



SOLANO COUNTY GRAND JURY
2014 - 2015

MITIGATING WATER LOSS

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2014-2015 Solano County Grand Jury

I. SUMMARY

The 2014-2015 Solano County Grand Jury chose to investigate the water loss and accountability of the municipal water systems throughout the County of Solano. This report also addresses the effects of the current four year drought and the resultant imposition of water conservation measures by each City within the County. This investigative report is about the mitigation of water loss in Solano County.

For purposes of this investigation, water loss is considered to be the difference in the amount of water that is treated by each municipality and the amount of water used that is billed to the final consumer.

The Grand Jury found that cities within the County; Benicia, Dixon, Fairfield, Rio Vista, City of Suisun City, Vacaville and Vallejo, each had annual water loss of 9% to 25% of their total distributed water supply. The Cities did not conduct regularly scheduled water audits in order to discover areas where large amounts of the water supply were being lost. The research indicated that the two main culprits of water loss in all the Cities are distribution pipeline leaks and inaccurate water meters. The Grand Jury completed collection of data for this report as of February 28, 2015.

Each City has implemented intervention programs to control the water losses, but only makes replacement or repairs as a reactive condition. Water conservation programs are instituted in all the Cities within the County. Public awareness is promoted via consumer utility bill inserts, mandatory water reductions and/or excessive water usage surcharges, city website information, and public display campaigns.

II. INTRODUCTION/BACKGROUND

California's drought, now in its fourth year, demonstrates with dramatic force the many deficiencies of the aging infrastructure of the water distribution system in all seven cities within Solano County. This leaking infrastructure is a major cause of water loss for each city. The other significant source of water loss experienced in these cities is inaccurate water meters at residences and businesses.

Solano County has several sources of water. Each city within the county has its own water source or is sourced by one or more State or County water agencies. For example, Rio Vista water is supplied by ground water wells, while Benicia must import all of its water supply. Ground water wells, the State Water Project, and the Solano County Water Agency are the major suppliers of water for Solano County. The Solano Irrigation District is a major distributor of water from the Solano County Water Agency. None of the water sources are infinite, as

ground water wells can pump aquifers dry and drought can empty reservoirs. Water is considered a valuable asset, one not to be wasted or squandered, but conserved and used wisely.

According to the Environmental Protection Agency, the nationwide average water loss in distribution systems is 16%, of which only 75% is recoverable. Water loss must be defined as real loss and apparent loss. Unavoidable annual real water loss, as defined by the American Water Works Association, is estimated at 3.3%. The current industry goal for North American water systems is to limit losses to 10% of the system input volume.

Types of Water Losses

Real water loss is physical. Physical water loss identified in the scope of this investigation includes loss within infrastructure and distribution from leakage during transmission and distribution mains, leakage and overflows from the water storage tanks, and leakage from service connections up to and including the meter. The issue of water loss from pipeline leakage is exacerbated by the shrinking water supplies allocated to Solano County.

Water meters, both at the source and at the service connection, are important for all aspects of the water supply operations and make accurate water auditing possible. Meters make it possible to charge customers based upon the quantities of water that the customers consume. As water meters age, they begin to under record water usage. For the older mechanical meters, a six year life expectancy is average. The older the meter, the less accurate the reading, resulting in consumers not knowing their actual water usage and the specific city not accurately billing for actual water usage. New meters allow for a more accurate reading of water usage and have a life expectancy of at least ten years.

Meters can encourage conservation by making customers aware of their usage, as well as help detect leaks and establish accountability. Meter records provide data that is used for planning purposes to determine future needs and to address water loss in the system.

Apparent water loss as identified in the scope of this investigation consists of unauthorized consumption or theft at hydrants, customer metering inaccuracies, and systematic data handling errors in the meter reading and billing processes.

Non-revenue water loss is identified as a water loss condition resulting from water usage not billed, not paid, and not reported. Unbilled authorized consumption consists of unbilled metered consumption and unbilled un-metered consumption. There can be authorized water losses that are unaccounted for, such as fire suppression, hydrant flushing, water pressure valve checks, and municipal use.

