City of Jal, New Mexico Public Water System

Water Conservation Plan
March 16, 2015 Copy

Small Town JAL NEW MEXICO Big Heart

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Abbreviations and Acronyms

AFY	acre-feet per year
EPA	Environmental Protection Agency
GPCD	gallons per capita day
gpm	gallons per minute
MG	million gallons
NEPA	National Environmental Policy Act
NMDOT	New Mexico Department of Transportation
NMED	New Mexico Environment Department
NMOSE	New Mexico Office of the State Engineer
psi	pounds per square inch
PVC	polyvinyl chloride
SCADA	System Control and Data Acquisition
SMA	Souder, Miller & Associates
ULFT	ultra-low flush toilet
USDA	United States Department of Agriculture

EXECUTIVE SUMMARY

The City of Jal, New Mexico Public Water System (JPWS) provides potable water for over 2,000 people in an area covering 2.9 square miles in the City of Jal, Lea County, New Mexico. Jal is located in the extreme southeast corner of New Mexico, being less than 10 miles from each of the New Mexico southern and eastern borders.

The City of Jal experienced moderate growth from 2000 to 2010 as it grew from 1,996 to 2,047 residents. In 2014, the Jal Water System included 915 residential accounts which projects to approximately 2,379 residents using the 2010 U.S. Census figure of 2.6 residents per home.

The Jal water system has almost 41 miles of water line and some of these lines have been in place for over 70 years. Approximately 4.5 miles of water line are 2" steel lines that were some of the first waterlines constructed in Jal in the 1940's and 1950's. The majority of these 2" lines are severely deteriorated and many have been found to be approximately 85% clogged. There have been approximately 80 water leaks repaired in Jal in the last five years and roughly 29% of these repairs have been performed on these 2" lines.

The Jal water system is supplied by the four primary production wells that are located in the Jal Basin which is part of the larger Pecos Alluvial Aquifer. These four wells, plus the El Paso leased water well have a total pumping capacity based on estimated well yields of 900,000 gallons per day (1,008 acre-feet per year). Production capability of these wells has continually declined over the years since they were installed.

In addition, a large well field that is hydraulically connected to the Jal Basin known as the T-Bar Ranch produces water for nearby Midland, Texas. This Midland well field is being expanded and is a potential threat to Jal's water supply.

Several studies of the Jal Water System have been performed in the last 10 years and the condition of the water system has been well documented. Replacement of the majority of the waterlines in the community is recommended, along with the installation of new water wells and system appurtenances. This document is one of the required steps to acquire Water Trust Board Funding to accomplish some of these required improvements.

An AWWA Water Audit and NMOSE GPCD analysis have been performed as part of this work and those documents have been included as attachments to this Water Conservation Plan. The Water Audit identified several areas where infrastructure and operational improvements can be made to increase the overall efficiency of the water system.

The GPCD analysis showed the total present use for the Jal Water System to be approximately 342 gallons per capita per day (GPCD). This was calculated using the 2010 population of 2,047 residents. When compared to other communities in southeast New Mexico this number is relatively high. The major reason

for this high number is that approximately 46% of the water pumped in the water system is non-billed and non-metered water. This water could be water that is being lost through system leakage or it could be water that is used in presently un-metered locations. A priority of this plan needs to be the identification of this lost water and the drastic reduction in the amount of non-billed and non-metered water.

The good news found in the GPCD analysis is that the Single Family Residential (SFR) use is approximately 122 Gallons per capita per day. This is a reasonable number and this is a figure to be maintained and slightly reduced in coming years under this plan.

The City of Jal Water Conservation Planning Team reviewed the findings of the AWWA Water Audit and the GPCD report, along with the potential Water Conservation Best Management Practices (BMP's) to determine the best steps to take to conserve water and increase the efficiency of the water system.

The City of Jal set the following goals for its water conservation program:

- Reduce nonrevenue water by 20% from the 2014 nonrevenue water by 2020
- Maintain residential gallon per capita day (GPCD) at or below 130 for the next five years
- Reduce outdoor water use,
- Reduce water waste,
- Reduce peak summer demands for more efficient system operation and reduced energy use,
- Reduce pumping and treatment costs,
- Ensure a revenue-neutral conservation program that can financed by the Water System revenues,
- Strengthen ordinances and policies relating to water conservation,
- Educate the public about water conservation,
- Create incentives for conservation behavior.
- Increase the water audit data validity score from 73 to 80 by 2020

The City of Jal set an overall water conservation goal of 270 GPCD by 2025. This goal is projected to reduce overall demand from 784 acre - feet in 2014 to 717 acre - feet in 2025 and projected to save 955 acre - feet over the ten year period (assuming a 2025 population of 2,370).

As noted in the last bullet point, the City of Jal set a goal to increase the AWWA Water Audit Data validity score from the present 73 up to 80 by 2020. The largest problem with the Jal Water System is the 46% of unaccounted for water. With the use of system operating improvements detailed in the Data Validity scores, this amount of unaccounted for water will be greatly reduced.

1. DATA COLLECTION AND SYSTEM OVERVIEW

1.1. Purpose

The purpose of this document is to set forth a water conservation program for the City of Jal, New Mexico to reduce water use to the maximum feasible extent to ensure that the City has a sustainable and affordable long term water supply in the face of diminishing water sources.

In the last few years, the City of Jal has experienced severe water disruptions due to repeated breaks in their water distribution system. After extensive planning to determine the extent of the need, the City Council of the City of Jal is pursuing Water Trust Board funding for a portion the needed improvements. The Water Conservation Plan is required to be prepared and approved prior to submittal of the Water Trust Board Application.

Because of the recent disruptions, the Jal residents clearly understand the value of water and place a high priority on conserving this resource. The Water Conservation Plan will provide strategic direction to the City's water conservation efforts and will assist with the development of a Water Conservation Ordinance to help encourage the best possible use of limited resources. Outside entities have recently begun to take a greater share of the aquifer being used by the City of Jal and along with these water conservation activities, steps are also being taken to ensure a long term water supply for the City of Jal.

1.2. Planning Team

To accomplish the preparation of this Water Conservation Plan, a Planning team made up of City of Jal personnel and Souder, Miller & Associates personnel was assembled. This team has the ability to provide information and monitor, assess and implement the Water Conservation Plan.

The City of Jal representatives on the Planning Team are the Mayor, Cheryl Chance; the City Manager, Bob Gallagher; the Utility Director, Van Myrick; and Leticia Lujan with the Water Department. The Souder Miller representatives on the team are Project Engineer Russell Doss, P.E., Water Conservation Specialist Marty Howell, P.E., and Groundwater Specialist Scott McKitrick, P.G.

1.3. Local Conditions

1.3.1 Location

The City of Jal is located in the southeast corner of New Mexico (NM), in the southeastern quadrant of Lea County. It is approximately 40 miles south of Hobbs, NM at the intersection of State Highway 128 and State Highway 18. The City is located approximately 8 miles north and 7.5 miles west of the Texas-NM borders. (Figure 1). Jal is situated at an elevation of approximately 3,070 feet above mean sea level (AMSL).

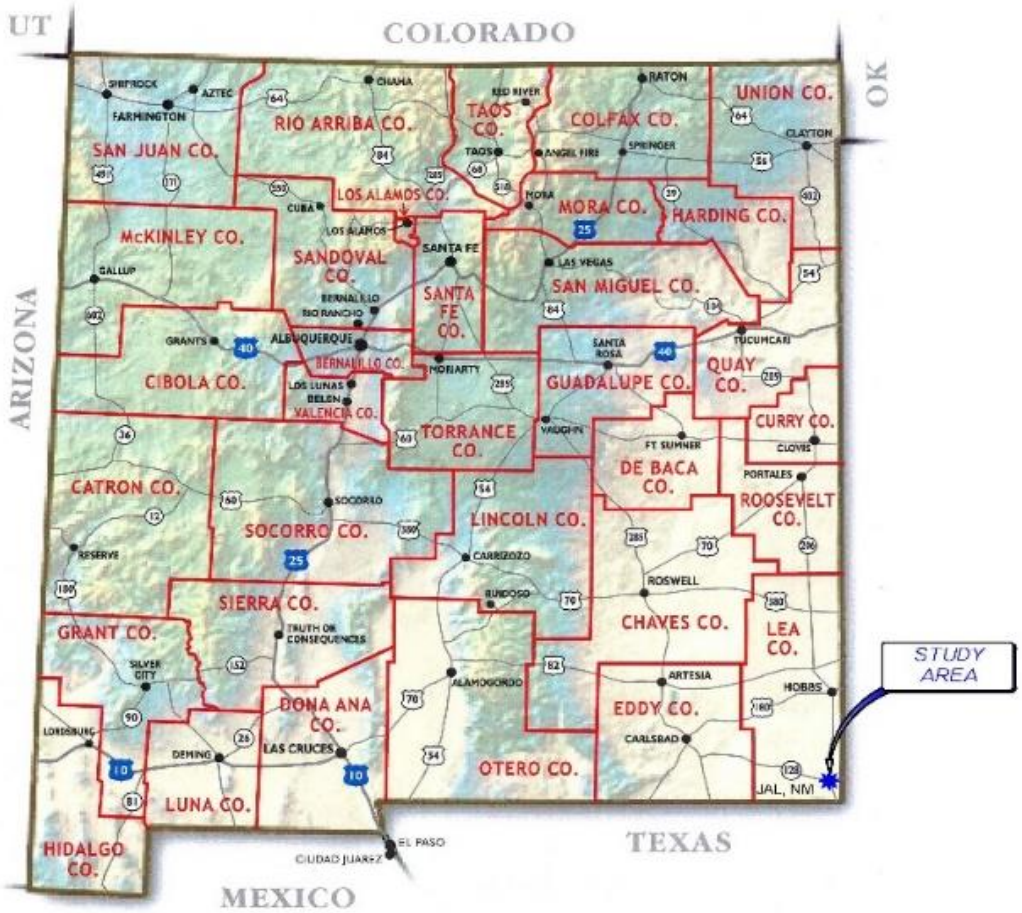


Figure 1. City of Jal Location Map

The majority of Jal's population is located west of State Highway 18. The City of Jal is comprised of residential and commercial properties, a senior center, City Hall, an animal shelter, a library, an elementary school, a middle school, a high school, a country club and golf course, several parks including City Park and Jal Lake Park, several gas stations, a grocery store, and several churches. (SEC, 2014a)

1.3.2 Water Supply Overview

The City of Jal obtains its water supply from four primary production wells that are located in the Jal Basin which is part of the larger Pecos Alluvial Aquifer. The Pecos Alluvial Aquifer extends from the north of Jal into Texas, with the bulk of the aquifer being in Texas (Figure 2).

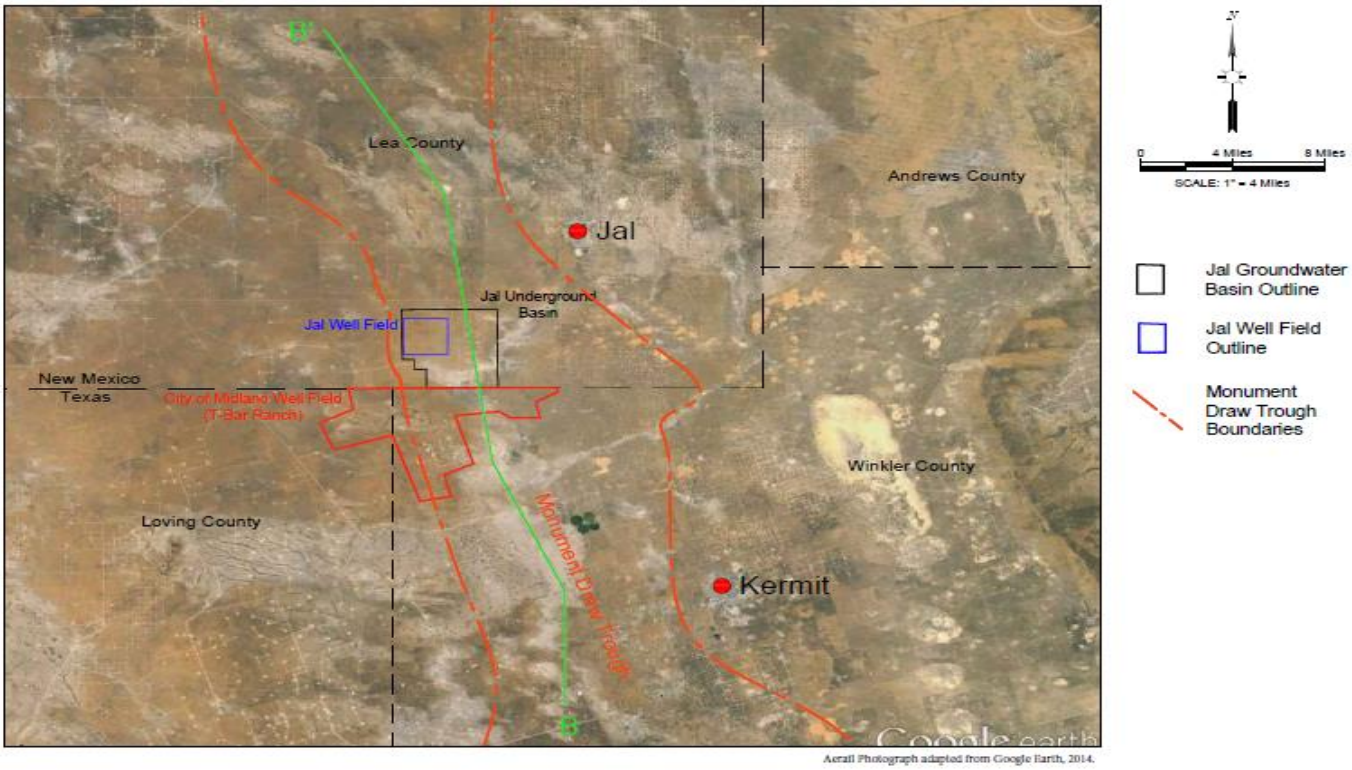


Figure 2. City of Jal Water Sources

The City of Jal has five wells that are currently included in their water rights. Four primary production wells (Wells No. 1, 3, 4 and 5) located approximately 8 miles southwest of Jal at the Westfield Facility supply drinking water to the City of Jal and the nearby town of Bennett. Jal leases the El Paso Natural Gas Well No. 1 for additional capacity.

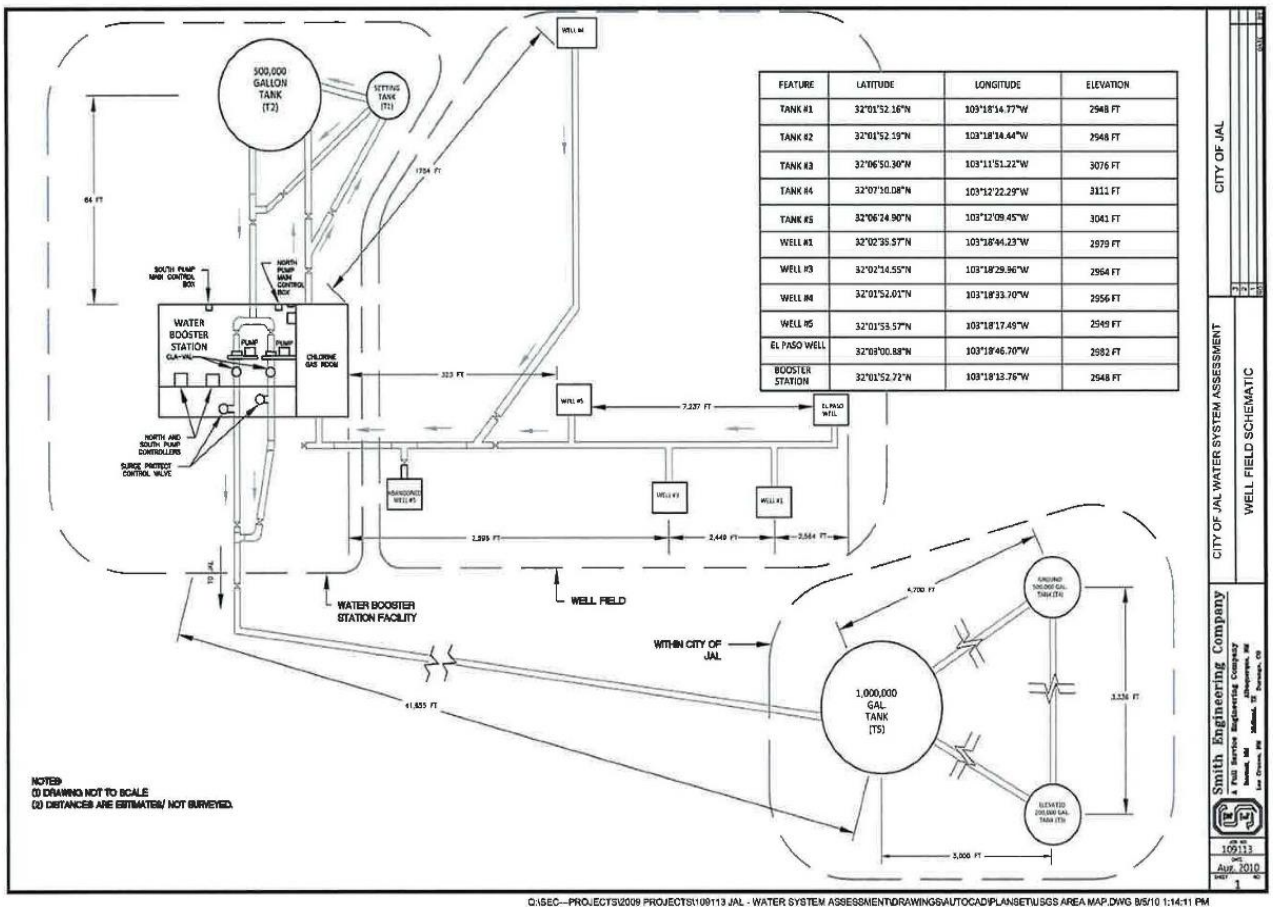
Production capability of these wells has continually declined over the years since they were installed. Water levels through 2004 have been declining at a rate of one foot per year, and projections of drawdown are three feet per year if Jal were to pump all water available under their existing water right (Shomaker, 2005). A large well field that is hydraulically connected to the Jal Basin known as the T-Bar Ranch produces water for nearby Midland, Texas. This well field is expanding and is a potential threat to Jal's water supply.

