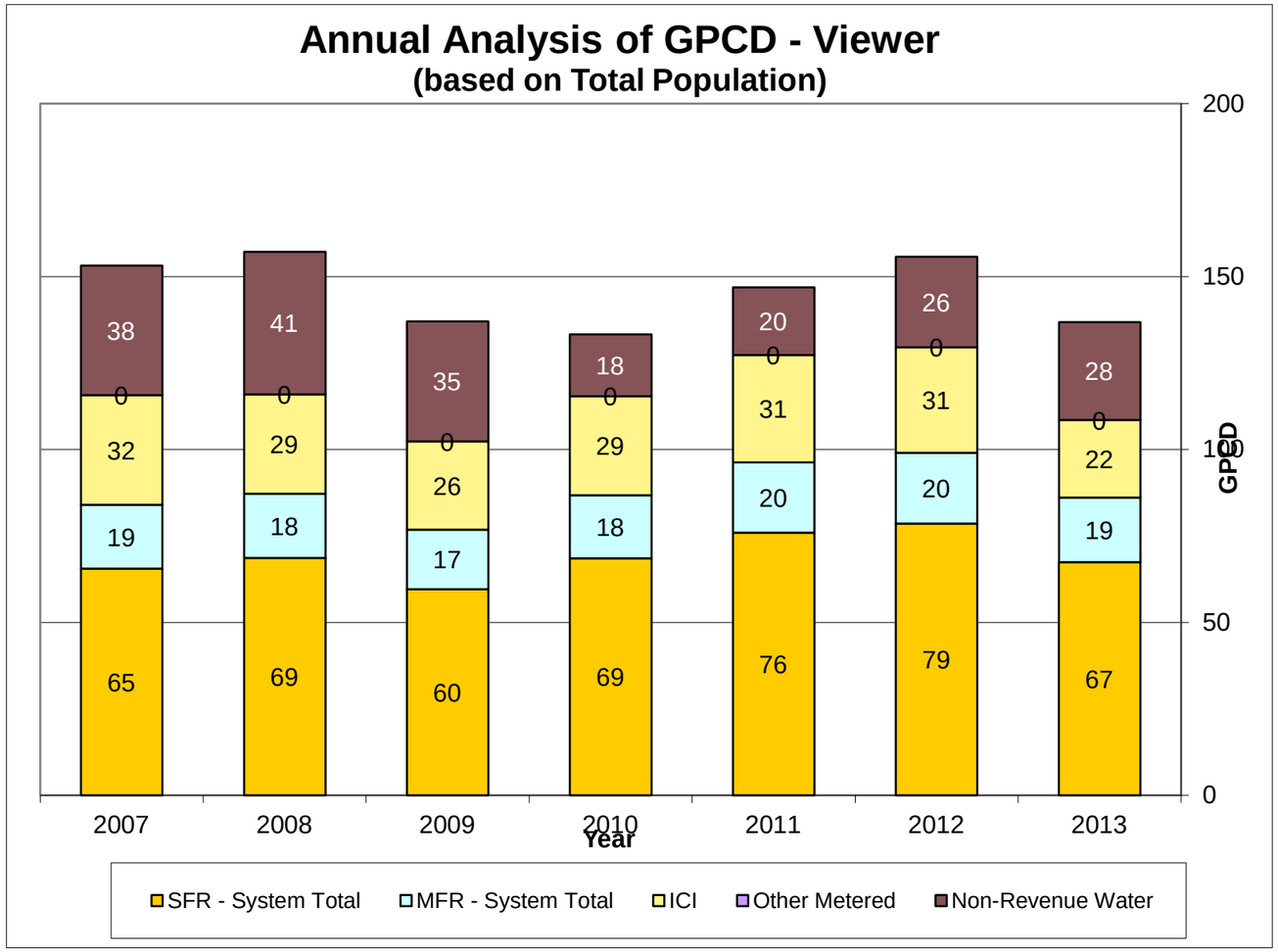
9. Annual Reporting Performance

Return to Instructions

Overall Annual GPCD (based on Total Population)

	SFR - System Total	MFR - System Total	ICI	Other Metered	Info Non-Revenue Water	Total Supplied	Non-Revenue Volume Million Gallons (US)
Year							
On Graph?	Yes	Yes	Yes	Yes	Yes		
2013	67.39	18.66	22.45	N/A	28.33	150.51	190.83
2012	78.54	20.46	30.56	N/A	26.19	173.70	174.90
2011	75.90	20.39	31.06	N/A	19.51	162.42	131.66
2010	68.52	18.22	28.67	N/A	17.91	146.80	121.63
2009	59.55	17.30	25.51	N/A	34.72	149.19	237.09
2008	68.66	18.48	28.83	N/A	41.18	171.21	280.74
2007	65.50	18.55	31.62	N/A	37.55	169.44	256.12

Los Alamos County		
2013	to	2007



10. Monthly Reporting Performance

Return to Instructions

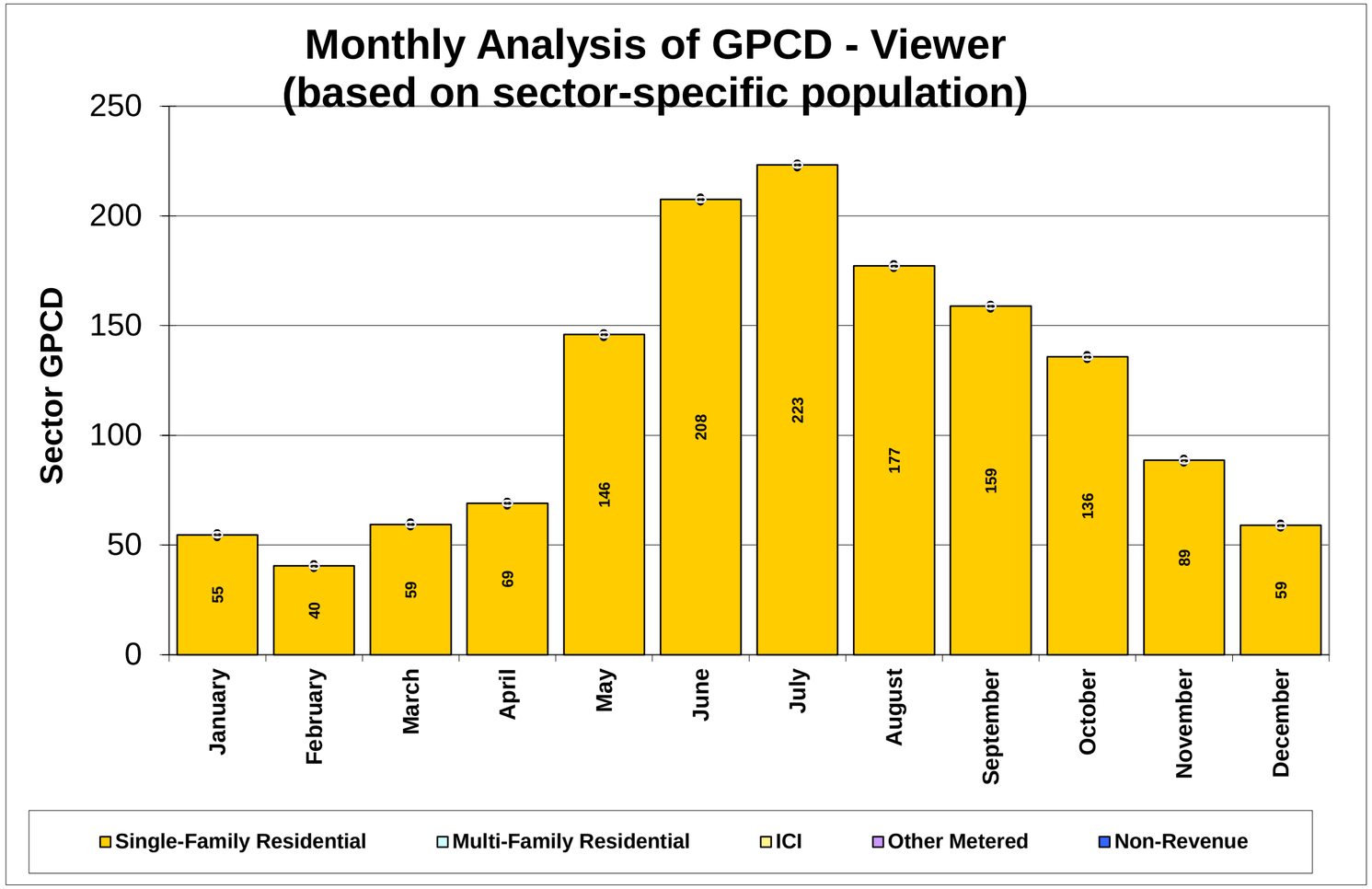
Choose Year for Monthly Analysis **2012**

Choose Sector **Single-Family Residential**

Monthly GPCD

Month	Single-Family Residential GPCD	Multi-Family Residential GPCD	ICI GPCD	Other Metered GPCD	Non-Revenue GPCD
JAN	54.68	48.94	18.67	0.00	20.53
FEB	40.50	48.15	13.81	0.00	17.37
MAR	59.45	39.01	16.20	0.00	25.43
APR	69.03	51.23	16.31	0.00	71.39
MAY	145.91	63.30	32.17	0.00	70.59
JUN	207.59	97.80	56.10	0.00	57.54
JUL	223.23	86.29	52.14	0.00	15.14
AUG	177.28	76.30	49.25	0.00	6.21
SEP	158.86	67.46	41.39	0.00	22.80
OCT	135.76	55.49	34.67	0.00	-8.78
NOV	88.62	47.63	20.57	0.00	-0.18
DEC	58.98	40.98	14.22	0.00	16.83

Los Alamos County		
2013	to	2007



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Item Name		Description
Active Connections		All active **Single Family Residential** connections within the utility. Connections that are not occupied or show zero activity are not counted in this category.
Annual Multi-Family Residential GPCD Calculation	Find	The MFR GPCD is Annual MF Calculation (4.6) divided by the annual MFR Population (4.9).
Annual Single Family Residential GPCD Calculation	Find	The SFR GPCD is Annual SFR Calculation (3.7) divided by the annual SFR Population average (3.13).
Billed Water Consumption (Multi-Family Residential)	Find	This is the total billed consumption for **Multi-Family** Residential uses only. Provide the amount of water used (gallons) for multi-family residential connections by month in Table 4.1, or by year in Table 4.5. If multi-family residential is not available as a separate category, provide an explanation in the Comments Box and include usage in the Industrial, Commercial and Institutional Table 5.1 or Other Metered Table 5.2 on Sheet 5.
Billed Water Consumption (Single-Family Residential)	Find	This is the total billed consumption for **Single-Family** residential uses only.
Calculated Growth Rate	Find	The calculated growth rate is a calculation developed to normalize the data to the growth in the utility. The growth is determined by evaluating the percentage change in the number of connections within the utility on an annual basis, provided in Table 3.9 Average Connections Calculated. If there are no more than one years' data, then this will not be calculated. This Table is for the utilities use in checking the growth percentage calculated against their own estimates. It is also used in Table 4.8 Number of (Multi-Family) Units if only the current number of multi-family units can be provided.
Census Data	Find	The Census data is used to standardize the calculation of population by utilizing numbers of people per household. It also records information on the vacancy rate within each city which enables calculation of the number of households actually being used. There is a link to a pdf document in Definitions showing the user how to find and record the relevant data.
Converter	Find	The user may develop a GPCD Analysis based on one of two input unit selections: 1) Gallons (US) 2) Cubic feet Please select the units from the instructions worksheet. An interactive unit converter is also provided below. Input volume in first box below and select units to be converted. **1** | **Gallons (US)** = **0.134** | **Cubic Feet**
Exported Water	Find	Enter all water exported from the system. This will include any pass-through arrangements or wholesale contracts to other drinking water suppliers, where the reporting utility is the water rights permit holder.
GPCD		Gallons per capita per day (GPCD) is a method utilized internationally to measure water use by drinking water suppliers. It is most commonly used to describe historical and current water uses, providing a baseline of water use that is not as susceptible to changes in population. GPCD is also used for planning purposes, allowing estimates of future demand requirements based on localized population projections. More sophisticated planning efforts utilize GPCD to determine conservation potential, track the results of program implementation, and calculate projections based on conservation adjusted GPCD.
General Information		The white boxes are data entry cells and are used for inputting data. All other cells except dropdown menus (purple boxes) are protected for the user's benefit to stop any overwriting of formulas and calculated cells. The green boxes are values that have been calculated based on inputs.
Graphing Results	Find	Datasets will automatically be graphed when using the graphing data tools in both the Annual and Monthly Performance worksheets. For example, choosing the year and the use sector from the purple dropdown boxes will allow these variables to be graphed.
Imported Water	Find	Enter all water imported from other systems. This will include any retail contracts with other drinking water suppliers where this utility purchases water from another utility and is not the permit holder.
Inactive and Zero Connections	Find	The inactive and zero connections are recorded in Table 3.3 so that unused single family residential connections will be removed from the calculation of single family population when Total Units is chosen from the drop down list in Table 3.2.

Industrial, Commercial and Institutional (ICI)	Find	Includes industrial properties, such as manufacturing, commercial properties such as restaurants, shopping malls, and institutional customers such as schools, universities and prisons.
Multi-Family Residential Connections	Find	A multifamily unit is living units in an apartment complex, duplexes, triplexes, trailer parks, and condo or town houses that have multiple units serviced by a single connection. They are not counted in the single-family residential category.
Multi-Family Residential Population	Find	Multi-family population is calculated from number of MFR units in the Annual Unit Calculation (4.8) minus Vacant MFR Connections (4.10). That number is then multiplied by Average Size of Occupied Housing Units from the US Census (2.1).
Non-Revenue Water		Non-revenue water is all the water the utility diverts and/or produces, but does not get paid for. Non-revenue water includes apparent losses such as meter inaccuracies, theft, and database errors, real losses such as leaks. It also includes unbilled authorized uses such as fire-fighting, line flushing and disinfection. The Calculator does not provide data entry for unmetered billed water. This might include bulk sales or monthly fees not based on usage. The non-revenue water in the Calculator includes all water that is not metered.
Other Metered	Find	All categories of billed metered use that is not otherwise classified in SFR, MFR or ICI. This provides the user the opportunity to track alternative categories. Examples included irrigation only, stand pipes, and fire hydrant/construction meters. Everything not included in SFR, MFR, ICI or Other will end up in non-revenue water.
Reuse	Find	Reuse, or Recycled water is former wastewater (sewage) that has been treated to remove solids and certain impurities and reused by a water supplier. In most locations, it is only intended to be used for nonpotable uses, such as irrigation, and dust control. This data is not included in any other calculation. It is provided as a tracking tool for the user.
Single Family Residential Connections	Find	SFR Connection is a stand alone or independently metered housing unit. The number used in the Calculator can be Total Connections or Active Connections only.
Single Family Residential Population	Find	Single Family Population (3.13) is calculated from number of active connections times size of average household (3.12). It can be calculated monthly or annually depending on the data provided. If Total Connections is chosen (3.2), then inactive connections are subtracted prior to multiplying by size of average household (3.12). If Active Connections is chosen (3.2), then number of connections are multiplied by size of average household (3.12) without any subtractions.
Size of Average Household	Find	This Table is determined from the US Census data in Table 2.1, Sheet 2. This data is used to determine a total single-family population and total multi-family population for both the monthly and annual data (Tables 3.4 and 3.13, Tables 4.3 and 4.9 respectively).
Total Connections	Find	All active and inactive **Single Family Residential** connections within the utility.
System Total GPCD	Find	The System Total GPCD is calculated by dividing the quantity of Total Water Diverted (plus imports minus exports) by the System Total Population
Total Population	Find	The Total Population estimate is the sum of the single-family population + multi-family population + group quarters population.
Vacant Single-Family Residential Connections	Find	This is a calculated field using either i) the average of the monthly vacant SFR connections, if monthly data are available or ii) an estimated value based on the Census data vacancy rate multiplied by the number of Total SFR connections. When Total Connections is chosen in Table 3.2, vacant single family residential connections are subtracted from Total Connections prior to calculating a population (based on household size) and a single family GPCD.

How to find the data required for Census section

NMOSE GPCD CALCULATOR

Gallons per Capita - v2.04 Beta

Release Date: Mar, 16, 2009

This spreadsheet-based GPCD calculator is designed to help quantify and track water uses associated with water distribution systems. The spreadsheet contains several separate worksheets. Sheets can be accessed using the tabs towards the bottom of the screen, or by clicking the buttons on the left below. Descriptions of each sheet are also given below.

It should be noted that all the recorded data should be from actual metered results and should not include any estimates.

THE FOLLOWING KEY APPLIES THROUGHOUT:

- Value to be entered by user
- Dropdown box, pick from list
- Value calculated based on input data
- No longer available for input

Look for the following boxes that provide addition Instructions Info

Please begin by providing the following information, then proceed through each sheet:

NAME OF CITY OR UTILITY: Los Alamos County — New Mexico

REPORTING YEARS: Enter the most recent reporting year: 2014 — Data can be entered back to: 2008

NAME OF CONTACT PERSON: Christine Chavez — **E-MAIL:** cy.chavez@lacnm.us — **TELEPHONE:** 505-662-8147 **Ext.**

SELECT THE REPORTING UNITS FOR VOLUME DATA: Gallons (US)

Gallons per Capita - v2.04 Beta

Instructions & Utility	This sheet
Census Data	Census data and the portal to get the data from the Census website
Single-Family	Single-Family residential gallons and population
Multi-Family	Multi-Family residential gallons and population
ICI & Other Metered	Other data including Commercial, Industrial and Institutional [1.3] and Other metered [1.4] categories
Reuse	Data related to water reuse projects
Total Diverted	Total Production and Diverted Water
Reported Data	The calculated data graphical review of most common performance indicators
Annual Performance	The calculated data graphical review of **annual** performance indicators
Monthly Performance	The calculated data graphical review of **monthly** performance indicators
Definitions	Use this sheet to understand terms used in the audit process

All parties reserve the right to validate the data recorded in this document. This does not bind the OSE or the Utility to the results. It is a tool used for planning purposes.

If you have questions or comments regarding the software please contact us at: waternm@state.nm.us

Census Information Data Table 2.1

Info

Click here to access the Census Web site

OR

Click here for instructions on how to find the data on the Census website

2014 TO 2008

Use the most recent census data

Return to Instructions

DATA

US Census Table	Description		INPUT
		CENSUS YEAR	2010
P37	Group Quarters Population	Total	**124**
H3	Occupancy Status	Total	**8,354**
from H3		Occupied	**7,663**
from H3		Vacant	**691**
H12	Ave. Household Size of Occupied Housing Units	Total	**2.33**

Formula: Household Size = Total Population / Total Number of Housing Units

Vacancy Rate %	8.3%

COMMENTS:

DATA INPUT SHEET

Los Alamos County

Instructions

3. SINGLE-FAMILY RESIDENTIAL (SFR)

Return to Instructions

MONTHLY DATA

TABLE 3.1 Info

2014 TO 2008

SFR BILLED WATER CONSUMPTION (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2014	18,284,000	15,516,000	18,537,000	21,927,000	40,100,000	58,293,000	64,336,000	50,511,000	55,548,000	67,465,000	22,535,000	24,325,000
2013												
2012												
2011												
2010												
2009												
2008												

TABLE 3.2 Info

Active Connections Only

You have chosen to enter Active Connections Only, enter the monthly values below, or enter annual values in table 3.8 Check message above Table 3.3 to see if additional data is required.

NUMBER OF SFR CONNECTIONS (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2014	5,389	5,058	5,363	5,017	5,377	5,354	5,059	5,277	5,279	5,367	4,235	5,352
2013												
2012												
2011												
2010												
2009												
2008												

TABLE 3.3 Info

You have entered Active Connections Only in Table 3.2; leave the cells below blank

INACTIVE (ZERO USE) SFR CONNECTIONS (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2014												
2013												
2012												
2011												
2010												
2009												
2008												

TABLE 3.4

Formula = (No. of Connections - No. of Zero Use Accounts) * Ave. Household Size

SFR POPULATION (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2014	12,556	11,785	12,496	11,690	12,528	12,475	11,787	12,295	12,300	12,505	9,868	12,470
2013	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2012	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2011	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2010	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2009	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2008	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data

TABLE 3.5

Formula = Billed Water Consumption (SFR only) / Calculated Population (SFR only)

SFR GPCD CALCULATION (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2014	46.97	47.02	47.85	62.53	103.25	155.76	176.06	132.52	150.54	174.03	76.12	62.92
2013	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2012	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2011	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2010	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2009	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2008	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data

COMMENTS:

ANNUAL DATA

TABLE 3.6

ANNUAL CONSUMPTION

TABLE 3.7

ANNUAL CALCULATION
457,377,000
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 3.8

AVG. ANNUAL CONNECTIONS

TABLE 3.9

AVG CONN. CALCULATION
5,177
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 3.10 Info

CALCULATED GROWTH RATE
N/A
N/A
N/A
N/A
N/A
N/A

Are you sure growth is zero?