Water Audit vs. Water Management Plan

A water audit identifies and quantifies the water uses and losses from a water system. Each Solano County city had either conducted a formal water audit or generated a water use measurement report in lieu of an audit, but none of the Cities conducted an audit on a scheduled or annual basis. At present, there is no State requirement for cities to conduct water audits.

There is a 1983 State requirement for cities to undertake and implement an Urban Water Management Plan (UWMP) every five years in order to preserve water supply sources and for water conservation programs. The purpose of a UWMP is to ensure that urban water suppliers have adequate water supplies for existing and future demands. Plans must identify and discuss various factors affecting current and projected water supplies and demand, and must identify steps being taken to ensure the availability and reliability of future supplies.

A water management plan will include preventive measures such as infrastructure design that allows for maximum structural integrity and effective maintenance for proactive repairs and optimal operating performance. Pipeline pressure management evaluates areas of excessive pressure and implements controls to reduce pipeline leakage and rupture. Repairing and replacing leaking pipes requires prompt fixes and scheduled detection procedures, as well as inventory of parts and materials.

III. METHODOLOGY

- Questionnaires were sent in November 2014, to the seven cities within Solano County requesting specific details regarding that City's water loss conditions and water loss control programs occurring in the past and current year. A Water Loss Control Comparative Analysis Matrix was prepared by the 2014-2015 Grand Jury.
- Tour of Benicia Water Treatment Plant and interviews with plant and Public Works personnel in September 2014.
- September 18, 2014 interview with Benicia City management.
- Various newspaper articles addressing water loss problems specific to Benicia, Vacaville, Solano County and the Bay Area that were published between August and December 2014 in the Daily Republic, Benicia Herald, Bay Area News Group; and magazine reporting on the California drought in the "The Kiplinger Letter".
- Federal, state and agency documents pertaining to water loss, water usage and water regulations:
 - Water Audits and Water Loss Control for Public Water Systems, Environmental Protection Agency, EPA816-13-002, July 2013
 - Water Loss Control Manual, Julian Thornton, McGraw-Hill Companies, 2002
 - Water Audits and Loss Control Programs, AWWA, Manual M36, 3rd edition, 2009
 - Metered Districts, Software, Help Stem Water Leakage, Carl Yates, "Waterworld", October 2007

- City of Benicia 2014 Water System Facts, September 22, 2014
- **Legislative Action Relative to Water Meters and Water Loss Control**
There are four (4) pertinent California legislative actions concerning water meters:
 - **AB2572** (2004) - requires water services to be billed at a metered rate. This bill, with certain exceptions, will require an urban water supplier to install water meters on all municipal and industrial water service connections that are located in its service area on or before January 1, 2025.
 - **AB1420** (2009) – requires compliance to the Best Management Practices (BMP) of the Urban Water Conservation Council. Also requires that the terms and eligibility for any water management grant or loan made to an urban water supplier (UWS) awarded or administered by the Department of Water Resources (DWR), State Water Resources (SWR), or California Bay-Delta Authority (CBDA) be conditioned on the implementation of the water demand management measures called best management practices.
 - **SBX7-7** (2009) – requires a statewide 20% reduction in urban per capita water use by 2020. It requires that urban water retail suppliers determine baseline water use and set reduction targets according to specified requirements, and requires agricultural water suppliers prepare plans and implement efficient water management practices. Compliance is required for continued State water grants and loan eligibility to special water districts.
 - **Urban Water Management Planning Act of 1983** – requires privately-owned and public water agencies that serve water for municipal purposes to more than 3,000 water service connections, or serve more than 3,000 acre-feet of water per year to prepare and submit an updated Urban Water Management Plan to the California State Department of Water Resources every five years.

IV. STATEMENT OF FACTS

In response to the 2014-2015 Grand Jury questionnaires requesting information regarding water loss experienced during the past years, each City provided the most recent data identifying the percentage of water supply loss, the causes of that water loss, water supply sources, and information on water audits, water loss intervention, and present and future water conservation plans, along with public awareness conservation programs. The data collection from each City was completed as of February 28, 2015, and is profiled below and in the form of the Water Loss Control Comparative Analysis Matrix attached to this report.

CITY OF BENICIA

Benicia states that their water loss is 25%. Inaccurate meters account for 10% of the total loss, water main breaks account for 7%, and service line leaks account for 6%. The remaining 2% of loss is due to theft and reservoir overflows.