Ground water in storage in the Jal Basin was estimated by West (1961) at 430,000 acre-feet (ac-ft) prior to groundwater development. It is important to note that not all of the ground water in storage can be economically pumped from an aquifer. After analysis, Shomaker noted that prior to development, the estimated recoverable ground water in storage in the Jal Basin is approximately 50-percent of the total ground water in storage or 215,000 ac-ft. (Shomaker, 2005)

Currently, Jal has the capability to produce an annual average rate of 710 gallons per minute (gpm). The peak day demand is estimated to be 785 gpm. The water supply system should be able to supply the peak day demand with largest producing well out of service. If one of the two largest producing wells are

removed from service, the production capacity drops to 510 gpm, which may leave Jal with a potential water shortage during peak use. (SMA, 2015)

Water is pumped from each well to a 500,000-gallon surge tank and booster station located adjacent to the well field at the Westfield Facility. The pumped water is de-sanded and chlorinated, and the booster station lifts water into the City through 8 miles of 14-inch high density polyethylene pipe at a rate of roughly 1,200 gpm (Figure 3).



FEATURE	LATITUDE	LONGITUDE	ELEVATION
TANK #1	32°01'52.16"N	103°18'14.77"W	2948 FT
TANK #2	32°01'52.19"N	103°18'14.44"W	2948 FT
TANK #3	32°06'50.30"N	103°11'51.22"W	3076 FT
TANK #4	32°07'10.08"N	103°12'22.29"W	3111 FT
TANK #5	32°06'24.90"N	103°12'09.45"W	3041 FT
WELL #1	32°02'35.57"N	103°18'44.23"W	2979 FT
WELL #3	32°02'14.55"N	103°18'29.96"W	2964 FT
WELL #4	32°01'52.01"N	103°18'33.70"W	2956 FT
WELL #5	32°01'53.57"N	103°18'17.49"W	2949 FT
EL PASO WELL	32°03'00.88"N	103°18'46.70"W	2982 FT
BOOSTER STATION	32°01'52.72"N	103°18'13.76"W	2948 FT

Figure 3. City of Jal Water System Improvement Map (Smith Engineering)

Water is pumped from the Westfield Facility to two above ground reservoirs, an elevated tank, and the city's water distribution system. Reservoir storage in the City consists of a 200,000-gallon elevated reservoir near the center of the City and a 500,000-gallon ground-level reservoir on the northwest edge of the City, which includes a booster pump system to elevate system pressure. In the event of a power outage, the 200,000 gallon elevated tank would be the only source of water for the City.

The water distribution system was first installed in the 1940s and consisted of 2-inch diameter unwrapped screw connected steel pipe, with a few 4-inch, 6-inch, and 8-inch diameter steel pipes. The water system now includes over 215,000 feet of waterline of various types and sizes. (SEC, 2014a)

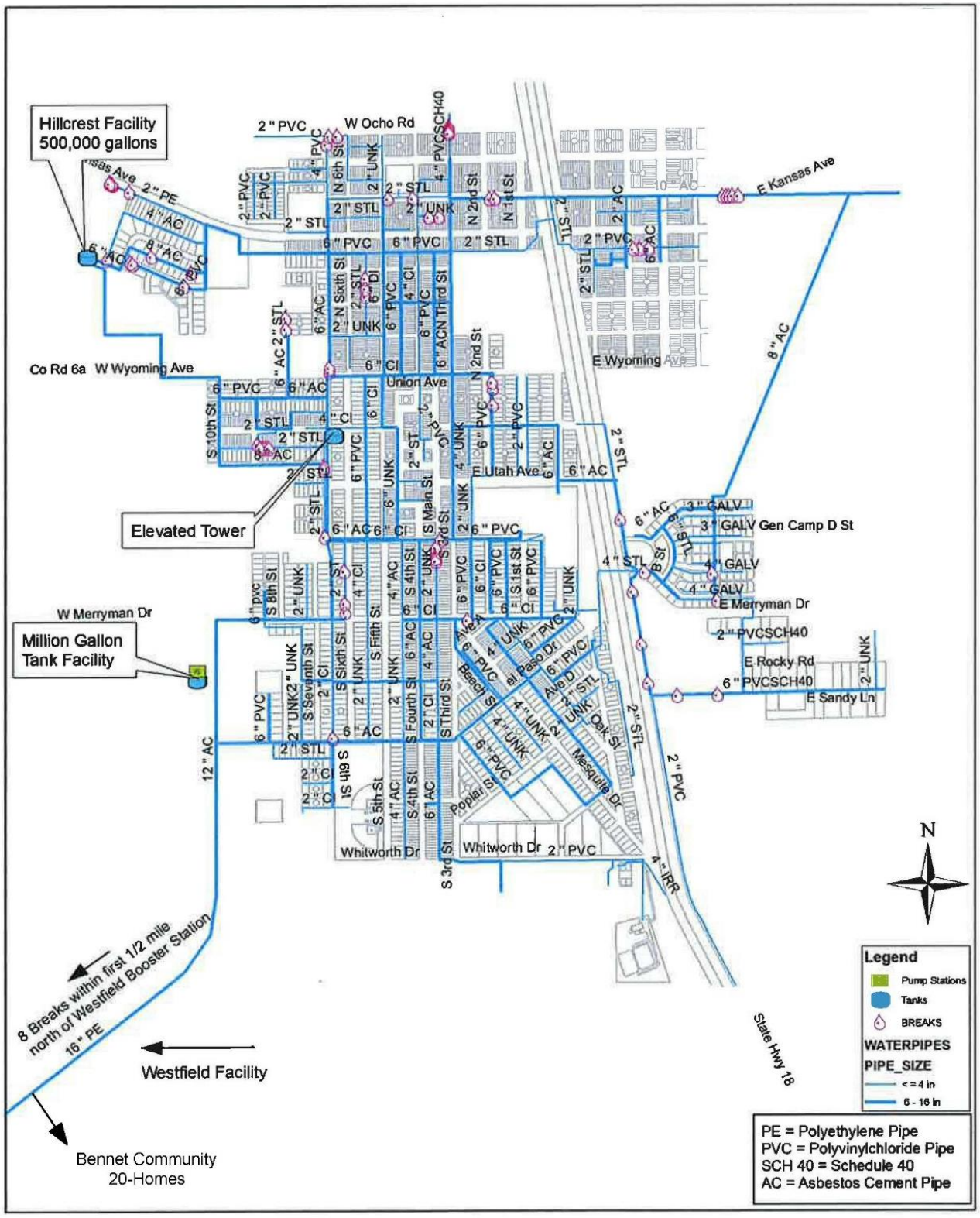


Figure 4. City of Jal Water Distribution Map

Currently, 11% of Jal's water system is comprised of 2-inch diameter steel pipe installed by El Paso Gas Company in the 1940s/50s. Some of the steel water lines have been replaced with cast iron (CI) pipe in the 1950s and 1960s, then asbestos cement (AC) pipe in the 1970s to mid-1980s, and then polyvinyl chloride (PVC) pipe after the mid 1980's. The 2" steel waterlines have lost an estimated 85% of their internal diameter by internal clogging and are associated with 29% of the city's water main breaks in the last 5 years. Overall, it was stated there were 80 repairs performed on waterlines in the last five years. (SEC, 2014a)

WATERLINE DESCRIPTION	LENGTH (ft)	BREAKS	% LENGTH	% BREAKS	Rank
<= 2 " STL	21,022	23	9.75%	29%	1
16 " PE	48,213	6	22.37%	8%	2
UNKNOWN MATERIAL	18,037	8	8.37%	10%	3
10 " AC	7,884	7	3.66%	9%	4
6 " PVC SCH 40	6,123	9	2.84%	11%	5
2 " PVC	15,789	2	7.32%	3%	6
12 " AC	7,646	4	3.55%	5%	7
6 " CI	7,303	2	3.39%	3%	8
4 " AC	5,278	2	2.45%	3%	9
8 " AC	9,479	1	4.40%	1%	10
2 " CI	2,725	3	1.26%	4%	11
2 " PE	1,480	5	0.69%	6%	12
2 " PVC SCH 40	2,157	3	1.00%	4%	13
4 " PVC SCH 40	1,286	4	0.60%	5%	14
4 " PVC	808	1	0.37%	1%	15
4 " IRRIGATION PIPE	745	-	0.35%	0%	16
2 " AC	169	-	0.08%	0%	17
3 " AC	433	-	0.20%	0%	18
6 " AC	25,181	-	11.68%	0%	19
4 " CI	5,200	-	2.41%	0%	20
6 " DI	1,934	-	0.90%	0%	21
6 " PVC	24,882	-	11.54%	0%	22
4 " STL	1,100	-	0.51%	0%	23
6 " STL	683	-	0.32%	0%	24
Total	**215,557**	**80**	**100%**	**100%**	

Table 1. Jal Water System Water Line Summary

As shown in Table 1, the remaining pipe system is comprised of l-inch to 16-inch pipe including asbestos cement, cast iron, and polyvinyl chloride (PVC) all installed in the seven subsequent decades. 9% of the existing system's piping material is without record and is of unknown size and material. A good portion of the existing water system is past its useful life. The pipes are clogged and breaking, and in need of replacement. Much of the system is undersized as there are many areas with inadequate pressure and inadequate fire protection.

Jal's master meter readings indicated that 329 million gallons were pumped from their wells from June 2011 to May 2012. That is equal to an average of 901,326 gallons per day. Based on usage data from that same time period, Jal used 488,058 gallons per day (178 MG/year), or 238 gallons per day per person (GPCD) for the estimated population of 2047. Comparing metered usage to billed usage, it appeared the city had 46% unaccounted water usage at that time. Average usage of 238 GPCD is considerably high due to the filling of Jal Lake and the demand required of the nearby oil and gas industry. (SEC, 2014a)

Item	Annual Volume (gallons)
Water Production[1.]	*329,000,000*
Metered Water Use[1.]	178,140,000
Un-accounted Water (46%)[1.]	81,940,000
Accounted Water	**96,200,000**

1. SEC, 2014a

Table 2. Current (6/11-5/12) Water Balance

The variance between produced water and metered usage is an unaccounted loss of 46 percent which can include leaks, pipe breaks, meter inaccuracy and unmetered or non-billed water. The U.S. Environmental Protection Agency (USEPA) recommends that the maximum unaccounted loss be in the range of 10 to 15 percent (USEPA, 2010). It can then be assumed that approximately 30 percent of the unaccounted water is from system leaks.

In response to that unaccounted water usage data, in 2013 the City of Jal implemented a meter replacement program for the entire water system, including the production meters and all residential, commercial, and city use meters.

In 2014 after the meter installation program was completed, the City of Jal had better meter reading information, but the City was still limited by the outdated billing software being used by the City. When attempting to secure good water use information for 2014 and the previous years, there were many portions of the necessary data that were unavailable. The City is now in the process of upgrading to new billing software in 2015 that should result in much better records for actual use and billing.

The next steps being pursued to bring the City of Jal water system into operation as a highly efficient public water system will be the replacement of the many very old waterlines and the implementation of an effective water conservation plan, of which this document is the first step. The City of Jal is also presently having the groundwater basin and existing wells studied to determine the necessary steps to secure groundwater rights and provide the well additions to access the water for the long term.

1.3.3 Demographics

In 1886, the Jal Ranch was established in Monument Draw located roughly 6 miles east of the present town. A post office originally located at the Jal Ranch was relocated to the town bringing the name Jal with it in 1916. Ranching was the primary economy in the area until1927, when oil and gas were discovered attracting major development companies including Texaco, El Paso Natural Gas Company, and Continental Oil Company. The oil and gas development within Jal led it to become officially incorporated as a town in 1928. The City of Jal was incorporated in 1950. Jal's economy continues to be dependent on the oil and gas industry. El Paso Natural Gas plants and main office were located in Jal for many years. (Miller, 1994)

As with many oil boom towns, Jal grew quickly after the discovery of oil and the construction of the El Paso Natural Gas plant. After the first Jal census in 1930 which showed a population of 404, Jal grew quickly to a population of 1,157 in 1940. The population almost doubled by the 1950 census to 2,047 and reached a record population of 3,051 in 1960. The population decreased gradually over the next 40 years after the El Paso Natural Gas plant closed and leveled off at 1,996 in the 2000 census. (NM BBER)

An oil and gas resurgence caused dramatic 16% increases in the other Lea County communities between 2000 and 2010, but due to a lack of available housing, the City of Jal did not grow at the same rate. According to US Census data, the population of Jal in 2000 was 1,996 and the population in 2010 was 2,047. The Census data indicates that the population of Jal only grew by approximately 2.5% over the 10-year period between 2000 and 2010.

The planning area for this project was predicted to have a growth rate of 5% for each 5-year period from the year 2000 until the year 2030 in accordance with a medium population growth scenario, as defined in the City of Jal's 2004 Comprehensive Plan.12 When viewed with the other Lea County communities' growth of over 1% per year from 2000 to 2010, this would not have been an unreasonable estimate.

However, population growth during the years of 2008-2010 was likely adversely affected by the overall downward economic trend of the nation. For example, housing developers did not begin any new projects in Jal due to the difficulties associated with acquiring bank loans. At the moment, there is still inadequate housing in Jal to support the current work force. New housing projects are now being developed in Jal to support the current energy related work force and anticipated job growth associated with Potash and other industries.

1.3.4 Housing

As noted earlier, the City of Jal has been tied to a "boom and bust" oil economy for decades. As a result, very few home developers built new homes in Jal in recent years. The 2020 U.S. Census provides information that there were 1,009 homes in Jal and 788 of them were occupied during that census. This resulted in 221 vacant units. (US Census)

The American Factfinder website gives a 2009-2013 estimate that there were 950 homes in Jal in 2013. It also lists that there were 43 new homes built from 2000-2010 and 23 new homes built from 1990-2000. The homes built after 1994 are said to have been built in accordance with the Energy Policy Act which required more energy efficient fixtures and appliances.

If you take the 23 homes built between 1990 and 2000 and assess that approximately 60% of the homes were built in the 60% of time elapsed between1994-2000, this would result in a calculated figure of 14 new homes built from 1994-2000. If these 14 homes were added to the 43 new homes built in Jal between 2000 and 2010, this would give an estimate of 57 new homes that may have been built in Jal after 1994 with energy efficient fixtures or appliances. When compared to the estimated 950 homes in 2013, only 6% are estimated to have energy efficient fixtures or appliances. (US Census)

1.3.5 Temperatures and Precipitation

The City of Jal planning region is entirely reliant on ground water for water supply. There are no surface-water sources to develop. Precipitation, season, and temperature play major roles in the demand for irrigation water, and oil and gas development activities play a major role in commercial sales of fresh water.

Precipitation and climate data can be used for estimating water demands during drought conditions, and developing drought contingency plans. The City of Jal is located within the High Plains geographic province, which is characterized by warm summers, mild fall and spring temperatures, and cool winters. Historical temperature data for the 90 year period from 1919 to 2010 is presented below in Table 3. (WRCC)

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Monthly Average	Annual Total
Average Max. Temperature (F)	59.9	65.2	72.7	81.6	88.9	95.5	96.2	94.8	88.7	80.3	68.6	61.1	79.5	NA
Average Min. Temperature (F)	28.0	32.5	38.8	47.5	56.8	65.2	68.0	66.7	60.2	48.9	36.7	29.1	48.2	NA
Average Total Precipitation (in.)	0.4	0.5	0.4	0.6	1.4	1.3	1.8	1.8	2.1	1.3	0.5	0.5	1.1	12.7
Average Total Snowfall (in.)	1.2	0.7	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.7	0.3	3.5
Average Snow Death (in.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA

Source: http://www.wrcc.dri.edu/
Period of Record: 3/1/1919 to 12/31/2010

Table 3. Jal, NM - Period of Record Monthly Climate Summary

Historical precipitation data over the last 60 years from 1942 to 2002 show an average of 12.3 inches per year as shown in Figure 5. This figure also shows the minimum annual precipitation of approximately 3 inches occurred in 2001, and the maximum annual precipitation of approximately 25 inches occurred in 1986. Periods of drought (below average precipitation) and above average periods of precipitation can also be observed on Figure 5. (Shomaker, 2005)

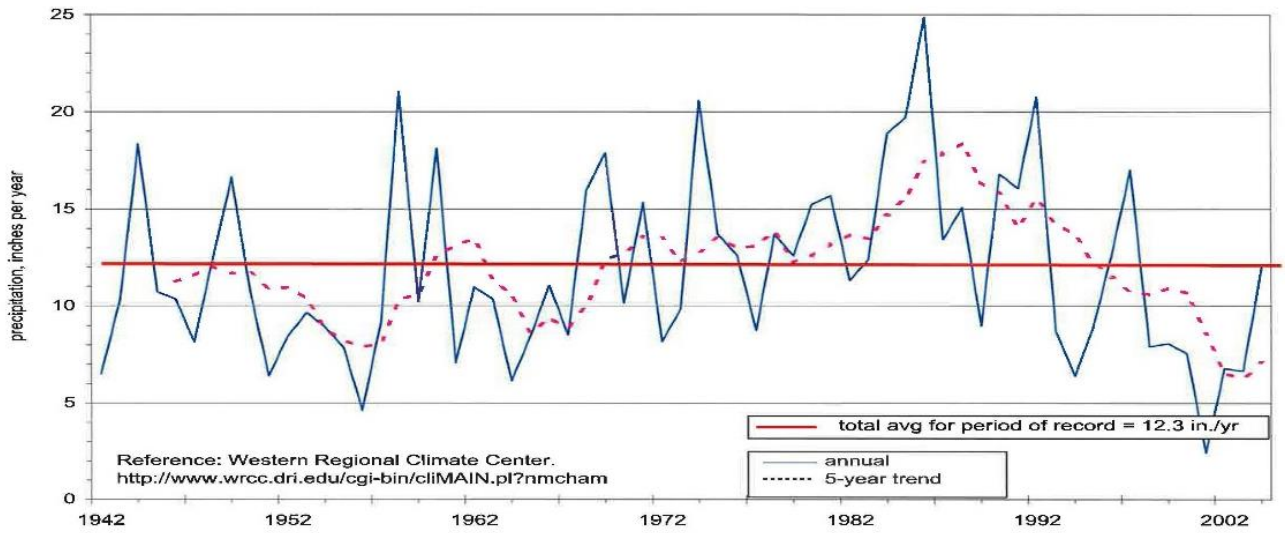


Figure 5. Hydrograph Showing Annual Precipitation at Jal Weather Station No. 294346, 1942 through 2002 (John Shomaker & Associates, Inc.)