TABLE 3.11

No. VACANT SFR CONNECTIONS

TABLE 3.12 Info

SIZE OF HOUSEHOLD
2.33
2.33
2.33
2.33
2.33
2.33
2.33

TABLE 3.13 Info

SFR POPULATION
12,063
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 3.14 Info

ANNUAL SFR GPCD
103.88
N/A
N/A
N/A
N/A
N/A
N/A

DATA INPUT SHEET

Los Alamos County

4. MULTI-FAMILY RESIDENTIAL (MFR)

Return to Instructions

Instructions

MONTHLY DATA

2014 TO 2008

TABLE 4.1 Info

MFR BILLED WATER CONSUMPTION (Monthly) (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2014	7,392,000	7,159,000	7,145,000	9,044,000	11,090,000	13,459,000	14,653,000	9,968,000	12,674,000	10,317,000	7,762,000	7,653,000
2013												
2012												
2011												
2010												
2009												
2008												

TABLE 4.2

If only Current Number of Units is Known, put this number in Table 4.7

NUMBER OF MFR UNITS (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2014	2,884	2,810	2,825	2,797	2,783	2,847	2,798	2,767	2,825	2,967	2,624	2,721
2013												
2012												
2011												
2010												
2009												
2008												

TABLE 4.3

Formula = (Number of Units - Vacant MFR Connections) * Ave. Household Size

MFR POPULATION (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2014	6,179	6,007	6,042	5,977	5,944	6,093	5,979	5,907	6,042	6,373	5,574	5,800
2013	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2012	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2011	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2010	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2009	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2008	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data

TABLE 4.4

Formula = MFR Billed Water Consumption (Monthly) / MFR Population (Monthly)

MFR GPCD CALCULATION (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2014	38.59	42.56	38.15	50.44	60.19	73.63	79.06	54.44	69.92	52.22	46.42	42.57
2013	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2012	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2011	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2010	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2009	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2008	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data

ANNUAL DATA

TABLE 4.5

ANNUAL CONSUMPTION

TABLE 4.6

ANNUAL CALCULATION
118,316,000
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 4.7

No. CURRENT UNITS

TABLE 4.8

ANNUAL UNIT CALCULATION
2,804
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 4.9 Info

MFR POPULATION
5,993
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 4.10

VACANT MFR CONNECTIONS
232
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 4.11 Info

ANNUAL MFR GPCD
54.09
N/A
N/A
N/A
N/A
N/A
N/A

DATA INPUT SHEET

5. INDUSTRIAL, COMMERCIAL & INSTITUTIONAL (ICI) AND OTHER METERED

Return to Instructions

Info

Los Alamos County

Instructions

MONTHLY DATA

2014 TO 2008

TABLE 5.1

ICI WATER CONSUMPTION (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2014	7,070,000	5,201,000	5,323,000	7,550,000	15,510,000	19,464,000	23,832,000	15,201,000	19,231,000	16,561,000	8,767,000	7,978,000
2013												
2012												
2011												
2010												
2009												
2008												

TABLE 5.2

OTHER METERED (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2014												
2013												
2012												
2011												
2010												
2009												
2008												

COMMENTS:

Municipal + commercial + educational

ANNUAL DATA

TABLE 5.3

ICI ANNUAL CONSUMPTION

TABLE 5.4

ICI GPCD
22.86
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 5.5

ICI ANNUAL CALCULATED
151,688,000
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 5.6

OTHER ANNUAL CONSUMPTION

TABLE 5.7

OTHER METERED GPCD
N/A
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 5.8

OTHER ANNUAL CALCULATED
N/A
N/A
N/A
N/A
N/A
N/A
N/A

DATA INPUT SHEET | Info

Los Alamos County

6. REUSE

Return to Instructions

Instructions

MONTHLY DATA

2014 TO 2008

TABLE 6.1

REUSE DIVERSIONS (Monthly) (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2014	1	1,012,477	4,544,270	7,256,932	14,125,782	18,148,354	8,197,735	12,815,537	16,036,338	7,517,914	1,651,125	1
2013												
2012												
2011												
2010												
2009												
2008												

COMMENTS:

A one was entered for the zero values for the months of Dec/Jan so that the spreadsheet could estimate a GPCD

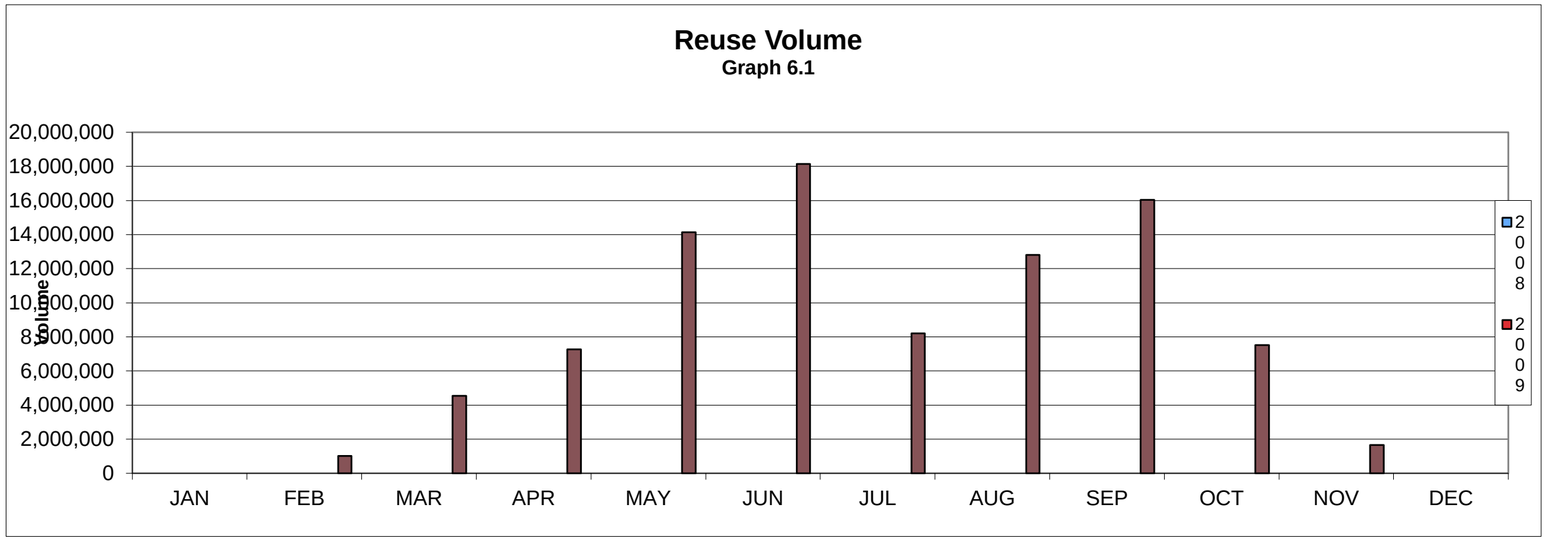
ANNUAL DATA

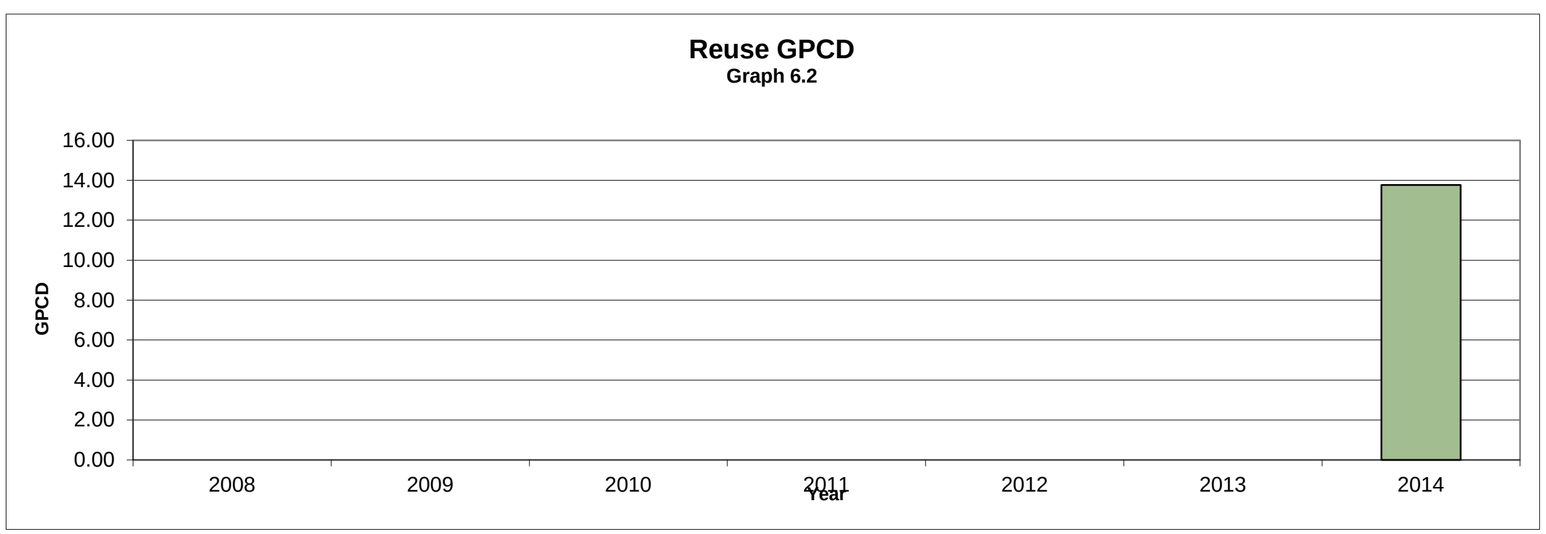
TABLE 6.2

REUSE ANNUAL DIVERSIONS

TABLE 6.3

REUSE GPCD
13.76
N/A
N/A
N/A
N/A
N/A
N/A





NMOSE GPCD Calculator v2.02

DATA INPUT SHEET

Los Alamos County

7. TOTAL WATER DIVERTED AND SUPPLIED

Return to Instructions

MONTHLY DATA

TABLE 7.1 2014 TO 2008

TOTAL WATER DIVERTED (Monthly) (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2014	72,788,000	63,558,600	74,087,000	92,820,300	126,168,200	144,961,500	128,608,400	114,519,900	127,900,700	94,064,703	78,473,703	75,270,703
2013												
2012												
2011												
2010												
2009												
2008												

TABLE 7.2

IMPORTED WATER (Monthly)(Gallons (US)) Info

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2014												
2013												
2012												
2011												
2010												
2009												
2008												

TABLE 7.3

EXPORTED WATER (Monthly) (Gallons (US)) Info

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2014	27,111,050	21,960,230	23,225,500	25,888,920	25,202,260	27,072,730	22,706,380	21,943,590	21,759,250	26,957,850	27,556,690	23,331,140
2013												
2012												
2011												
2010												
2009												
2008												

TABLE 7.4 **Formula = Total Water Diverted + Imported water - Exported Water**

TOTAL WATER SUPPLY (Monthly) (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2014	45,676,950	41,598,370	50,861,500	66,931,380	100,965,940	117,888,770	105,902,020	92,576,310	106,141,450	67,106,853	50,917,013	51,939,563
2013	0	0	0	0	0	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0	0	0	0	0
2010	0	0	0	0	0	0	0	0	0	0	0	0
2009	0	0	0	0	0	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	0	0	0	0	0	0

ANNUAL DATA

TABLE 7.6

ANNUAL TOTAL DIVERTED

TABLE 7.7

ANNUAL TOTAL DIVERTED CALC
1,193,221,709
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 7.8

ANNUAL TOTAL IMPORTED

TABLE 7.9

ANNUAL TOTAL IMPORT CALC
N/A
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 7.10

ANNUAL TOTAL EXPORTED

TABLE 7.11

ANNUAL TOTAL EXPORT CALC
294,715,590
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 7.12

Info

ANNUAL TOTAL WATER SUPPLY
898,506,119
0
0
0
0
0
0

TABLE 7.13

TOTAL POP. EST.
18,180
N/A
N/A
N/A
N/A
N/A
N/A

Table 7.5

SYSTEM TOTAL GPCD (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2014	81	82	90	123	179	216	188	164	195	119	93	92
2013	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2012	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2011	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2010	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2009	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2008	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data

COMMENTS:

TABLE 7.14

Info

Year	SYSTEM TOTAL GPCD
2014	**135.41**
2013	**NA**
2012	**NA**
2011	**NA**
2010	**NA**
2009	**NA**
2008	**NA**

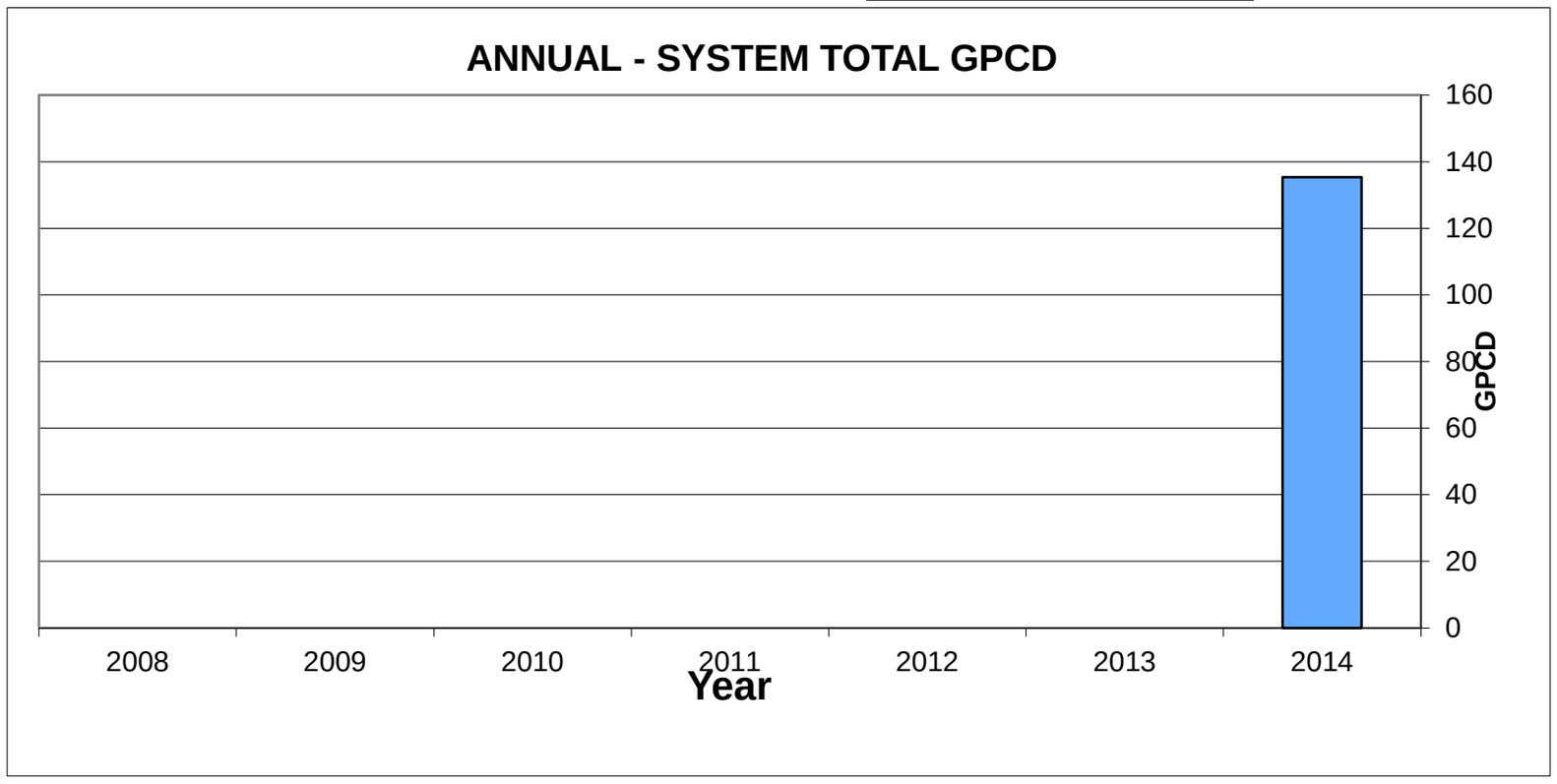
8. GPCD REPORTED DATA

Los Alamos County		
2014	To:	2008

Return to Instructions

ANNUAL

Year	SYSTEM GPCD
2014	135.41
2013	NA
2012	NA
2011	NA
2010	NA
2009	NA
2008	NA

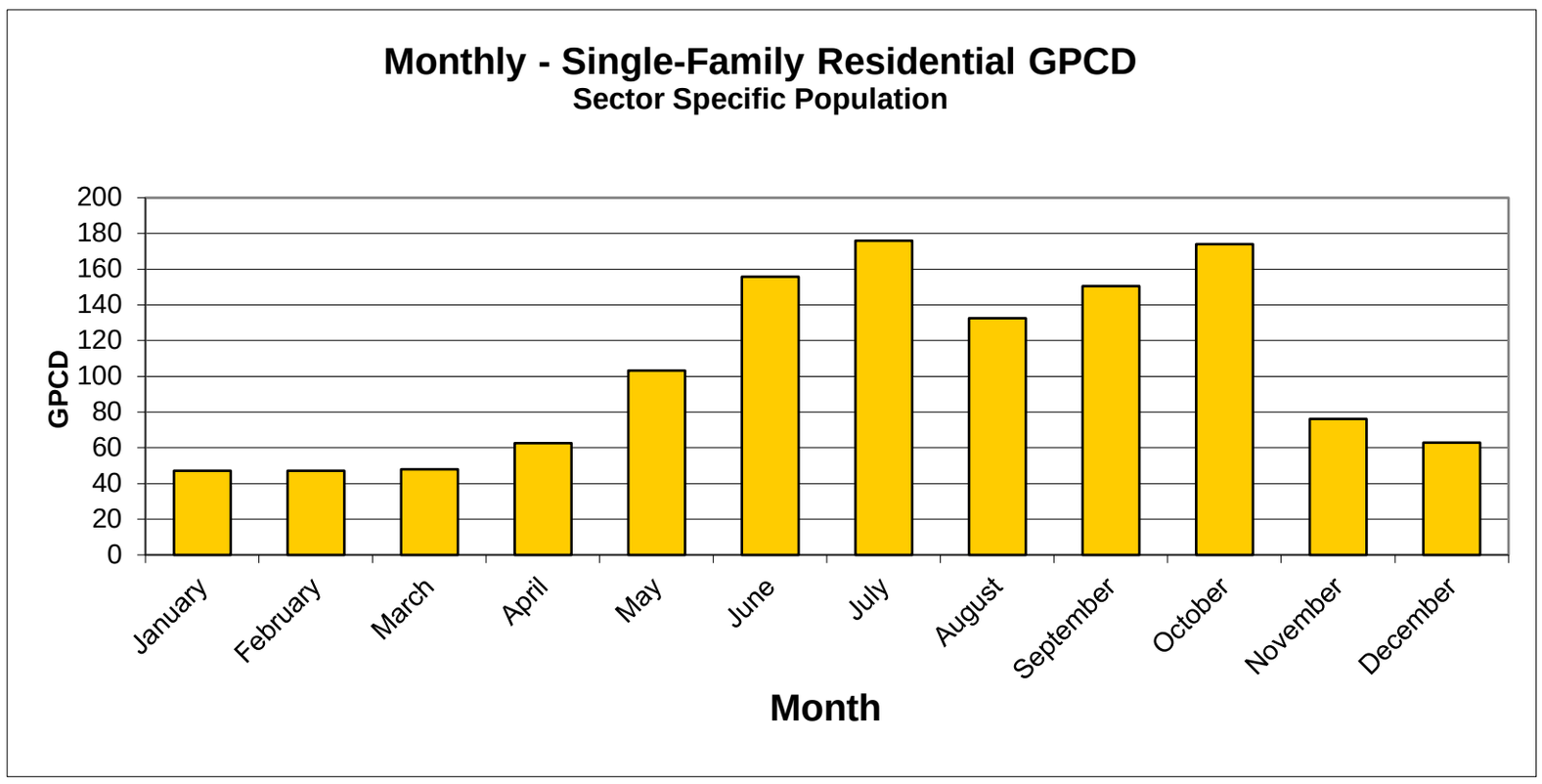


MONTHLY

Month	SFR GPCD
January	46.97
February	47.02
March	47.85
April	62.53
May	103.25
June	155.76
July	176.06
August	132.52
September	150.54
October	174.03
November	76.12
December	62.92

Year	2014

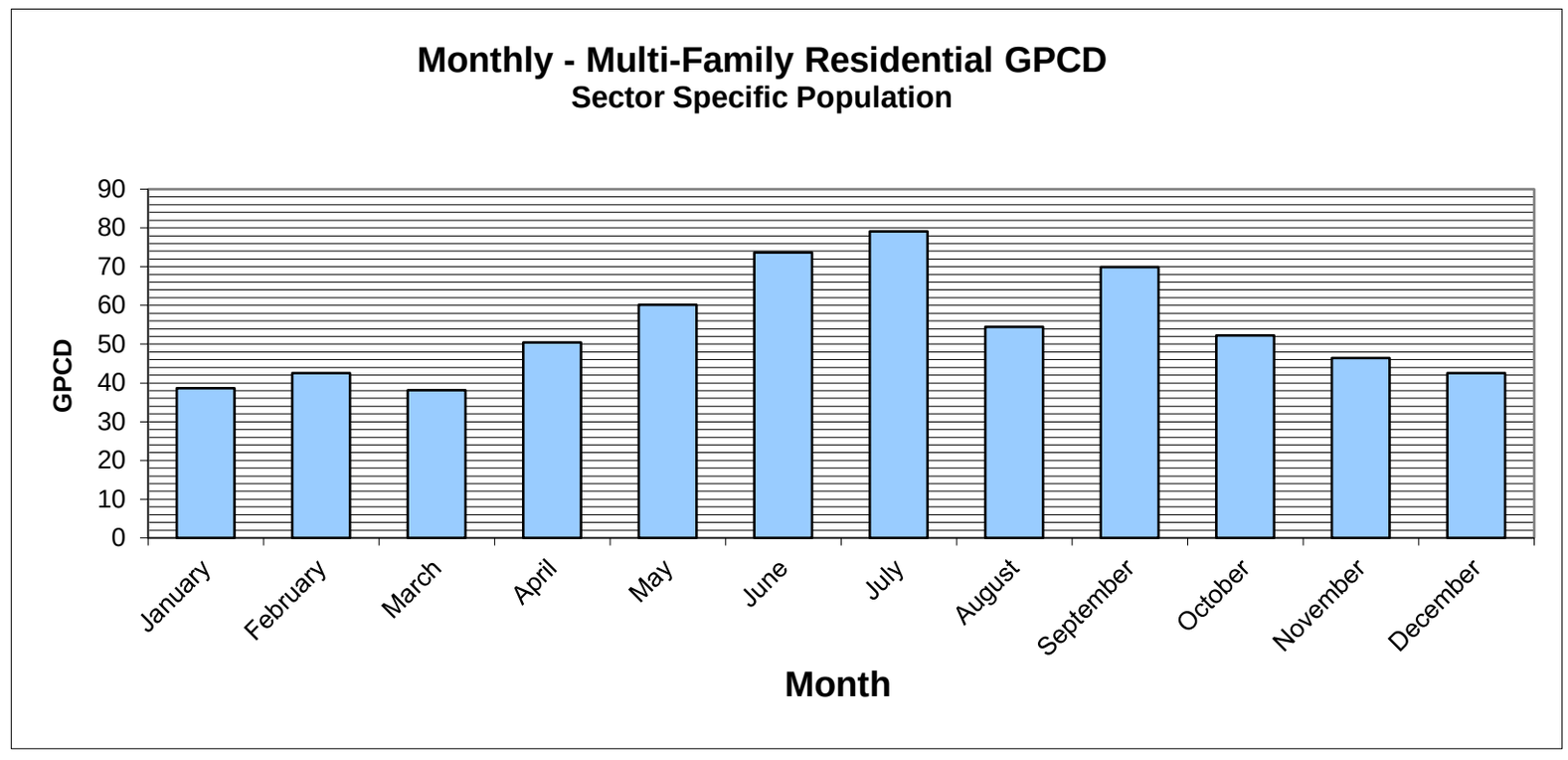
Peak/Ave	1.71



YEAR 2014

Month	MFR GPCD
January	38.59
February	42.56
March	38.15
April	50.44
May	60.19
June	73.63
July	79.06
August	54.44
September	69.92
October	52.22
November	46.42
December	42.57