All of the City of Benicia's water supply is imported, with 85% of supply received from the State Water Project (SWP) North Bay Aqueduct. The secondary source is Putah Canal water received from the Solano Project (SP). Benicia has an emergency water supply source from Lake Herman located in the City limits. In 2014, the City was put in the position of having to purchase replacement water when the SWP allocation was reduced by 85%.

The City has developed a water meter replacement program which has yet to be instituted. A plan to secure a contractor for the detection of water main and service line leaks is underway. Repair of the leaks by the City will follow with a planned completion by end of 2015. Benicia imposed a three-tier surcharge over and above regular water rates in order to recover the cost of the additional water purchases in 2014. The rate surcharge is intended to encourage conservation. Benicia instituted a program through the Solano County Water Agency (SCWA) to reduce water usage by 20% city-wide.

The City of Benicia has established water conservation signage, publically displayed banners, and conservation pamphlets which are available throughout the City. Additional consumer water conservation information is available on the City website.

CITY OF DIXON

In August 2014, the City of Dixon experienced a change of water providers. The City of Dixon now administers water services for approximately one-half of the City's consumers. A contractor, Severn Trent Services (STS) provides maintenance and operations for those consumers. California Water Service Company (CalWater) provides administration, operations and management for the other half of the City water consumers, primarily in the older, downtown area.

Ground well water is the City of Dixon's only water supply source. In a circumstance when the City would need a supplemental source, there is an agreement in place with Solano County Water Agency for water purchases from the North Bay Aqueduct, but Dixon would need to finance and construct the infrastructure to both deliver and treat that water.

To date, identifiable causes of water loss have included non-calibrated pumping facility meters, contractors not correctly utilizing hydrant meters/ backflow devices during construction practices, and street sweeping services utilizing hydrants without meters for water supply. As the providers have had less than a year to compile pertinent information, they were not able to submit enough water loss data for the purpose of this inquiry. Water audits, which are integral components of operation planning, have not been conducted as of this date by either of the current providers. Initial surveys, however, have begun to identify areas of concern and a means to direct appropriate remedies. Addressing the water loss issues, STS has begun monitoring construction sites and increased the use of hydrant meters and backflow devices, providing leak detection services when requested by customers, and replacing leaking customer meters.

In regard to water conservation programs, the City adopted an Urgency Ordinance on August 26, 2014, to enact water conservation measures. Dixon intends to perform activities to accurately account for water usage. Water conservation programs funded through SCWA are highlighted on the City's website. The City has also used utility bill inserts to increase public awareness of water conservation requirements.

CITY OF FAIRFIELD

Fairfield reports approximately 10% of the total water produced that is treated water and distributed from the water treatment plants is unaccounted for or lost. The primary losses of water are from inaccurate and under-recorded amounts of water that flow through the meters, leaks in pipelines through water services, and unauthorized or unreported consumption.

The City of Fairfield water supply comes from two sources: Lake Berryessa, which is distributed by the Solano Project, and the Sacramento-San Joaquin Delta via the North Bay Aqueduct, administered by the State Water Project.

Within the past few years, Fairfield has replaced all existing water meter heads with radio-read technology, increasing frequency of reads and early leak detection. Infrastructure cast iron water mains still exist and are scheduled for replacement over the next several years as part of the annual pipeline replacement and renewal program.

Although the City of Fairfield completes a desktop water audit each year using software provided by the American Water Works Association, it also conducted a water audit in 2013. The City participates in the regional water conservation program administered by Solano County Water Agency, which includes free customer water audits, free water conservation devices, and rebate programs to help residents reduce usage. As a member of the Urban Water Conservation Council, the City implemented water conservation best management practices, and continues to investigate programs that will reduce unaccounted for and lost water. To promote consumer water conservation, the City website provides conservation information.

CITY OF RIO VISTA

The City of Rio Vista experiences an annual water loss of approximately 9%, calculated by volume of water pumped from flow meters at ground wells compared to the water measured at the metered consumers. Aging equipment, pipelines, valves, and under-reporting water meters are the primary causes of water loss.

The City's only water supply source is seven operating ground water wells. There are no other supplemental water supply sources at this time.