The majority of the annual precipitation occurs during the summer months (May through September), as shown on Figure 6. The comparison of monthly potential evaporation vastly exceeding precipitation is show in Figure 7 (Shomaker, 2005).

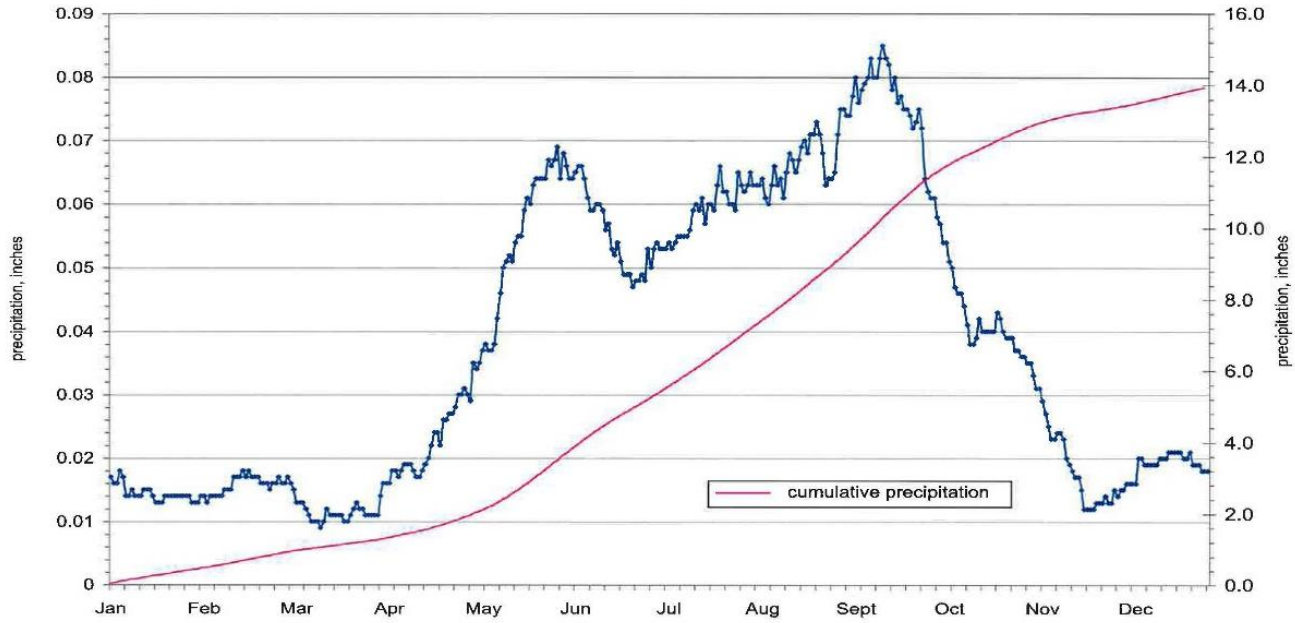


Figure 6. Hydrograph showing Daily Average Precipitation and Cumulative Daily Precipitation at Jal Weather Station No. 294346, 1971 through 2000 (Shomaker, 2005)

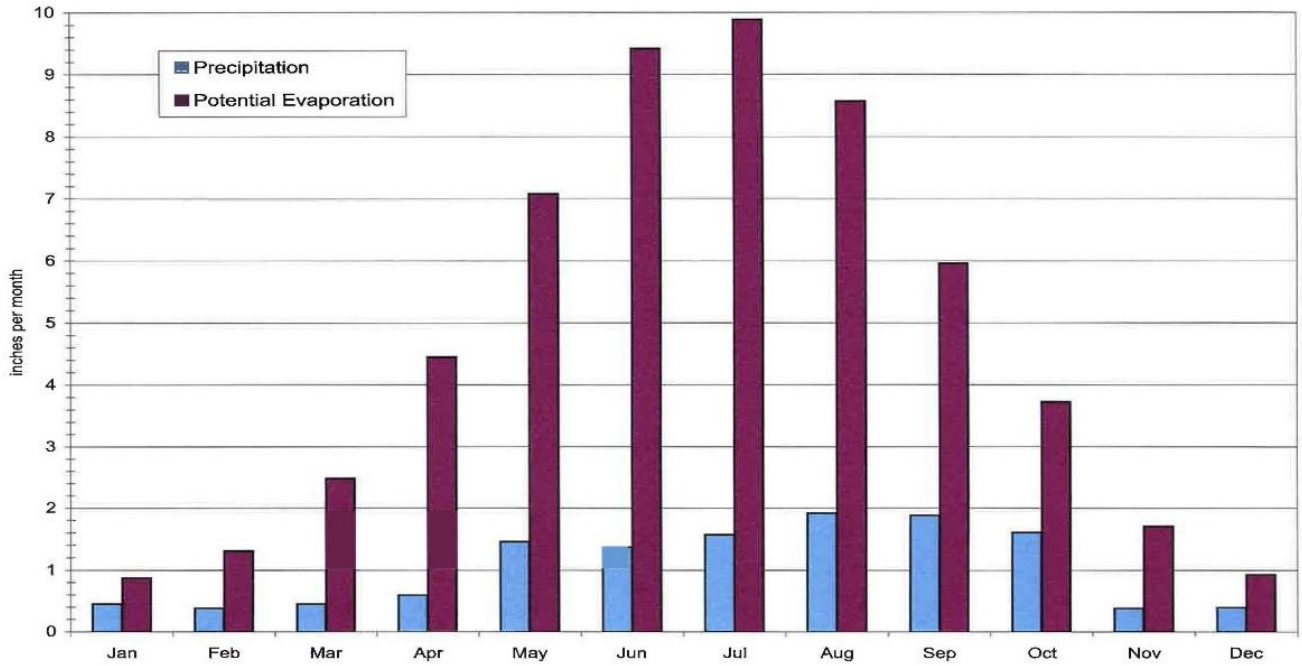


Figure 7. Bar Graph showing City of Jal Monthly Average Precipitation and Monthly Estimated Potential Evaporation (Shomaker, 2005)

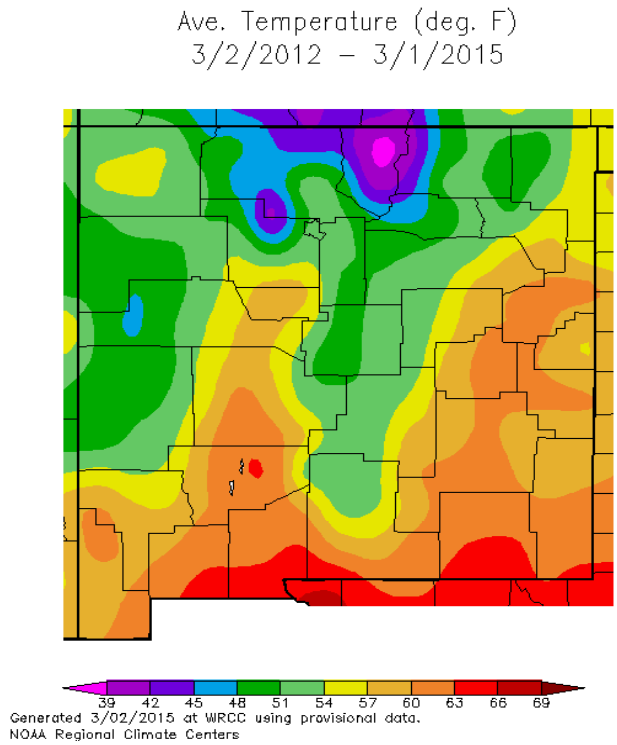


Figure 8. New Mexico Average Temperature Map (NMSU.edu/Climate maps)

Recent Temperature Data for the last three years from 3/2/2012 to 3/2/2015 shows the Jal area to be in the highest average temperature zone for the State of New Mexico as seen in Figure 8.

The Average Temperature for the last three years shows to be in the 63-66 degree F range which tracks closely with the 90 year record of average maximum and minimum temperature date shown earlier in Table 3.

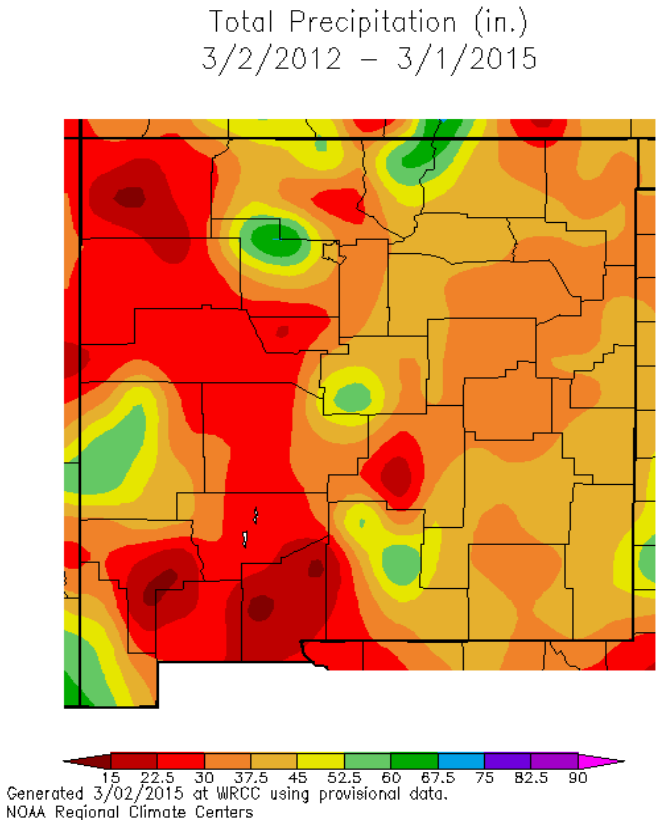


Figure 9. New Mexico Total Precipitation Map (NMSU.edu/Climate Maps)

Recent Total Precipitation Data for the last three years from 3/2/2012 to 3/2/2015 shows the Jal area to have received Total Precipitation in the 30-37.5 inches range.

With Figure 9 showing an average precipitation of 12.3 inches/year for the 1942 - 2002 period, this would reflect an approximate 37" of precipitation in a three year period. Table 3 shows that the most recent precipitation data is tracking with the historical data shown earlier in Figure 5.

One of the major users for the Jal Water System is the Jal Lake and Park Area. Annual average potential evaporation for the Jal area was estimated at 56.4 inches by Gabin and Lesperance (1975) and the rate of lake evaporation for the Jal area was estimated at 80 in/yr by SCS (1972). (Gabin/Lesperance, 1975)

It should be noted that water use as metered for the Jal Lake does not exclusively serve to replenish water evaporated from the lake. The Jal Park Irrigation system and the Cemetery irrigation system are both fed from the lake. So the total metered water use is jointly used by the park irrigation system, the Cemetery irrigation system, and the lake evaporation.

1.3.6 Other Local Conditions – Water Rights Analysis

The City of Jal's water rights were recently researched in 2015 by Souder Miller and Associates using the New Mexico Office of the State Engineer (NMOSE) records. The City has total water rights of 1,970 acre-feet per year including Well No 1, 3, 4, 5 and the El Paso Natural Gas Well (EPNG). Jal leases the EPNG Well No. 1 for commercial use and has a water right of 384 acre-feet per year. Well No 1, 3, 4 and 5 have total water rights of 1,586-acre feet per year. Table 4 summarizes Jal's current water rights.

NMOSE File Number	Associated Wells	Declared Water Right (acre-feet)	Current Water Right Put to Beneficial Use (acre-feet)	Current Beneficial Use (2014) (acre-feet)
J 0001	Well 1 and 5	600	600	484
J 0002	Well 3 and 4	986	986	661
J 0005	EPNG No. 1	384	0	-
Total Water Rights (acre-feet/year)		**1970**	**1586**	**1,145**
Unused (Available) Water Rights for New Wells				441 (273 gpm)

Table 4. Water Rights Summary

If Jal were to expand their Westfield Well system, only one well producing an average of 273 gpm could be installed. The City has three permitted locations for additional wells to access their water rights (Shomaker, 2005).

Pump test results suggest that the Pecos Valley Aquifer is most productive in the northern portions of the well field. Aquifer transmissivity measured in Well No. 1 in the northern portion of the field is much greater than those of Wells No. 4 and No. 5 in the southern portion of the field. Therefore, it is recommended that new wells would be completed in the northern portion of the Westfield facility near Well No. 1.

It is recommended that two new production wells be installed within Jal's current water rights in the Pecos Alluvium in the northern region of the Westfield facility. Given the demand for water in the Pecos Alluvium, it is advised that additional water rights within the Capitan Basin be obtained by the City. (SMA, 2015)

2. ASSESSING CITY OF JAL WATER SYSTEM PERFORMANCE

2.1 Data Results and Analysis, AWWA Water Loss Control Committee (WLCC) Free Water Audit Software Reporting Worksheet

2.1.1 Performance Indicators

The American Water Works Association (AWWA) helped to develop a standard water audit methodology that accounts for all water uses within a common water provider's system. The audit focuses on supply-side uses. AWWA also created a free spreadsheet tool to facilitate completing the audit. The water audit provides a systematic method to organize water diversion data and track its path through the distribution system. The main result of this analysis is "nonrevenue water," which is an estimation of water losses, theft, meter inaccuracies, and non-billed authorized consumption.

Based on the audit methodology, the City of Jal shows approximately 46% nonrevenue water, which tracks closely with previous studies performed for the City of Jal. However, this is an extremely high value and specific steps must be taken to reduce this amount of nonrevenue water.

The AWWA spreadsheet for the City of Jal is located in Appendix A.

The Audit Data Results are as follows:

a. Financial –

The annual cost of apparent losses is $ 6,335. This is a relatively small number and is primarily the result of the new sonic flow meters installed by the City of Jal in 2013. However, the City has not yet been able to institute a meter testing program to verify meter accuracy. We do not know if the 3% inaccuracy estimate will be found true. However, the meters have only been in place for one year, so the accuracy for these new meters should be relatively good. A meter testing program will be a recommendation of this plan and will be added in the fifth year after the new meters have become five years old.

The annual cost of real losses is $ 46,682. This is the number that really causes concern. The reason this loss number is so high is because of the approximate 46% of nonrevenue water figure found in the audit. The 2014 residential and commercial use figures are 119.5 MG/year and these are reasonable for a town estimated at 2,379 residents (915 residential meters x 2.6 residents/home). With this population, the residential and commercial metered use results in a figure of 137.6 gallons per capita per day (GPCD).

Even though the City installed new meters for all of the existing metered locations in 2013, we were still unable to obtain good data for the metered unbilled water use by the City of Jal for 2014. The printout for the City metered unbilled water for 2014 showed 185,166,800 gallons for the year. This number could not be correct, because when added to the existing residential and commercial usage it exceeded the total amount pumped for the year.

This metered unbilled use by the City included 20,442,474 gallons/year for 9 city parks and General Camp locations and 164,724,326 gallons for the Jal Lake meter, which included the Jal

Lake Park irrigation water. When we asked about this number, we were told that was inaccurate and an incorrect meter multiplier may have been used in the old billing software. City of Jal representatives informed us that the correct multiplier would have resulted in a 16,472,432 gallon usage for the Jal Lake and Park. Accordingly, this is the number we used in our calculations.

However, when the total 36.915 MG figure is used for the City metered unbilled use, this results in a total authorized consumption of 160.2 MG/year and an unauthorized consumption of 140.9 MG/year which is very high. The unauthorized consumption is still approximately 46%.

This analysis has revealed a problem with the outdated billing software presently used by the City of Jal. Although they have new meters, they are unable to get correct data with the old billing software. We have been informed that the City of Jal will be purchasing new billing software in 2015.

The other financial problem revealed with this Analysis is that the present Jal water system operational cost breakdown does not separate the production costs from the water distribution system costs items necessary to accurately calculate the cost of the next million gallons of production needed. This plan recommends that the new billing software and the City Budget process be tailored together to accurately allow the determination of this information.

b. Operational Efficiency

The apparent losses per service connection per day is 17.53 gallons/connection/day. This number was determined with the estimated 0.25% unauthorized use figure along with the estimated 3% meter accuracy figure, and an estimate 0.5 MG/year for systematic data handling errors.

As will be discussed more in detail during the data validity score analysis, the City of Jal does not presently have a set of procedures established to document or calculate unauthorized water use. The creation of clear policies and good record keeping procedures are recommended to quantify and limit unauthorized water use.

As noted earlier, all of the Jal water system meters are new in 2013 but a meter testing program has not yet been implemented. It is the intent of the City of Jal to begin testing the meters regularly to verify a good accuracy level and allow for the systematic replacement of meters as they age.

With regard to the systematic data handling error estimate, the City of Jal will be acquiring new water system billing software in 2015. A byproduct of this new billing system should be the reduction of data handling errors through the checks and balances of the new system.

2.1.2 Data Validity Score

The overall data validity score for the City of Jal water system was 73 out of 100. This is a good number, but rather than being a result of above average scores in every category, the scores were very high in some categories and very low in other categories.

High scores were received in the several categories as a result of the City installing all new meters in 2013. However, since the meters are so new, a meter accuracy testing program has not been able to be set up yet. According to the Jal staff, this is a priority and the meter accuracy testing program will be set up in the very near future. This meter testing program will also guide replacement of a statistically significant number of meters each year as they age.