Peak/Ave	1.46



YEAR 2014

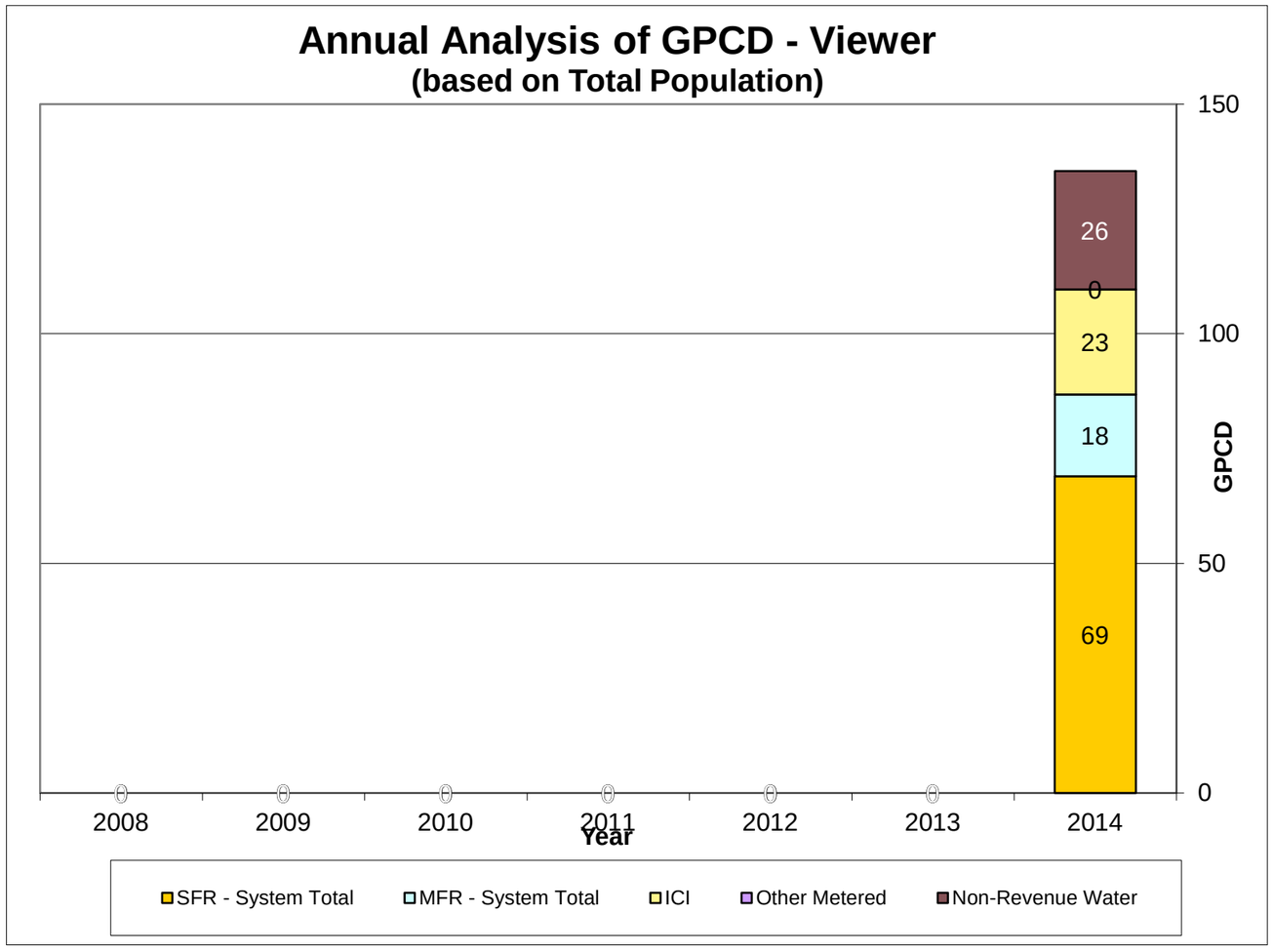
9. Annual Reporting Performance

Return to Instructions

Overall Annual GPCD (based on Total Population)

	SFR - System Total	MFR - System Total	ICI	Other Metered	Info Non-Revenue Water	Total Supplied	Non-Revenue Volume Million Gallons (US)
Year							
On Graph?	Yes	Yes	Yes	Yes	Yes		
2014	68.93	17.83	22.86	N/A	25.79	149.17	171.13
2013	N/A	N/A	N/A	N/A	#VALUE!	#VALUE!	-
2012	N/A	N/A	N/A	N/A	#VALUE!	#VALUE!	-
2011	N/A	N/A	N/A	N/A	#VALUE!	#VALUE!	-
2010	N/A	N/A	N/A	N/A	#VALUE!	#VALUE!	-
2009	N/A	N/A	N/A	N/A	#VALUE!	#VALUE!	-
2008	N/A	N/A	N/A	N/A	#VALUE!	#VALUE!	-

Los Alamos County		
2014	to	2008



10. Monthly Reporting Performance

Return to Instructions

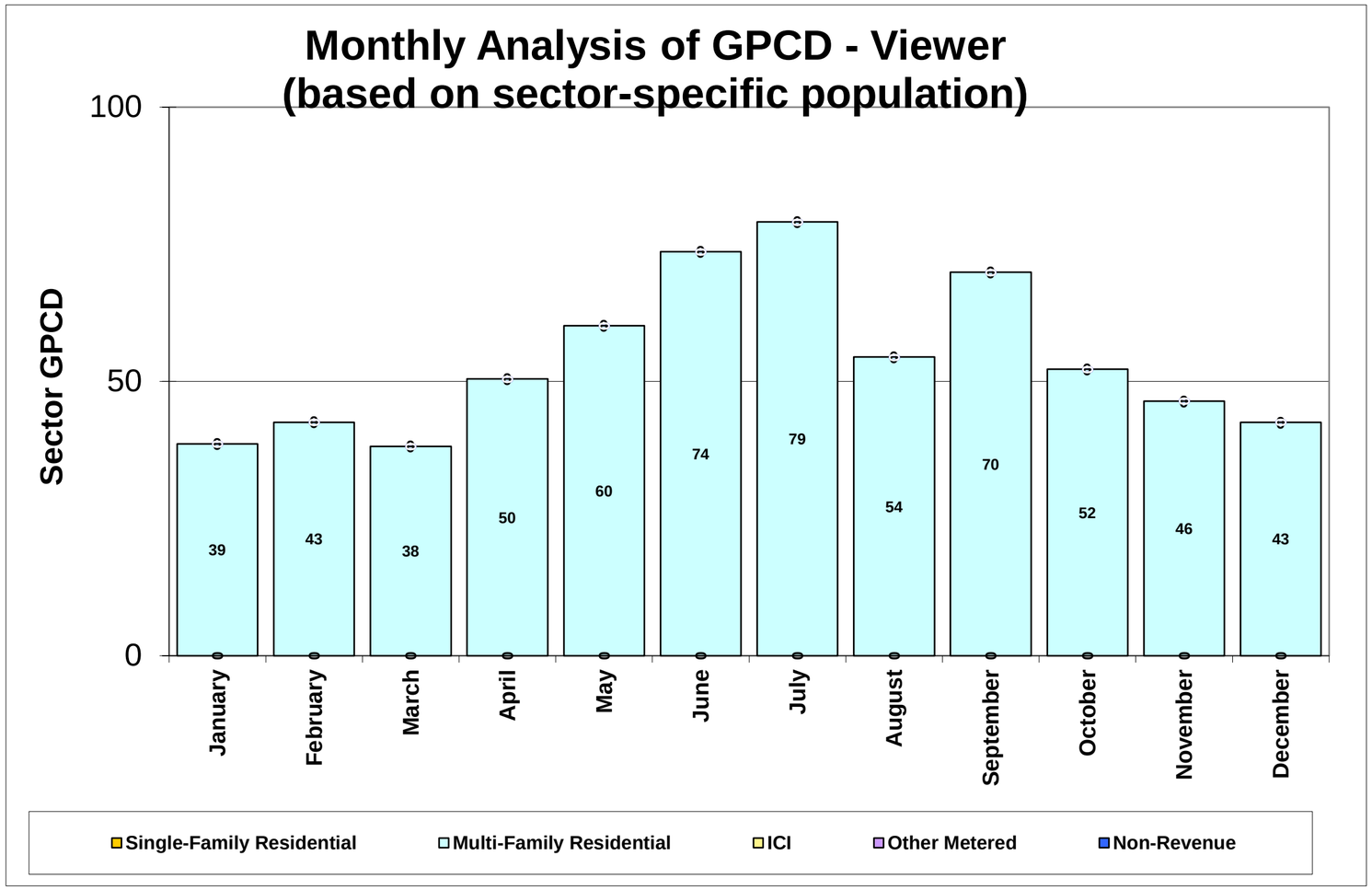
Choose Year for Monthly Analysis **2014**

Choose Sector **Multi-Family Residential**

Monthly GPCD

Month	Single-Family Residential GPCD	Multi-Family Residential GPCD	ICI GPCD	Other Metered GPCD	Non-Revenue GPCD
JAN	46.97	38.59	12.54	0.00	22.94
FEB	47.02	42.56	10.22	0.00	26.96
MAR	47.85	38.15	9.45	0.00	35.23
APR	62.53	50.44	13.84	0.00	52.09
MAY	103.25	60.19	27.52	0.00	60.80
JUN	155.76	73.63	35.69	0.00	48.91
JUL	176.06	79.06	42.29	0.00	5.47
AUG	132.52	54.44	26.97	0.00	29.98
SEP	150.54	69.92	35.26	0.00	34.27
OCT	174.03	52.22	29.39	0.00	-48.33
NOV	76.12	46.42	16.07	0.00	21.73
DEC	62.92	42.57	14.16	0.00	21.26

Los Alamos County		
2014	to	2008



16 Appendix 5: AWWA Audit

AWWA Free Water Audit Software v5.0

This spreadsheet-based water audit tool is designed to help quantify and track water losses associated with water distribution systems and identify areas for improved efficiency and cost recovery. It provides a "top-down" summary water audit format, and is not meant to take the place of a full-scale, comprehensive water audit format.

Auditors are strongly encouraged to refer to the most current edition of AWWA M36 Manual for Water Audits for detailed guidance on the water auditing process and targetting loss reduction levels

The spreadsheet contains several separate worksheets. Sheets can be accessed using the tabs towards the bottom of the screen, or by clicking the buttons below.

Please begin by providing the following information

Name of Contact Person:	Christine Y. Chavez
Email Address:	cy.chavez@lacnm.us
Telephone | Ext.:	505-662-8147
Name of City / Utility:	Los Alamos County
City/Town/Municipality:	Los Alamos
State / Province:	New Mexico (NM)
Country:	United States
Year:	2014 Financial Year
Start Date:	07/2013 Enter MM/YYYY numeric format
End Date:	06/2014 Enter MM/YYYY numeric format
Audit Preparation Date:	3/9/2015
Volume Reporting Units:	Million gallons (US)
PWSID / Other ID:	

The following guidance will help you complete the Audit

All audit data are entered on the ***Reporting Worksheet***

- Value can be entered by user
- Value calculated based on input data
- These cells contain recommended default values

Use of Option (Radio) Buttons: Pcnt: 0.25% Value:

Select the default percentage by choosing the option button on the left

To enter a value, choose this button and enter a value in the cell to the right

The following worksheets are available by clicking the buttons below or selecting the tabs along the bottom of the page

Instructions
The current sheet. Enter contact information and basic audit details (year, units etc)

Reporting Worksheet
Enter the required data on this worksheet to calculate the water balance and data grading

Comments
Enter comments to explain how values were calculated or to document data sources

Performance Indicators
Review the performance indicators to evaluate the results of the audit

Water Balance
The values entered in the Reporting Worksheet are used to populate the Water Balance

Dashboard
A graphical summary of the water balance and Non-Revenue Water components

Grading Matrix
Presents the possible grading options for each input component of the audit

Service Connection Diagram
Diagrams depicting possible customer service connection line configurations

Definitions
Use this sheet to understand the terms used in the audit process

Loss Control Planning
Use this sheet to interpret the results of the audit validity score and performance indicators

Example Audits
Reporting Worksheet and Performance Indicators examples are shown for two validated audits

Acknowledgements
Acknowledgements for the AWWA Free Water Audit Software v5.0

If you have questions or comments regarding the software please contact us via email at: wlc@awwa.org

AWWA Free Water Audit Software:
Reporting Worksheet

WAS v5.0

Click to access definition
Click to add a comment

Water Audit Report for: Los Alamos County
Reporting Year: 2014 | 7/2013 - 6/2014

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it.

Master Meter and Supply Error Adjustments

WATER SUPPLIED

<---------- Enter grading in column 'E' and 'J' ---------->

			Pcnt:	Value:	
Volume from own sources:	1,138.000	MG/Yr			MG/Yr
Water imported:	0.000	MG/Yr			MG/Yr
Water exported:	368.000	MG/Yr			MG/Yr
WATER SUPPLIED:	**770.000**	MG/Yr			

Enter negative % or value for under-registration
Enter positive % or value for over-registration

AUTHORIZED CONSUMPTION

Click here: for help using option buttons below

			Pcnt:	Value:	
Billed metered:	683.636	MG/Yr			
Billed unmetered:		MG/Yr			
Unbilled metered:		MG/Yr			
Unbilled unmetered:	9.625	MG/Yr	1.25%		MG/Yr
AUTHORIZED CONSUMPTION:	**693.261**	MG/Yr			

Default option selected for Unbilled unmetered - a grading of 5 is applied but not displayed

Use buttons to select percentage of water supplied OR value

WATER LOSSES (Water Supplied - Authorized Consumption)

76.739 MG/Yr

Apparent Losses

			Pcnt:	Value:	
Unauthorized consumption:	1.925	MG/Yr	0.25%		MG/Yr

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

Customer metering inaccuracies:	0.000	MG/Yr			MG/Yr
Systematic data handling errors:	1.709	MG/Yr	0.25%		MG/Yr

Default option selected for Systematic data handling errors - a grading of 5 is applied but not displayed

Apparent Losses: **3.634** MG/Yr

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: **73.105** MG/Yr

WATER LOSSES: **76.739** MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: **86.364** MG/Yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	162.0	miles
Number of active AND inactive service connections:	7,295	
Service connection density:	45	conn./mile main
Are customer meters typically located at the curbstop or property line?	Yes	
Average length of customer service line:		(length of service line, beyond the property boundary, that is the responsibility of the utility)

Average length of customer service line has been set to zero and a data grading score of 10 has been applied

Average operating pressure:		psi

COST DATA

Total annual cost of operating water system:	$6,482,487	$/Year
Customer retail unit cost (applied to Apparent Losses):	$4.19	$/1000 gallons (US)
Variable production cost (applied to Real Losses):		$/Million gallons

☑ Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

Add a grading value for 10 parameter(s) to enable an audit score to be calculated

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Volume from own sources
2: Billed metered
3: Customer metering inaccuracies

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

Water Audit Report for: Los Alamos County
Reporting Year: 2014 | 7/2013 - 6/2014

********** DATA GRADING MUST BE COMPLTED ON THE REPORTING WORKSHEET BEFORE PERFORMANCE INDICATORS CAN BE DISPLAYED **********

System Attributes:

	Apparent Losses:		MG/Yr
+	Real Losses:		MG/Yr
=	**Water Losses:**		MG/Yr
?	Unavoidable Annual Real Losses (UARL):		MG/Yr
	Annual cost of Apparent Losses:		
	Annual cost of Real Losses:		Valued at **Customer Retail Unit Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:		
	Non-revenue water as percent by cost of operating system:		Real Losses valued at Customer Retail Unit Cost
Operational Efficiency:	Apparent Losses per service connection per day:		gallons/connection/day
	Real Losses per service connection per day:		gallons/connection/day
	Real Losses per length of main per day*:		
	Real Losses per service connection per day per psi pressure:		gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):		million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:		

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

Use this worksheet to add comments or notes to explain how an input value was calculated, or to document the sources of the information used.

General Comment:	

Audit Item	Comment
Volume from own sources:	
Vol. from own sources: Master meter error adjustment:	
Water imported:	
Water imported: master meter error adjustment:	
Water exported:	
Water exported: master meter error adjustment:	
Billed metered:	
Billed unmetered:	
Unbilled metered:	

Audit Item	Comment
Unbilled unmetered:	
Unauthorized consumption:	
Customer metering inaccuracies:	
Systematic data handling errors:	
Length of mains:	
Number of active AND inactive service connections:	
Average length of customer service line:	
Average operating pressure:	
Total annual cost of operating water system:	
Customer retail unit cost (applied to Apparent Losses):	
Variable production cost (applied to Real Losses):	

AWWA Free Water Audit Software: Water Balance

WAS v5.0

Water Audit Report for:	Los Alamos County	
Reporting Year:	2014	7/2013 - 6/2014
Data Validity Score:	N/A*	* Confirm Units and Data Grading are Complete

Own Sources (Adjusted for known errors): 1,138.000

Water Imported: 0.000

System Input: 1,138.000

Water Exported: 368.000

Water Supplied: 770.000

Authorized Consumption: 693.261

- **Billed Authorized Consumption**: 683.636
  - **Billed Water Exported**
    - **Billed Metered Consumption (water exported is removed)**: 683.636
    - **Billed Unmetered Consumption**: 0.000
  - **Billed Water Exported**: 683.636
- **Unbilled Authorized Consumption**: 9.625
  - **Unbilled Metered Consumption**: 0.000
  - **Unbilled Unmetered Consumption**: 9.625

Water Losses: 76.739

- **Apparent Losses**: 3.634
  - **Unauthorized Consumption**: 1.925
  - **Customer Metering Inaccuracies**: 0.000
  - **Systematic Data Handling Errors**: 1.709
- **Real Losses**: 73.105
  - **Leakage on Transmission and/or Distribution Mains**: Not broken down
  - **Leakage and Overflows at Utility's Storage Tanks**: Not broken down
  - **Leakage on Service Connections**: Not broken down

Revenue Water: 368.000

- **Revenue Water**: 683.636

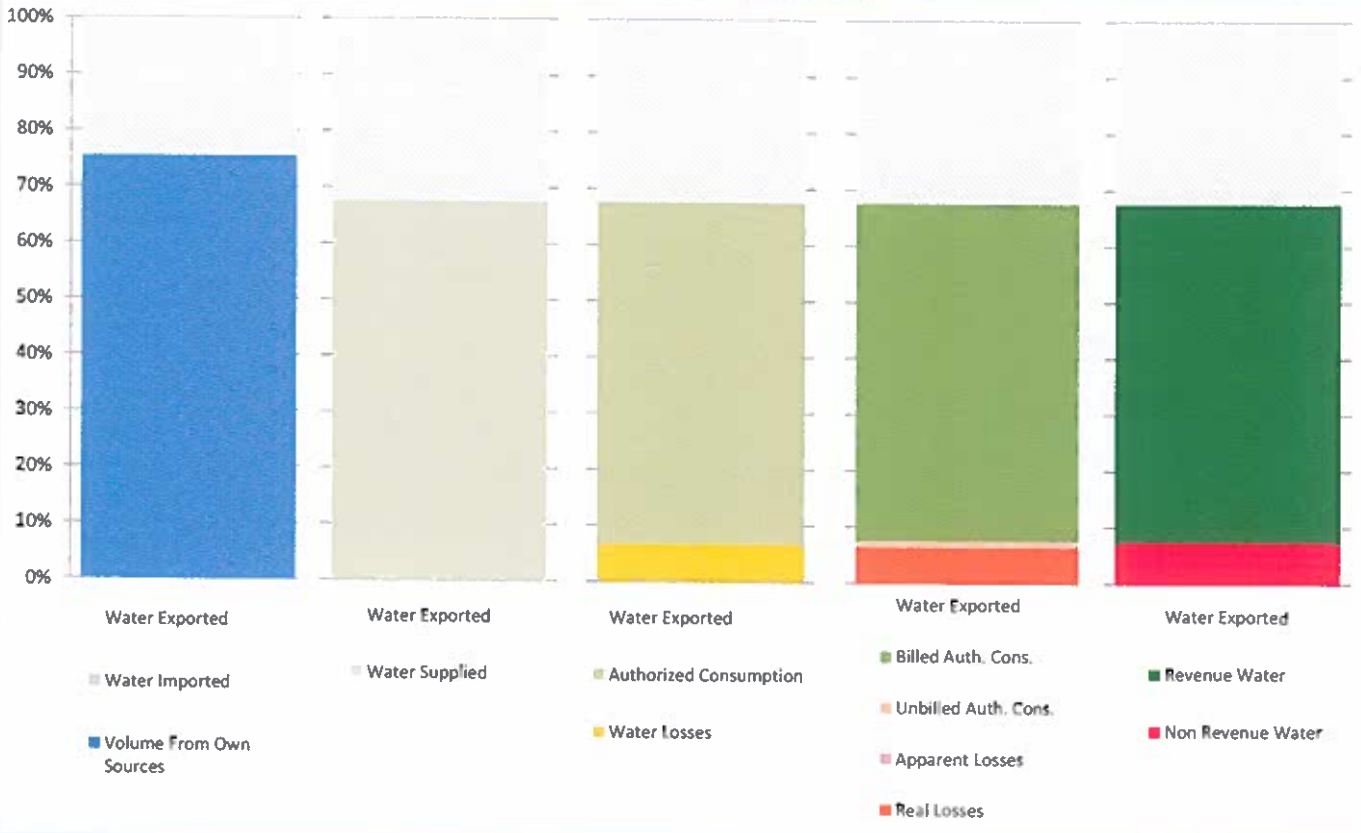
Non-Revenue Water (NRW): 86.364

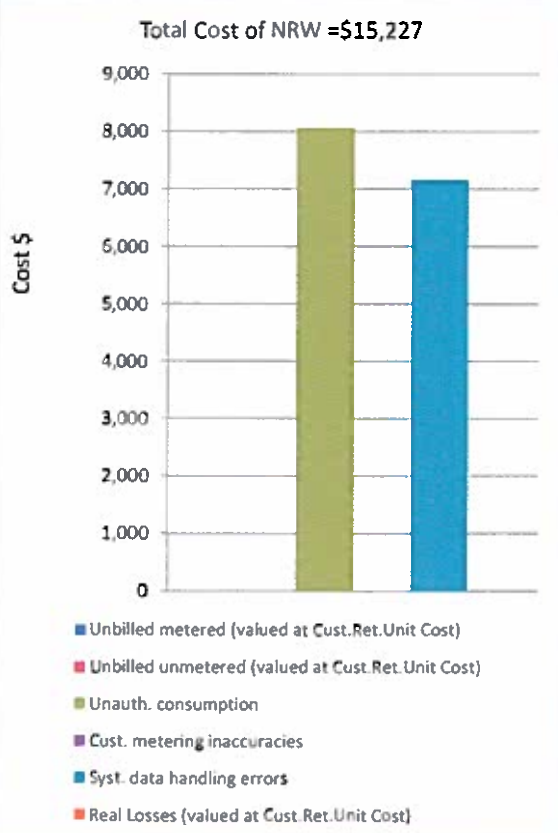
AWWA Free Water Audit Software:
Dashboard

The graphic below is a visual representation of the Water Balance with bar heights propotional to the volume of the audit components

Water Audit Report for: Los Alamos County
Reporting Year: 2014 | 7/2013 - 6/2014
Data Validity Score: N/A* | * Confirm Units and Data Grading are Complete

○ Show me the VOLUME of Non-Revenue Water
◉ Show me the COST of Non-Revenue Water





AWWA Free Water Audit Software: Grading Matrix

WAS 5.0

The grading assigned to each audit component and the corresponding recommended improvements and actions are highlighted in yellow. Audit accuracy is likely to be improved by prioritizing those items shown in red