Rio Vista is currently conducting a water audit of their water distribution infrastructure. Since 2010, the City has spent over \$2 million to replace the aging equipment that is a major cause of water loss. In July 2014, Rio Vista adopted the new State requirements for water conservation.

Currently, there is a project under construction for replacing old supply pipelines. There is a plan in 2015 for the City to complete a water meter installation and replacement project to better manage water distribution and production losses.

The City sends water conservation tips in monthly utility bills and also has a demonstration garden at the airport that promotes water conservation.

CITY OF SUISUN CITY

Approximately 22% of total water produced into the Suisun City distribution system is lost. The physical water loss is primarily from leaks in the pipeline system, and apparent water losses due to customer meter read inaccuracies, data handling errors, and water theft.

The City water supply is provided from Lake Berryessa through the Suisun-Solano Water Authority and Solano Irrigation District, and has no other supplemental water supply sources.

In 2013, Suisun City conducted a water audit for calendar year 2011, which confirmed the loss volume and infrastructure leak sources. A thorough leak detection survey and minimum night flow analysis was conducted on the Old Town Suisun City distribution system in 2013. Discovered leaks were repaired, saving an estimated 50 acre foot per year of treated water.

Suisun City water conservation activities are based on the Suisun-Solano Water Authority Urban Water Management Plan. The City's Water Loss Control Program includes implementation of district metered areas for proactive leak detection and advanced pressure management, and the development of a detailed inventory of the customer meters and services using a Geographic Information System that will be implemented by Solano Irrigation District in 2015, for the purpose of meter testing and meter replacement. The City participates in State and local water conservation programs sponsored by Solano Water Agency and the California Department of Water Resources. Suisun City uses local media and mail inserts to increase public water conservation awareness.

CITY OF VACAVILLE

Vacaville reports that approximately 10% of their annual water production is unaccounted for and reported as lost. As with other cities in Solano County, these losses are from breaks or leaks in the distribution pipeline system and the deterioration in accuracy of the water meter consumption reporting.

Vacaville has three annual authorized water sources: 9,000 acre feet from Lake Berryessa through Solano County Water Agency and the Solano Irrigation District; 18,000 acre feet from the North Bay Aqueduct through the Solano Water Project; plus 8,100 acre feet of ground water from the 12 permitted wells located in the City. The City of Vacaville's annual average consumption is approximately 17,200 acre feet of water. There are no other supplemental water sources.

The City has not conducted a formal water audit, but production reports are produced and reviewed on a monthly basis. Annual reports on water production and loss are reported to the State. Ongoing water loss intervention and prevention measures include repair of pipeline breaks and leaks when detected or reported. The City also has a program to replace aging water meters that has been ongoing since 2007. Between 2012 and 2013, the City replaced approximately 14,000 conventional water meters with automatic-read meters for residential customers. The goal is to replace all meters on a ten year cycle, which is the expected time period for the automatic-read meters to remain highly accurate.

Vacaville has an aggressive water conservation program which consists of public and school education, commercial and residential fixtures and landscape rebates and water use surveys. Personalized water usage information has been provided in utility bills since 2009 to aid consumers to better track their usage. The City recently updated its Urban Water Shortage Contingency Plan to comply with State drought regulations, and updated the municipal code sections related to water conservation to align with the Urban Water Shortage Contingency Plan to establish fines and penalties for water waste and prohibitions. Early in 2015, Vacaville implemented a mandatory 20% reduction in water use city-wide. Extensive conservation information is located on the City website.

CITY OF VALLEJO

In Fiscal Year 2013-2014, the City of Vallejo estimated the City's water loss to be 11%. Identified causes of physical water losses are: leakage from water pipeline systems, leakage and overflows at storage facilities, and leakage on service connection laterals up to and including the City's side of the service meter, and under-reporting water meters. Causes of apparent water losses reported are: unauthorized consumption which includes direct water theft, customer metering inaccuracies, and data handling errors, including unmetered City use of water and incorrect allowable unmetered water use.

The City of Vallejo's water supply sources are Lake Berryessa, the Sacramento River via the North Bay Aqueduct, and Lakes Madigan and Frey. Due to drought-related water rights curtailment from the North Bay Aqueduct, the City had to exchange a Lake Berryessa water allotment with the Cities of Benicia and Suisun City for an equal portion of Sacramento River water supply.