Automatic meter reading (AMR) is another area where the City of Jal received a relatively high score and has plans to expand. Automatic meter reading equipment is being purchased for use with the new meters and will be expanded as funds are available to continue implementation of the AMR process.

One problem area noted as a concern was in the Master meter error adjustment category. Although the Master meter was replaced in 2013, there is no automatic data logging or hourly production meter data reviewed on at least a weekly basis. Tank/storage elevation changes could also be read automatically and used to help provide a check on production volumes. SCADA additions are now being contemplated to address these concerns.

In the billed unmetered category, a concern surfaced with regard to accuracy of use records for the City uses. The outdated billing software has resulted in errors in this data. As discussed previously, the City is moving to acquire new billing software in 2015 that should be much more accurate and have built in checks and balances to find potential record errors more quickly.

In the unbilled unmetered category, it was determined that there are a few City buildings that are presently not metered, such as City Hall. Placement of meters on these buildings would increase the amount of accounted for water. Also, temporary meters or procedures can be set up to assist with determination of the amount of water usage from fire hydrant testing and fire hydrant use.

As noted earlier, in the unauthorized consumption categories, the City presently does not have a good set of procedures established to document or calculate unauthorized water use. The creation of clear policies and good record keeping procedures are recommended to quantify and limit unauthorized water use.

In the average operating pressure category, the City presently has no system to electronically determine pressures throughout the water system. This is an area for possible improvement as the system is upgraded.

Finally, in the category of determining variable production cost, the City of Jal has total water system costs, but the operational cost breakdown does not separate the production costs from the water distribution system costs items necessary to accurately calculate the cost of the next million gallons of production needed. The new billing software and the City Budget process should be tailored together to accurately allow the determination of this information.

2.1.3 Priority Areas for Attention

a. Establish meter testing and electronic calibration procedures to be conducted annually on all production meters.

b. Establish a customer meter accuracy testing program for all water use meters.

c. Use meter accuracy testing to develop a program to replace a statistically significant number of meters each year as they age.

d. Complete the replacement process for the outdated billing software with new billing software. Audit the billing records for global and detailed statistics and verify the audit with a 3rd party review.

e. Continue implementation of the Automated Meter Reading (AMR) program in phases.

f. Establish clear policies and record keeping procedures for determining all types of unbilled unmetered use and unauthorized consumption. Minimize unmetered accounts and set up specific procedures to estimate the different types of unmetered water use.

g. Separate water production costs from distribution costs in the City Budget and cost tracking software to allow determination of the variable production cost for the next MG of water needed.

h. Complete the replacement of dilapidated waterlines in the system to reduce water losses associated with leakage and line breaks.

i. Set up clear procedures to add records of new lines placed into the system. Work toward setting up an Asset Management Plan for the Water System.

j. Install SCADA and data logging equipment on water production meters and review data weekly. Determine Tank/Storage facility elevation changes electronically and use the information to double check water production quantities.

k. Work toward setting up pressure reading equipment at various locations around the city to accurately gauge pressure zone readings. Use telemetry or dataloggers to read the pressures and record them.

2.2 Data Results and Analysis, GPCD Calculator Table

As noted in the AWWA Water Audit review, it was very difficult to obtain the required water system data to perform this GPCD analysis. This analysis has revealed a problem with the outdated billing software presently used by the City of Jal.

Residential and industrial/commercial/institutional (ICI) use meter totals and usage were able to be obtained for the years 2010-2014, but some of the data looked suspect. The total metered residential use for 2013 was reported from Jal representatives for this study as 245,251,000 gallons and the total metered ICI for 2013 was reported as 22,081,004 gallons.

When comparing this 2013 data to the other years use from 2010-2014, the 2013 residential and ICI use was approximately double the average of the other years use. In 2013 all city meters were replaced because the old meters had reached the end of their effective usable life. After speaking to Jal representatives about this, they were asked if the multiplier could have been entered incorrectly in the billing software that would have resulted in this double figure. They responded that they did not realize this large discrepancy existed and that was most likely the cause of that approximately double usage figure. Accordingly, to determine the proper input for the GPCD analysis, the 2013 residential and ICI use figures were divided by 2 to reflect the correct multiplier.

As noted in the AWWA Water Audit section earlier, even though the City installed new meters for all of the existing metered locations in 2013, we were still unable to obtain good data for the metered unbilled water use by the City of Jal for 2014. The printout for the City metered unbilled water for 2014 showed 185,166,800 gallons for the year. After discussions with Jal representatives regarding meter multipliers, the appropriate multiplier corrections were applied to the Jal Lake and Park Meter use. This reduced the Jal Lake and Park use from 164.7 MG/year to 16.47 MG/year. When this number is added to the 20.4 MG/year usage at the other City metered locations, this results in a 36,914,800 gallons/year figure for the City metered unbilled use. Since we had no other information, this amount was used in Table 5.6 of the spreadsheet as other metered consumption for each year of the study period.

In addition, total water production data was only able to be obtained for the full calendar years of 2011, 2013, 2014 and partial year reports for 2010 and 2012. In calendar year 2011, 42% of the total water pumped was for the January to May period, and 58% of the total water pumped was for the June to December period. These percentages were applied to 2010 and 2012 which resulted in estimated total pumping of 339.5 MG in 2010 and 285 MG in 2012.

Good total pumping data was also only available for the El Paso Well in 2014 in the amount of 2.509 MG, although this well was used for the entire period from 2010-2014. We were required to assume that an approximate amount of 2.5 MG was produced from this well for each of the study years. This amount was removed from the total pumping quantity and placed in the “imported” spreadsheet location to properly reflect that this well is not owned by the City of Jal.

When reviewing the overall 2010-2014 water system data to see if it was reasonable, the figures still show an increase in residential and ICI use in 2013 over 2012 even with the revised meter factor taken into account. This increase is reasonable when you consider that new meters were installed and they were reading the water use levels more accurately. And when you note that the 2014 use figures are significantly lower than the 2013 use figures, this makes sense also. When the customer's gallon usage in 2013 increased with the new meter readings, their water bill increased also. The reduced use in 2014 reflected the customer's desire to decrease their water bill.

The City of Jal Water System data input items for the GPCD spreadsheet have been entered accordingly and the entire GPCD spreadsheet is attached as Exhibit B of this document.

With regard to estimated indoor or outdoor Water use for Single Family or Multi-family residences, since we had minimal monthly data to evaluate, we relied on the built in estimated values in the spreadsheet.

As noted earlier, the largest user of water in Jal is the Jal Lake and Park facility. Data indicates that this facility uses an estimated 17 MG/year of water. This is a very large use of groundwater. In response to this concern, the City of Jal is presently taking steps to drill four new water wells at the Jal Lake Park location to provide the needed water to operate this facility independently of the Jal Water System. This will result in an immediate pumping reduction in approximately 17 MG/year for the Jal Water System.

The second largest user of water in the Jal Water System is the Jal Country Club. City of Jal metered unbilled records indicate that 9.2 MG was used by the Country Club in 2014. It was previously reported that the largest water conservation measure for the City of Jal is the reuse of wastewater at the Golf Course. Wastewater reuse is a 250 to 310 ac-ft/yr savings in fresh water. (Shomaker, 2005) This relates to a savings of between 80 and 100 MG/year of fresh water at the Golf Course. It is our understanding that this reuse of wastewater at the Country Club is still ongoing. However, the use of 9.2 MG per year of fresh water still represents one of the largest users in the community and should be investigated for possible water conservation measures.

The third largest user of water in the Jal Water System is a large construction firm who uses a large volume of water in their construction processes. Their total water use was 2,255,055 gallons in 2014. It is our understanding that they have been instructed to keep their usage at this level or less even though they have the need for much more water. In this situation, the inverted rate structure where higher water rates are charged for higher levels of consumption could help keep this high use to a reasonable level.

The fourth largest user of water in the Jal Water System is the Jal School System. It is reported they use 1.637 MG/year. Water Conservation measures could possibly result in decreased use here.

The GPCD spreadsheet gives several key findings that will be of use in the preparation of a Water Conservation Program. The first finding is the 122.63 SFR GPCD use. The second finding is the 14.01

Industrial, Commercial, and Institutional (ICI) GPCD use. These are both reasonable numbers and indicate that although there is room for improvement in these numbers, the largest water conservation opportunities can be found in other categories.

There are two more numbers found in the GPCD spreadsheet that are very important. The first number is the Total Jal Water System GPCD number of 342.06 in 2014. This is high and represents a significant opportunity to save water through Water Conservation measures. For comparison, a 2009 preliminary 40-year planning document for Hobbs indicates the current total GPCD use of 250 to 300 GPCD at that time, with a goal of 264 GPCD. Las Cruces has a total GPCD goal of 180 GPCD by 2045, and Alamogordo has a total GPCD goal of 165 GPCD by 2045. The City of Lovington has a 240 GPCD goal listed in their 40 year plan. (Stephens, 2009)

The final number listed in the GPCD spreadsheet that is important is the amount of non-metered water used in the Jal Water System. The non-metered nonrevenue water represents 164 GPCD of the total 342 use figure for the entire water system. As noted throughout this study, this relates to an approximate 46-48% of non-metered unaccounted for water used in the system. This category represents the greatest level of opportunity for Water Conservation within the City of Jal.

3. WATER CONSERVATION GOALS

3.1 Objective

The objective of the City of Jal's water conservation program is to reduce water use to the maximum feasible extent to ensure that the City has a sustainable and affordable long term water supply in the face of diminishing water sources.

3.2 Reason Why the PWS is developing a Water Conservation Plan

In the last few years, the City of Jal has experienced severe water disruptions due to repeated breaks in their water distribution system. After extensive planning to determine the extent of the need, the City of Jal is pursuing Water Trust Board funding for a portion of the needed improvements. The Water Conservation Plan is required to be prepared and approved prior to submittal of the Water Trust Board Application. The Water Conservation Plan will also provide strategic direction to the City's water conservation efforts and will assist with the development of a Water Conservation Ordinance to help encourage the best possible use of limited resources. Outside entities have also recently begun to take a greater share of the aquifer being used by the City of Jal. Jal residents understand the value of water and place a high priority on conserving this resource.

3.3 Identify Water Conservation Goals

As previously discussed, approximately 46% of the City's water is unaccounted for on an annual basis. On average, utilities lose approximately 10% of their water to leaks and unmetered connections. In addition, the Jal Water System uses an average of 342 gallons of water per day per resident. Average daily use in the southwest varies from a low of below 100 gpcd up to 300 gpcd. Other cities in Lea County (Hobbs, Lovington, and Eunice) are reported to have a per capita water consumption ranging from approximately 250 to 350 GPCD. (Miller, 1994)

Based on this information, the City of Jal set the following goals for its water conservation program:

- Reduce nonrevenue water by 20% from the 2014 nonrevenue water by 2020
- Maintain residential gallon per capita day (GPCD) at or below 130 for the next five years
- Reduce outdoor water use,
- Reduce water waste,
- Reduce peak summer demands for more efficient system operation and reduced energy use,
- Reduce pumping and treatment costs,
- Ensure a revenue-neutral conservation program that can financed by the Water System revenues,
- Strengthen ordinances and policies relating to water conservation,
- Educate the public about water conservation, and
- Create incentives for conservation behavior.
- Increase the water audit data validity score from 73 to 80 by 2020

The City of Jal set an overall water conservation goal of 270 GPCD by 2025. This goal is projected to reduce overall demand from 784 acre - feet in 2014 to 717 acre - feet in 2025 and projected to save 955 acre - feet over the ten year period (assuming a 2025 population of 2,370).

As noted in the last bullet point, the City of Jal set a goal to increase the AWWA Water Audit Data validity score from the present 73 up to 80 by 2020. The largest problem with the Jal Water System is the 46% of unaccounted for water. With the use of system operating improvements detailed in the Data Validity scores, this amount of unaccounted for water will be significantly reduced.

3.4 Prioritize Goals

Since the City has higher than average unaccounted for water (46%) with average daily uses that are closer to average, the City is prioritizing those goals related to reducing losses. Specifically, the City's primary goal is to reduce nonrevenue water by 20% from its 2014 use rate by 2020. The City's next goal is to maintain residential GPCD at or below 130 for the next five years. The final goal is to increase the data validity score up to 80 within the next five years.

3.5 Evaluate Goals

To evaluate progress towards achieving their primary goals, the City will determine their unaccounted for water and average GPCD on an annual basis. The City will also perform the AWWA Water Audit to determine their data validity score on an annual basis.

3.6 Best Management Practices

3.6.1 Describe Best Management Practices (BMPs) Considered

The City evaluated the following best management practices to determine their cost-effectiveness, their feasibility for implementation, and their appropriateness for the Jal community:

- Source Water Metering (with Testing and Calibration)
- Program to test, calibrate, repair & replace meters systematically
- Meter Public Use
- Account for Water
- Analyze Non-accounted for Water
- Water System Audit/GPCD Analysis
- Repair Known Leaks
- Water System Audits for largest Commercial/Industrial users
- Encourage re-use of water for Commercial/Industrial users
- Inclining Block Water rate structure
- Leak Detection & Repair Strategy
- Automated Sensors/Telemetry (SCADA)
- Informative Water Bill
- Workshops
- Information Available

- Water Bill Inserts
- Advisory Committee
- Public School Education Program
- Selective End Use Audits
- Home Water Conservation Equipment Reimbursement Program
- Promotion of Landscape Efficiency
- Rebates and incentives (nonresidential)
- Rebates and incentives (residential)
- Requirements for New Developments (Efficient Fixtures/Landscaping/Irr.)

The City of Jal decided to include a large majority of the potential Best Management Practices listed above. In order to keep the program manageable, the Jal Water Conservation Committee tried to select the most effective goals that would result in the practices that would most directly impact water conservation. Consequently, some of the practices that were deemed less effective were not included in the program.

3.6.2 List BMPs Selected

Based on the City's goals, the following BMP's were selected:

1) Source Water Metering Testing and Calibration
2) Program to test, calibrate, repair & replace meters systematically
3) Meter Public Use
4) Account for Water
5) Water System Audits for largest Commercial/Industrial users
6) Encourage re-use of water for Commercial/Industrial users
7) Inclining Block Water rate structure
8) Analyze "Unaccounted For" Water
9) Repair Known Leaks
10) Water System Audit/GPCD Analysis
11) Leak Detection & Repair Strategy
12) Informative Water Bill
13) Water Bill Inserts
14) Public School Education Program
15) Home Water Conservation Equipment Reimbursement Program
16) Promotion of Landscape Efficiency
17) Requirements for New Developments (Efficient Fixtures/Landscaping/Irr.)
18) Automated Sensors/Telemetry (SCADA)

4. PUBLIC INVOLVEMENT, EDUCATION, AND OUTREACH

4.1 Describe the Public Involvement during the Planning Process.

As noted in Section 1.2, to aid in the preparation of this Water Conservation Plan, a Planning team made up of City of Jal personnel and Souder, Miller & Associates personnel was assembled. This Water Conservation Planning team also has the ability to provide information and monitor, assess and implement the Water Conservation Plan.

The first public involvement action taken early in the Water Conservation planning process was to compile the list of Best Water Conservation Practices into a public survey format where Jal residents can provide input as to which practices they would like to see put into practice immediately and which ones they would only want to see in the most extreme situations. After notifying the public by electronic media, the survey was made available to the Jal Residents as they came in to pay their water bill.

This water conservation plan is being prepared for the NMOSE in advance of the Water Trust Board application and there is a very short schedule from the time the water conservation planning process is begun until it needs to be completed. Consequently, we were only able to receive comments for a one week period. However, during that period we were able to obtain seventeen surveys from Jal Residents.

In addition to the survey, the Draft Water Conservation Planning Document will be advertised and made available to the Jal Residents for viewing and comment for a two week period after it is completed.

After the Water Conservation Plan is prepared, the Jal Water Conservation Ordinance will be updated to reflect the new activities described in the Plan. At such time as that ordinance is prepared, it will be discussed at a public meeting and then advertised for 30 days for public comment. After the 30 day comment period, it will be discussed again at a public meeting prior to adoption.

4.2 Describe Outreach Program Activities

The majority of the actions described in this Water Conservation Plan to reduce the 46% unaccounted for water will be performed by the City of Jal. However, the next targeted audience for Water Conservation improvements are the Jal Residents and the Jal ICI (Industrial, Commercial, and Institutional) users. To reach this target audience, a multi-faceted outreach program will be implemented.

The City of Jal has a local weekly newspaper that is well read by Jal residents. This newspaper will be used to disseminate regular water conservation public service announcements as well as news articles regarding the Jal Water System and their water conservation efforts.

The City of Jal is also presently updating and upgrading their municipal website. A separate page of the website is proposed exclusively for Water Conservation. Information regarding the Jal Water System, the

Water Conservation plan, and Water Conservation tips are proposed to be included on this web page in addition to having links to key web sites that provide water conservation information, such as the State Engineer's Office website and others.

The Jal Water Department will produce and acquire Water Conservation brochures and handouts to be set up in an information kiosk in the Jal Water Office. In Jal, many residents pay their bill in person and will be able to access these brochures and handouts regularly.

Water Conservation information will also be included as inserts with the water bills to help encourage water conservation by the customers. The water bill will be redesigned to be more easily read and one of the inserts will provide instructions regarding the new water bill format.

As specific water conservation needs are determined, specific water conservation educational presentations can be scheduled to address these specific needs. One potential area is in regard to reducing excess lawn watering with the use of soil moisture meters. One of the Lea County Master Gardeners may be able to come to Jal and give specific and accurate information regarding the best way to use these moisture meters and what are the optimum soil moisture levels for lawn, shrub, and flower bed growth.

As part of this Water Conservation Plan, outreach will be made each year to the top two ICI water users in the system. These large water users will be contacted and an audit will be performed on their processes in accordance with NMOSE recommendations. As part of this work, they will also be encouraged to develop water "re-use" in their processes.

Finally, the City of Jal will work with the Jal School System to begin an "In School" Water Conservation Education program to educate students. This program will be discussed in more detail in the next section.