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
WATER SUPPLIED											
Volume from own sources:	Select the grading only if the water utility purchases/imports all of its water resources (i.e. has no sources of its own)	Less than 25% of water production sources are metered; remaining sources are estimated. No regular meter accuracy testing or electronic calibration conducted	25% - 50% of treated water production sources are metered; other sources estimated. No regular meter accuracy testing or electronic calibration conducted	Conditions between 2 and 4	50% - 75% of treated water production sources are metered; other sources estimated. Occasional meter accuracy testing or electronic calibration conducted	Conditions between 4 and 6	At least 75% of treated water production sources are metered, or at least 90% of the source flow is derived from metered sources. Meter accuracy testing and/or electronic calibration of related instrumentation is conducted annually. Less than 25% of tested meters are found outside of +/- 6% accuracy	Conditions between 6 and 8	100% of treated water production sources are metered; meter accuracy testing and electronic calibration of related instrumentation is conducted annually; less than 10% of meters are found outside of +/- 6% accuracy	Conditions between 8 and 10	100% of treated water production sources are metered; meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually with less than 10% found outside of +/- 3% accuracy. Procedures are reviewed by a third party knowledgeable in the M36 methodology
Improvements to attain higher data grading for "Volume from own Sources" component:		to qualify for 2: Organize and launch efforts to collect data for determining volume from own sources	to qualify for 4: Locate all water production sources on maps and in the field, launch meter accuracy testing for existing meters, begin to install meters on unmetered water production sources and replace any obsolete/defective meters		to qualify for 6: Formalize annual meter accuracy testing for all source meters, specify the frequency of testing. Complete installation of meters on unmetered water production sources and complete replacement of all obsolete/defective meters		to qualify for 8: Conduct annual meter accuracy testing and calibration of related instrumentation on all meter installations on a regular basis. Complete project to install new or replace defective existing meters so that entire production meter population is metered. Repair or replace meters outside of +/- 6% accuracy		to qualify for 10: Maintain annual meter accuracy testing and calibration of related instrumentation for all meter installations. Repair or replace meters outside of +/- 3% accuracy. Investigate new meter technology; pilot one or more replacements with innovative meters in attempt to further improve meter accuracy		to maintain it: Standardize meter accuracy test frequency to semi-annual, or more frequent, for all meters. Repair or replace meters outside of +/- 3% accuracy. Continually investigate/pilot improving metering technology
Volume from own sources: master meter and supply error adjustment	Select n/a only if the water utility fails to have meters on its sources of supply	Inventory information on meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition; data error cannot be determined	No automatic datalogging of production volumes; daily readings are sorted on paper records without any accountability controls. Flows are not balanced across the water distribution system; tank/storage elevation changes are not employed in calculating the "Volume from own sources" component and archived flow data is adjusted only when grossly evident data error occurs	Conditions between 2 and 4	Production meter data is logged automatically in electronic format and reviewed at least on a monthly basis with necessary corrections implemented. "Volume from own sources" tabulations include estimate of daily changes in tanks/storage facilities. Meter data is adjusted when gross data errors occur, or occasional meter testing deems the necessary	Conditions between 4 and 6	Hourly production meter data logged automatically & reviewed on at least a weekly basis. Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected and/or error is confirmed by meter accuracy testing. Tank/storage facility elevation changes are automatically used in calculating a balanced "Volume from own sources" component, and data gaps in the archived data are corrected on at least a weekly basis	Conditions between 6 and 8	Continuous production meter data is logged automatically & reviewed each business day. Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and/or results of meter accuracy testing. Tank/storage facility elevation changes are automatically used in "Volume from own sources" tabulations and data gaps in the archived data are corrected on a daily basis	Conditions between 8 and 10	Computerized system (SCADA or similar) automatically balances flows from all sources and storages; results are reviewed each business day. Tight accountability controls ensure that all data gaps that occur in the archived flow data are quickly detected and corrected. Regular calibrations between SCADA and sources meters ensures minimal data transfer error
Improvements to attain higher data grading for "Master meter and supply error adjustment" component:		to qualify for 2: Develop a plan to restructure recordkeeping system to capture all flow data; set a procedure to review flow data on a daily basis to detect input errors. Obtain more reliable information about existing meters by conducting field inspections of meters and related instrumentation, and obtaining manufacturer literature	to qualify for 4: Install automatic datalogging equipment on production meters. Complete installation of level instrumentation at all tanks/storage facilities and include tank level data in automatic calculation routine in a computerized system. Construct a computerized listing or spreadsheet to archive input volumes, tank/storage volume changes and import/export flows in order to determine the composite "Water Supplied" volume for the distribution system. Set a procedure to review this data on a monthly basis to detect gross anomalies and data gaps.		to qualify for 6: Refine computerized data collection and archive to include hourly production meter data that is reviewed at least on a weekly basis to detect specific data anomalies and gaps. Use daily net storage change to balance flows in calculating "Water Supplied" volume. Necessary corrections to data errors are implemented on a weekly basis		to qualify for 8: Ensure that all flow data is collected and archived on at least an hourly basis. All data is reviewed and detected errors corrected each business day. Tank/storage levels variations are employed in calculating balanced "Water Supplied" component. Adjust production meter data for gross error and inaccuracy confirmed by testing		to qualify for 10: Link all production and tank/storage facility elevation change data to a Supervisory Control & Data Acquisition (SCADA) System, or similar computerized monitoring/control system, and establish automatic flow balancing algorithm and regularly calibrate between SCADA and source meters. Data is reviewed and corrected each business day		to maintain 10: Monitor meter innovations for development of more accurate and less expensive flowmeters. Continue to replace or repair meters as they perform outside of desired accuracy limits. Stay abreast of new and more accurate water level instruments to better record tank/storage levels and archive the variations in storage volume. Keep current with SCADA and data management systems to ensure that archived data is well-managed and error free
Water Imported	Select n/a if the water utility's supply is exclusively from its own water resources (no bulk purchased/ imported water)	Less than 25% of imported water sources are metered; remaining sources are estimated. No regular meter accuracy testing	25% - 50% of imported water sources are metered; other sources estimated. No regular meter accuracy testing	Conditions between 2 and 4	50% - 75% of imported water sources are metered; other sources estimated. Occasional meter accuracy testing conducted.	Conditions between 4 and 6	At least 75% of imported water sources are metered; meter accuracy testing and/or electronic calibration of related instrumentation is conducted annually for all meter installations. Less than 25% of tested meters are found outside of +/- 6% accuracy	Conditions between 6 and 8	100% of imported water sources are metered; meter accuracy testing and electronic calibration of related instrumentation is conducted annually; less than 10% of meters are found outside of +/- 6% accuracy	Conditions between 8 and 10	100% of imported water sources are metered; meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually for all meter installations; with less than 10% of accuracy tests found outside of +/- 3% accuracy
Improvements to attain higher data grading for "Water Imported Volume" component. (Note: usually the water supplier selling the water = "the Exporter" - to the utility being audited is responsible to maintain the metering installation measuring the imported volume. The utility should coordinate carefully with the Exporter to ensure that adequate meter upkeep takes place and an accurate measure of the Water Imported volume is quantified.)		to qualify for 2: Review bulk water purchase agreements with partner suppliers; confirm requirements for use and maintenance of accurate metering. Identify needs for new or replacement meters with goal to meter all imported water sources	To qualify for 4: Locate all imported water sources on maps and in the field, launch meter accuracy testing for existing meters, begin to install meters on unmetered imported water interconnections and replace obsolete/defective meters		to qualify for 6: Formalize annual meter accuracy testing for all imported water meters, planning for both regular meter accuracy testing and calibration of the related instrumentation. Continue installation of meters on unmetered imported water interconnections and replacement of obsolete/defective meters		to qualify for 8: Complete project to install new, or replace defective, meters on all imported water interconnections. Maintain annual meter accuracy testing for all imported water meters and conduct calibration of related instrumentation at least annually. Repair or replace meters outside of +/- 6% accuracy		to qualify for 10: Conduct meter accuracy testing for all meters on a semi-annual basis along with calibration of all related instrumentation. Repair or replace meters outside of +/- 3% accuracy. Investigate new meter technology; pilot one or more replacements with innovative meters in attempt to improve meter accuracy		to maintain 10: Standardize meter accuracy test frequency to semi-annual, or more frequent, for all meters. Continue to conduct calibration of related instrumentation on a semi-annual basis. Repair or replace meters outside of +/- 3% accuracy. Continually investigate/pilot improving metering technology

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Water imported master meter and supply error adjustment	Select n/a if the imported water supply is unmetered with imported water quantities estimated on the billing invoices sent by the Exporter to the purchasing Utility	Inventory information on imported meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition, data error cannot be determined. Written agreement(s) with water Exporter(s) are missing or written in vague language concerning meter management and testing	No automatic datalogging of imported supply volumes, daily readings are scribed on paper records without any accountability controls to confirm data accuracy and the absence of errors and data gaps in recorded volumes. Written agreement requires meter accuracy testing but is vague on the details of how and who conducts the testing	Conditions between 2 and 4	Imported supply metered flow data is logged automatically in electronic format and reviewed at least on a monthly basis by the Exporter with necessary corrections implemented. Meter data is adjusted by the Exporter when gross data errors are detected. A coherent data trail exists for this process to protect both the selling and the purchasing Utility. Written agreement exists and clearly states requirements and roles for meter accuracy testing and data management	Conditions between 4 and 6	Hourly imported supply metered data is logged automatically & reviewed on at least a weekly basis by the Exporter. Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected, and to correct for error confirmed by meter accuracy testing. Any data gaps in the archived data are detected and corrected during the weekly review. A coherent data trail exists for the process to protect both the selling and the purchasing Utility	Conditions between 6 and 8	Continuous imported supply metered flow data is logged automatically & reviewed each business day by the Exporter. Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and/or results of meter accuracy testing. Any data errors/gaps are detected and corrected on a daily basis. A data trail exists for the process to protect both the selling and the purchasing Utility	Conditions between 8 and 10	Computerized system (SCADA or similar) automatically records data which is reviewed each business day by the Exporter. Tight accountability controls ensure that all error/data gaps that occur in the archived flow data are quickly detected and corrected. A reliable data trail exists and contract provisions for meter testing and data management are reviewed by the selling and purchasing Utility at least once every five years
Improvements to attain higher data grading for "Water imported master meter and supply error adjustment" component:		To qualify for 2: Develop a plan to restructure recordkeeping system to capture all flow data; set a procedure to review flow data on a daily basis to detect input errors. Obtain more reliable information about existing meters by conducting field inspections of meters and related instrumentation, and obtaining manufacturer literature. Review the written agreement between the selling and purchasing Utility.	To qualify for 4: Install automatic datalogging equipment on imported supply meters. Set a procedure to review this data on a monthly basis to detect gross anomalies and data gaps. Launch discussions with the Exporters to jointly review terms of the written agreements regarding meter accuracy testing and data management; revise the terms as necessary.		To qualify for 6: Refine computerized data collection and archive to include hourly imported supply metered flow data that is reviewed at least on a weekly basis to detect specific data anomalies and gaps. Make necessary corrections to errors/data errors on a weekly basis.		To qualify for 8: Ensure that all imported supply metered flow data is collected and archived on at least an hourly basis. All data is reviewed and errors/data gaps are corrected each business day.		To qualify for 10: Conduct accountability checks to confirm that all imported supply metered data is reviewed and corrected each business day by the Exporter. Results of all meter accuracy tests and data corrections should be available for sharing between the Exporter and the purchasing Utility. Establish a schedule for a regular review and updating of the contractual language in the written agreement between the selling and the purchasing Utility; at least every five years.		To maintain 10: Monitor meter innovations for development of more accurate and less expensive flowmeters, work with the Exporter to help identify meter replacement needs. Keep communication lines with Exporters open and maintain productive relations. Keep the written agreement current with clear and explicit language that meets the ongoing needs of all parties.
Water Exported	Select n/a if the water utility sells no bulk water to neighboring water utilities (no exported water sales)	Less than 25% of exported water sources are metered, remaining sources are estimated. No regular meter accuracy testing	25% - 50% of exported water sources are metered, other sources estimated. No regular meter accuracy testing	Conditions between 2 and 4	50% - 75% of exported water sources are metered, other sources estimated. Occasional meter accuracy testing conducted	Conditions between 4 and 6	At least 75% of exported water sources are metered, meter accuracy testing and/or electronic calibration conducted annually. Less than 25% of tested meters are found outside of +/- 6% accuracy	Conditions between 6 and 8	100% of exported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted annually, less than 10% of meters are found outside of +/- 6% accuracy	Conditions between 8 and 10	100% of exported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually for all meter installations, with less than 10% of accuracy tests found outside of +/- 3% accuracy
Improvements to attain higher data grading for "Water Exported Volume" component: *(Note: usually, if the water utility being audited sells (Exports) water to a neighboring purchasing Utility, it is the responsibility of the utility exporting the water to maintain the metering installation measuring the Exported volume. The utility exporting the water should ensure that adequate meter upkeep takes place and an accurate measure of the Water Exported volume is quantified.)*		To qualify for 2: Review bulk water sales agreements with purchasing utilities; confirm requirements for use & upkeep of accurate metering. Identify needs to install new, or replace defective meters as needed	To qualify for 4: Locate all exported water sources on maps and in field, launch meter accuracy testing for existing meters, begin to install meters on unmetered exported water interconnections and replace obsolete/defective meters.		To qualify for 6: Formalize annual meter accuracy testing for all exported water meters. Continue installation of meters on unmetered exported water interconnections and replacement of obsolete/defective meters.		To qualify for 8: Complete project to install new, or replace defective, meters on all exported water interconnections. Maintain annual meter accuracy testing for all exported water meters. Repair or replace meters outside of +/- 6% accuracy.		To qualify for 10: Maintain annual meter accuracy testing for all meters. Repair or replace meters outside of +/- 3% accuracy. Investigate new meter technology; pilot one or more replacements with innovative meters in attempt to improve meter accuracy.		To maintain 10: Standardize meter accuracy test frequency to semi-annual, or more frequent, for all meters. Repair or replace meters outside of +/- 3% accuracy. Continually investigate/pilot improving metering technology.
Water exported master meter and supply error adjustment	Select n/a only if the water utility fails to have meters on its exported supply interconnections	Inventory information on exported meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition, data error cannot be determined. Written agreement(s) with the utility purchasing the water are missing or written in vague language concerning meter management and testing	No automatic datalogging of exported supply volumes, daily readings are scribed on paper records without any accountability controls to confirm data accuracy and the absence of errors and data gaps in recorded volumes. Written agreement requires meter accuracy testing but is vague on the details of how and who conducts the testing	Conditions between 2 and 4	Exported metered flow data is logged automatically in electronic format and reviewed at least on a monthly basis with necessary corrections implemented. Meter data is adjusted by the utility selling (exporting) the water when gross data errors are detected. A coherent data trail exists for this process to protect both the utility exporting the water and the purchasing Utility. Written agreement exists and clearly states requirements and roles for meter accuracy testing and data management	Conditions between 4 and 6	Hourly exported supply metered data is logged automatically & reviewed on at least a weekly basis by the utility selling the water. Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected, and to correct for error found by meter accuracy testing. Any data gaps in the archived data are detected and corrected during the weekly review. A coherent data trail exists for the process to protect both the selling (exporting) utility and the purchasing Utility	Conditions between 6 and 8	Continuous exported supply metered flow data is logged automatically & reviewed each business day by the utility selling (exporting) the water. Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and any error confirmed by meter accuracy testing. Any data errors/gaps are detected and corrected on a daily basis. A data trail exists for the process to protect both the selling (exporting) Utility and the purchasing Utility	Conditions between 8 and 10	Computerized system (SCADA or similar) automatically records data which is reviewed each business day by the utility selling (exporting) the water. Tight accountability controls ensure that all error/data gaps that occur in the archived flow data are quickly detected and corrected. A reliable data trail exists and contract provisions for meter testing and data management are reviewed by the selling Utility and purchasing Utility at least once every five years.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Improvements to attain higher data grading for "Water exported master meter and supply error adjustment" component.		to qualify for 2: Develop a plan to restructure recordkeeping system to capture all flow data; set a procedure to review flow data on a daily basis to detect input errors. Obtain more reliable information about existing meters by conducting field inspections of meters and related instrumentation, and obtaining manufacturer literature. Review the written agreement between the utility selling (exporting) the water and the purchasing Utility.	to qualify for 4: Install automatic datalogging equipment on exported supply meters. Set a procedure to review this data on a monthly basis to detect gross anomalies and data gaps. Launch discussions with the purchasing utilities to jointly review terms of the written agreements regarding meter accuracy testing and data management, revise the terms as necessary		to qualify for 6: Refine computerized data collection and archive to include hourly exported supply metered flow data that is reviewed at least on a weekly basis to detect specific data anomalies and gaps. Make necessary corrections to errors/data errors on a weekly basis.		to qualify for 8: Ensure that all exported metered flow data is collected and archived on at least an hourly basis. All data is reviewed and errors/data gaps are corrected each business day		to qualify for 10: Conduct accountability checks to confirm that all exported metered flow data is reviewed and corrected each business day by the utility selling the water. Results of all meter accuracy tests and data corrections should be available for sharing between the utility and the purchasing Utility. Establish a schedule for a regular review and updating of the contractual language in the written agreements with the purchasing utilities at least every five years		to maintain 10: Monitor meter innovations for development of more accurate and less expensive flowmeters; work with the purchasing utilities to help identify meter replacement needs. Keep communication lines with the purchasing utilities open and maintain productive relations. Keep the written agreement current with clear and explicit language that meets the ongoing needs of all parties.
AUTHORIZED CONSUMPTION											
Billed metered:	n/a (not applicable). Select n/a only if the entire customer population is not metered and is billed for water service on a flat or fixed rate basis. In such a case the volume entered must be zero.	Less than 50% of customers with volume-based billings from meter readings; flat or fixed rate billing exists for the majority of the customer population.	At least 50% of customers with volume-based billing from meter reads; flat rate billing for others. Manual meter reading is conducted with less than 50% meter read success rate; remanding accounts' consumption is estimated. Limited meter records; no regular meter testing or replacement. Billing data maintained on paper records; with no auditing.	Conditions between 2 and 4	At least 75% of customers with volume-based billing from meter reads; flat or fixed rate billing for remaining accounts. Manual meter reading is conducted with at least 50% meter read success rate; consumption for accounts with failed reads is estimated. Purchase records verify age of customer meters; only very limited meter accuracy testing is conducted. Customer meters are replaced only upon complete failure. Computerized billing records exist, but only sporadic internal auditing conducted.	Conditions between 4 and 6	At least 90% of customers with volume-based billing from meter reads; consumption for remaining accounts is estimated. Manual customer meter reading gives at least 80% customer meter reading success rate; consumption for accounts with failed reads is estimated. Good customer meter records exist, but only limited meter accuracy testing is conducted. Regular replacement is conducted for the oldest meters. Computerized billing records exist with annual auditing of summary statistics conducted by utility personnel.	Conditions between 6 and 8	At least 97% of customers exist with volume-based billing from meter reads. At least 90% customer meter reading success rate or at least 80% read success rate with planning and budgeting for trials of Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) in one or more pilot areas. Good customer meter records. Regular meter accuracy testing guides replacement of statistically significant number of meters each year. Routine auditing of computerized billing records for global and detailed statistics occurs annually by utility personnel, and is verified by third party at least once every five years.	Conditions between 8 and 10	At least 99% of customers exist with volume-based billing from meter reads. At least 95% customer meter reading success rate or minimum 80% meter reading success rate with Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) trials underway. Statistically significant customer meter testing and replacement program in place on a consensus basis. Computerized billing with routine detailed auditing, including field investigation of representative sample of accounts undertaken annually by utility personnel. Audit is conducted by third party auditors at least once every three years.
Improvements to attain higher data grading for "Billed Metered Consumption" component	If n/a is selected because the customer meter population is unmetered consider establishing a new policy to meter the customer population and employ water rates based upon metered volumes.	to qualify for 2: Conduct investigations or trials of customer meters to select appropriate meter models. Budget funding for meter installations. Investigate volume based water rate structures.	to qualify for 4: Purchase and install meters on unmetered accounts. Implement policies to improve meter reading success. Catalog meter information during meter read visits to identify age/model of existing meters. Test a minimal number of meters for accuracy. Install computerized billing system.		to qualify for 6: Purchase and install meters on unmetered accounts. Eliminate flat fee billing and establish appropriate water rate structure based upon measured consumption. Continue to achieve verifiable success in removing manual meter reading barriers. Expand meter accuracy testing. Launch regular meter replacement program. Launch a program of annual auditing of global billing statistics by utility personnel.		to qualify for 8: Purchase and install meters on unmetered accounts. If customer meter reading success rate is less than 97% assess cost-effectiveness of Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) system for portion or entire system; or otherwise achieve ongoing improvements in manual meter reading success rate to 97% or higher. Refine meter accuracy testing program. Set meter replacement goals based upon accuracy test results. Implement annual auditing of detailed billing records by utility personnel and implement third party auditing at least once every five years.		to qualify for 10: Purchase and install meters on unmetered accounts. Launch Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) system trials if manual meter reading success rate of at least 99% is not achieved within a five-year program. Continue meter accuracy testing program. Conduct planning and budgeting for large scale meter replacement based upon meter life cycle analysis using cumulative flow target. Continue annual detailed billing data auditing by utility personnel and conduct third party auditing at least once every three years.		to maintain 10: Continue annual internal billing data auditing and third party auditing at least every three years. Continue customer meter accuracy testing to ensure that accurate customer meter readings are obtained and entered as the basis for volume based billing. Stay abreast of improvements in Automatic Meter Reading (AMR) and Advanced Metering Infrastructure (AMI) and information management. Plan and budget for justified upgrades in metering, meter reading and billing data management to maintain very high accuracy in customer metering and billing.
Billed unmetered	Select n/a if it is the policy of the water utility to meter all customer connections and it has been confirmed by detailed auditing that all customers do indeed have a water meter, i.e. no intentionally unmetered accounts exist.	Water utility policy does not require customer metering, flat or fixed fee billing is employed. No data is collected on customer consumption. The only estimates of customer population consumption available are derived from data estimation methods using average fixture count multiplied by number of connections or similar approach.	Water utility policy does not require customer metering, flat or fixed fee billing is employed. Some metered accounts exist in parts of the system (pilot areas or District Metered Areas) with consumption read periodically or recorded on portable dataloggers over one, three, or seven day periods. Data from these sample meters are used to infer consumption for the total customer population. Site specific estimation methods are used for unusual buildings/water uses.	Conditions between 2 and 4	Water utility policy does require metering and volume based billing in general. However, a liberal amount of exemptions and a lack of clearly written and communicated procedures result in up to 20% of billed accounts believed to be unmetered by exemption, or the water utility is in transition to becoming fully metered, and a large number of customers remain unmetered. A rough estimate of the annual consumption for all unmetered accounts is included in the annual water audit, with no inspection of individual unmetered accounts.	Conditions between 4 and 6	Water utility policy does require metering and volume based billing but established exemptions exist for a portion of accounts such as municipal buildings. As many as 15% of billed accounts are unmetered due to the exemption or meter installation difficulties. Only a group estimate of annual consumption for all unmetered accounts is included in the annual water audit, with no inspection of individual unmetered accounts.	Conditions between 6 and 8	Water utility policy does require metering and volume based billing for all customer accounts. However, less than 5% of billed accounts remain unmetered because meter installation is hindered by unusual circumstances. The goal is to minimize the number of unmetered accounts. Reliable estimates of consumption are obtained for these unmetered accounts via site specific estimation methods.	Conditions between 8 and 10	Water utility policy does require metering and volume based billing for all customer accounts. Less than 2% of billed accounts are unmetered and exist because meter installation is hindered by unusual circumstances. The goal exists to minimize the number of unmetered accounts to the extent that is economical. Reliable estimates of consumption are obtained at these accounts via site specific estimation methods.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Improvements to attain higher data grading for "Billed Unmetered Consumption" component.		to qualify for 2: Conduct research and evaluate cost/benefit of a new water utility policy to require metering of the customer population; thereby greatly reducing or eliminating unmetered accounts. Conduct pilot metering project by installing water meters in small sample of customer accounts and periodically reading the meters or datalogging the water consumption over one, three, or seven day periods.	to qualify for 4: Implement a new water utility policy requiring customer metering. Launch or expand pilot metering study to include several different meter types, which will provide data for economic assessment of full scale metering options. Assess sites with access difficulties to devise means to obtain water consumption volumes. Begin customer meter installation.		to qualify for 6: Refine policy and procedures to improve customer metering participation for all but solidly exempt accounts. Assign staff resources to review billing records to identify errant unmetered properties. Specify metering needs and funding requirements to install sufficient meters to significant reduce the number of unmetered accounts		to qualify for 8: Push to install customer meters on a full scale basis. Refine metering policy and procedures to ensure that all accounts including municipal properties, are designated for meters. Plan special efforts to address "hard-to-access" accounts. Implement procedures to obtain a reliable consumption estimate for the remaining few unmetered accounts awaiting meter installation.		to qualify for 10: Continue customer meter installation throughout the service area, with a goal to minimize unmetered accounts. Sustain the effort to investigate accounts with access difficulties, and devise means to install water meters or otherwise measure water consumption.		to maintain 10: Continue to refine estimation methods for unmetered consumption and explore means to establish metering for as many billed remaining unmetered accounts as is economically feasible
Unbilled metered	select n/a if all billing-exempt consumption is unmetered	Billing practices exempt certain accounts, such as municipal buildings, but written policies do not exist, and a reliable count of unbilled metered accounts is unavailable. Meter upkeep and meter reading on these accounts is rare and not considered a priority. Due to poor recordkeeping and lack of auditing water consumption for all such accounts is purely guesstimated	Billing practices exempt certain accounts, such as municipal buildings, but only scattered, dated written directives exist to justify the practice. A reliable count of unbilled metered accounts is unavailable. Sporadic meter replacement and meter reading occurs on an as-needed basis. The total annual water consumption for all unbilled, metered accounts is estimated based upon approximating the number of accounts and assigning consumption from actively billed accounts of same meter size	Conditions between 2 and 4	Dated written procedures permit billing exemption for specific accounts, such as municipal properties, but are unclear regarding certain other types of accounts. Meter reading is given low priority and is sporadic. Consumption is quantified from meter readings where available. The total number of unbilled, unmetered accounts must be estimated along with consumption volumes	Conditions between 4 and 6	Written policies regarding billing exemptions exist but adherence in practice is questionable. Metering and meter reading for municipal buildings is reliable but sporadic for other unbilled metered accounts. Periodic auditing of such accounts is conducted. Water consumption is quantified directly from meter readings where available, but the majority of the consumption is estimated	Conditions between 6 and 8	Written policy identifies the types of accounts granted a billing exemption. Customer meter management and meter reading are considered secondary priorities, but meter reading is conducted at least annually to obtain consumption volumes for the annual water audit. High level auditing of billing records ensures that a reliable census of such accounts exists	Conditions between 8 and 10	Clearly written policy identifies the types of accounts given a billing exemption, with emphasis on keeping such accounts to a minimum. Customer meter management and meter reading for these accounts is given proper priority and is reliably conducted. Regular auditing confirms the total water consumption for these accounts is taken from reliable readings from accurate meters
Improvements to attain higher data grading for "Unbilled Metered Consumption" component.		to qualify for 2: Reassess the water utility's policy allowing certain accounts to be granted a billing exemption. Draft an outline of a new written policy for billing exemptions, with clear justification as to why any accounts should be exempt from billing, and with the intention to keep the number of such accounts to a minimum.	to qualify for 4: Review historic written directives and policy documents allowing certain accounts to be billing-exempt. Draft an outline of a written policy for billing exemptions, identify criteria that grants an exemption, with a goal of keeping the number of accounts to a minimum. Consider increasing the priority of reading meters on unbilled accounts at least annually.		to qualify for 6: Draft a new written policy regarding billing exemptions based upon consensus criteria allowing this occurrence. Assign resources to audit meter records and billing records to obtain census of unbilled metered accounts. Gradually include a greater number of these metered accounts to the routes for regular meter reading.		to qualify for 8: Communicate billing exemption policy throughout the organization and implement procedures that ensure proper account management. Conduct inspections of accounts confirmed in unbilled metered status and verify that accurate meters exist and are scheduled for routine meter readings. Gradually increase the number of unbilled metered accounts that are included in regular meter reading routes		to qualify for 10: Ensure that meter management (meter accuracy testing, meter replacement) and meter reading activities for unbilled accounts are accorded the same priority as billed accounts. Establish ongoing annual auditing process to ensure that water consumption is reliably collected and provided to the annual water audit process		to maintain 10: Reassess the utility's philosophy in allowing any water uses to go "unbilled". It is possible to meter and bill all accounts, even if the fee charged for water consumption is discounted or waived. Metering and billing all accounts ensures that water consumption is tracked and water waste from plumbing leaks is detected and minimized
Unbilled unmetered		Extent of unbilled, unmetered consumption is unknown due to unclear policies and poor recordkeeping. Total consumption is quantified based upon a purely subjective estimate	Clear extent of unbilled, unmetered consumption is unknown, but a number of events are randomly documented each year, confirming existence of such consumption, but without sufficient documentation to quantify an accurate estimate of the annual volume consumed	Conditions between 2 and 4	Extent of unbilled, unmetered consumption is partially known, and procedures exist to document certain events such as miscellaneous fire hydrant uses. Formulae is used to quantify the consumption from such events (time running multiplied by typical flowrate, multiplied by number of events).	Default value of 1.25% of system input volume is employed	Coherent policies exist for some forms of unbilled, unmetered consumption, but others await closer evaluation. Reasonable recordkeeping for the managed uses exists and allows for annual volumes to be quantified by inference, but unsupervised uses are guesstimated	Conditions between 6 and 8	Clear policies and good recordkeeping exist for some uses (ex: water used in periodic testing of unmetered fire connections), but other uses (ex: miscellaneous uses of fire hydrants) have limited oversight. Total consumption is a mix of well quantified use such as from formulae (time running multiplied by typical flow multiplied by number of events), or temporary meters, and relatively subjective estimates of less regulated use	Conditions between 8 and 10	Clear policies exist to identify permitted uses of water in unbilled, unmetered fashion, with the intention of minimizing this type of consumption. Good records document each occurrence and consumption is quantified via formulae (time running multiplied by typical flow multiplied by number of events) or use of temporary meters
Improvements to attain higher data grading for "Unbilled Unmetered Consumption" component.		to qualify for 5: Utilize the accepted default value of 1.25% of the volume of water supplied as an expedient means to gain a reasonable quantification of this use. to qualify for 2: Establish a policy regarding what water uses should be allowed to remain as unbilled and unmetered. Consider tracking a small sample of one such use (ex: fire hydrant flushings).	to qualify for 5: Utilize accepted default value of 1.25% of the volume of water supplied as an expedient means to gain a reasonable quantification of this use. to qualify for 4: Evaluate the documentation of events that have been observed. Meet with user groups (ex: for fire hydrants - fire departments, contractors to ascertain their need and/or volume requirements for water from fire hydrants).		to qualify for 6: Utilize accepted default value of 1.25% of the volume of water supplied as an expedient means to gain a reasonable quantification of all such use. This is particularly appropriate for water utilities who are in the early stages of the water auditing process, and should focus on other components since the volume of unbilled, unmetered consumption is usually a relatively small quality component, and other larger-quantity components should take priority	to qualify for 6 or greater: Finalize policy and begin to conduct field checks to better establish and quantify such usage. Proceed if top-down audit exists and/or a great volume of such use is suspected.	to qualify for 8: Assess water utility policy and procedures for various unmetered usages. For example, ensure that a policy exists and permits are issued for use of fire hydrants by persons outside of the utility. Create written procedures for use and documentation of fire hydrants by water utility personnel. Use same approach for other types of unbilled, unmetered water usage.		to qualify for 10: Refine written procedures to ensure that all uses of unbilled, unmetered water are overseen by a structured permitting process managed by water utility personnel. Reassess policy to determine if some of these uses have value in being converted to billed and/or metered status.		to maintain 10: Continue to refine policy and procedures with intention of reducing the number of allowable uses of water in unbilled and unmetered fashion. Any uses that can feasibly become billed and metered should be converted eventually
APPARENT LOSSES											