An annual estimated water balance report is prepared, but no formal audit has been conducted. A record keeping system tracks several parameters of leak repair, but does not yet capture the full range of required data, including leak running time from report to repair. The City is implementing a new asset management and maintenance activity database software program, which will include information needed for a standard water audit.

Vallejo implements various means to mitigate their water loss. Leak detection equipment is used to pinpoint locations of underground leaks, repairing the leaks when found, and an ongoing water main replacement program to replace aging infrastructure is in place. The

Water Loss Control Program consists of ongoing water meter calibrations and advising customers whenever leaks exist on the customer's side of the meter. The City has a replacement program to replace aging and inaccurate meters and has taken steps to reduce the loss of water through contractor construction mishaps involving pipeline ruptures.

Vallejo has an active water conservation program to reduce municipal water use and loss. In addition to the Wasteful Water Use Prohibition Ordinance, the City adopted the drought restrictions imposed by the State, along with a Water Shortage Contingency Plan to monitor stages of water supply shortage. There is consumer water conservation program information on the City's website.

STATEMENT OF FACTS SUMMARY:

- The seven cities within Solano County have and are experiencing water loss ranging from 9% to 25% of distributed water.
- All cities reported water loss primarily due to leaking pipelines and non-reporting or inaccurately reporting water meters.
- All cities are not conducting water audits on a regularly scheduled basis.
- All cities are planning and/or are progressing in replacement of leaking pipelines, replacing or recalibrating inaccurate water meters, detecting leakage in supply and distribution pipelines.
- All cities have invoked water conservation plans.
- All cities have created and are promoting public awareness programs for community conservation.

V. FINDINGS AND RECOMMENDATIONS

Finding 1

Not all of the cities are conducting regularly scheduled water audits.

Recommendation 1

Each city conduct routine scheduled water audits in order to improve control of water loss and for water supply planning.

Finding 2

All the cities face deteriorating water delivery infrastructure.

Recommendation 2

Each city identify and replace aging infrastructure.

Finding 3

All the cities have identified under-recording water meters as a cause of apparent water loss.

Recommendation 3

Each city comply with programs to address inaccurate reading water meters.

Finding 4

All the cities have developed water loss mitigation and conservation programs that serve their communities.

Recommendation 4

Each city enforce and continue expanding water conservation measures for residential and business consumers.

Comments

The 2014-2015 Grand Jury found the seven cities to be very cooperative in their response to the information requests. Ongoing developments of water supply and conservation complicated by the current drought are a challenge for everyone. Each city has paid attention in varying degrees to address their water concerns. However, the action to mitigate the pipeline infrastructure water losses has been slow and incomplete. All water consumers in Solano County must take responsibility in water conservation efforts.

Required Responses:

City of Benicia – All Findings

City of Dixon – All Findings

City of Fairfield – All Findings

City of Rio Vista – All Findings

City of Suisun City – All Findings

City of Vacaville – All Findings

City of Vallejo – All Findings

Courtesy Copies:

Clerk, Solano County Board of Supervisors

VI. GLOSSARY

Acre foot of water: a unit of volume commonly used in reference to reservoirs, aqueducts, canals, sewer flow capacity, irrigation water and river flows. Defined as the volume of one acre of surface area to a depth of one foot and is equal to 325,851 gallons of water. One acre-foot is taken to be the planned annual water usage of a suburban family household. One acre-foot per year equates to approximately 893 gallons of water per day.

American Water Works Association (AWWA): largest nonprofit, scientific and educational association dedicated to managing and treating public water. With approximately 50,000 members, AWWA provides solutions to improve public health and protect the environment.

Apparent Water Loss: non-physical water loss that occurs due to customer meter inaccuracies, data handling errors and water theft. Water is consumed but is not properly measured or accounted for.

California Water Service Company (CalWater): California Water Service Company (Cal Water) is the largest investor-owned American water utility west of the Mississippi River and the third largest in the country. Formed in 1926, the San Jose-based company serves more than 473,100 customers through 28 Customer and Operations Centers throughout the State. To meet the needs of Dixon customers, eight wells are utilized (with an additional well under construction), one storage tank, and 32 miles of pipeline to pump and deliver one million gallons of local groundwater per day.