4.3 Describe In-School Educational Programs

The City of Jal proposes to use the following procedures to develop an in-school water conservation program.

A. Prepare an "Introduction to Water" Report. A briefing paper will be created for educators that describes the current and projected status of the Jal water supply along with the condition of the existing aquifer and the water demand in the Jal area. An important element of this paper will be an overview of the utility's conservation plan. The report will explain the value of an in-school conservation program can be for the entire community and it will describe the support the utility can provide to the educational system.

B. Contact the School System. Contact the school board and the superintendent of education to schedule a meeting to solicit their support in establishing an in-school water conservation program. Obtain approval to establish a steering committee to direct the development and implementation of the program. This steering committee can be comprised of utility staff, educators, parents, and

other interested parties (which may include high school students). Define the responsibilities of the steering committee and its overall role in the conservation program.

C. Announce the Water Conservation Initiative.
Using various public media and school communication networks, announce the cooperative educational initiative. Solicit participation on the steering committee from interested parties. Subsequent steps in this procedure will require the assistance of the steering committee.

D. Assign Utility Personnel to the Program. Determine the Jal utility personnel who will develop and run the program. Designate the office space and equipment needed to conduct the program. Allow time for the program coordinator to visit schools during the formative and implementation phases of the project.

E. Contact Schools to Determine Existing Conservation Activities. Contact schools and other agencies that work with children to determine what conservation activities, if any, are already underway. Determine if there are any teachers who have introduced conservation education into their classroom activities. If so, ask them to share what they have learned about teaching conservation. Contact the USDA, the Soil and Water Conservation District, and the County Extension Agent for assistance, resources, or recommendations. Note that 4-H groups may also be involved in providing group learning activities on water conservation.

F. Review Conservation Materials. A list of existing conservation materials will be reviewed and the most appropriate items for each grade level will be selected, or new materials will be developed as needed. Conservation materials can include exercise books for students, computer games and exercises, slides, videos, models, experiments, guest presentations, other materials for field and classroom projects, or teacher's guides.

The quantity of selected items that will be required for the school system will be estimated and the annual cost will be calculated. Research and review the list of quality educational materials offered by the Office of the State Engineer, Water Use and Conservation Bureau.

G. Establish Evaluation Methods. Create a means of evaluating the students' understanding of the subject matter before and after the conservation lessons have been completed. Tests for this purpose are often included with the available instructional materials. Results from student tests may be used to measure the effectiveness of the program and to identify deficiencies in the teaching materials and techniques that need to be corrected.

H. Establish In-Service Training. Determine a means of providing in-service conservation training for teachers, as needed, and estimate the annual cost of providing such training. One potential training program is Project WET Teacher Training. Project WET (Water Education for Teachers) is a nationally developed K-12 environmental education program that utilizes water as its theme. Designed for delivery by formal or non-formal teachers, it contains lab exercises and activities designed for small or large classes. Trained facilitators present the curricula to teachers in a six-hour workshop, after which teachers receive their own copy of the Project WET book—a collection of 80 water related lessons. For information on Project WET in New Mexico, visit www.werc.net.

I. Determine Annual Budget. Compile the costs of educational materials and necessary teacher training to arrive at the total annual cost of the Education Program. The purchase of educational materials and teacher training may be able to be subsidized by various state agencies, federal agencies, and private institutions in addition to the City of Jal.

If financial resources fall short of the required funding, proposals may be sought to obtain grants from institutions such as community-minded businesses, federal and/or state government agencies, or private foundations.

J. Implement the Education Programs on a "Phased Basis". It is proposed that the City of Jal will work with the Jal Municipal Schools to develop the program in the first year and start implementation in the second year for grades 1 to 4. Implementation of the grades 5 and 6 could begin in the third year, with grades 7 and 8 in the fourth year, and grades 9 to 12 in the fifth year of the program.

5 DEVELOPING A WATER CONSERVATION PROGRAM

5.1 Challenges

The main challenge with the development of a Water Conservation program is in regard to the timing of the implementation. As can be seen from this report, the water lines in the community are badly deteriorated and in need of replacement. Major water losses are being experienced due to the very poor waterline conditions. This water line replacement and system upgrade work are estimated in excess of $ 10 million. Although this plan can be implemented relatively rapidly, it will be difficult to make a major difference in the water losses until these lines can be replaced.

However, this challenge also goes along with a tremendous opportunity. If all the needed lines can be replaced within a 18-24 month period and new billing software can be acquired along with the implementation of a meter accuracy testing and calibration program for all of the new meters purchased in 2013, the City of Jal may have a top flight system to work with. With all of this new and sophisticated equipment, the final tracking and elimination of water losses may be a very straight forward and systematic process to reach the goals ahead of schedule.

One of the main challenges to the successful and timely implementation of this plan will be having access to available manpower of the City of Jal to take all of the actions detailed in the plan. The City of Jal is a very small community with a very small public works staff. Their existing staff time is fully allocated and it will be difficult to add the actions detailed in this plan. Existing staff time or additional personnel will need to be allocated to the implementation of this plan in order for it to accomplish the stated goals.

One of the additional challenges to water conservation is related to the oil field related economy of the community and the preponderance of oil field workers who work a high level of overtime hours each week along with the very low percentage of homes that have automatic irrigation systems. When a worker comes home and finds the time to water the lawn, they sometimes “flood” the lawn to provide “deep” watering on an occasional basis. Ordinarily this is a good system, but when too much water is applied to the lawn, it does not provide the full benefit to the lawn and it is just wasted. It is our hope to provide inexpensive access to soil moisture meters and increase their use to help people learn the correct amount of water to put on their lawns on a sporadic basis. It would seem that this scenario would lend itself to families revising their landscaping away from standard lawns and shrubs to xeriscape landscaping with native vegetation. However, the local residents are very traditional and may not want to make the move toward xeriscaping.

As noted in the plan, a large municipal entity has begun to make major withdrawals from the same aquifer being used by the City of Jal. Although this is a major threat to the long term water supply of the City of Jal, this threat has galvanized the city leaders and residents of Jal to take action to conserve their long term water supply. For this reason, most of the conservation measures being proposed may meet with more receptive ears than usually happens in cases like this.

Although the opportunity to conserve water may bring positive feedback, one portion of this water conservation plan is not likely to be accepted with open arms. The action to create an inclining block rate

structure that will provide sufficient income to pay for the water system improvements will cause all types of water bills to increase significantly.

This same scenario was experienced in Hobbs following the construction of their new Wastewater Treatment Plant. However, since the residents of Jal have experienced severe water shortages due to major line failures, they may realize that this additional funding is required in order for them to have a truly dependable and efficient water system.

5.2 Program Components

5.2.1 Program Title

City of Jal Water Conservation Plan.

5.2.2 Summary of Program

The below program summary lists four main headings that the water conservation programs can be categorized. There are eighteen water conservation measures listed earlier in Section 3.6.2 and they are listed below under their applicable headings along with their number.

Also, as noted in the Data Validity Analysis Sections 2.1.2 and 2.1.3, there are several system and program improvements that will be necessary to improve the water system operation and efficiency to help the water system meet the Data Validity goal of 80 as established by the planning committee. These actions are listed in Section 2.1.3 and they are labeled with letters from a. to k. Data Validity actions that correlate to a water conservation measure are listed in parenthesis following the applicable water conservation program.

Metering –
The City of Jal will add the following elements to its metering program to:

1. Source Water Metering Testing and Calibration.
    a. Establish meter testing and electronic calibration procedures to be conducted annually on all production meters.

2. Program to test, calibrate, repair & replace meters systematically.
    b. Establish a customer meter accuracy testing program for all water use meters. c. Use meter accuracy testing to develop a program to maintain, repair, and replace a statistically significant number of meters each year as they age.

3. Meter Public Use. The City will implement a program to install meters at public use locations including City buildings and parks that may not presently be metered.

Water Accounting and Loss Control -

The City of Jal will implement a Water Accounting and Loss Control Program to improve the system efficiency, reduce unaccounted for water, and reduce lost water using the following elements:

4. Water accounting.

   d. The City will complete the replacement process to install the new billing software, audit the billing records for global and detailed statistics, and verify the audit with a 3rd party review.

   e. The City will continue full implementation of the Automated Meter Reading (AMR) program.

   f. The City will establish clear policies and record keeping procedures for determining all types of unbilled unmetered use and unauthorized consumption. The City will take action to minimize unmetered accounts and set up specific procedures to estimate the different types of unmetered use in accordance with best management practices.

   g. The City will work to separate water production costs from distribution costs in the City Budget and cost tracking software to allow determination of the variable production cost for "the next MG of water needed" calculation.

5. Analyze unaccounted for Water. The City will regularly analyze non-account water use and conduct system audits to identify potential revenue-producing opportunities, as well as recoverable losses and leaks.

6. Repair known Leaks. The City will continue to repair all known leaks as soon as practically possible.

   h. The City will complete the replacement of dilapidated water lines in the system to reduce water losses associated with leakage and line breaks.

7. Water System Audit/GPCD. The City will perform the AWWA Water Audit and GPCD Analysis each year to reliably track water uses and provide the information to address unnecessary water and revenue losses.

   i. The City will also set up clear procedures to add records of new lines placed into the system. The City will also work toward setting up an Asset Management Plan for the water system.

8. Leak Detection and Repair Strategy. The City will develop a leak detection and repair strategy to detect leaks along water distribution mains, valves, services, and meters.

9. Automated Sensors/SCADA. Elevation sensors on production tanks will be modified for automatic reading and recording to double check production meter reading. Pressure gauges with telemetry will be installed in five zones of water system to obtain automatic pressure readings in each zone.

   j. Install SCADA and data logging equipment on water production meters and review data weekly. Determine Tank/Storage facility elevation changes electronically and use the information to double check the water production quantities.

Water Conservation Steps -

A specific course of Water Conservation Steps must be pursued to increase water conservation among the residents, developers, and major ICI users in the community.

10. Water System Audits for the largest Commercial/Industrial users.

11. Encourage re-use of water for Commercial/Industrial users (during the #5 Water Audits).

12 Implement an Inclining Block Water rate structure to financially encourage conservation of water.

13. Home Water Conservation Equipment Reimbursement Program. Implement a reimbursement program for customers who purchase and install home water conservation equipment to receive up to $25 credit on their next monthly water bill.

14. Requirements for New Developments (Efficient Fixtures/Landscaping/Irr.) Develop water conservation regulations for new development that will require use of water efficient fixtures, water wise landscaping, and water efficient landscape irrigation systems.

Information and Education -

Information and education that are critical to the success of any conservation program. Information and education measures can produce direct water savings when customers change behaviors. Educational measures also enhance the effectiveness of other conservation measures. The City will implement a public information and education program that includes the following measures:

15. Informative water bill. The water bill will be redesigned to include clear information about volume of usage, rates and charges, along with relevant information to allow comparison of previous water use and help the customer understand how water conservation is beneficial.

16. Informative Water bill inserts. The City will include inserts in their customers' water bills that provide information on water use, water costs and tips for home water conservation.

17. Public School Water Conservation Education Program. The City will partner with the school district and other agencies to provide water conservation programs on a phased basis to all students.

18. Promotion of Landscape Efficiency. In conjunction with item 17 above, the City will provide information to customers to promote low water-use landscaping by residential and nonresidential customers.

5.2.3 Why the Program was Chosen

The City of Jal decided to include a large majority of the potential Best Management Practices given consideration. In order to keep the program manageable, the Jal Water Conservation Committee tried to select the most effective goals that would result in the practices that would most directly impact water conservation. Consequently, some of the practices that were deemed less effective were not included in the program.

5.2.4 How the Program will be Implemented

The first step in this process would be to acquire the funding and staff support to implement the program with full administrative and council support. The next step would be to review this document and develop a clear plan regarding who is going to implement each item in accordance with the proposed schedule. Outreach should be made to the community and key stakeholders to provide helpful information that will allow water system customers to fully understand the need for water conservation and begin to "buy in" to the implementation of the program. After these items are completed, the individual steps of the water conservation plan can begin to be implemented.

As noted earlier, the City of Jal has already made significant improvements to the water system and is in the process of implementing several more system improvements in the next two years. Although the City purchased all new meters in 2013, they have not yet set up a program for meter testing, calibration, repair and systematic replacement program for older meters. One of the first programs placed into operation will be to develop a program for production meter testing, calibration, and repair, as needed. This production meter testing process is proposed to be contracted out.

Another system improvement already in the planning stages is the acquisition of a new billing program to accurately record and bill customer uses. The new billing program should be put in place as soon as possible. After the new billing system is in operation, it will help account for water more accurately and will be a helpful tool to reduce the amount of nonrevenue water.

A significant water conservation tool that will need to be developed and implemented as soon as possible as part of a condition to receive funding for the major water line replacement project will be the inclining block rate structure. This rate structure will provide the necessary revenue to fund the Jal Water System share of the system improvements and it will also encourage water conservation by charging higher rates for excessive water use.

The largest impact toward water savings will be realized when the Water Line replacement project is completed. It is hoped that funding can be acquired early in the first year of this program to allow the majority of the dilapidated lines in the system to be replaced by year two. This should result in an immediate drastic reduction in water losses due to line leakage.

The next steps would focus on disseminating the water conservation information and education processes including redesigning the water bill, adding water conservation information as water bill inserts (including information on promoting landscaping water efficiency), and implementing the public school water conservation education program. The Public School Water Conservation Education Program would be planned and coordinated with the help of school system representatives and partnering agencies. The steps laid out in this document can be followed to complete the education program planning in the first year, with phased implementation each year following.

After these first steps are being implemented, the next actions will center on the development of policies, programs, and new procedures to improve the overall system operations. A new list of procedures to govern the immediate repair of leaks and development of a leak detection and repair strategy will be the next focus.

After the above policies and procedures are developed, the two largest ICI water users should be identified and contacted to perform a water audit of their processes using the NMOSE ICI water audit guidelines and forms. As part of this audit process, the customers should also be encouraged to redesign their water processes to include water re-use.

After the first two ICI water audits are performed, the guidelines for providing water bill credit incentives for the installation of home water conservation measures should be developed. Since this is a reimbursement program for water conservation equipment that is purchased and installed by the customer, this program should be implemented as soon as the guidelines are complete. The reimbursement of up to $ 25 per home would be given as a credit on the customer's next water bill and would follow city inspection of the home to verify the water conservation items are installed properly.

The final action proposed to be taken during the first year would be drafting water conservation regulations for new development to have water conserving fixtures, water wise landscaping and water efficient irrigation systems. After the new regulations are fully reviewed and approved, they could be placed into effect early in the second year of the five year program.

As noted above, the several of the programs proposed for the second year would follow immediately after development of the new procedures, programs, or regulations created in year one. The placement of new meters for un-metered City facilities or SCADA equipment installation could be started in year two as the costs from year one may be winding down.

Years three through five would consist of continued implementation of the phased programs as begun in year two, along with continued use of water audits; water loss analysis; and additional SCADA implementation to continually improve the water system.

In the fifth year of this plan, after the distribution meters have become five years old, a meter testing, calibration, repair and systematic replacement program will be started for these meters. A 10% stock of meters will be purchased to be kept in stock and meters will be sent off for testing, calibration, and/or repair. This work will include meter replacement program monitoring and reports.

5.2.5 Implementation Dates

Water Conservation Measure	Year 1	Year 3	Year 3	Year 4	Year 5
1. Source water metering/testing	Begin	Continue	Continue	Continue	Continue
2. Test, calibrate, repair/replace meters	-	-	-	-	Begin
3. Meter Public Use facilities	-	Begin	Complete	-	-
4. Account for Water	Begin	Continue	Continue	Continue	Continue
5. Water Audits for large ICI users	Two largest	Next Two	Next Two	Next Two	Next Two
6. Encourage re-use for large ICI users	Two largest	Next Two	Next Two	Next Two	Next Two
7. Inclining Block Water Rates	Implement	Continue	Continue	Continue	Continue
8. Analyze unaccounted for water	Begin	Continue	Continue	Continue	Continue
9. Repair known Leaks	Continue	Continue	Continue	Continue	Continue
10. Water System Audit/GPCD	Continue	Continue	Continue	Continue	Continue
11. Leak detection/repair strategy	Create	Begin	Continue	Continue	Continue
12. Informative water bill	Create	Continue	Continue	Continue	Continue
13. Water Bill Inserts	Begin	Continue	Continue	Continue	Continue
14. Public School Education program	Create	Grade 1-4	Grade 5-6	Grade 7-8	Grade 9-12
15. Water Cons. Equip. Reimb. Program	Create	Begin	Continue	Continue	Continue
16. Promotion of Landscape efficiency	Begin	Continue	Continue	Continue	Continue
17. New development regulations	Create	Implement	Continue	Continue	Continue
18. Automated sensors/SCADA	-	Phase 1	Phase 2	Phase 3	Phase 4

Table 5. Water Conservation Measures Implementation Dates

5.2.6 Targeted Users

The targeted users for this Water Conservation Plan are as listed below. The Conservation Measures that are applicable to that user are listed following the user name.

- Residential Users – Sections 7, 12, 13, 15, and 16
- ICI Users – Sections 5, 6, and 7
- School Students (Future Users) – Section 14
- New Developments – Section 17
- The City of Jal – Sections 1, 2, 3, 4, 8, 9, 10, 11, and 18

5.2.7 Anticipated Cost (By year and total project)

Please note that Water System Improvement that have already been anticipated under the standard municipal capital planning and budgeting process will not be included in the Water Conservation Plan estimated costs as noted below. This table is being prepared to show the actual additional funding required to implement this Water Conservation Plan only. Capital improvement costs not directly applicable to, or included in the Water Conservation Plan implementation costs will be denoted with a star (*).