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Unauthorized consumption		Extent of unauthorized consumption is unknown due to unclear policies and poor recordkeeping. Total unauthorized consumption is guesstimated.	Unauthorized consumption is a known occurrence but its extent is a mystery. There are no requirements to document observed events but periodic field reports capture some of these occurrences. Total unauthorized consumption is approximated from the limited data.	conditions between 2 and 4	Procedures exist to document some unauthorized consumption such as observed unauthorized fire hydrant openings. Use formulae to quantify this consumption (time running multiplied typical flowrate, multiplied by number of events)	Default value of 0.25% of volume of water supplied is employed	Coherent policies exist for some forms of unauthorized consumption (more than simply fire hydrant misuse) but others await closer evaluation. Reasonable surveillance and recordkeeping exist for occurrences that fall under the policy. Volumes quantified by inference from these records	Conditions between 6 and 8	Clear policies and good auditable recordkeeping exist for certain events (ex: tampering with water meters, illegal bypasses of customer meters); but other occurrences have limited oversight. Total consumption is a combination of volumes from formulae (time x typical flow) and subjective estimates of unconfirmed consumption	Conditions between 8 and 10	Clear policies exist to identify all known unauthorized uses of water. Staff and procedures exist to provide enforcement of policies and detect violations. Each occurrence is recorded and quantified via formulae (estimated time running multiplied by typical flow) or similar methods. All records and calculations should exist in a form that can be audited by a third party
Improvements to attain higher data grading for "Unauthorized Consumption" component		to qualify for 5 Use accepted default of 0.25% of volume of water supplied. to qualify for 2 Review utility policy regarding what water uses are considered unauthorized, and consider tracking a small sample of one such occurrence (ex: unauthorized fire hydrant openings)	to qualify for 5 Use accepted default of 0.25% of system input volume to qualify for 4 Review utility policy regarding what water uses are considered unauthorized, and consider tracking a small sample of one such occurrence (ex: unauthorized fire hydrant openings)		to qualify for 5 Utilize accepted default value of 0.25% of volume of water supplied as an expedient means to gain a reasonable quantification of all such use. This is particularly appropriate for water utilities who are in the early stages of the water auditing process.	to qualify for 6 or greater Finalize policy updates to clearly identify the types of water consumption that are authorized from those usages that fall outside of the policy and are, therefore, unauthorized. Begin to conduct regular field checks. Proceed if the top-down audit already exists and/or a great volume of such use is suspected	to qualify for 8 Assess water utility policies to ensure that all known occurrences of unauthorized consumption are outlawed, and that appropriate penalties are prescribed. Create written procedures for detection and documentation of various occurrences of unauthorized consumption as they are uncovered		to qualify for 10 Refine written procedures and assign staff to seek out likely occurrences of unauthorized consumption. Explore new locking devices, monitors and other technologies designed to detect and thwart unauthorized consumption.	to maintain 10 Continue to refine policy and procedures to eliminate any loopholes that allow or tacitly encourage unauthorized consumption. Continue to be vigilant in detection, documentation and enforcement efforts
Customer metering inaccuracies	select n/a only if the entire customer population is unmetered. In such a case the volume entered must be zero	Customer meters exist, but with unorganized paper records on meters; no meter accuracy testing or meter replacement program for any size of retail meter. Metering workflow is driven chaotically with no proactive management. Loss volume due to aggregate meter inaccuracy is guesstimated	Poor recordkeeping and meter oversight is recognized by water utility management who has allotted staff and funding resources to organize improved recordkeeping and start meter accuracy testing. Existing paper records gathered and organized to provide cursory deposition of meter population. Customer meters are tested for accuracy only upon customer request	Conditions between 2 and 4	Reliable recordkeeping exists, meter information is improving as meters are replaced. Meter accuracy testing is conducted annually for a small number of meters (more than just customer requests, but less than 1% of inventory). A limited number of the oldest meters are replaced each year. Inaccuracy volume is largely an estimate, but refined based upon limited testing data.	Conditions between 4 and 6	A reliable electronic recordkeeping system for meters exists. The meter population includes a mix of new high performing meters and dated meters with suspect accuracy. Routine but limited meter accuracy testing and meter replacement occur. Inaccuracy volume is quantified using a mix of reliable and less certain data.	Conditions between 6 and 8	Ongoing meter replacement and accuracy testing result in highly accurate customer meter population. Testing is conducted on samples of meters of varying age and accumulated volume of throughput to determine optimum replacement time for various types of meters	Ongoing meter replacement and accuracy testing result in highly accurate customer meter population. Statistically significant number of meters are tested in audit year. This testing is conducted on samples of meters of varying age and accumulated volume of throughput to determine optimum replacement time for these meters	Good records of all active customer meters exist and include as a minimum meter number, account number/location, type, size and manufacturer. Ongoing meter replacement occurs according to a targeted and justified base. Regular meter accuracy testing gives a reliable measure of composite inaccuracy volume for the customer meter population. New metering technology is embraced to keep overall accuracy improving. Procedures are reviewed by a third party knowledgeable in the M36 methodology
Improvements to attain higher data grading for "Customer meter inaccuracy volume" component	If n/a is selected because the customer meter population is unmetered, consider establishing a new policy to meter the customer population and employ water rates based upon metered volumes	to qualify for 2 Gather available meter purchase records. Conduct testing on a small number of meters believed to be the most inaccurate. Review staffing needs of the metering group and budget for necessary resources to better organize meter management.	to qualify for 4 Implement a reliable record keeping system for customer meter histories, preferably using electronic methods typically linked to, or part of, the Customer Billing System or Customer Information System. Expand meter accuracy testing to a larger group of meters		to qualify for 6 Standardize the procedures for meter recordkeeping within an electronic information system. Accelerate meter accuracy testing and meter replacements guided by testing results.		to qualify for 8 Expand annual meter accuracy testing to evaluate a statistically significant number of meter makes/models. Expand meter replacement program to replace statistically significant number of poor performing meters each year.		to qualify for 9 Continue efforts to manage meter population with reliable recordkeeping. Test a statistically significant number of meters each year and analyze test results in an ongoing manner to serve as a base for a target meter replacement strategy based upon accumulated volume throughput.	to qualify for 10 Continue efforts to manage meter population with reliable recordkeeping, meter testing and replacement. Evaluate new meter types and install one or more types in 5-10 customer accounts each year in order to pilot improving metering technology.	to maintain 10 Increase the number of meters tested and replaced as justified by meter accuracy test data. Continually monitor development of new metering technology and Advanced Metering Infrastructure (AMI) to grasp opportunities for greater accuracy in metering of water flow and management of customer consumption data.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Systematic Data Handling Errors	Note: all water utilities incur some amount of this error. Even in water utilities with unmetered customer populations and fixed rate billing, errors occur in annual billing tabulations. Enter a positive value for the volume and select a grading.	Policies and procedures for activation of new customer water billing accounts are vague and lack accountability. Billing data is maintained on paper records which are not well organized. No auditing is conducted to confirm billing data handling efficiency. An unknown number of customers escape routine billing due to lack of billing process oversight.	Policy and procedures for activation of new customer accounts and oversight of billing records exist but need refinement. Billing data is maintained on paper records or insufficiently capable electronic database. Only periodic unstructured auditing work is conducted to confirm billing data handling efficiency. The volume of unbilled water due to billing lapses is a guess.	Conditions between 2 and 4	Policy and procedures for new account activation and oversight of billing operations exist but needs refinement. Computerized billing system exists, but is dated or lacks needed functionality. Periodic, limited internal audits conducted and confirm with approximate accuracy the consumption volumes lost to billing lapses.	Conditions between 4 and 6	Policy and procedures for new account activation and oversight of billing operations is adequate and reviewed periodically. Computerized billing system is in use with basic reporting available. Any effect of billing adjustments on measured consumption volumes is well understood. Internal checks of billing data error conducted annually. Reasonably accurate quantification of consumption volume lost to billing lapses is obtained.	Conditions between 6 and 8	New account activation and billing operations policy and procedures are reviewed at least biannually. Computerized billing system includes an array of reports to confirm billing data and system functionality. Checks are conducted routinely to flag and explain zero consumption accounts. Annual internal checks conducted with third party audit conducted at least once every five years. Accountability checks flag billing lapses. Consumption lost to billing lapses is well quantified and reducing year-by-year.	Conditions between 8 and 10	Sound written policy and procedures exist for new account activation and oversight of customer billing operations. Robust computerized billing system gives high functionality and reporting capabilities which are utilized, analyzed and the results reported each billing cycle. Assessment of policy and data handling errors are conducted internally and audited by third party at least once every three years, ensuring consumption lost to billing lapses is minimized and detected as it occurs.
Improvements to attain higher data grading for "Systematic Data Handling Error volume" component:		to qualify for 2: Draft written policy and procedures for activating new water billing accounts and oversight of billing operations. Investigate and budget for computerized customer billing system. Conduct initial audit of billing records by flow-charting the basic business processes of the customer account/billing function.	to qualify for 4: Finalize written policy and procedures for activation of new billing accounts and overall billing operations management. Implement a computerized customer billing system. Conduct initial audit of billing records as part of this process.		to qualify for 6: Refine new account activation and billing operations procedures and ensure consistency with the utility policy regarding billing, and minimize opportunity for missed billings. Upgrade or replace customer billing system for needed functionality - ensure that billing adjustments don't corrupt the value of consumption volumes. Procedurize internal annual audit process.		to qualify for 8: Formalize regular review of new account activation process and general billing practices. Enhance reporting capability of computerized billing system. Formalize regular auditing process to reveal scope of data handling error. Plan for periodic third party audit to occur at least once every five years.		to qualify for 10: Close policy/procedure loopholes that allow some customer accounts to go unbilled, or data handling errors to exist. Ensure that billing system reports are utilized, analyzed and reported every billing cycle. Ensure that internal and third party audits are conducted at least once every three years.		to maintain 10: Stay abreast of customer information management developments and innovations. Monitor developments of Advanced Metering Infrastructure (AMI) and integrate technology to ensure that customer endpoint information is well-monitored and errors/lapses are at an economic minimum.
SYSTEM DATA											
Length of mains		Poorly assembled and maintained paper as-built records of existing water main installations makes accurate determination of system pipe length impossible. Length of mains is guesstimated.	Paper records in poor or uncertain condition (no annual tracking of installations & abandonments). Poor procedures to ensure that new water mains installed by developers are accurately documented.	Conditions between 2 and 4	Sound written policy and procedures exist for documenting new water main installations, but gaps in management result in a uncertain degree of error in tabulation of mains length.	Conditions between 4 and 6	Sound written policy and procedures exist for permitting and commissioning new water mains. Highly accurate paper records with regular field validation, or electronic records and asset management system in good condition. Includes system backup.	Conditions between 6 and 8	Sound written policy and procedures exist for permitting and commissioning new water mains. Electronic recordkeeping such as a Geographical Information System (GIS) and asset management system are used to store and manage data.	Conditions between 8 and 10	Sound written policy exists for managing water mains extensions and replacements. Geographic Information System (GIS) data and asset management database agree and random field validation proves truth of databases. Records of annual field validation should be available for review.
Improvements to attain higher data grading for "Length of Water Mains" component:		to qualify for 2: Assign personnel to inventory current as-built records and compare with customer billing system records and highway plans in order to verify poorly documented pipelines. Assemble policy documents regarding permitting and documentation of water main installations by the utility and building developers; identify gaps in procedures that result in poor documentation of new water main installations.	to qualify for 4: Complete inventory of paper records of water main installations for several years prior to audit year. Review policy and procedures for commissioning and documenting new water main installation.		to qualify for 6: Finalize updates/improvements to written policy and procedures for permitting/commissioning new main installations. Confirm inventory of records for five years prior to audit year, correct any errors or omissions.		to qualify for 8: Launch random field checks of limited number of locations. Convert to electronic database such as a Geographic Information System (GIS) with backup as justified. Develop written policy and procedures.		to qualify for 10: Link Geographic Information System (GIS) and asset management databases, conduct field verification of data. Record field verification information at least annually.		to maintain 10: Continue with standardization and random field validation to improve the completeness and accuracy of the system.
Number of active AND inactive service connections		Vague permitting (of new service connections) policy and poor paper recordkeeping of customer connections/billings result in suspect determination of the number of service connections, which may be 10-15% in error from actual count.	General permitting policy exists but paper records, procedural gaps, and weak oversight result in questionable total for number of connections which may vary 5-10% of actual count.	Conditions between 2 and 4	Written account activation policy and procedures exist, but with some gaps in performance and oversight. Computerized information management system is being brought online to replace dated paper recordkeeping system. Reasonably accurate tracking of service connection installations & abandonments, but count can be up to 5% in error from actual total.	Conditions between 4 and 6	Written new account activation and overall billing policies and procedures are adequate and reviewed periodically. Computerized information management system is in use with annual installations & abandonments totaled. Very limited field verifications and audits. Error in count of number of service connections is believed to be no more than 3%.	Conditions between 6 and 8	Policies and procedures for new account activation and overall billing operations are written, well-structured and reviewed at least biannually. Well-managed computerized information management system exists and routine, periodic field checks and internal system audits are conducted. Counts of connections are no more than 2% in error.	Conditions between 8 and 10	Sound written policy and well managed and audited procedures ensure reliable management of service connection population. Computerized information management system, Customer Billing System, and Geographic Information System (GIS) information agree. Field validation proves truth of databases. Count of connections recorded as being in error at less than 1% of the entire population.
Improvements to attain higher data grading for "Number of Active and Inactive Service Connections" component:	**Note: The number of Service Connections does not include fire hydrant leads/lines connecting the hydrant to the water main.**	to qualify for 2: Draft new policy and procedures for new account activation and overall billing operations. Research and collect paper records of installations & abandonments for several years prior to audit year.	to qualify for 4: Refine policy and procedures for new account activation and overall billing operations. Research computerized recordkeeping system (Customer Information System or Customer Billing System) to improve documentation format for service connections.		to qualify for 6: Refine procedures to ensure consistency with new account activation and overall billing policy to establish new service connections or decommission existing connections. Improve process to include all totals for at least five years prior to audit year.		to qualify for 8: Formalize regular review of new account activation and overall billing operations policies and procedures. Launch random field checks of limited number of locations. Develop reports and auditing mechanisms for computerized information management system.		to qualify for 10: Close any procedural loopholes that allow installations to go undocumented. Link computerized information management system with Geographic Information System (GIS) and formalize field inspection and information system auditing processes. Documentation of new or decommissioned service connections encounters several levels of checks and balances.		to maintain 10: Continue with standardization and random field validation to improve knowledge of system.
	Note: if customer water	Gradings 1-9 apply if customer properties are unmetered, if customer meters exist and are located inside the customer building premises, or if the water utility owns and is responsible for the entire service connection piping from the water main to the customer building. In any of these cases the average distance between the curb stop or boundary separating utility/customer responsibility for service connection piping and the typical first point of use (ex: faucet) or the customer meter must be quantified. Gradings of 1-9 are used to grade the validity of the means to quantify the value. (See the "Service Connection Diagram" worksheet)									Either of two conditions can be met for a grading of 10:

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Average length of customer service line	If meters are located outside of the customer building next to the curb stop or boundary separating utility/customer responsibility then the auditor should answer "Yes" to the question on the Reporting Worksheet asking about this. If the answer is Yes, the grading description listed under this Grading of 10(a) will be followed, with a value of zero automatically entered as a Grading of 10. See the Service Connection Diagram worksheet for a visual presentation of this distance.	Vague policy exists to define the delineation of water utility ownership and customer ownership of the service connection piping. Curb stops are perceived as the breakpoint but these have not been well-maintained or documented. Most are buried or obscured. Their location varies widely from site-to-site, and estimating the distance is arbitrary due to the unknown location of many curb stops.	Policy requires that the curb stop serves as the delineation point between water utility ownership and customer ownership of the service connection piping. The piping from the water main to the curb stop is the property of the water utility; and the piping from the curb stop to the customer building is owned by the customer. Curb stop locations are not well documented and the average distance is based upon a limited number of locations measured in the field.	Conditions between 2 and 4	Good policy requires that the curb stop serves as the delineation point between water utility ownership and customer ownership of the service connection piping. Curb stops are generally installed as needed and are reasonably documented. Their location varies widely from site-to-site, and an estimate of the distance is hindered by the availability of paper records of limited accuracy.	Conditions between 4 and 6	Clear written policy exists to define utility/customer responsibility for service connection piping. Accurate, well-maintained paper or basic electronic recordkeeping system exists. Periodic field checks confirm piping lengths for a sample of customer properties.	Conditions between 6 and 8	Clearly worded policy standardizes the location of curb stops and meters which are inspected upon installation. Accurate and well maintained electronic records exist with periodic field checks to confirm locations of service lines, curb stops and customer meters. An accurate number of customer properties from the customer billing system allows for reliable averaging of the length.	Conditions between 8 and 10	a) Customer water meters exist outside of customer buildings next to the curb stop or boundary separating utility/customer responsibility for service connection piping. If so, answer "Yes" to the question on the Reporting Worksheet asking about this condition. A value of zero and a Grading of 10 are automatically entered in the Reporting Worksheet. b) Meters exist inside customer buildings or properties are unmetered. In either case, answer "No" to the Reporting Worksheet question on meter location, and enter a distance determined by the auditor. For a Grading of 10 this value must be a very reliable number from a Geographic Information System (GIS) and confirmed by a statistically valid number of field checks.
Improvements to attain higher data grading for "Average Length of Customer Service Line" component.		<u>to qualify for 2</u>: Research and collect paper records of service line installations. Inspect several sites in the field using pipe locators to locate curb stops. Obtain the length of the small sample of connections in this manner.	<u>to qualify for 4</u> Formalize and communicate policy delineating utility/customer responsibilities for service connection piping. Assess accuracy of paper records by field inspection of a small sample of service connections using pipe locators as needed. Research the potential migration to a computerized information management system to store service connection data.		<u>to qualify for 6</u> Establish coherent procedures to ensure that policy for curb stop, meter installation and documentation is followed. Gain consensus within the water utility for the establishment of a computerized information management system.		<u>to qualify for 8</u> Implement an electronic means of recordkeeping, typically via a customer information system, customer billing system, or Geographic Information System (GIS). Standardize the process to conduct field checks of a limited number of locations.		<u>to qualify for 10</u> Link customer information management system and Geographic Information System (GIS); standardize process for field verification of data.		<u>to maintain 10</u> Continue with standardization and random field validation to improve knowledge of service connection configurations and customer meter locations.
Average operating pressure		Available records are poorly assembled and maintained paper records of supply pump characteristics and water distribution system operating conditions. Average pressure is guesstimated based upon this information and ground elevations from crude topographical maps. Widely varying distribution system pressures due to undulating terrain, high system head loss and weak/erratic pressure controls further compromise the validity of the average pressure calculation.	Limited telemetry monitoring of scattered pumping station and water storage tank sites provides some static pressure data, which is recorded in handwritten logbooks. Pressure data is gathered at individual sites only when low pressure complaints arise. Average pressure is determined by averaging relatively crude data, and is affected by significant variation in ground elevations, system head loss and gaps in pressure controls in the distribution system.	Conditions between 2 and 4	Effective pressure controls separate different pressure zones; moderate pressure variation across the system; occasional open boundary valves are discovered that breech pressure zones. Basic telemetry monitoring of the distribution system logs pressure data electronically. Pressure data gathered by gauges or dataloggers at fire hydrants or buildings when low pressure complaints arise, and during fire flow tests and system flushing. Reliable topographical data exists. Average pressure is calculated using the mix of data.	Conditions between 4 and 6	Reliable pressure controls separate distinct pressure zones; only very occasional open boundary valves are encountered that breech pressure zones. Well-covered telemetry monitoring of the distribution system (not just pumping at source treatment plants or wells) logs extensive pressure data electronically. Pressure gathered by gauges/dataloggers at fire hydrants and buildings when low pressure complaints arise, and during fire flow tests and system flushing. Average pressure is determined by using the mix of reliable data.	Conditions between 6 and 8	Well-managed, discrete pressure zones exist with generally predictable pressure fluctuations. A current full-scale SCADA System or similar real-time monitoring system exists to monitor the water distribution system and collect data, including real time pressure readings at representative sites across the system. The average system pressure is determined from reliable monitoring system data.	Conditions between 8 and 10	Well-managed pressure districts/zones, SCADA System and hydraulic model exist to give very precise pressure data across the water distribution system. Average system pressure is reliably calculated from extensive, reliable and cross-checked data. Calculations are reported on an annual basis as a minimum.
Improvements to attain higher data grading for "Average Operating Pressure" component.		<u>to qualify for 2</u>: Employ pressure gauging and/or datalogging equipment to obtain pressure measurements from fire hydrants. Locate accurate topographical maps of service area in order to confirm ground elevations. Research pump data sheets to find pump pressure/flow characteristics.	<u>to qualify for 4</u> Formalize a procedure to use pressure gauging/datalogging equipment to gather pressure data during various system events such as low pressure complaints, or operational testing. Gather pump pressure and flow data at different flow regimes. Identify faulty pressure controls (pressure reducing valves, altitude valves, partially open boundary valves) and plan to properly configure pressure zones. Make all pressure data from these efforts available to generate system-wide average pressure.		<u>to qualify for 6</u> Expand the use of pressure gauging/datalogging equipment to gather scattered pressure data at a representative set of sites, based upon pressure zones or areas. Utilize pump pressure and flow data to determine supply head entering each pressure zone or district. Correct any faulty pressure controls (pressure reducing valves, altitude valves, partially open boundary valves) to ensure properly configured pressure zones. Use expanded pressure dataset from these activities to generate system-wide average pressure.		<u>to qualify for 8</u> Install a Supervisory Control and Data Acquisition (SCADA) System, or similar real-time monitoring system, to monitor system parameters and control operations. Set regular calibration schedule for instrumentation to insure data accuracy. Obtain accurate topographical data and utilize pressure data gathered from field surveys to provide extensive, reliable data for pressure averaging.		<u>to qualify for 10</u> Annually obtain a system-wide average pressure value from the hydraulic model of the distribution system that has been calibrated via field measurements in the water distribution system and confirmed in comparisons with SCADA System data.		<u>to maintain 10</u> Continue to refine the hydraulic model of the distribution system and consider linking it with SCADA System for real-time pressure data calibration, and averaging.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
COST DATA											
Total annual cost of operating water system		Incomplete paper records and lack of financial accounting documentation on many operating functions makes calculation of water system operating costs a pure guesstimate	Reasonably maintained, but incomplete paper or electronic accounting provides data to estimate the major portion of water system operating costs	Conditions between 2 and 4	Electronic, industry-standard cost accounting system in place. However, gaps in data are known to exist; periodic internal reviews are conducted but not a structured financial audit	Conditions between 4 and 6	Reliable electronic, industry-standard cost accounting system in place with all pertinent water system operating costs tracked. Data audited periodically by utility personnel, but not a Certified Public Accountant (CPA)	Conditions between 6 and 8	Reliable electronic, industry-standard cost accounting system in place with all pertinent water system operating costs tracked. Data audited at least annually by utility personnel, and at least once every three years by third-party CPA.	Conditions between 8 and 10	Reliable electronic, industry-standard cost accounting system in place with all pertinent water system operating costs tracked. Data audited annually by utility personnel and annually also by third-party CPA.
Improvements to attain higher data grading for "Total Annual Cost of Operating the Water System" component.		to qualify for 2: Gather available records, institute new financial accounting procedures to regularly collect and audit basic cost data of most important operations functions.	to qualify for 4 Implement an electronic cost accounting system, structured according to accounting standards for water utilities		to qualify for 6 Establish process for periodic internal audit of water system operating costs; identify cost data gaps and institute procedures for tracking these outstanding costs		to qualify for 8 Standardize the process to conduct routine financial audit on an annual basis. Arrange for CPA audit of financial records at least once every three years		to qualify for 10 Standardize the process to conduct a third-party financial audit by a CPA on an annual basis		to maintain 10: Maintain program; stay abreast of expenses subject to erratic cost changes and long-term cost trend; and budget/track costs proactively
Customer retail unit cost (applied to Apparent Losses)	Customer population unmetered and/or only a fixed fee is charged for consumption	Antiquated, cumbersome water rate structure is used with periodic historic amendments that were poorly documented and implemented, resulting in classes of customers being billed inconsistent charges. The actual composite billing rate likely differs significantly from the published water rate structure, but a lack of auditing leaves the degree of error indeterminate	Dated, cumbersome water rate structure not always employed consistently in actual billing operations. The actual composite billing rate is known to differ from the published water rate structure, and a reasonably accurate estimate of the degree of error is determined, allowing a composite billing rate to be quantified	Conditions between 2 and 4	Straight-forward water rate structure in use, but not updated in several years. Billing operations reliably employ the rate structure. The composite billing rate is derived from a single customer class such as residential customer accounts, neglecting the effect of different rates from varying customer classes	Conditions between 4 and 6	Clearly written, up-to-date water rate structure is in force and is applied reliably in billing operations. Composite customer rate is determined using a weighted average residential rate using volumes of water in each rate block	Conditions between 6 and 8	Effective water rate structure is in force and is applied reliably in billing operations. Composite customer rate is determined using a weighted average composite consumption rate which includes residential, commercial, industrial, institutional (CII), and any other distinct customer classes within the water rate structure	Conditions between 8 and 10	Current, effective water rate structure is in force and applied reliably in billing operations. The rate structure and calculations of composite rate - which includes residential, commercial, industrial, institutional (CII), and other distinct customer classes - are reviewed by a third party knowledgeable in the M36 methodology at least once every five years
Improvements to attain higher data grading for "Customer Retail Unit Cost" component.		to qualify for 2: Formalize the process to implement water rates, including a secure documentation procedure. Create a current, formal water rate document, and gain approval from all stakeholders.	to qualify for 4: Review the water rate structure and update/formalize as needed. Assess billing operations to ensure that actual billing operations incorporate the established water rate structure		to qualify for 6: Evaluate volume of water used in each usage block by residential users. Multiply volumes by full rate structure.	Launch effort to fully meter the customer population and change rates based upon water volumes	to qualify for 8: Evaluate volume of water used in each usage block by all classifications of users. Multiply volumes by full rate structure.		to qualify for 10: Conduct a periodic third-party audit of water used in each usage block by all classifications of users. Multiply volumes by full rate structure		to maintain 10: Keep water rate structure current in addressing the water utility's revenue needs. Update the calculation of the customer unit rate as new rate components, customer classes, or other components are modified
Variable production cost (applied to Real Losses).	Note: if the water utility purchases/imports its entire water supply, then enter the unit purchase cost of the bulk water supply in the Reporting Worksheet with a grading of 10	Incomplete paper records and lack of documentation on primary operating functions (electric power and treatment costs most importantly) makes calculation of variable production costs a pure guesstimate	Reasonably maintained, but incomplete, paper or electronic accounting provides data to roughly estimate the basic operations costs (pumping power costs and treatment costs) and calculate a unit variable production cost.	Conditions between 2 and 4	Electronic, industry-standard cost accounting system in place. Electric power and treatment costs are reliably tracked and allow accurate weighted calculation of unit variable production costs based on these two inputs and water imported purchase costs (if applicable). All costs are audited internally on a periodic basis	Conditions between 4 and 6	Reliable electronic, industry-standard cost accounting system in place with all pertinent water system operating costs tracked. Pertinent additional costs beyond power, treatment and water imported purchase costs (if applicable) such as liability, residuals management, wear and tear on equipment, impending expansion of supply are included in the unit variable production cost, as applicable. The data is audited at least annually by utility personnel.	Conditions between 6 and 8	Reliable electronic, industry-standard cost accounting system in place with all pertinent primary and secondary variable production and water imported purchase (if applicable) costs tracked. The data is audited at least annually by utility personnel, and at least once every three years by a third-party knowledgeable in the M36 methodology	Conditions between 8 and 10	Either of two conditions can be met to obtain a grading of 10: 1) Third party CPA audit of all pertinent primary and secondary variable production and water imported purchase (if applicable) costs on an annual basis or 2) Water supply is entirely purchased as bulk water imported and the unit purchase cost - including all applicable marginal supply costs - serves as the variable production cost. If all applicable marginal supply costs are not included in this figure, a grade of 10 should not be selected
Improvements to attain higher data grading for "Variable Production Cost" component.		to qualify for 2: Gather available records, institute new procedures to regularly collect and audit basic cost data and most important operations functions.	to qualify for 4: Implement an electronic cost accounting system, structured according to accounting standards for water utilities		to qualify for 6: Formalize process for regular internal audits of production costs. Assess whether additional costs (liability, residuals management, equipment wear, impending infrastructure expansion) should be included to calculate a more representative variable production cost.		to qualify for 8: Formalize the accounting process to include direct cost components (power, treatment) as well as indirect cost components (liability, residuals management, etc.). Arrange to conduct audits by a knowledgable third-party at least once every three years.		to qualify for 10: Standardize the process to conduct a third-party financial audit by a CPA on an annual basis		to maintain 10: Maintain program; stay abreast of expenses subject to erratic cost changes and budget/track costs proactively

Average Length of Customer Service Line

The three figures shown on this worksheet display the assignment of the Average Length of Customer Service Line, Lp, for the three most common piping configurations.

Figure 1 shows the configuration of the water meter outside of the customer building next to the curb stop valve. In this configuration Lp = 0 since the distance between the curb stop and the customer metering point is essentially zero.

Figure 2 shows the configuration of the customer water meter located inside the customer building, where Lp is the distance from the curb stop to the water meter.

Figure 3 shows the configuration of an unmetered customer building , where Lp is the distance from the curb stop to the first point of customer water consumption, or, more simply, the building line.

In any water system the Lp will vary notably in a community of different structures, therefore the average Lp value is used and this should be approximated or calculated if a sample of service line measurements has been gathered.

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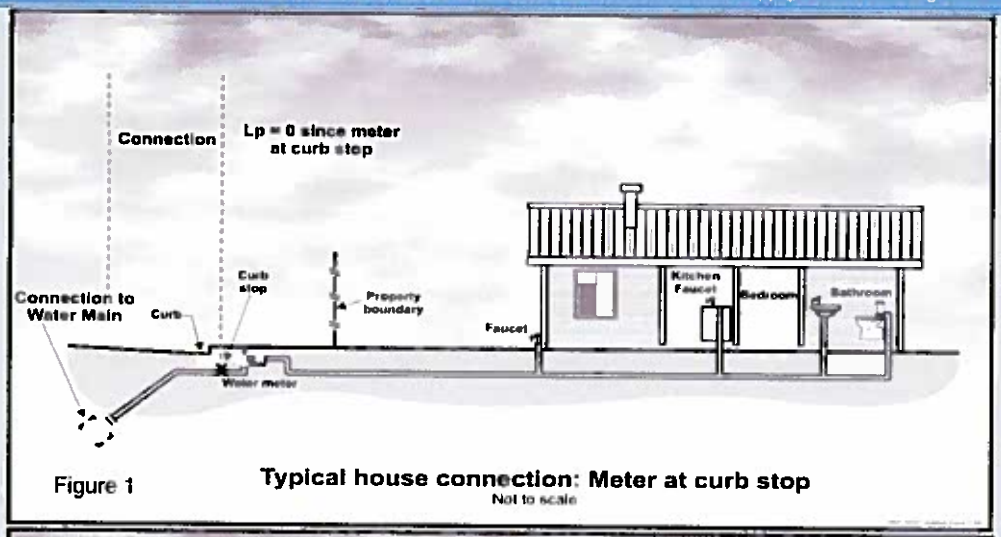


Figure 1 **Typical house connection: Meter at curb stop**
Not to scale

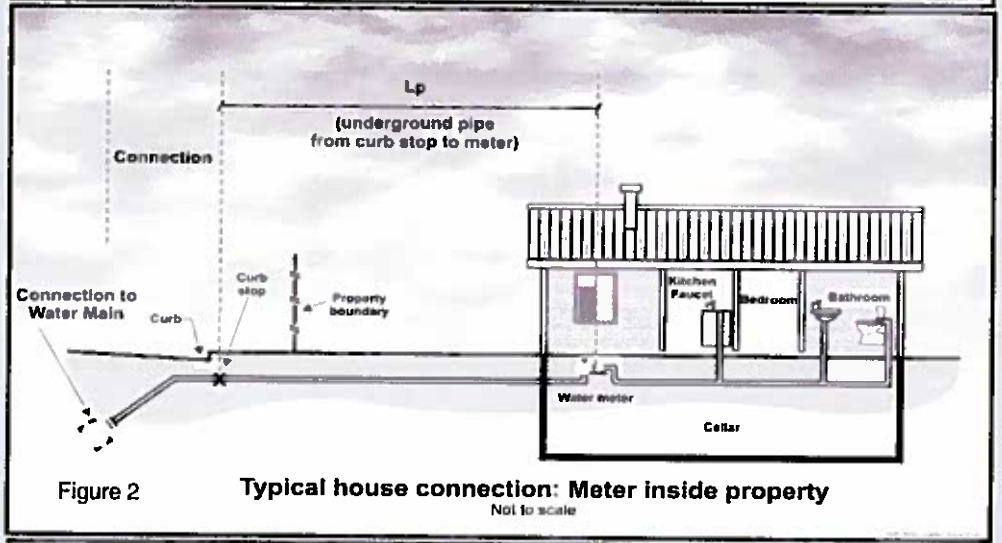


Figure 2 **Typical house connection: Meter inside property**
Not to scale

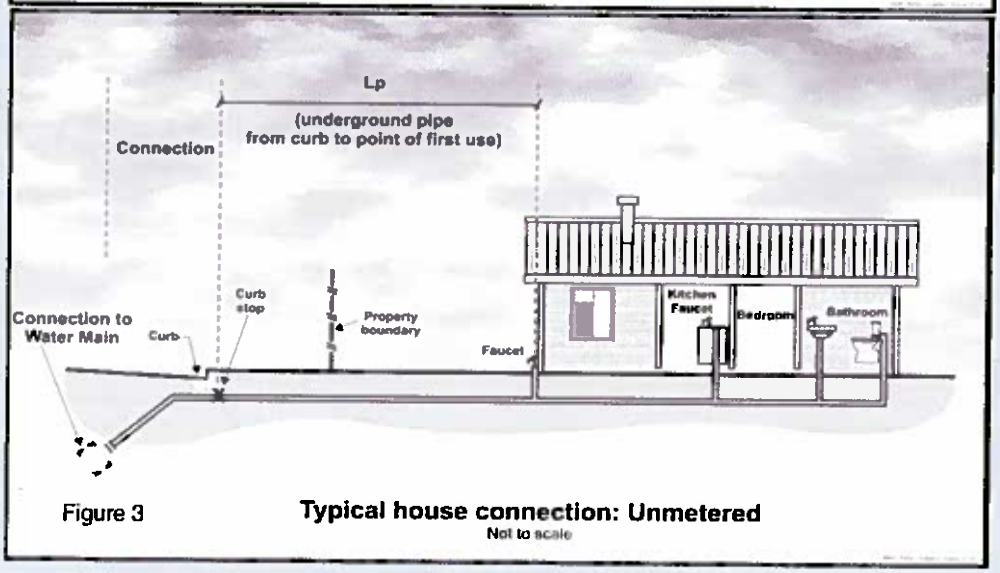


Figure 3 **Typical house connection: Unmetered**
Not to scale

AWWA Free Water Audit Software: Definitions

WAS v5.0
American Water Works Association

Item Name	Description
Apparent Losses Find	= unauthorized consumption + customer metering inaccuracies + systematic data handling errors Apparent Losses include all types of inaccuracies associated with customer metering (worn meters as well as improperly sized meters or wrong type of meter for the water usage profile) as well as systematic data handling errors (meter reading, billing, archiving and reporting), plus unauthorized consumption (theft or illegal use). NOTE: Over-estimation of Apparent Losses results in under-estimation of Real Losses. Under-estimation of Apparent Losses results in over-estimation of Real Losses.
AUTHORIZED CONSUMPTION Find	= billed water exported + billed metered + billed unmetered + unbilled metered + unbilled unmetered consumption The volume of metered and/or unmetered water taken by registered customers, the water utility's own uses, and uses of others who are implicitly or explicitly authorized to do so by the water utility; for residential, commercial, industrial and public-minded purposes. Typical retail customers' consumption is tabulated usually from established customer accounts as billed metered consumption, or - for unmetered customers - billed unmetered consumption. These types of consumption, along with billed water exported, provide revenue potential for the water utility. **Be certain to tabulate the water exported volume as a separate component and do not "double-count" it by including in the billed metered consumption component as well as the water exported component.** Unbilled authorized consumption occurs typically in non-account uses, including water for fire fighting and training, flushing of water mains and sewers, street cleaning, watering of municipal gardens, public fountains, or similar public-minded uses. Occasionally these uses may be metered and billed (or charged a flat fee), but usually they are unmetered and unbilled. In the latter case, the water auditor may use a default value to estimate this quantity, or implement procedures for the reliable quantification of these uses. This starts with documenting usage events as they occur and estimating the amount of water used in each event. (See Unbilled unmetered consumption)
Average length of customer service line View Service Connection Diagram Find	This is the average length of customer service line, Lp, that is owned and maintained by the customer; from the point of ownership transfer to the customer water meter, or building line (if unmetered). The quantity is one of the data inputs for the calculation of Unavoidable Annual Real Losses (UARL), which serves as the denominator of the performance indicator: Infrastructure Leakage Index (ILI). The value of Lp is multiplied by the number of customer service connections to obtain a total length of customer owned piping in the system. The purpose of this parameter is to account for the unmetered service line infrastructure that is the responsibility of the customer for arranging repairs of leaks that occur on their lines. In many cases leak repairs arranged by customers take longer to be executed than leak repairs arranged by the water utility on utility-maintained piping. Leaks run longer - and lose more water - on customer-owned service piping, than utility owned piping. If the customer water meter exists near the ownership transfer point (usually the curb stop located between the water main and the customer premises) this distance is zero because the meter and transfer point are the same. This is the often encountered configuration of customer water meters located in an underground meter box or "pit" outside of the customer's building. The Free Water Audit Software asks a "Yes/No" question about the meter at this location. If the auditor selects "Yes" then this distance is set to zero and the data grading score for this component is set to 10. If water meters are typically located inside the customer premise/building, or properties are unmetered, it is up to the water auditor to estimate a system-wide average Lp length based upon the various customer land parcel sizes and building locations in the service area. Lp will be a shorter length in areas of high density housing, and a longer length in areas of low density housing and varied commercial and industrial buildings. General parcel demographics should be employed to obtain a composite average Lp length for the entire system. Refer to the "Service Connection Diagram" worksheet for a depiction of the service line/metering configurations that typically exist in water utilities. This worksheet gives guidance on the determination of the Average Length, Lp, for each configuration.
Average operating pressure Find	This is the average pressure in the distribution system that is the subject of the water audit. Many water utilities have a calibrated hydraulic model of their water distribution system. For these utilities, the hydraulic model can be utilized to obtain a very accurate quantity of average pressure. In the absence of a hydraulic model, the average pressure may be approximated by obtaining readings of static water pressure from a representative sample of fire hydrants or other system access points evenly located across the system. A weighted average of the pressure can be assembled; but be sure to take into account the elevation of the fire hydrants, which typically exist several feet higher than the level of buried water pipelines. If the water utility is compiling the water audit for the first time, the average pressure can be approximated, but with a low data grading. In subsequent years of auditing, effort should be made to improve the accuracy of the average pressure quantity. This will then qualify the value for a higher data grading.
Billed Authorized Consumption	All consumption that is billed and authorized by the utility. This may include both metered and unmetered consumption. See "Authorized Consumption" for more information.
Billed metered consumption Find	All metered consumption which is billed to retail customers, including all groups of customers such as domestic, commercial, industrial or institutional. **It does NOT include water supplied to neighboring utilities (water exported) which is metered and billed. Be sure to subtract any consumption for exported water sales that may be included in these billing roles. Water supplied as exports to neighboring water utilities should be included only in the Water Exported component.** The metered consumption data can be taken directly from billing records for the water audit period. The accuracy of yearly metered consumption data can be refined by including an adjustment to account for customer meter reading lag time since not all customer meters are read on the same day of the meter reading period. However additional analysis is necessary to determine the lag time adjustment value, which may or may not be significant.
Billed unmetered consumption Find	All billed consumption which is calculated based on estimates or norms from water usage sites that have been determined by utility policy to be left unmetered. This is typically a very small component in systems that maintain a policy to meter their customer population. However, this quantity can be the key consumption component in utilities that have not adopted a universal metering policy. **This component should NOT include any water that is supplied to neighboring utilities (water exported) which is unmetered but billed. Water supplied as exports to neighboring water utilities should be included only in the Water Exported component.**