Non-Revenue Water Loss: unbilled metered water consumption and un-billed un-metered water consumption with no payment received.

Raw Water: ground or surface water that is taken directly from its source without treatment. Not potable water. Water is considered to be raw until it is treated by a potable water treatment process.

Real Water Loss: physical water loss that occurs due to pipe leaks and breaks, storage tank overflows, and undetected water leaks in the distribution system.

Severn Trent Services (STS): private company employed by City of Dixon to provide water operations services, calibrate well production meters, leak detection services, and monitoring construction sites for hydrant construction meter assembly.

Solano County Water Agency (SCWA): a wholesale water agency providing untreated water to cities and agricultural districts in Solano County from the Federal Solano Project and the North Bay Aqueduct of the State Water Project. The agency also has a flood control function.

Solano Irrigation District (SID): an independent special district, a local government agency, formed in 1948. SID has entitlements for 141,000 acre feet of agricultural and domestic water for service to many areas in Solano County each year. The district is the operator of the Solano Project, which delivers Lake Berryessa water to four cities, the Maine Prairie Water District, and SID customers. The district owns and operates the hydroelectric power plant at the base of Monticello Dam. SID is partners with Suisun City in water delivery.

Solano Project (SP): The Solano Project is mostly in Solano County. Monticello Dam at the Lake Berryessa reservoir is the main project feature. Other important features are Putah Diversion Dam, Putah South Canal with a small terminal reservoir, and the necessary waste-ways, laterals, and drainage works. The project was designed to irrigate approximately 96,000 acres of land. The project also furnishes municipal and industrial water to the principal cities of Solano County. Putah Creek is the source of water for the Solano Project.

State Water Project (SWP): the nation's largest state-built water and power development and conveyance system. Planned, designed, constructed and now operated and maintained by the California Department of Water Resources, this unique facility provides water supplies for 25 million Californians and 750,000 acres of irrigated farmland. SWP is a water storage and delivery system of reservoirs, aqueducts, power plants and pumping plants. Its main purpose is to store water and distribute it to 29 urban and agricultural water suppliers in Northern California, the San Francisco Bay Area, the San Joaquin Valley, the Central Coast, and Southern California. Of the contracted water supply, 70 percent goes to urban users and 30 percent goes to agricultural users. SWP makes deliveries to two-thirds of California's population. SWP is also operated to improve water quality in the Delta, control Feather River flood waters, provide recreation, and enhance fish and wildlife.

Suisun-Solano Water Authority (SSWA): a joint powers authority partnership with Suisun City and the Solano Irrigation District to provide domestic water service in Suisun City. Suisun Solano Water Authority qualifies as an Urban Water Supplier under the Urban Water Management Planning Act. SSWA is a public agency directly providing water for municipal purposes to 8,400 customers. An UWMP is required to be completed for 2010 and every five years thereafter and submitted to the California Department of Water Resources.

Urban Water Conservation Council (UWCC): California Urban Water Conservation Council was created to increase efficient water use statewide through partnerships among urban water agencies, public interest organizations, and private entities. The Council's goal is to integrate urban water conservation Best Management Practices into the planning and management of California's water resources.

Urban Water Management Plan (UWMP): the Urban Water Management Plan has been prepared in response to the Urban Water Management Planning Act, California Water Code Sections 10610 through 10650. The main purposes of the Act are to achieve proper water supply planning.

Urban Water Supplier (UWS): a supplier, either publicly or privately owned, providing water for municipal purposes directly or indirectly to 3,000 or more service connections or supplying 3,000 acre-feet or more of water annually. UWS includes a supplier or contractor for water, regardless of basis of water rights, which distributes or sells for ultimate resale to customers.