Water Conservation Measure	Year 1	Year 2	Year 3	Year 4	Year 5
1. Source water metering/testing *	$2k(L)	$2k(L)	$2k(L)	$2k(L)	$2k(L)
2. Test, calibrate, repair/replace meters *	-	-	-	-	$10k(L)
3. Meter Public Use facilities	-	$6k+$2k(L)	-	-	-
4. Account for Water	$10k(L)	$10k(L)	$10k(L)	$10k(L)	$10k(L)
5. Water Audits for large ICI users	$3k(L)	$2k(L)	$2k(L)	$2k(L)	$2k(L)
6. Encourage re-use for large ICI users	$1k(L)	$1k(L)	$1k(L)	$1k(L)	$1k(L)
7. Inclining Block Water Rates (* study)	$6k(L)	-	-	-	-
8. Analyze unaccounted for water	$2k(L)	$2k(L)	$2k(L)	$2k(L)	$2k(L)
9. Repair known Leaks (* WL project)	$4k(L)	$2k(L)	$1k(L)	$1k(L)	$1k(L)
10. Water System Audit/GPCD	$12k(L)	$12k(L)	$12k(L)	$12k(L)	$12k(L)
11. Leak detection/repair strategy	$3k(L)	$2K+$2K(L)	$2K(L)	$2K(L)	$2K(L)
12. Informative water bill	$2K(L)	$1K(L)	$1K(L)	$1K(L)	$1K(L)
13. Water Bill Inserts	$2K(L)	$2K(L)	$2K(L)	$2K(L)	$2K(L)
14. Public School Education program	$6K(l)	$2k+$2k(L)	$2k+$2k(L)	$2k+$2k(L)	$2k+$2k(L)
15. Water Cons. Equip. Reimb. Program	$4K(L)	$2k+$2k(L)	$2k+$2k(L)	$2k+$2k(L)	$2k+$2k(L)
16. Promotion of Landscape efficiency	$2K(L)	$1K(L)	$1K(L)	$1K(L)	$1K(L)
17. New development regulations	$6K(L)	$2K(L)	$2K(L)	$2K(L)	$2K(L)
18. Automated sensors/SCADA *	-	$2K(L)	$1K(L)	$1K(L)	$1K(L)
Yearly Cost -	$65k	$59k	$47k	$47k	$57k
Total Program Cost-$ 275,000/five years					

Table 6. Water Conservation Measures Estimated Program Costs

Many of the water conservation activities will be performed by the water conservation manager, who is anticipated to be a new position for the City of Jal. It is estimated that the cost for this person could be approximately $ 50,000 per year including salary and benefits. Other work may be performed by existing City employees as part of their normal duties. All of these labor costs are included in the appropriate water conservation item and shown with an (L) to denote the labor cost clearly.

5.2.8 Anticipated Staffing Needs and Partnerships

It is estimated that the full implementation of this Water Conservation Plan will take up the majority of one person's time for the first few years of the program. After the systems are fully put in place, the ongoing operation of the water conservation plan may be require slightly less labor time.

Because there are several sets of policies, procedures and regulations to be written that require a high level of knowledge about the existing water system, it is anticipated that these could only be developed by the

existing Jal Director of Public Works. Because his time is fully allocated at the present time, if a full time high level assistant could be hired to assist him with duties that could be delegated to the new employee, that may free the necessary time needed to create the new policies, procedures, and regulations. The new employee payroll cost is estimated at $ 50,000/year, including benefit costs.

The new employee could also be the primary water system designee to perform ICI water audits; coordinate new education programs with the school system; oversee, monitor and report on meter accuracy, calibration, and meter replacement programs; operate the water conservation reimbursement program for home water efficiency retrofit items; gather the system data for the Annual Water Audit; and serve as the primary source for outreach education of the community.

If the Director of Public Works still did not have the time to prepare the several sets of policies, procedures and regulations that need to be written, this could possibly be contracted out to an outside agency.

As noted earlier, there are several agencies who could be potential partners for the implementation of this water conservation program. In addition to the NMOSE who has a great amount of water conservation literature and guidelines available online, Jal representatives could contact USDA representatives, the local Soil and Water Conservation District, and the County Extension Agent for assistance, resources, or recommendations.

5.2.9 Funding Source

It is proposed that the funding required for this program is provided through the Water System Enterprise funds. In 2014, the water system expenses exceeded the income by approximately $ 400,000. This amount of shortfall was required to be covered by the City Enterprise Fund cash reserve. This subsidy depleted that account.

It is anticipated that the replacement of the severely dilapidated water lines and system improvements will result in a drastic reduction in the 46% unaccounted for water that was pumped by the water system. It is hoped that the funding for this program can be considered as an investment to save future costs that would be incurred if the 46% unaccounted for water is not stopped, or at least significantly reduced.

As noted earlier, the water rates will need to be significantly increased to pay for the necessary water system improvements that will be made. It is hoped that the cost to implement the water conservation plan will be included in the annual budget for the water system in realization that every dollar spent to conserve water will be paid back several times in future water system cost savings.

However, if Jal water system financial resources fall short of the required funding, proposals may be sought to obtain grants from institutions such as community-minded businesses, federal and/or state government agencies, or private foundations.

5.2.10 Anticipated Results and How They Align with Goals

Water Conservation Measure	Results	System GPDC reduction	SFR GPCD reduction	Nonrevenue water reduction	Data Validity increase
1. Source water metering/testing	100% sources metered, less than 10% worse than 3% accuracy	X			X
2. Test, calibrate, repair/replace meters	Statistically significant meter testing/replacement program in place.	X			X
3. Meter Public Use facilities	Write exemption policy & read meter each year for audit	X		X	X
4. Account for Water	Write policies, 99% metered billing, records audited.	X		X	X
5. Water Audits for large ICI users	Identify unauthorized uses, reduce water use.	X		X	
6. Encourage re-use for large ICI users	Reduce pumped water use.	X		X	
7. Inclining Block Water Rates	Fiscally encourage water conservation.	X	X		
8. Analyze unaccounted for water	Write policies, and estimate un-accounted use.	X		X	X
9. Repair known Leaks	Reduce un-accounted use.	X		X	X
10. Water System Audit/GPCD	Raise system efficiency, reduce un-accounted use.	X	X	X	X
11. Leak detection/repair strategy	Reduce un-accounted use.	X		X	X
12. Informative water bill	Reduce SFR and ICI water use.	X	X		
13. Water Bill Inserts	Reduce SFR and ICI water use.	X	X		
14. Public School Education program	Reduce future water use.	X	X		
15. Water Cons. Equip. Reimb. Prog.	Reduce SFR home water use.	X	X		
16. Promotion of Landscape efficiency	Reduce SFR and ICI water use.	X	X		
17. New development regulations	Reduce future water use.	X	X		
18. Automated sensors/SCADA	Raise system efficiency, reduce high pressure leaks.	X	X	X	X

Table 7. Water Conservation Measures Goal Alignment

5.2.11 Explanation of Tracking and Evaluation

Each water conservation program will be tracked for target group participation and time or costs expended to implement the program. Evaluation measures will be developed and used during the operation of each conservation program to establish a measure of its effectiveness. Overall evaluation of the water

conservation program will be assessed through the updated water audit and GPCD analysis that will be performed annually. The results of the updated AWWA Water Audit and GPCD Analysis will be reported to the NMOSE annually.

5.2.12 Estimated Lifetime Impact of the Program

When considering the potential lifetime impact of the Jal Water Conservation program, it is essential to remember that the Jal Water System is beginning at a rate of 342 GPCD. This is a high rate, but it also reflects that there is considerable room for improvement when determining what might be a feasible end goal.

The below table shows the GPCD usage for several cities across the western United States. The only New Mexico city listed on the table is Albuquerque, with an approximate 175 GPCD rate. While Albuquerque is a major metropolitan city, Berthoud, CO has a population of just over 5,000 and it is also included on the list with an approximate 200 GPCD rate. This information leads to a conclusion that the ultimate Lifetime Impact of the program, if implemented consistently, could be to have a Jal rate of between 175 and 200 GPCD.

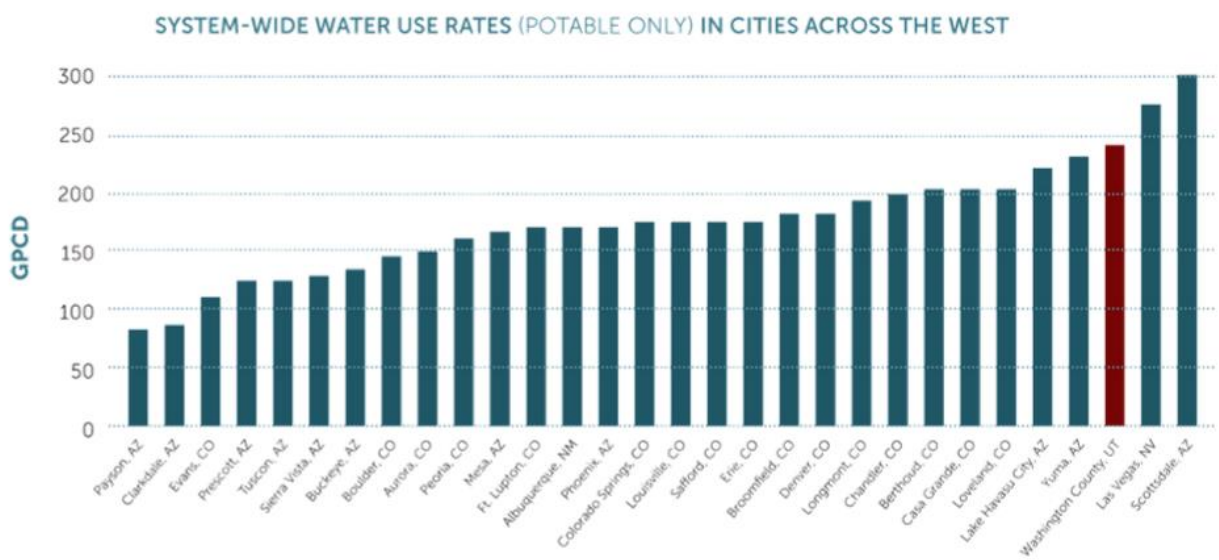


Table 8. System-wide Water User Rates

5.2.13 Annual Reporting and Updates

As noted earlier, overall evaluation of the water conservation program will be assessed through the updated water audit and GPCD analysis that will be performed annually. The results of the updated AWWA Water Audit and the GPCD Analysis will be reported to the NMOSE each year.

In addition, those system evaluation measures will be reviewed each year by the water conservation planning committee to help determine what portions of the water conservation plan are being effective and which portions need to be revised or amended. The water conservation plan will then be amended on an "as needed" basis following review of that water system data.

5.3 Describe Process of prioritizing Programs

As noted earlier in this document, the City of Jal already has completed a few major water system improvement projects and has several other system improvements scheduled for completion in 2015. A great deal of benefit can be derived by completing these improvements early in this phased process.

For example, all of the meters for the water system were replaced in 2013, but there has not yet been a program established to test the production and usage meters for accuracy, calibrate them, and set up a systematic program to maintain, repair, and replace the meters using testing results data. A large investment has already been made in the meters. Without this additional program, the water system would not realize the full benefit of this major investment in meters. For this reason, these items were placed in year one of the plan.

In the same manner, the City of Jal is also taking steps to replace the outdated water billing system in 2015 as part of their normal water system planning and improvement process. As noted above, a large investment has already been made in new meters. Without this new billing system, the water system would not be able to accurately account for water and track real water losses as is required under this water conservation plan. For this reason, the purchase and installation of the new billing system was placed in year one of the plan.

One of the major requirements of this plan is necessary on two levels. The inclining block rate structure sufficient to pay for improvements to the water system will be required as a condition of receiving funding. In addition, the inclining block rate structure will reward residents and ICI users for implementing water conservation methods to reduce their personal and corporate water use. As they reduce their water system usage, they will pay less in water bills than what they would have paid without conservation. This is a critical component of the system and the water rate study to accomplish this will need to be placed in year one.

The creation of the Water Loss Prevention Program, the improved process to Repair Known Leaks, and the Leak Detection and Repair Strategy are all items that will directly cause a reduction in the amount of unauthorized water use within the system. Although these programs will not be able to be created and implemented in one year, the processes and procedures should be developed in the first year, to allow the implementation of these programs in the second year.

Another program that should begin in year one that could potentially provide some level of immediate reduction in water use would be the Water Audits for the largest two ICI water users. The Water Audit would follow the format as proposed in the NMOSE Water Conservation Guidelines for Industrial,

Commercial, and Institutional Users (http://www.ose.state.nm.us/WUC/PDF/cii-users-guide.pdf). At the same time the Audit is performed and the water use processes are discussed, the Utility representatives performing the Audit could recommend re-use of water at key areas of the ICI water use process. The Audit of the next two largest ICI users could follow in year two, with two more in each successive year.

With regard to the dissemination of education and water conservation outreach, two items can be begun in the first year that would directly get the water conservation message out to customers immediately. It is proposed that the water bills be redesigned to make them more easily readable and understood to the customer whereby they can actually see the benefit of water conservation. The second item would be to create and send out water conservation flyers and brochures with the water bills to begin to educate customers on the benefits of water conservation. Flyers to encourage landscaping and irrigation efficiency as noted in conservation activity 17 can be started with this process at this same time.

Continuing on the education message, the Public School water conservation program steps to plan an design the program should be begun in year one. With a one year lead time, this would allow the first phase of the education program to be implemented in year two with 1st-4th graders. The other grades would be added on a phased basis through the five year period.

Another program that would not take a lot of time or funding would be the implementation of the reimbursement program to encourage customer purchase of home water efficiency retrofit items. The program guidelines could be created in year one and the system could be put into operation as soon as the program is adopted. The program could give up to $ 25 reimbursement per home for approved and installed home water conservation improvements such as toilet flappers; toilet tank displacement devices; low flow aerators for kitchen, bath, and shower; yard moisture meters; or reduced flow yard watering nozzles. The reimbursement would be received as credit applied to the next water bill after the approved items are verified to be properly installed via inspection by a City Employee.

With regard for water conservation requirements for new development, it is proposed that new regulations be researched and developed during the first year. After the new regulations are fully reviewed and approved, they could be placed into effect early in the second year of the five year program.

As noted above, several of the programs proposed for the second year would follow immediately after development of the new procedures, programs, or regulations created in year one. The placement of new meters for un-metered City facilities or SCADA equipment installation could be started in year two as the costs from year one may be winding down.

Years three through five would consist of continued implementation of the phased programs as begun in year two, along with continued use of water audits; water loss analysis; system wide distribution meter accuracy, calibration, and replacement program (including monitoring and reports); and additional SCADA implementation to continually improve the water system.

5.4 Current and past Water Conservation Programs

5.4.1. Summary, Time Frame, and Results

The City of Jal has had a water conservation program that was adopted in 2012 and included basic water conservation measures including unlawful use, prohibition of water waste, slightly inclining block water rates, and water conservation control for several levels of water shortage beginning with Level I Voluntary Conservation, through Level III Mandatory Water Use Restrictions on landscape watering and other water use, up to Level IV requirements for Water Emergency Conditions, Level V requirements for Water Crisis Conditions, and Level VI requirements for Emergency Water Shortage Conditions including Water Rationing.

This water conservation ordinance has been in effect since 2012, however it is difficult to assess its effectiveness on actual water conservation. One area where it has been extremely effective is in the response to crisis and emergency water situations. Several times the water system has had to be totally shut down and the emergency water requirements were implemented during those times. It is anticipated that these main components of the existing water conservation ordinance will be preserved when a new water conservation ordinance is adopted.

Also, although the system is still experiencing severe water loss through leakage of very old pipes, the total GPCD as seen in the analysis, has decreased each year since 2010. So, even though the program may not be very sophisticated, it has assisted with achieving one end result of decreasing water use.

5.5 Proposed Water Conservation Programs

5.5.1 How Water Conservation Programs will meet Stated Goals and Objectives

The City of Jal set the following goals for its water conservation program:

- Reduce nonrevenue water by 20% from the 2014 nonrevenue water use amount by 2020
- Maintain residential GPCD at or below 130 for the next five years
- reduce outdoor water use,
- reduce water waste,
- reduce peak summer demands for more efficient system operation and reduced energy use,
- reduce pumping and treatment costs,
- ensure a revenue-neutral program that can be financed by the water enterprise fund,
- strengthen ordinances and policies relating to water conservation,
- educate the public about water conservation, and
- create incentives for conservation behavior.
- Increase the data validity score from 73 to 80 by 2020

The first part of the water conservation program concerns production water metering. With the implementation of a rigorous meter testing, and calibration programs for the production meters, the Jal Water System should eliminate inaccurate production meter readings. Since the distribution meters are new and should still be very accurate, this will allow an immediate accurate comparison of pumped water to

metered water used by customers and the city, which will be beneficial to reduce the amount of nonrevenue water and accomplish the above goals.

The water accounting and loss control measures will include the acquisition of a new billing program to accurately record and bill customer uses. This will also account for water more accurately and will be helpful to reduce the amount of nonrevenue water. The immediate repair of leaks and the leak detection and repair strategy will work together to directly reduce water loss and accomplish the above goals.

The water conservation steps proposed include working with the largest ICI water users each year to reduce water use and encourage re-use, implementing an inclining block rate structure that will encourage water conservation by charging higher rates for excessive water use, providing water bill credit incentives for the installation of home water conservation measures, and requiring new development to have water conserving fixtures, landscaping and irrigation systems will all work together to conserve water and directly accomplish the above listed goals.

Finally, the water conservation information and education steps including redesigning the water bill, adding water conservation information as water bill inserts (including information on promoting landscaping water efficiency), and implementing a public school water conservation education program will make the residents of Jal more informed regarding the status of their water system and aquifer, along with making them more knowledgeable of steps that can be taken to conserve water and extend the life of the Jal water supply. These steps should assist the residents to make wise water conservation choices that will result in decreased water use and will help accomplish the stated goals.

The 2014 baseline figure of 342 GPCD presented previously suggests that water system improvements and conservation efforts are likely to result in significant (>10%) reductions in water loss and total system pumping within the first year after the system improvements are completed. After those initial reductions are accomplished, further percentage reductions each year are likely still possible due to ongoing education and community outreach by keeping the message of conservation in front of the residents and ICI users.