Item Name	Description
Customer metering inaccuracies Find	Apparent water losses caused by the collective under-registration of customer water meters. Many customer water meters gradually wear as large cumulative volumes of water are passed through them over time. This causes the meters to under-register the flow of water. This occurrence is common with smaller residential meters of sizes 5/8-inch and 3/4 inch after they have registered very large cumulative volumes of water, which generally occurs only after periods of years. For meters sized 1-inch and larger - typical of multi-unit residential, commercial and industrial accounts - meter under-registration can occur from wear or from the improper application of the meter, i.e. installing the wrong type of meter or the wrong size of meter, for the flow pattern (profile) of the consumer. For instance, many larger meters have reduced accuracy at low flows. If an oversized meter is installed, most of the time the routine flow will occur in the low flow range of the meter, and a significant portion of it may not be registered. It is important to properly select and install all meters, but particularly large customer meters, size 1-inch and larger. The auditor has two options for entering data for this component of the audit. The auditor can enter a percentage under-registration (typically an estimated value), this will apply the selected percentage to the two categories of metered consumption to determine the volume of water not recorded due to customer meter inaccuracy. Note that this percentage is a composite average inaccuracy for all customer meters in the entire meter population. The percentage will be multiplied by the sum of the volumes in the Billed Metered and Unbilled Metered components. Alternatively, if the auditor has substantial data from meter testing activities, he or she can calculate their own loss volumes, and this volume may be entered directly. Note that a value of zero will be accepted but an alert will appear asking if the customer population is unmetered. Since all metered systems have some degree of inaccuracy, a positive value should be entered. A value of zero in this component is valid only if the water utility does not meter its customer population.
Customer retail unit cost Find	The Customer Retail Unit Cost represents the charge that customers pay for water service. This unit cost is applied routinely to the components of Apparent Loss, since these losses represent water reaching customers but not (fully) paid for. Since most water utilities have a rate structure that includes a variety of different costs based upon class of customer, a weighted average of individual costs and number of customer accounts in each class can be calculated to determine a single composite cost that should be entered into this cell. Finally, the weighted average cost should also include additional charges for sewer, storm water or biosolids processing, but only if these charges are based upon the volume of potable water consumed. For water utilities in regions with limited water resources and a questionable ability to meet the drinking water demands in the future, the Customer Retail Unit Cost might also be applied to value the Real Losses; instead of applying the Variable Production Cost to Real Losses. In this way, it is assumed that every unit volume of leakage reduced by leakage management activities will be sold to a customer. Note: the Free Water Audit Software allows the user to select the units that are charged to customers (either $/1,000 gallons, $/hundred cubic feet, or $/1,000 litres) and automatically converts these units to the units that appear in the "WATER SUPPLIED" box. The monetary units are United States dollars, $.
Infrastructure Leakage Index (ILI) Find	The ratio of the Current Annual Real Losses (Real Losses) to the Unavoidable Annual Real Losses (UARL). The ILI is a highly effective performance indicator for comparing (benchmarking) the performance of utilities in operational management of real losses.
Length of mains Find	Length of all pipelines (except service connections) in the system starting from the point of system input metering (for example at the outlet of the treatment plant). It is also recommended to include in this measure the total length of fire hydrant lead pipe. Hydrant lead pipe is the pipe branching from the water main to the fire hydrant. Fire hydrant leads are typically of a sufficiently large size that is more representative of a pipeline than a service connection. The average length of hydrant leads across the entire system can be assumed if not known, and multiplied by the number of fire hydrants in the system, which can also be assumed if not known. This value can then be added to the total pipeline length. Total length of mains can therefore be calculated as: Length of Mains, miles = (total pipeline length, miles) + [{(average fire hydrant lead length, ft) x (number of fire hydrants)} / 5,280 ft/mile] or Length of Mains, kilometres = (total pipeline length, kilometres) + [{(average fire hydrant lead length, metres) x (number of fire hydrants)} / 1,000 metres/kilometre]
NON-REVENUE WATER Find	= Apparent Losses + Real Losses + Unbilled Metered Consumption + Unbilled Unmetered Consumption. This is water which does not provide revenue potential to the utility.
Number of active AND inactive service connections Find	Number of customer service connections, extending from the water main to supply water to a customer. Please note that this includes the actual number of distinct piping connections, including fire connections, whether active or inactive. This may differ substantially from the number of customers (or number of accounts). **Note: this number does not include the pipeline leads to fire hydrants - the total length of piping supplying fire hyrants should be included in the "Length of mains" parameter.**
Real Losses Find	Physical water losses from the pressurized system (water mains and customer service connections) and the utility's storage tanks, up to the point of customer consumption. In metered systems this is the customer meter, in unmetered situations this is the first point of consumption (stop tap/tap) within the property. The annual volume lost through all types of leaks, breaks and overflows depends on frequencies, flow rates, and average duration of individual leaks, breaks and overflows.
Revenue Water	Those components of System Input Volume that are billed and have the potential to produce revenue.
Service Connection Density Find	=number of customer service connections / length of mains

Item Name	Description
Systematic data handling errors Find	Apparent losses caused by accounting omissions, errant computer programming, gaps in policy, procedure, and permitting/activation of new accounts; and any type of data lapse that results in under-stated customer water consumption in summary billing reports. **Systematic Data Handling Errors result in a direct loss of revenue potential. Water utilities can find "lost" revenue by keying on this component.** Utilities typically measure water consumption registered by water meters at customer premises. The meter should be read routinely (ex: monthly) and the data transferred to the Customer Billing System, which generates and sends a bill to the customer. Data Transfer Errors result in the consumption value being less than the actual consumption, creating an apparent loss. Such error might occur from illegible and mis-recorded hand-written readings compiled by meter readers, inputting an incorrect meter register unit conversion factor in the automatic meter reading equipment, or a variety of similar errors. Apparent losses also occur from Data Analysis Errors in the archival and data reporting processes of the Customer Billing System. Inaccurate estimates used for accounts that fail to produce a meter reading are a common source of error. Billing adjustments may award customers a rightful monetary credit, but do so by creating a negative value of consumption, thus under-stating the actual consumption. Account activation lapses may allow new buildings to use water for months without meter readings and billing. Poor permitting and construction inspection practices can result in a new building lacking a billing account, a water meter and meter reading; i.e., the customer is unknown to the utility's billing system. Close auditing of the permitting, metering, meter reading, billing and reporting processes of the water consumption data trail can uncover data management gaps that create volumes of systematic data handling error. Utilities should routinely analyze customer billing records to detect data anomalies and quantify these losses. For example, a billing account that registers zero consumption for two or more billing cycles should be checked to explain why usage has seemingly halted. Given the revenue loss impacts of these losses, water utilities are well-justified in providing continuous oversight and timely correction of data transfer errors & data handling errors. If the water auditor has not yet gathered detailed data or assessment of systematic data handling error, it is recommended that the auditor apply the default value of 0.25% of the the Billed Authorized Consumption volume. However, if the auditor has investigated the billing system and its controls, and has well validated data that indicates the volume from systematic data handling error is substantially higher or lower than that generated by the default value, then the auditor should enter a quantity that was derived from the utility investigations and select an appropriate grading. Note: negative values are not allowed for this audit component. If the auditor enters zero for this component then a grading of 1 will be automatically assigned.
Total annual cost of operating the water system Find	These costs include those for operations, maintenance and any annually incurred costs for long-term upkeep of the drinking water supply and distribution system. It should include the costs of day-to-day upkeep and long-term financing such as repayment of capital bonds for infrastructure expansion or improvement. Typical costs include employee salaries and benefits, materials, equipment, insurance, fees, administrative costs and all other costs that exist to sustain the drinking water supply. Depending upon water utility accounting procedures or regulatory agency requirements, it may be appropriate to include depreciation in the total of this cost. This cost should not include any costs to operate wastewater, biosolids or other systems outside of drinking water.
Unauthorized consumption Find	Includes water illegally withdrawn from fire hydrants, illegal connections, bypasses to customer consumption meters, or tampering with metering or meter reading equipment; as well as any other ways to receive water while thwarting the water utility's ability to collect revenue for the water. Unauthorized consumption results in uncaptured revenue and creates an error that understates customer consumption. In most water utilities this volume is low and, if the water auditor has not yet gathered detailed data for these loss occurrences, it is recommended that the auditor apply a default value of 0.25% of the volume of water supplied. However, if the auditor has investigated unauthorized occurrences, and has well validated data that indicates the volume from unauthorized consumption is substantially higher or lower than that generated by the default value, then the auditor should enter a quantity that was derived from the utility investigations. Note that a value of zero will not be accepted since all water utilities have some volume of unauthorized consumption occurring in their system. Note: if the auditor selects the default value for unauthorized consumption, a data grading of 5 is automatically assigned, but not displayed on the Reporting Worksheet.
Unavoidable Annual Real Losses (UARL) Find	UARL (gallons)=(5.41Lm + 0.15Nc + 7.5Lc) xP, or UARL (litres)=(18.0Lm + 0.8Nc + 25.0Lc) xP where: Lm = length of mains (miles or kilometres) Nc = number of customer service connections Lp = the average distance of customer service connection piping (feet or metres) (see the Worksheet "Service Connection Diagram" for guidance on deterring the value of Lp) Lc = total length of customer service connection piping (miles or km) Lc = Nc X Lp (miles or kilometres) P = Pressure (psi or metres) The UARL is a theoretical reference value representing the technical low limit of leakage that could be achieved if all of today's best technology could be successfully applied. It is a key variable in the calculation of the Infrastructure Leakage Index (ILI). Striving to reduce system leakage to a level close to the UARL is usually not needed unless the water supply is unusually expensive, scarce or both. NOTE: The UARL calculation has not yet been proven as fully valid for very small, or low pressure water distribution systems. If, in gallons: (Lm x 32) + Nc < 3000 or P <35psi in litres: (Lm x 20) + Nc < 3000 or P < 25m then the calculated UARL value may not be valid. The software does not display a value of UARL or ILI if either of these conditions is true.

Item Name	Description
Unbilled Authorized Consumption	All consumption that is unbilled, but still authorized by the utility. This includes Unbilled Metered Consumption + Unbilled Unmetered Consumption. See "Authorized Consumption" for more information. For Unbilled Unmetered Consumption, the Free Water Audit Software provides the auditor the option to select a default value if they have not audited unmetered activities in detail. The default calculates a volume that is 1.25% of the Water Supplied volume. If the auditor has carefully audited the various unbilled, unmetered, authorized uses of water, and has established reliable estimates of this collective volume, then he or she may enter the volume directly for this component, and not use the default value.
Unbilled metered consumption Find	Metered consumption which is authorized by the water utility, but, for any reason, is deemed by utility policy to be unbilled. This might for example include metered water consumed by the utility itself in treatment or distribution operations, or metered water provided to civic institutions free of charge. **It does not include water supplied to neighboring utilities (water exported) which may be metered but not billed.**
Unbilled unmetered consumption Find	Any kind of Authorized Consumption which is neither billed or metered. This component typically includes water used in activities such as fire fighting, flushing of water mains and sewers, street cleaning, fire flow tests conducted by the water utility, etc. In most water utilities it is a small component which is very often substantially overestimated. **It does NOT include water supplied to neighboring utilities (water exported) which is unmetered and unbilled – an unlikely case.** This component has many sub-components of water use which are often tedious to identify and quantify. Because of this, and the fact that it is usually a small portion of the water supplied, it is recommended that the auditor apply the default value, which is 1.25% of the Water Supplied volume. Select the default percentage to enter this value. If the water utility has carefully audited the unbilled, unmetered activities occurring in the system, and has well validated data that gives a value substantially higher or lower than the default volume, then the auditor should enter their own volume. However the default approach is recommended for most water utilities. Note that a value of zero is not permitted, since all water utilities have some volume of water in this component occurring in their system.
Units and Conversions	The user may develop an audit based on one of three unit selections: 1) Million Gallons (US) 2) Megalitres (Thousand Cubic Metres) 3) Acre-feet Once this selection has been made in the instructions sheet, all calculations are made on the basis of the chosen units. Should the user wish to make additional conversions, a unit converter is provided below (use drop down menus to select units from the yellow unit boxes): Enter Units: 1 — Convert From... Million Gallons (US) = **Converts to.....** 3.06888329 Acre-feet (conversion factor = 3.06888328973723)
Use of Option Buttons	To use the default percent value choose this button To enter a value choose this button and enter the value in the cell to the right Pcnt 1.25% ◉ ○ Value **NOTE:** For Unbilled Unmetered Consumption, Unauthorized Consumption and Systematic Data Handling Errors, a recommended default value can be applied by selecting the Percent option. The default values are based on fixed percentages of Water Supplied or Billed Authorized Consumption and are recommended for use in this audit unless the auditor has well validated data for their system. Default values are shown by purple cells, as shown in the example above. If a default value is selected, the user does not need to grade the item; a grading value of 5 is automatically applied (however, this grade will not be displayed).
Variable production cost (applied to Real Losses) Find	The cost to produce and supply the next unit of water (e.g., $/million gallons). This cost is determined by calculating the summed unit costs for ground and surface water treatment and all power used for pumping from the source to the customer. It may also include other miscellaneous unit costs that apply to the production of drinking water. It should also include the unit cost of bulk water purchased as an import if applicable. It is common to apply this unit cost to the volume of Real Losses. However, if water resources are strained and the ability to meet future drinking water demands is in question, then the water auditor can be justified in applying the Customer Retail Rate to the Real Loss volume, rather than applying the Variable Production Cost. The Free Water Audit Software applies the Variable Production costs to Real Losses by default. However, the auditor has the option on the Reporting Worksheet to select the Customer Retail Cost as the basis for the Real Loss cost evaluation if the auditor determines that this is warranted.
Volume from own sources Find	The volume of water withdrawn (abstracted) from water resources (rivers, lakes, streams, wells, etc) controlled by the water utility, and then treated for potable water distribution. Most water audits are compiled for utility retail water distribution systems, so this volume should reflect the amount of treated drinking water that entered the distribution system. Often the volume of water measured at the effluent of the treatment works is slightly less than the volume measured at the raw water source, since some of the water is used in the treatment process. Thus, it is useful if flows are metered at the effluent of the treatment works. If metering exists only at the raw water source, an adjustment for water used in the treatment process should be included to account for water consumed in treatment operations such as filter backwashing, basin flushing and cleaning, etc. If the audit is conducted for a wholesale water agency that sells untreated water, then this quantity reflects the measure of the raw water, typically metered at the source.

Item Name	Description
Volume from own sources: Master meter and supply error adjustment Find	An estimate or measure of the degree of inaccuracy that exists in the master (production) meters measuring the annual Volume from own Sources, and any error in the data trail that exists to collect, store and report the summary production data. This adjustment is a weighted average number that represents the collective error for all master meters for all days of the audit year and any errors identified in the data trail. Meter error can occur in different ways. A meter or meters may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Data error can occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some degree of inaccuracy in master meters and data errors in archival systems are common; thus a value of zero should not be entered. Enter a negative percentage or value for metered data under-registration; or, enter a positive percentage or value for metered data over-registration.
Water exported Find	The Water Exported volume is the bulk water conveyed and sold by the water utility to neighboring water systems that exists outside of their service area. Typically this water is metered at the custody transfer point of interconnection between the two water utilities. Usually the meter(s) are owned by the water utility that is selling the water; i.e. the exporter. If the water utility who is compiling the annual water audit sells bulk water in this manner, they are an exporter of water. Note: The Water Exported volume is sold to wholesale customers who are typically charged a wholesale rate that is different than retail rates charged to the retail customers existing within the service area. Many state regulatory agencies require that the Water Exported volume be reported to them as a quantity separate and distinct from the retail customer billed consumption. For these reasons - and others - the Water Exported volume is always quantified separately from Billed Authorized Consumption in the standard water audit. **Be certain not to "double-count" this quantity by including it in both the Water Exported box and the Billed Metered Consumption box of the water audit Reporting Worksheet. This volume should be included only in the Water Exported box.**
Water exported: Master meter and supply error adjustment Find	An estimate or measure of the volume in which the Water Exported volume is incorrect. This adjustment is a weighted average that represents the collective error for all of the metered and archived exported flow for all days of the audit year. Meter error can occur in different ways. A meter may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Error in the metered, archived data can also occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some degree of error in their metered data, particularly if meters are aged and infrequently tested. Occasional errors also occur in the archived data. Thus, a value of zero should not be entered. Enter a negative percentage or value for metered data under-registration; or enter a positive percentage or value for metered data over-registration. If regular meter accuracy testing is conducted on the meter(s) - which is usually conducted by the water utility selling the water - then the results of this testing can be used to help quantify the meter error adjustment. Corrections to data gaps or other errors found in the archived data should also be included as a portion of this meter error adjustment.
Water imported Find	The Water Imported volume is the bulk water purchased to become part of the Water Supplied volume. Typically this is water purchased from a neighboring water utility or regional water authority, and is metered at the custody transfer point of interconnection between the two water utilities. Usually the meter(s) are owned by the water supplier selling the water to the utility conducting the water audit. The water supplier selling the bulk water usually charges the receiving utility based upon a wholesale water rate.
Water imported: Master meter and supply error adjustment Find	An estimate or measure of the volume in which the Water Imported volume is incorrect. This adjustment is a weighted average that represents the collective error for all of the metered and archived imported flow for all days of the audit year. Meter error can occur in different ways. A meter may be inaccurate by under registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Error in the metered, archived data can also occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some level of meter inaccuracy, particularly if meters are aged and infrequently tested. Occasional errors also occur in the archived metered data. Thus, a value of zero should not be entered. Enter a negative percentage or value for metered data under-registration; or, enter a positive percentage or value for metered data over-registration. If regular meter accuracy testing is conducted on the meter(s) - which is usually conducted by the water utility selling the water - then the results of this testing can be used to help quantify the meter error adjustment.
WATER LOSSES Find	= apparent losses + real losses Water Losses are the difference between Water Supplied and Authorized Consumption. Water losses can be considered as a total volume for the whole system, or for partial systems such as transmission systems, pressure zones or district metered areas (DMA), if one of these configurations are the basis of the water audit.

AWWA Free Water Audit Software:
Determining Water Loss Standing

WAS v5.0

Water Audit Report for: Los Alamos County
Reporting Year: 2014 | 7/2013 - 6/2014
Data Validity Score: N/A* * Confirm Units and Data Grading are Complete

Water Loss Control Planning Guide

	Water Audit Data Validity Level / Score				
Functional Focus Area	**Level I** (0-25)	**Level II** (26-50)	**Level III** (51-70)	**Level IV** (71-90)	**Level V** (91-100)
Audit Data Collection	Launch auditing and loss control team; address production metering deficiencies	Analyze business process for customer metering and billing functions and water supply operations. Identify data gaps.	Establish/revise policies and procedures for data collection	Refine data collection practices and establish as routine business process	Annual water audit is a reliable gauge of year-to-year water efficiency standing
Short-term loss control	Research information on leak detection programs. Begin flowcharting analysis of customer billing system	Conduct loss assessment investigations on a sample portion of the system: customer meter testing, leak survey, unauthorized consumption, etc.	Establish ongoing mechanisms for customer meter accuracy testing, active leakage control and infrastructure monitoring	Refine, enhance or expand ongoing programs based upon economic justification	Stay abreast of improvements in metering, meter reading, billing, leakage management and infrastructure rehabilitation
Long-term loss control		Begin to assess long-term needs requiring large expenditure: customer meter replacement, water main replacement program, new customer billing system or Automatic Meter Reading (AMR) system.	Begin to assemble economic business case for long-term needs based upon improved data becoming available through the water audit process.	Conduct detailed planning, budgeting and launch of comprehensive improvements for metering, billing or infrastructure management	Continue incremental improvements in short-term and long-term loss control interventions
Target-setting			Establish long-term apparent and real loss reduction goals (+10 year horizon)	Establish mid-range (5 year horizon) apparent and real loss reduction goals	Evaluate and refine loss control goals on a yearly basis
Benchmarking			Preliminary Comparisons - can begin to rely upon the Infrastructure Leakage Index (ILI) for performance comparisons for real losses (see below table)	Performance Benchmarking - ILI is meaningful in comparing real loss standing	Identify Best Practices/ Best in class - the ILI is very reliable as a real loss performance indicator for best in class service

For validity scores of 50 or below, the shaded blocks should not be focus areas until better data validity is achieved.

Once data have been entered into the Reporting Worksheet, the performance indicators are automatically calculated. How does a water utility operator know how well his or her system is performing? The AWWA Water Loss Control Committee provided the following table to assist water utilities is gauging an approximate Infrastructure Leakage Index (ILI) that is appropriate for their water system and local conditions. The lower the amount of leakage and real losses that exist in the system, then the lower the ILI value will be.

Note: this table offers an approximate guideline for leakage reduction target-setting. The best means of setting such targets include performing an economic assessment of various loss control methods. However, this table is useful if such an assessment is not possible.

General Guidelines for Setting a Target ILI
(without doing a full economic analysis of leakage control options)

Target ILI Range	Financial Considerations	Operational Considerations	Water Resources Considerations
1.0 - 3.0	Water resources are costly to develop or purchase; ability to increase revenues via water rates is greatly limited because of regulation or low ratepayer affordability.	Operating with system leakage above this level would require expansion of existing infrastructure and/or additional water resources to meet the demand.	Available resources are greatly limited and are very difficult and/or environmentally unsound to develop.
>3.0 -5.0	Water resources can be developed or purchased at reasonable expense; periodic water rate increases can be feasibly imposed and are tolerated by the customer population.	Existing water supply infrastructure capability is sufficient to meet long-term demand as long as reasonable leakage management controls are in place.	Water resources are believed to be sufficient to meet long-term needs, but demand management interventions (leakage management, water conservation) are included in the long-term
>5.0 - 8.0	Cost to purchase or obtain/treat water is low, as are rates charged to customers.	Superior reliability, capacity and integrity of the water supply infrastructure make it relatively immune to supply shortages.	Water resources are plentiful, reliable, and easily extracted.
Greater than 8.0	Although operational and financial considerations may allow a long-term ILI greater than 8.0, such a level of leakage is not an effective utilization of water as a resource. Setting a target level greater than 8.0 - other than as an incremental goal to a smaller long-term target - is discouraged.		
Less than 1.0	If the calculated Infrastructure Leakage Index (ILI) value for your system is 1.0 or less, two possibilities exist. a) you are maintaining your leakage at low levels in a class with the top worldwide performers in leakage control. b) A portion of your data may be flawed, causing your losses to be greatly understated. This is likely if you calculate a low ILI value but do not employ extensive leakage control practices in your operations. In such cases it is beneficial to validate the data by performing field measurements to confirm the accuracy of production and customer meters, or to identify any other potential sources of error in the data.		