VII. APPENDIX

WATER LOSS CONROL COMPARATIVE ANALYSIS MATRIX

CONDITION	BENICIA	DIXON	FAIRFIELD	RIO VISTA	SUISUN	VACAVILLE	VALLEJO
% OF TOTAL WATER SUPPLY LOST	25% between metered treatment plant and metered customers	Data unavailable	9-10% of total treated water	9% annually from pumped flow meters to measured meters	22% of water put into the system	10% of water production lost annually	10.8%, add 3.3% for unavoidable Real Loss
CAUSES OF WATER LOSS	<ul style="list-style-type: none"> *Water main pipe breaks *Service pipeline leaks *Hydrant damage *Reservoir overflows *Unaccounted for water due to low reading meters 	<ul style="list-style-type: none"> *Non-calibrated pumping facility meters *Unmetered hydrant use 	<ul style="list-style-type: none"> * Leaks in supply pipelines and water services * Under-recording of water flow through meters *Unauthorized use *Unreported use (theft) 	<ul style="list-style-type: none"> *Aging equipment, pipelines, valves, water meters 	<ul style="list-style-type: none"> *Apparent Loss: inaccurate meters *Real Loss: leaks and overflows 	<ul style="list-style-type: none"> *Leaks and deterioration or failure of meters 	<ul style="list-style-type: none"> *Theft, old meters, unmetered water leakage
LAST WATER AUDIT	AWWA audit in 2011	Last water audit unknown	<ul style="list-style-type: none"> *2013 *Annual desktop water audit 	No audit reported	Audit in 2013 for calendar year 2011	Annual State reports submitted	Annual water balance estimate only

CONDITION	BENICIA	DIXON	FAIRFIELD	RIO VISTA	SUISUN	VACAVILLE	VALLEJO
INTERVENTION	<ul style="list-style-type: none"> *Leak detection survey and repair *Meter replacement program for all users in 2015 	<ul style="list-style-type: none"> *Calibrating well production meters *Leak detection at customer request *Monitoring hydrant construction meter assembly at construction sites 	<ul style="list-style-type: none"> *Replacing cast iron water mains *Replaced all water meter heads with radio-read meter heads 	<ul style="list-style-type: none"> Since 2010, \$2M spent to replace aging equipment 	<ul style="list-style-type: none"> *Water Audit *Leak detection survey in Old Town with indicated repairs 	<ul style="list-style-type: none"> *System leak repairs *14,000 residential meters replaced during 2012-2013 	<ul style="list-style-type: none"> *Leak identify and repair *Water main replacement program *Replacement aging and inaccurate meters
WATER CONSERVATION PLANS	<ul style="list-style-type: none"> *Voluntary 20% reduction *Implemented drought surcharge on water utility bill *Leak detection and repair *Water main pipe and service pipeline repair 	<ul style="list-style-type: none"> *Compliance with California conservation measures *Enacted Urgency Ordinance 14-012 in 2014 	<ul style="list-style-type: none"> *Free customer water audits *Free water conservation devices *Implement UWCC best management practices 	<ul style="list-style-type: none"> *Adopted State requirements *2015 project to install and replace water meters 	<ul style="list-style-type: none"> *Leak detection and pressure management *Inventory of customer meters 	<ul style="list-style-type: none"> *On-going leak repair *Ten year cycle to replace City meters *Mandatory 20% use reduction. 	<ul style="list-style-type: none"> *Minimize City water use *State and County water recommendations of water waste reporting

CONDITION	BENICIA	DIXON	FAIRFIELD	RIO VISTA	SUISUN	VACAVILLE	VALLEJO
	<ul style="list-style-type: none"> *Reduced hydrant testing *Reduced distribution system flushing program *Water meter replacement *Reduced irrigation at City parks 						
PUBLIC AWARENESS CONSERVATION PROGRAMS	<ul style="list-style-type: none"> *WaterSmart conservation program *Conservation signage in public areas *City website and at community events *Water usage devices and landscape rebates 	<ul style="list-style-type: none"> *Customer utility bill inserts *City website conservation information 	<ul style="list-style-type: none"> *Conservation information on City website *Staff promotes conservation at community events 	<ul style="list-style-type: none"> *Water conservation demo garden *Water-wise flyers inserts in water utility bill 	<ul style="list-style-type: none"> *Solano County Water Agency website *Solano Irrigation District website 	<ul style="list-style-type: none"> *Water use surveys, landscape rebates all with local media coverage *Conservation information on City website 	<ul style="list-style-type: none"> *Public information campaigns *Referrals to Solano County website

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