5.5.2 Overall Timeline of Programs as Related to Objectives

A. System total GPCD Reduction

B. SFR GPCD Reduction

C. Nonrevenue water Reduction

D. Data Validity Improvement

Water Conservation Measure/Objective	Year 1	Year 3	Year 3	Year 4	Year 5
1. Source water metering/testing A,C,D	Begin	Continue	Continue	Continue	Continue
2. Test, calibrate, replace meters A,B,C,D	Begin	Continue	Continue	Continue	Continue
3. Meter Public Use facilities A,C,D	-	Begin	Continue	Continue	Continue
4. Account for Water A,C,D	Begin	Continue	Continue	Continue	Continue
5. Water Audits for large ICI users A,C	Two largest	Next Two	Next Two	Next Two	Next Two
6. Encourage re-use for Lg. ICI users A,C	Two largest	Next Two	Next Two	Next Two	Next Two
7. Inclining Block Water Rates A,B	Implement	Continue	Continue	Continue	Continue
8. Analyze unaccounted for water A,C,D	Begin	Continue	Continue	Continue	Continue
9. Repair known Leaks A,C,D	Continue	Continue	Continue	Continue	Continue
10. Water System Audit/GPCD A,B,C,D	Continue	Continue	Continue	Continue	Continue
11. Leak detection/repair strategy A,C,D	Create	Begin	Continue	Continue	Continue
12. Informative water bill A,B	Create	Continue	Continue	Continue	Continue
13. Water Bill Inserts A,B	Begin	Continue	Continue	Continue	Continue
14. Public School Education Prog. A,B	Create	Grade 1-4	Grade 5-6	Grade 7-8	Grade 9-12
15. Water Cons. Equip. Reimb. Prog. A,B	Create	Begin	Continue	Continue	Continue
16. Promotion of Landscape eff. A,B	Begin	Continue	Continue	Continue	Continue
17. New development regulations A,B	Create	Implement	Continue	Continue	Continue
18. Automated sensors/SCADA A,B,C,D	-	Phase 1	Phase 2	Phase 3	Phase 4

Table 9. Water Conservation Measures Timeline

5.5.3 Anticipated/Reported Results for the Entire Water Conservation Plan

a. System Total GPCD over Time.

The City of Jal set an overall water conservation goal of 270 GPCD by 2025. This goal is projected to reduce overall demand from 784 acre - feet in 2014 to 717 acre - feet in 2025 and projected to save 955 acre-feet over the ten year period (assuming a 2025 population of 2,370).

b. SFR GPCD over Time.

Average water use goals for other communities in New Mexico are highly variable and reflect a diversity of residential and industrial water uses. The City of Jal, in contrast, is almost entirely residential in nature. Changes that impact this singular customer base, such as fee schedule changes, will likewise tend to influence the overall GPCD. With consideration of that the current SFR GPCD value of 123 is actually fairly low in comparison to other communities, substantial reduction may not be likely. However, small changes in behavior and continued implementation of a rate structure that stresses conservation should result in a long-term planning average of 120 GPCD or less.

c. Nonrevenue Water over Time.

As noted in this document, the nonrevenue water for the Jal Water System has been approximately 46-48% for the last five years. It is believed that this figure is largely from system losses associated with leaks on the main pipeline system. However, some of the water loss may be attributed to non-calibrated water pumping meter data that may be incorrect or suffering from billing software errors.

As part of this plan, major portions of the water lines in the Jal system will be replaced and the billing system will be upgraded, along with the completion of improvements to other water system amenities. When this work is completed, along with the implementation of water meter testing, calibration, repair and systematic replacement programs, the total amount of nonrevenue water should drop significantly. The goal for this program is for the nonrevenue water to be reduced by 20% during the first five years of this water conservation program.

6. REFERENCES

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Appendix A
AWWA Water Audit

Appendix B
GCPD v2.04 Beta Model

Appendix C
Best Management Practices

SYSTEM WATER AUDIT AND WATER LOSS

A. Description

System water audits and water loss programs are effective methods of accounting for all water usage by a utility within its service area. Performing a reliable water audit is the foundation of proper water resource management and loss control in public drinking water systems. There has been much recent interest in revising and developing water audit procedures to move away from simply considering "unaccounted for water" to a systematic methodology of accounting for all water uses. The structured approach of a water audit allows a utility to reliably track water uses and provide the information to address unnecessary water and revenue losses. The resulting information from a water audit will be valuable in setting performance indicators and in setting goals and priorities for cost-effectively reducing water losses.

Compiling a water audit is a two-step approach, a top-down audit followed by a bottom-up audit. The first step, the top-down audit, is a desktop audit using existing records and some estimation to provide an overall picture of water losses. If a utility has been conducting a water audit using the American Water Works Association ("AWWA") M36 Manual, the utility will already have the data needed to complete the first step of this audit. The records that will be needed include quantity of water entering the system, customer billing summaries, leak repair summaries, average pressures, meter accuracy test, meter change-out summary, permitted fire hydrant use, and other records that may be kept on water theft and unmetered uses such as street cleaning.

The second step of the audit, the bottom-up approach, involves a detailed investigation into actual policies and practices of the utility. This part of the audit is phased in over several years. There are several areas to be addressed including development of better estimates of water use by the fire department, water used in line flushing and street cleaning, and metering of all authorized uses. The procedures of the detailed water audit also include using night flow and zonal analysis to better estimate leakage; analysis of leakage repair records for length of time from reporting to repair of the leak; and analyzing pressure throughout the system.

Several indicators from the analyses in a water audit should be considered by utilities in order to improve water loss control procedures. These include:

1) <u>Real Losses</u>
   Losses due to leakage and excess system pressure. Real losses can be reduced by more efficient leakage management, improved response time to repair leaks, improved pressure management and level control, and improved system maintenance, replacement, and rehabilitation. The cost of real losses is estimated using the marginal production costs, such as energy and chemicals needed to treat and deliver the water.

2) Apparent Losses
Losses due to meter accuracy error, data transfer errors between meter and archives, data analysis errors between archived data and data used for billing/water balance, and unauthorized consumption including theft. The cost of apparent losses is estimated using the retail commodity rates.

3) Unavoidable Annual Real Losses ("UARL")
This represents the theoretically low level of annual real losses in millions of gallons daily ("MGD") that could exist in a system if the current best management practices for leak management are successfully implemented. It is based on data obtained from systems where effective leakage management was implemented. The calculation of the UARL is based on number of miles of water mains, number of service connections, average water pressure, and length of service connections. The UARL is allocated to service lines and water mains.
The revised AWWA M36 Manual will provide details on how to calculate unavoidable annual real losses.

4) Infrastructure Leakage Index ("ILI")
Ratio of annual real losses divided by UARL. The ILI provides a ratio of current leakage relative to the best level obtainable with current best management practices for leakage. A ratio of 1.0 would indicate that the utility has reduced losses to the theoretically lowest level possible.

5) Economic Level of Leakage ("ELL")
This is a calculation based on the cost of reducing leakage. It is the theoretical level at which the cost of leakage reduction meets the cost of the water saved through leakage reduction. These costs include not only the cost of producing water but also the avoided cost of replacing the water.

In order to reduce water losses due to leakage, a utility should maintain a proactive water loss program. A structured approach to leakage management has proven to be successful in limiting losses. Potential elements of an active water loss program include:

1) Conducting regular inspections and soundings of all water main fittings and connections;
2) Using a water loss modeling program. A model can range from the AWWA M36 Manual Water Audit Spreadsheet to a commercially available statistical model;
3) Metering individual pressure zones;
4) Establishing district metering areas ("DMA") and measuring daily, weekly or monthly flows with portable or permanently installed metering equipment;

5) Continuous or intermittent night-flow measurement;
6) Installing temporary or permanent leak noise detectors and loggers;
7) Reducing repair time on leaks since long-running small to medium size leaks can be the greatest volume of annual leakage;
8) Controlling pressure just above the utility's standard-of-service level taking into account fire requirements, outdoor seasonal demand and requisite tank filling;
9) Operating pressure zones based on topography;
10) Limiting surges in pressure; and
11) Reducing pressure seasonally and/or where feasible to reduce losses from background leaks.

If a utility has not had regular leak surveys performed it will probably need at least three leak surveys performed in consecutive years or every other year for these reasons:

1) The first survey will uncover leaks that have been running for a long time;
2) The second survey will uncover additional long-running leaks whose sounds were masked by larger nearby leaks; and
3) By the third survey, the level of new leaks should start to approximate the level of new reported leaks.

The utility should make every effort to inform customers when leaks exist on the customer side of the meter. If customer service line leaks are significant, a utility might consider the option of making the repairs itself.

The utility should reduce apparent losses since reducing these losses will increase utility revenue. Some of the areas that should be examined are:

1) Customer meter inaccuracy due to meter wear, malfunction or inappropriate size or type of meter;
2) Data transfer error when transferring customer metered consumption data into the billing system;
3) Data analysis errors including poor estimates of unmetered or unread accounts;
4) Inaccurate accounting resulting in some accounts not being billed for water use;
5) All forms of unauthorized consumption including meter or meter reading tampering, fire hydrant theft by contractors, unauthorized taps, and unauthorized restoration of water service cutoffs; and
6) Unmetered municipal connections (every effort should be made to meter municipal connections in order to better account for water use).

B. Implementation

To successfully implement this BMP, the utility should start by forming a working group from the following work areas: management, distribution, operations, production, customer service, finance, and conservation. Each of these work areas has an essential role to play in implementing this BMP. Smaller utilities may have the same person doing several of these functions and therefore the working group may just be one or two individuals. The utility should also consider a public involvement process to solicit outside input as well as to enhance public relations.

Initially the working group should focus on gathering relevant data and identifying current practices listed above in Section B that form the basis for the top-down audit. Some of the questions that should be addressed during the top-down audit are:

1) How often do we test production meters? Commercial meters over 1 inch? Over 2 inches?
2) How often do we replace or repair ⅝ and ¾-inch meters?
3) How inaccurate are the ⅝ and ¾ inch meters on average when they are replaced?
4) Do we estimate total leakage from each leak based on the leakage flow rate and length of leakage from time reported when we fix leaks?
5) How long does it take to repair leaks, itemized by size of leak?
6) Are customers encouraged to report leaks?
7) Do we have a system for tracking location of leaks and a method to calculate when it is cost-effective to replace mains and service lines?
8) Are meter readers trained to look for and report leaks?
9) Do we adjust consumption records when billing records are adjusted?
10) Is backwash and other in-plant water use optimized?
11) How effective is our theft reduction program?

Based on the data collected and information from the questions above, the utility should have enough information to complete a top-down audit.

An ILI of 3 should be used as an example of an achievable target. If the ILI is 3 or below, then further implementation of the BMP is not required until the following year. This would indicate that the utility already has an effective water audit and water loss program. If the ILI is above 3, then the utility should implement a more effective water audit and water loss program. The utility then proceeds to conduct a bottom-up audit.

In conducting the bottom-up audit, the utility addresses the relevant issues identified during the top-down audit and further investigates those issues discussed in Section B. The utility uses the results of the audit to focus on the best approaches to reduce both real and apparent losses. Depending on whether the ILI is relatively high or low determines the number of years it may take to reduce the ILI to 3.

Each subsequent year, the utility completes another top-down audit. Over time the utility should be able to gradually reduce its ILI to 3. If the utility finds the ILI is increasing, then it should perform a bottom up audit.

C. Schedule

To accomplish this BMP, the utility should:

1) Gather the necessary information for conducting the top-down audit, develop the procedures and complete the audit within the first twelve (12) months of implementing this BMP.
2) The bottom-up refinements should start to be implemented in the twelve (12) months immediately following the completion of the top-down audit if the ILI exceeds 3.
3) Based on the goal of achieving an ILI target of 3, the utility continues to implement bottom-up refinements to reduce real and apparent losses each subsequent year until the utility achieves an ILI of 3.
4) The utility's ILI should be calculated each year.

D. Scope

To accomplish this BMP, the utility should:

1) Conduct a periodic system audit following the methodology contained in the revised AWWA M36 Manual.
2) Develop and perform a proactive distribution system water loss program and repair identified leaks.
3) If the utility's ILI is greater than 3:
    a. Implement a pressure reduction strategy if warranted;
    b. Implement a program to reduce real losses, including a leak detection and repair program;
    c. Implement a program to reduce apparent losses; and
    d. Advise customers when it appears that leaks exist on the customer's side of the meter and evaluate a program to repair leaks on the customer's service line.

E. Documentation

To track the progress of this BMP, the utility should gather and have available the following documentation:

1) A copy of each annual system audit, the ILI for each year, and a list of actions taken in response to audit recommendations.
2) Annual leak detection and repair survey, including number and sizes of leaks repaired.
3) Number of customer service line leaks identified and actions taken to repair these leaks.
4) Pressure reduction actions taken, if any; and
5) Annual revenue increased through reducing apparent losses.

F. Determination of Water Savings

Potential water savings are an integral part of the system water audit process and should be contained in the audit report. Based on the results of the audit, the utility should set goals for reducing its losses.

G. Cost-Effectiveness Considerations

Direct costs that should be considered in implementing this BMP include the initial and ongoing costs for performing and updating the water audits and capital costs for items such as leak detection equipment and billing software upgrades. Utilities may wish to do the work in house with technical staff or by using outside consultants and contractors.

A recommended method to make cost effectiveness decisions is based on the economic value of real losses and apparent losses. (*See* Section I. References for Additional Information, 4.) Real losses are losses due to leaks and are valued at actual costs to produce and deliver the water. Apparent losses, sometimes called paper losses, are those attributable to meter and billing inaccuracies and are valued at the retail rates charged by the utility. The amount of lost revenue due to real losses, based on the utility's marginal production cost, and apparent losses, valued at the retail rate charged to customers, can be compared to the costs of reducing the sources of loss.

SCHOOL EDUCATION

A. Description

School education programs, while not directly related to an equipment change, may result in both short and long-term water savings. Behavioral changes by the students based upon greater knowledge are often shared with parents and implemented at home. To be effective, a school education program should provide curriculum material appropriate to the grade level of the student, increasing in complexity from elementary school through high school. If such a curriculum does not already exist, local curriculum experts may be willing to help develop the desired materials.

A complementary aspect can be to include a water audit unit as part of the curriculum where the students take flow measurements of showerheads and faucet aerators at their homes. If the showerheads and faucet aerators are higher than the current standard, the students would receive efficient showerheads and faucet aerators to install with the assistance of their parents. This unit can be successfully implemented in grade 5 or higher and can meet the requirements of this BMP without additional curriculum development.

The circumstances and challenges of the local water resources should be considered in choosing or developing a conservation curriculum. Grade level appropriate material is important in ensuring that the students understand the information. A quality water conservation program for schools provides teachers with materials that contribute to learning mathematics, science, social studies and history while educating the students about water conservation and local water resources.

Another option beyond offering a supplemental curriculum is to offer an education entertainment show for grades 1 to 4. In addition, the percentage of students that can be reached is often higher than for adoption of a curriculum.

To evaluate the effectiveness of the education materials, presentation or show, the utility should use an evaluation tool such as a pre- and posttest or survey.

B. Implementation

Implementation should consist of at least the following actions:

1) Evaluate local, regional, state or national resources available to determine applicability to the utility's local water conditions. Consider creating an advisory committee of local educators to assist in choosing or creating the curriculum;

2) Implement a school education program to promote water conservation and water conservation related benefits.

Programs include working with school districts and private schools in the water suppliers' service area to provide instructional assistance, educational materials, and classroom presentations that identify urban, agricultural, and environmental issues and conditions in the local watershed and water service area.

A water oriented curriculum that is focused on conservation and resource issues should be made available for all grades.

a. Grade appropriate programs and/or materials should be implemented for grade levels 1 to 6 initially. Alternatively, a presentation or educational show can be offered for some or all of these grade levels.

b. For grades 7 to 8 and for high school students, the utility should do one of the following: distribute grade appropriate materials for high school science, political science, or other appropriate classes; present assembly type programs to high schools; sponsor science fairs with emphasis on conservation; or implement education programs with community groups like Scouts, 4-H clubs, etc.

The utility can elect to meet this BMP by focusing only on grades 1 to 6 or 7 to 12 and achieving higher participation rates.

C. Schedule

Depending on the program option(s) selected, the following schedule should be followed:

1) Utility should adopt or develop the program in the first year and start implementation in the second year for grades 1 to 4.
2) Utility should adopt or develop the program in the second year and start implementation in the third year for grades 5 to 6.
3) Utility should adopt or develop the program in the third year and start implementation in the fourth year for grades 7 to 8.
4) Utility should adopt or develop the program in the fourth year and start implementation in the fifth year for grades 9 to 12.

D. Scope

Select items 1 and 2 or item 3.

1) The utility should strive to reach 10 percent of students in grades 1 to 6 with a presentation or curriculum each year by the third year of implementation, following the schedule above, and
2) The utility should strive to reach at least 10 percent of students in grades 7 to 12 with a presentation or curriculum each year by the third year of implementation following the schedule above. Or,
3) Alternatively this BMP will be met if the utility only focuses on grades 1 to 6 or 7 to 12. The program would be developed in the first year and implemented in the second year for either alternative. The utility should strive to reach either 15 percent of students in grades 1 to 6 each year by the third year of implementation or 15 percent of students in grades 7 to 12 by the third year of implementation.
4) The utility can count as participant students reached through clubs and educational events; and students impacted by utility sponsored program outside the utility service area.
5) For smaller utilities, or those in which service area boundaries overlap school district boundaries with another water utility, jointly operated or funded programs should be considered.

E. Documentation

To track the progress of this BMP, the utility should gather and have available the following documentation:

1) Number of school presentations made during reporting period;
2) Number and type of curriculum materials developed and/or provided by water supplier, including confirmation that curriculum materials meet state education framework requirements and are grade-level appropriate;
3) Number and percent of students reached by presentations and by curriculum;
4) Number of students reached outside the utility service area;
5) Number of in-service presentations or teacher's workshops conducted during reporting period;
6) Results of evaluation tools used, such as pre- and posttests, student surveys, teacher surveys;
7) Copies of program marketing and educational materials; and
8) Annual budget for school education programs related to conservation.