Example Audit 1a:

AWWA Free Water Audit Software: Reporting Worksheet

Click to access definition
Click to add a comment

Water Audit Report for: City of Asheville (01-11-010)
Reporting Year: 2013 7/2012 - 6/2013

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it.

WATER SUPPLIED

<---------- Enter grading in column 'E' and 'J' ----------> Master Meter Error Adjustments

	Grading	Volume		Pcnt:	Value:	
Volume from own sources:	7	7,352.880	MG/Yr		285.450	MG/Yr
Water imported:	n/a	0.000	MG/Yr			MG/Yr
Water exported:	n/a	0.000	MG/Yr			MG/Yr
WATER SUPPLIED:		**7,067.430**	MG/Yr			

Enter negative % or value for under-registration
Enter positive % or value for over-registration

AUTHORIZED CONSUMPTION

Click here: for help using option buttons below

	Grading	Volume		Pcnt:	Value:	
Billed metered:	8	4,782.250	MG/Yr			
Billed unmetered:	n/a	0.000	MG/Yr			
Unbilled metered:	7	27.757	MG/Yr			
Unbilled unmetered:	8	157.790	MG/Yr		157.790	MG/Yr

Unbilled Unmetered volume entered is greater than the recommended default value

Use buttons to select percentage of water supplied OR value

AUTHORIZED CONSUMPTION:	**4,967.797**	MG/Yr	
WATER LOSSES (Water Supplied - Authorized Consumption)	**2,099.633**	MG/Yr	

Apparent Losses

	Grading	Volume		Pcnt:	Value:	
Unauthorized consumption:		17.669	MG/Yr	0.25%		MG/Yr
Customer metering inaccuracies:	7	111.220	MG/Yr	2.26%		MG/Yr
Systematic data handling errors:	5	11.956	MG/Yr	0.25%		MG/Yr

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

Default option selected for Systematic data handling errors - a grading of 5 is applied but not displayed

Apparent Losses:	**140.844**	MG/Yr

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses:	**1,958.789**	MG/Yr
WATER LOSSES:	**2,099.633**	MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER:	**2,285.180**	MG/Yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

	Grading		
Length of mains:	4	1,236.5	miles
Number of active AND inactive service connections:	7	55,256	
Service connection density:		45	conn./mile main
Are customer meters typically located at the curbstop or property line?		Yes	
Average length of customer service line:			(length of service line, beyond the property boundary, that is the responsibility of the utility)

Average length of customer service line has been set to zero and a data grading score of 10 has been applied

Average operating pressure:	4	145.3	psi

COST DATA

	Grading		
Total annual cost of operating water system:	10	$33,630,676	$/Year
Customer retail unit cost (applied to Apparent Losses):	10	$3.22	$/100 cubic feet (ccf)
Variable production cost (applied to Real Losses):	8	$335.94	$/Million gallons

☐ Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

*** YOUR SCORE IS: 72 out of 100 ***

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Volume from own sources
2: Variable production cost (applied to Real Losses)
3: Unauthorized consumption

Example Audit 1b:

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

Water Audit Report for: City of Asheville (01-11-010)
Reporting Year: 2013 7/2012 - 6/2013

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 72 out of 100 ***

System Attributes:

	Apparent Losses:	140.844	MG/Yr
+	Real Losses:	1,958.789	MG/Yr
=	**Water Losses:**	2,099.633	MG/Yr
	Unavoidable Annual Real Losses (UARL):	794.34	MG/Yr
	Annual cost of Apparent Losses:	$606,265	
	Annual cost of Real Losses:	$658,036	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	32.3%	
	Non-revenue water as percent by cost of operating system:	3.9%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	6.98	gallons/connection/day
	Real Losses per service connection per day:	97.12	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	0.67	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	1,958.79	million gallons/year
	Infrastructure Leakage Index (ILI) [CARL/UARL]:	2.47	

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

Example Audit 2a:

AWWA Free Water Audit Software: Reporting Worksheet

Click to access definition
Click to add a comment

Water Audit Report for: The City of Calgary
Reporting Year: 2013 (1/2013 - 12/2013)

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: MEGALITRES (THOUSAND CUBIC METRES) PER YEAR

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it.

Master Meter Error Adjustments

WATER SUPPLIED

<---------- Enter grading in column 'E' and 'J' ---------->

	Volume		Pcnt:	Value:	
Volume from own sources:	174,324.000 ML/Yr	7	1.00%		ML/Yr
Water imported:	0.000 ML/Yr	n/a			ML/Yr
Water exported:	8,190.131 ML/Yr	7	1.00%		ML/Yr

Enter negative % or value for under-registration
Enter positive % or value for over-registration

WATER SUPPLIED: 164,488.979 ML/Yr

AUTHORIZED CONSUMPTION

Click here: for help using option buttons below

	Volume		Pcnt:	Value:	
Billed metered:	125,111.268 ML/Yr	8			
Billed unmetered:	3,503.386 ML/Yr	8			
Unbilled metered:	166.157 ML/Yr	7			
Unbilled unmetered:	1,444.000 ML/Yr	6		1,444.000	ML/Yr

Use buttons to select percentage of water supplied OR value

AUTHORIZED CONSUMPTION: 130,224.811 ML/Yr

WATER LOSSES (Water Supplied - Authorized Consumption)

34,264.168 ML/Yr

Apparent Losses

	Volume		Pcnt:	Value:	
Unauthorized consumption:	411.222 ML/Yr		0.25%		ML/Yr

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

Customer metering inaccuracies:	1,265.429 ML/Yr	6	1.00%		ML/Yr
Systematic data handling errors:	312.778 ML/Yr		0.25%		ML/Yr

Default option selected for Systematic data handling errors - a grading of 5 is applied but not displayed

Apparent Losses: 1,989.429 ML/Yr

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: 32,274.739 ML/Yr

WATER LOSSES: 34,264.168 ML/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 35,874.325 ML/Yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	4,945.0	8	kilometers
Number of active AND inactive service connections:	312,075	8	
Service connection density:	63		conn./km main
Are customer meters typically located at the curbstop or property line?	No		
Average length of customer service line:	12.0	8	metres (length of service line, beyond the property boundary, that is the responsibility of the utility)
Average operating pressure:	50.8	8	metres (head)

COST DATA

Total annual cost of operating water system:	$169,973,759	9	$/Year
Customer retail unit cost (applied to Apparent Losses):	$2.35	9	$/1000 litres
Variable production cost (applied to Real Losses):	$73.54	9	$/Megalitre

Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

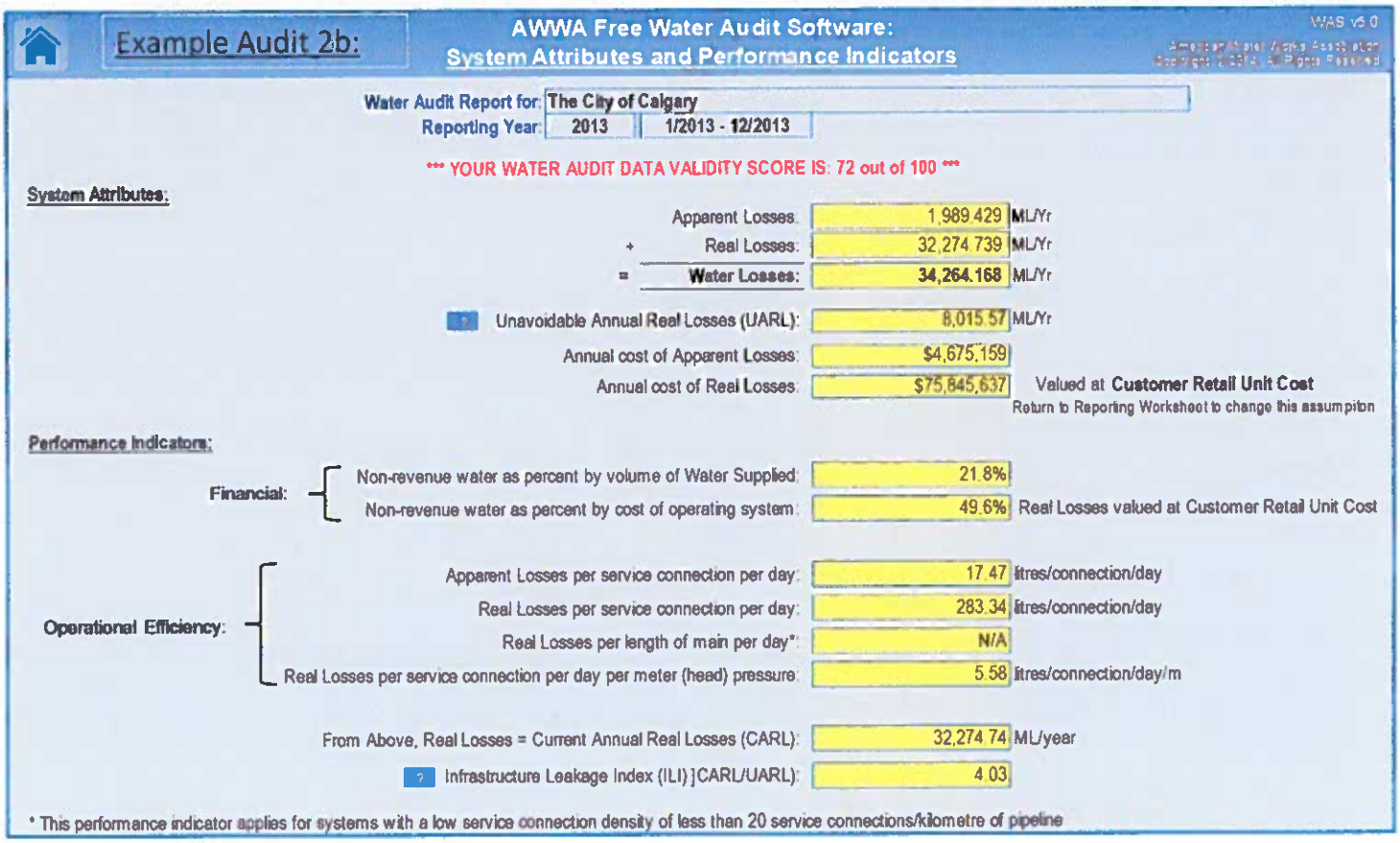
*** YOUR SCORE IS: 72 out of 100 ***

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Volume from own sources
2: Billed metered
3: Customer metering inaccuracies


Example Audit 2b:
AWWA Free Water Audit Software:
System Attributes and Performance Indicators
WAS v5.0
Water Audit Report for: The City of Calgary
Reporting Year: 2013 1/2013 - 12/2013
*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 72 out of 100 ***
System Attributes:
Apparent Losses: 1,989.429 ML/Yr
+ Real Losses: 32,274.739 ML/Yr
= Water Losses: 34,264.168 ML/Yr
Unavoidable Annual Real Losses (UARL): 8,015.57 ML/Yr
Annual cost of Apparent Losses: $4,675,159
Annual cost of Real Losses: $75,845,637 Valued at Customer Retail Unit Cost
Return to Reporting Worksheet to change this assumpiton
Performance Indicators:
Financial:
Non-revenue water as percent by volume of Water Supplied: 21.8%
Non-revenue water as percent by cost of operating system: 49.6% Real Losses valued at Customer Retail Unit Cost
Operational Efficiency:
Apparent Losses per service connection per day: 17.47 litres/connection/day
Real Losses per service connection per day: 283.34 litres/connection/day
Real Losses per length of main per day*: N/A
Real Losses per service connection per day per meter (head) pressure: 5.58 litres/connection/day/m
From Above, Real Losses = Current Annual Real Losses (CARL): 32,274.74 ML/year
Infrastructure Leakage Index (ILI) [CARL/UARL]: 4.03
* This performance indicator applies for systems with a low service connection density of less than 20 service connections/kilometre of pipeline

AWWA Water Audit Software Version 5.0 Developed by the Water Loss Control Committee of the American Water Works Association August, 2014

This software is intended to serve as a basic tool to compile a preliminary, or "top-down", water audit. It is recommended that users also refer to the current edition of the AWWA M36 Publication, Water Audits and Loss Control Programs, for detailed guidance on compiling a comprehensive, or "bottom-up", water audit using the same water audit methodology.

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REFERENCES:

- *Alegre, H., Hirner, W., Baptista, J. and Parena, R. Performance Indicators for Water Supply Services. IWA Publishing 'Manual of Best Practice' Series, 2000. ISBN 1 900222 272*
- *Kunkel, G. et al, 2003. Water Loss Control Committee Report: Applying Worldwide Best Management Practices in Water Loss Control. Journal AWWA, 95:8:65*
- *AWWA Water Audits and Loss Control Programs, M36 Publication, 3rd Edition, 2009*
- *Service Connection Diagrams courtesy of Ronnie McKenzie, WRP Pty Ltd.*

VERSION HISTORY:

Version:	Release Date:	Number of Worksheets:	Key Features and Developments
v1	2005/ 2006	5	The AWWA Water Audit Software was piloted in 2005 (v1.0 beta). The early versions (1.x) of the software restricted data entry to units of Million Gallons per year. For each entry into the audit, users identified whether the input was measured or estimated.
v2	2006	5	The most significant enhancement in v2 of the software was to allow the user to choose the volumetric units to be used in the audit, Million Gallons or Thousand Cubic Metres (megalitres) per year. Two financial performance indicators were added to provide feedback to the user on the cost of Real and Apparent losses.
v3	2007	7	In v3, the option to report volumetric units in acre-feet was added. Another new feature in v3 was the inclusion of default values for two water audit components (unbilled unmetered and unauthorized consumption). v3 also included two examples of completed audits in units of million gallons and Megalitres. Several checks were added into v3 to provide instant feedback to the user on common data entry problems, in order to help the user complete an accurate water audit.
v4 - v4.2	2010	10	v4 (and versions 4.x) of the software included a new approach to data grading. The simple "estimated" or "measured" approach was replaced with a more granular scale (typically 1-10) that reflected descriptions of utility practices and served to describe the confidence and accuracy of the input data. Each input value had a corresponding scale fully described in the Grading Matrix tab. The Grading Matrix also showed the actions required to move to a higher grading score. Grading descriptions were available on the Reporting Worksheet via a pop-up box next to each water audit input. A water audit data validity score is generated (max = 100) and priority areas for attention (to improve audit accuracy) are identified, once a user completes the requied data grading. A service connection diagram was also added to help users understand the impact of customer service line configurations on water losses and how this information should be entered into the water audit software. An acknoweldgements section was also added. Minor bug fixes resulted in the release of versions 4.1 and 4.2. A French language version was also made available for v4.2.
v5	2014	12	In v5, changes were made to the way Water Supplied information is entered into software, with each major component having a corresponding Master Meter Error Adjustment entry (and data grading requirement). This required changes to the data validity score calculation; v5 of the software uses a weighting system that is, in part, proportional to the volume of input components. The Grading Matrix was updated to reflect the new audit inputs and also to include clarifications and additions to the scale descriptions. The appearance of the software was updated in v5 to make the software more user-friendly and several new features were added to provide more feedback to the user. Notably, a dashboard tab has been added to provide more visual feedback on the water audit results and associated costs of Non-Revenue Water. A comments sheet was added to allow the user to track notes, comments and to cite sources used.

17 Appendix 6: Glossary of Relevant Water and Energy Conservation Terms

Commonly used Energy and Water Conservation Terms	
Term	**Definition**
Acre-foot	The volume of water required to cover one acre of land to a depth of one foot (43,560 cubic feet or 325,851 gallons)
Adjudication	The judicial process through which the existence of a water right is confirmed by a court decree.
Aquifer	Underground deposits of sand, gravel, or rock saturated with water. The two major types of aquifers are confined and unconfined.
Basin	The area of land that drains into a particular river
Behavior Based Program	Energy efficiency programs that utilize an understanding of how individuals interact with energy in order to decrease energy demand.
Beneficial Use	The application of water necessary to accomplish the purpose of the appropriation, without waste. Some common types of beneficial use are agriculture, municipal, wildlife, recreation and mining.
Blower Door	A home performance test conducted by a contractor (or energy auditor) to evaluate a home's air-tightness. During this test a powerful fan mounts into the frame of an exterior door and pulls air out of the house in order to lower the inside air pressure. While the fan operates, the contractor can determine the house's air infiltration rate and better identify specific leaks around the house.
BTU	British Thermal Unit – the amount of heat required to raise the temperature of 1 pound of liquid water by 1 degree Fahrenheit at the temperature at which water has its greatest density (approximately 39 degrees Fahrenheit)
Capacitor	A device that maintains or increases voltage in power lines and improves efficiency of the system by compensating for inductive losses.
Compact Fluorescent light bulbs	For a given light output, CFL's use between 20 and 33 percent of the power of equivalent incandescent light bulbs.
Comprehensive Home Energy Audits	An assessment of a home's energy use that includes a visual inspection, diagnostic testing, analysis, and a list of proposed improvements, ending with guidance to complete the work, or actual completion of the work.
Demand Response	The reduction of customer energy usage at times of peak usage in order to help address system reliability, reflect market conditions and pricing and support infrastructure optimization or deferral
Demand side management	The planning, implementation and monitoring of utility activities designed to encourage consumers to modify patterns of electricity usage, including the timing of electricity demand. It refers to only energy and load shape modifying activities that are undertaken in response to utility-administered programs.
Department of Energy	A cabinet-level department tasked with "promoting America's energy security through reliable, clean and affordable energy".
Diversion	Removal of water from its natural course or location by canal, pipe, or other conduit.
Drought	An extended period with below average precipitation
Effluent	Water discharged after use
Electricity Distribution	Regulating voltage to distribution levels and distributing electricity to end-users from substations.
Electricity Generation	Converting a primary energy source (coal, natural gas, wind) into electricity
Energy Conservation	Saving energy by doing with less or doing without (e.g. setting thermostats lower in winter and higher in summer, turning off lights, taking shorter showers,

	turning off air conditioners; etc.)
Energy Efficiency Measure	A particular good practice that provides an energy efficiency benefit. Upgraded insulation, energy efficient appliances, and adjusting a boiler's limit control are examples of measures.
Evaporation	The process of changing a liquid to a gas (vapor); for example when water turns into steam or water vapor.
Evapotranspiration	Process by which water is evaporated from soil surface and water is transpired by plants growing on that surface.
Green Building	A building that utilizes design and construction practices that dramatically improve the efficiency of its use of resources-including energy, water and materials-over the complete life cycle of the building, while improving human health and productivity.
Greenhouse Gas	Gases that trap heat in the atmosphere are often called greenhouse gases. Some, like carbon dioxide, occur naturally and are emitted through both natural processes and human activities, but other greenhouse gases are created and emitted solely through human activities.
Grey Water	Grey water is wastewater generated from domestic activities such as laundry, dishwashing, and bathing, which can be recycled on-site for uses such as landscape irrigation and constructed wetlands. Grey water differs from water from the toilets which is designated sewage or black water to indicate it contains human waste.
Ground water	Ground water, as opposed to surface water, is water that does not run off, and is not taken up by plants. But soaks down into an aquifer; a supply of fresh water under the earth's surface which forms a natural reservoir.
Hydropower	Hydropower or water power is power derived from the energy of falling water, which may be harnessed for useful purposes.
HVAC	Heating, ventilation and Air Conditioning – The mechanical systems that provide thermal comfort and air quality in an indoor space are often grouped together because they are generally interconnected.
Integrated Resource Plan (IRP)	A comprehensive and systematic blueprint developed by a supplier, distributor, or end user of energy who has evaluated demand side and supply side resource options and economic parameters and determined which options will best help them meet their energy goals at the lowest reasonable energy, environmental, and societal cost.
Kilowatt (kW)	1000 W(watts) or 1/1000 of a MW (megawatt) of power
Kilowatt-hour	A unit of energy used to measure electricity, measured as 1 kilowatt (1,000 watts) of power expended for one hour. One kWh is equivalent to 3,412 Btu (British thermal unit)
Potable	Water that is considered safe for domestic human consumption; drinkable water
Power Pool	Two or more inter-connected electric systems planned and operated to supply power in the most reliable and economical manner for their combined load requirements and maintenance programs.
Reclaimed water	Effluent usable for irrigation or ready for release into lakes and rivers
Renewable Generation	Electric power generation from a renewable energy source such as wind, solar, sustainably harvested biomass, or geothermal.
Reservoir	A natural or artificial place to store water; water storage created by building a

	dam; a pond, lake, or basin used for the storage, regulation, and control of water.
Retrofit	A retrofit involves the installation of new, usually more efficient equipment into an existing building or process prior to the existing equipment's failure or end of its economic life.
Return Flow	The amount of water that reaches a surface or ground water source after it has been released from the point of use and thus becomes available for further reuse.
Smart Meter	An advanced electricity meter that uses real time sensors to provide information on power consumption and price.
State Engineer	The chief executive office in the executive department of the state government who administers the adjudication and decree similar to other water rights.
Supply Side	In the utility industry, the term "supply side" refers to new sources of energy (including both renewable sources and fossil fuels). These resources are sometimes contrasted with "demand-side" resources that utilities can access through energy efficiency programs.
Surface Water	Water on the surface of the ground (lakes, rivers, ponds, floodwater, oceans, etc); precipitation which does not soak into the ground or return to the atmosphere by evaporation or transpiration.
Tiered Water Rate	Tiered rates in which the volumetric rate increases as the quantity of water used increases.
Wastewater	Water that has been used and contains unwanted materials from homes, businesses, and industries; a mixture of water and dissolved or suspended substances.
Wastewater treatment	Any of the mechanical or chemical processes used to modify the quality of wastewater in order to make it more compatible or acceptable to humans and the environment.
Water Conservation	The wise use of water with methods ranging from more efficient practices in farm, home and industry to capturing water for use through water storage and conservation projects.
Water Right	A right to use, in accordance with its priority, a certain amount of water.
Weatherization	The activity of making a building more energy efficient by reducing air filtration, improving insulation and taking other actions to reduce the energy consumption required to heat and or cool the building.
Well	Any structure or device used for the purpose or with the effect of obtaining ground water for beneficial use form an aquifer. A shaft or hole into the earth to tap an underground supply of water.
Xeriscape	The use of plant materials and practices that minimizes landscaping water use; usually native plants; environmentally friendly form of landscaping. The term "Xeriscape" was copyrighted by Denver Water in 1981.

18 Appendix 7: Referenced Documents in the Plan

- EPA Water Conservation Plan Guidelines - http://epa.gov/watersense/pubs/guide.html
- Energy Management Guidebook for Wastewater and Water Utilities - http://www.epa.gov/owm/waterinfrastructure/pdfs/guidebook_si_energymanagement.pdf
- Los Alamos County Environmental Sustainability Plan January 10, 2013 DRAFT - http://www.losalamosnm.us/gogreen/Documents/Sustainability%20Plan%20Draft%20with%20Appendices.pdf
- 2006 Daniel B. Stephens Report, Long Range Water Supply Plan for Los Alamos County - http://www.losalamosnm.us/utilities/Documents/Reports/Long-RangePln_8-06_for%20Web%20posting.pdf
- Los Alamos County Non-Potable Master Plan - http://www.losalamosnm.us/utilities/DPUDocuments/DPU_BR130901NonPotableMasterPlan-Final.pdf
- Information on the Integrated Resource Plan for the Western Area Power Administration - http://ww2.wapa.gov/sites/western/es/irp/Pages/default.aspx
- New Mexico Office of the State Engineer Technical Report 53 - http://www.ose.state.nm.us/WUC/PDF/Planning%20Guide_Final_.pdf