G. Determination of Water Savings

Water savings for school education programs are difficult to quantify and therefore estimated savings are not included in this BMP. If the retrofit kit is distributed, water savings can be calculated as described in the Residential Retrofit BMP**.** A 1991 study conducted for The Harris Galveston Coastal Subsidence District found an average savings of 18 percent or 1,400 gallons per month in homes where the student and parent had installed efficient showerheads and aerators on bathroom and kitchen sinks.

H. Cost-effectiveness Considerations

A true cost-effectiveness analysis cannot be determined without a measure of water savings. By implementing this BMP, the utility will enhance its public image, increase customer goodwill, and increase the viability of its overall water conservation efforts.

School education costs vary widely due to the varying types of programs. Curriculum units can be developed and implemented for $1 to $3 per student. Educational entertainment programs can be developed or contracted out for $2 to $5 per student. There are prepackaged contractor programs with extensive features that cost up to $35 per student. Most programs will require utility staff oversight and outreach efforts to schools and students.

WATER SURVEY FOR SINGLE-FAMILY AND MULTI-FAMILY CUSTOMERS

A. Applicability

This BMP is intended for a Municipal Water User Group ("utility") that has 20 percent of homes and apartments constructed before 1995 and/or more than 10 percent of landscapes with automatic irrigation systems. If the utility is unaware of the number or percentage of customers using automated irrigation systems, a drive-by survey can be conducted of a sample of customers to develop an estimate of how many have automatic systems. Once a utility decides to adopt this BMP, the utility should follow the BMP closely in order to achieve the maximum water efficiency benefit from this BMP.

B. Description

A Water Survey Program can be an effective method of reducing both indoor and outdoor water usage. Under this BMP, the utility conducts a survey of single-family and multi-family customers to provide information to them about methods to reduce indoor water use through replacement of inefficient showerheads, toilets, aerators, clothes washers, and dishwashers. If the customer has an automatic irrigation system, the survey includes an evaluation of the schedule currently used and recommends any equipment repairs or changes to increase the efficiency of the irrigation system.

Surveys should be offered based on water use starting with the highest single-family and multi-family accounts, respectively. Multi-family accounts should be analyzed based on gallons per unit, although almost all multi-family customers would benefit by this survey if they have not already retrofitted plumbing fixtures. The irrigation component of the single-family survey should target single-family customers using more than a certain amount of water per billing period that could be considered excessive for the particular geographic area and other characteristics of the service area. Typically, this is around 20,000 gallons per month in summer since that could represent an outdoor use of more than 12,000 gallons per month.

Surveying outdoor water use in homes with water use below 20,000 gallons per month does not usually provide as significant an opportunity for water reductions. Customer water use records can give the utility a snapshot of which neighborhoods have higher than average water use. The drive by survey should note which lawns have monoculture of a turfgrass species and/or visible irrigation heads indicating an automated sprinkler system. Once the scope of services is determined, there are three options for conducting the survey: train utility staff to conduct an onsite survey; hire an outside contractor to conduct the onsite surveys; or provide a printed or online survey for customers to complete on their own. When conducting an onsite survey for a customer with an automatic irrigation system that is managed by an irrigation or maintenance contractor, it is beneficial to have the contractor present for the irrigation system survey.

For the indoor water use survey, a form can be used to provide the information on water reductions that would be achieved with each type of equipment change and the length of the payback period, taking into account any utility incentives that may be available. If it is an onsite survey, showerhead and faucet aerators can be changed during the survey.

A leak check should be conducted to determine if there are any toilet leaks occurring and any dripping faucets. If 1.6 gallons per flush toilets have already been installed, the flush volume should be checked and, if needed, the water level in the tank should be adjusted to restore the flush volume to 1.6 gpf. If after the water level in the tank is adjusted, the flush volume is still well above 1.6 gpf, it is likely that the toilet originally had an early closure flapper. Using the model number on the inside of the tank and the Flapper Table (see References for Additional Information), the flapper required to restore the flush volume to 1.6 gpf can usually be determined. If the flapper is one of several early models of closure flappers, the flapper should be replaced during the survey and the information on the correct replacement flapper should be provided to the customer.

Information on water use habit changes such as shorter showers, for example, should also be provided at the time of the survey. The customer should be provided information on climate-appropriate landscaping and about any programs the utility has for incentives to replace inefficient landscaping. The survey of automatic irrigation systems should include a check of the entire system for broken, misdirected or misting heads and pipe or valve leaks. The customer's service line and meter box should also be checked for leaks.

The system should be run to determine precipitation rates for typical zones. Each zone should be checked to be sure that rotors and spray heads are not on the same zone since they have greatly different precipitation rates. Head spacing should be checked to determine if proper heads are installed. The schedule on the irrigation controller should be checked and the customer queried about how the schedule is adjusted during the year.

A schedule should be provided based on evapotranspiration ("ETo")-based water-use budgets equal to no more than 80 percent of reference ETo per square foot of irrigated landscape. The statewide Texas Evapotranspiration Network (http://texaset.tamu.edu/) should be consulted for historical evapotranspiration data and methodology for calculating reference evapotranspiration and allowable stress. More aggressive landscape conservation programs can utilize stress coefficients lower than 80 percent (See website).

For larger water users, a uniformity analysis can be conducted. The customer should be provided a written report on the system repairs and equipment changes needed and the appropriate efficient irrigation schedule by month. The controller should be reset with the efficient schedule. If the system does not have a rain sensor, it should be installed as part of the survey if feasible or provided to the customer to be installed by a contractor. Information should be provided on the installation of dedicated landscape meters for multi-family customers if offered by the utility.

C. Implementation

The utility should develop and implement a plan to market these surveys to both single-family and multi-family customers. Marketing should be done by ranking single-family customers according to water use on a monthly average and offer the program starting with those with the highest water use as a means of increasing cost effectiveness and water savings rapidly. Multi- family customers should be ranked by water use per unit. The survey can be offered by mail, telephone calls, email or through utility bill stuffers or other appropriate methods of communication.

The customer incentive to participate can be reduced utility costs and also recognition as a water efficient customer. If the utility has incentive programs for 1.6 gpf toilets, efficient clothes washers, irrigation systems upgrades, or water efficient landscape, the survey should include this information in the report to the customer.

Once a customer agrees to participate, the utility should collect the following information in the survey:

1) Calculation of the ratio of summer to winter use based on a review of the customer water bills;
2) Pressure on the customer's side of the meter;
3) Number and flush volume for each toilet;
4) If any 1.6 gpf toilets are flushing at greater than 1.6 gpf due to replacement of early closure flapper with standard flapper;
5) If any toilets are leaking around the flapper or over the overflow tube;
6) Showerhead and aerator flow rates in gallons per minute ("gpm") when valve is fully open;
7) Estimated capacity of current clothes washer. If it is a top loading inefficient model, use 41 gallons per load as an estimate;
8) If customer has a swimming pool, the frequency and duration of backflow. Check fill valve and float to determine if working properly. Turn fill valve off at the start of survey to see if any drop in water level is noticed. Ask customer if they have noticed any leakage from pool;
9) Irrigation schedule as indicated on the controller. Ask customer who is responsible for changing the schedule and how often that occurs, if the system is turned off in winter months and if turfgrass areas are over seeded in winter.

The changes that can be made immediately at the time of the survey include:

1) If needed, installation of showerheads using 2.0 gpm or less; kitchen faucet aerators using 2.2 gpm or less and bathroom faucet aerators using 1.5 gpm or less;
2) Resetting the toilet tank water levels to the correct level. Replacement of leaking flappers or flappers that cause the toilet to flush above the design flush volume.

3) Determination of irrigation system precipitation rate for representative zones or all zones if needed;
4) Resetting controller with efficient schedule based on ET and measured precipitation rates;
5) Providing the customer a copy of the twelve months irrigation schedule and attach a copy near the controller;
6) Showing the customer how to use the controller so they can adjust controller throughout the year;
7) Installing a rain sensor on the irrigation system if needed and feasible;
8) Explaining to customer any incentives that the utility offers and how to take advantage of these incentives; and
9) Providing customers a brief report on estimated savings for each item listed in the report and the estimated payback for each item.

The changes that may need to be done after the survey by either a contractor for the utility or by the customer include:

1) Replacing inefficient toilets with 1.6 gpf models;
2) Restoring correct flush volume of existing 1.6 gpf toilets by installation of early closure flapper correctly matched to the model of toilet;
3) Fixing faucet leaks;
4) Replacing the inefficient clothes washer with a new efficient model;
5) If needed, repairing the fill valve on the swimming pool;
6) Replacing damaged portions of the irrigation system;
7) Installing a new controller if warranted such as an ET based irrigation controller;
8) Installing a rain sensor; and
9) Installing a pressure reduction valve if needed.

To assure that the water savings measures recommended during and after the survey are achieved, the utility should follow up with the customer to determine which were actually implemented. The utility should begin a notification program to remind customers of the need for maintenance and adjustments in irrigation schedules as the seasons change and to check toilets and faucets for leaks.

D. Schedule

1) The scope of this BMP should be realized within five years of the date implementation commences.
2) Develop and implement a plan to target and market water-use surveys to all residential customers using more than 20,000 gallons per month in summer months and all multi-family customers in the six months of the first year after implementing this BMP.

3) Repeat marketing efforts until the goals are reached.

E. Determination of Water Savings

Saving should be based on measures implemented by each customer. Savings are calculated by multiplying the number of each type of measure implemented by the savings for that measure as listed below.

1) Single-Family Home
    - Irrigation Audit: Actual utility survey results or 26 gallons per day ("gpd") per house.
    - Showerhead and aerator replacements: 5.5 gpd per person

2) Multi-Family Community
    - Irrigation Audit: Actual utility survey results or 15 percent2 of outdoor water use or 208 gpd1
    - Showerhead and aerators: 5.5 gpd per person

Savings for resetting toilet tank levels, toilet leak repair, flapper replacement and installation of rain shut-offs should be estimated during the water survey. The rain shut-off savings depend both on the ET of the customer as well as the setting on the rain shut-off switch which can be set to shut off after rainfall of ¼ to 1 inch. If the survey results in toilet and clothes washer replacements, these savings can be included in either this BMP or the Toilet Retrofit or Efficient Clothes Washer BMP if the utility has adopted those BMPs.

F. Cost-Effectiveness Considerations

If water efficient plumbing fixtures are distributed during the survey, the costs of that equipment should be considered. High quality showerheads purchased in bulk are available starting at less than $2 each with aerators costing less than $1 each. Flappers range in cost from $3 to $10.

There may be other one-time costs such as purchase of leak detection equipment and meters. Marketing and outreach costs range from $5 to $15 per survey. Administrative and overhead costs range from 10 to 20 percent of labor costs.

PUBLIC INFORMATION

A. Description

Public information programs, even though they may not be directly related to any equipment or operational change, can result in both short and long-term water savings. Behavioral changes by customers will only occur if a reasonable yet compelling case can be presented with sufficient frequency to be recognized and absorbed by customers. There are many resources that can be consulted to provide insight into implementing effective public information programs. Like any marketing or public information program, to be effective, water conservation public information should be planned out and implemented in a consistent and continual manner.

The goal is education of customers about the overall picture of water resources in the community and how conservation is important for meeting the goals of managing and sustaining existing water supplies and avoiding or delaying building of new facilities. An equally important part of the program is to provide data and information on specific actions and measures the customers should take to implement these community goals. Showing customers that the results of those actions have made a difference encourages greater participation in conservation efforts.

There are a variety of tools that can be effectively used to communicate water conservation public education. These include use of print, radio, and television media; billboards; direct distribution of materials; special events such as exhibits and facilities tours; and maintenance of an informative website.

Print media activities can include press conferences, articles and news releases. Regular columns and contributions to gardening and environmental reports are also good ways to reach a wide audience. Electronic media efforts include talk shows, news conferences, press releases, public service announcements, and even paid commercials.

Besides media, utilities can use direct distribution of materials such as inserts or messages on the utility bill, a newsletter, flyers, direct mail, and door hangers. Direct distribution allows targeting of specific messages to specific target audiences.

Special events provide excellent opportunities for direct interaction with the public. These events include facility tours, exhibits, participation in community events, trade shows, presentations to groups, water efficient landscape judging and competitions, and classes and seminars. Development of demonstration gardens and permanent exhibits are also effective.

Websites are now an essential element of public information. Much of the same printed material made available to the media and through direct distribution can be put on a website. Electronically delivered newsletters should include links to the utility's website.

An early step in development of the public information program is to identify the target audiences and what messages need to be conveyed. Themes should be selected that both convey the importance of water conservation and provide customers an opportunity to act. Thematic messages that stress the importance of water as a natural resource can be linked with specific tips or water conserving activities. The most successful public information campaigns also promote or "market" opportunities for customers to participate in utility sponsored conservation programs such as rebate and/or retrofit programs described in other BMPs.

Each public information program should be tailored to the utility and the community. The types of communication methods most effective for the target audience should be identified. Certain media outlets will be more effective than others. For example, television may be effective for large city utilities where it would not be for suburban or rural utilities. In those areas, a local newspaper or direct distribution of materials would likely be better choices.

There are many publications, brochures, videos, DVDs, etc. already available on water conservation that can be used as published or modified to meet the goals of the utility.

Some of the most effective education initiatives involve the participation of customers in the planning process. Creation of stakeholders committees, task forces, or advisory groups have proven effective for utilities in both defining the message and in recruiting allies in the community for promotion of water conservation. Such participatory programs should be well planned and may require an extensive process with numerous meetings or could be a relatively shorter process with representatives of key community organizations. The representative approach could involve neighborhood associations, business groups (i.e. nursery/landscape or other water-related businesses), academic institutions, not-for-profit agencies and environmental organizations among the mix of groups invited to participate. This process will be most successful if public input is sought not only for the public information plan but also for the entire Conservation Plan.

Partnership programs are another effective means of expanding the utility's public information efforts. Numerous not-for-profit agencies include environmental education among their goals. Integrating the utility's public information efforts with programs of other local agencies expands the impact of utility efforts.

Some business associations, neighborhood associations or not-for-profit groups may also provide partnering opportunities for the overall utility conservation program or specific BMPs. Together with these partners utility staff may be able to develop a speaker's bureau to offer adult education about specific water efficiency related topics such as Water Wise landscaping, irrigation system management, and retrofit and behavioral changes available to reduce water bills.

Another important marketing tool for successful conservation programs is public recognition of water-conserving customers. This is often used to focus attention on commercial customers as an incentive to promote greater efficiency by providing positive coverage of company conservation efforts. Awards or certification programs exist in a number of utility programs in Texas and across the nation. These programs have also been used to recognize water-saving landscape designs.

For utilities that are pursuing a number of BMPs, it is important that the public information efforts be integrated with the promotion of implementation of the other conservation BMPs. Promotional efforts or "marketing" of rebates, retrofits, surveys, or educational events should be tied together in the Public Information Plan, much like commercial entities develop a marketing plan.

B. Implementation

The first step in implementation is to develop a Public Information Plan with goals and objectives and a schedule of activities for the first year and a tentative second year schedule. Forming a committee composed of customers and community leaders can help with the development of an effective plan. Committee members may be directly involved in implementing the plan, such as partnership programs with other agencies promoting water conservation, businesses or residents which implement BMPs and receive public recognition, or providing non-utility volunteers to promote conservation through a speakers bureau. Utilities should take advantage of and coordinate their efforts with State programs on conservation[2]. Another option is using firms that specialize in marketing and public information to develop a public information program.

The goal should be, at a minimum, to provide information to each customer at least four times each year on each action that the utility would like the customer to take. The plan should be updated every year continuing with a two-year time horizon. Every other year, the utility should survey a sample of customers or consider the use of focus groups to determine if the utility messages are reaching customers and how effective the messages are in terms of customer actions.

The Public Information Plan should be a substantial part of the utility's overall Conservation Plan. Implementation of the Public Information program should be integrated with the implementation of specific BMPs included in the Conservation Plan. A successful public information effort will promote participation in other BMPs

C. Schedule

1) Utilities pursuing this BMP should begin implementing this BMP according to the following schedule: The utility should complete the Public Information Plan within six (6) months of adopting this BMP.
2) In the second year and each year thereafter, the utility should complete a revised Public Information Plan.

3) In the second year and every other year thereafter, the utility should conduct and complete a survey of customers to determine the effectiveness of its message and actions that customers have taken.
4) Every other year, the utility should survey customers or convene focus groups to assist in determining the effectiveness of materials used or to be used in the public information campaign.

D. Scope

The Public Information Plan should provide conservation information on each BMP being implemented to customers at least four times per year. For utilities focused on reducing summertime peak usage, themes and scheduling of message should be repeated numerous times during the late spring and early summer, rather than being spaced evenly throughout the year.

E. Documentation

To track the progress of this BMP, the utility should gather and have available the following documentation:

1) Number of activities and pieces of information and how many customers were at that activity or received each piece of information;
2) Number and schedule of activities or information pieces related to promoting specific BMPs adopted by the utility;
3) Number of news programs or advertisements that featured the utility message and how many customers had the opportunity to receive each message;
4) Total population in the utility service area;
5) Total budget by category for public information; and
6) Results of annual or biannual customer survey and/or focus groups to determine the reach and impact of the program.

F. Determination of Water Savings

Water savings due to public information efforts are difficult to quantify. If the public information effort was for a specific action such as a showerhead distribution, the savings can be calculated under this BMP if the utility did not implement the BMP containing the product or action. Water savings for other public information programs that result in specific actions by customers such as changes in irrigation scheduling or reduction in water waste occurrences could also be quantified through surveys or analysis of water waste reporting.

G. Cost-effectiveness Considerations

The costs for implementing this BMP depend on the scope of the public information effort. There may be costs for administration and materials. A comprehensive program would range in costs starting at $0.50

to $3.00 per customer per year depending on the size of the utility. Larger utilities should have lower unit costs due to economies of scale. The public information program can be developed and managed by utility staff or outside contractors. Media purchases with TV, radio and print media may be done directly by utility staff.