

2001

## Southern Nevada Water Authority

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### Repository Citation

Hasley, Statler, "Southern Nevada Water Authority" (2001). *UNLV Theses, Dissertations, Professional Papers, and Capstones*. 475.

<http://dx.doi.org/10.34917/1489568>

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## Abstract

The arid Southwest of the United States is confronted with increasing water demands. Past efforts to meet water demand have been directed toward development of scarce water resources. Now the times are changing and conservation programs are being instituted to expand supplies for the growing population. In Las Vegas, the tides are shifting to conservation programs. The Southern Nevada Water Authority (SNWA), an agency comprised of the local water utilities, have united to find new sources of water to feed the growing city. SNWA has invested a great deal of money into the conservation programs as an alternative to developing new water supplies. This research studied a conservation program's effect on the water consumption after residential customers participated in a site review. The site review program can also be referred to as an irrigation audit. Irrigation audits systematically evaluate an irrigation system and matches the scheduling of the system to the plant requirements, soil type, shade, sun exposure, and slope. The homeowner is then provided with a new water schedule and often their irrigation clock is reprogrammed. The condition of the system is reviewed to inform the owner of any broken parts or maintenance needed. Improving the system's maintenance increases watering efficiency, which in turn reduces the amount of water required to irrigate. The evaluation of these water conservation programs is limited and relatively unknown. This research analyzes the effectiveness of this program in reducing water consumption.

## Introduction

The Southern Nevada Water Authority (SNWA) was originated to address Nevada's unique water needs on a regional basis. The organization is committed to managing the region's water resources and developing solutions that will provide adequate future water supplies for the Las Vegas Valley. The organization is governed by a seven-member board that consists of representatives from each of the member agencies. These member agencies are the following: Boulder City, Henderson, Las Vegas, North Las Vegas, Big Bend Water District, Clark County Sanitation District, and Las Vegas Valley Water District.

The most important responsibility of the Water Authority is to manage all water supplies available to Southern Nevada, as well as address regional water resource management and conservation programs. The Water Authority also allocates and distributes among water purveyors the remaining Colorado River and any other water that becomes available. It is also necessary to provide water quality as determined by EPA standards. Furthermore, it presents a position on water issues facing the region. Lastly, it operates regional facilities to ensure a reliable drinking water delivery system to agencies.

The purpose of this study was to explore the details and effects of an educational water conservation program on water usage of participating residences in southern Nevada. The Las Vegas area is one of the fastest-growing urban centers in the West. It is important to know the result of a demand management program considering the problems with meeting water demand in the future. Las Vegas has also developed the reputation for the highest per capita water use compared to other major cities in the arid West (Morris and Devitt 1997). Demand management can be defined as projects related to education in regard to water use behavior, promotions of water saving devices, promotion of conservation landscaping, efficient pricing and controlling

growth (O'Grady and Opitz and Dziegielewski 1994). These types of programs are sometimes referred to as water conservation programs. Site Reviews are a type of demand management project that systematically evaluates residential irrigation system and matches the scheduling of the systems to plant requirements, soil types, shade, sun exposure, and slope (Greg and Curry 1995). The homeowner is educated in using the irrigation clock. They are supplied with a lawn watering guide and a drip watering guide in order to maintain scheduling. Both of the guides describe the seasonal watering schedules for the region by suggesting the time of day to operate the irrigation system, the number of days per week, the number of times to water per day, and the period of time to run the irrigation system.

Conservation efforts such as site reviews will contribute to a decrease in per capita water use, and an increase in water supply in the future for the Las Vegas Valley. The success of the program may later help southern Nevada utilities to balance demand and supply at a cost that is below the economic, social and environmental costs of new supply development. However, in order to make water demand management an integral part of water supply planning, it is necessary to have adequate analytical tools for the formulation and evaluation of demand management alternatives. Water supply agencies should develop reliable estimates of water savings and customer participation, as well as the cost and potential benefits of each demand program before they can expend their financial resources on implementing such a program (Dziegielewski 1992). The educational program that was the topic of this research is that of residential site reviews. The program has been in effect for five years by the Southern Nevada Water Authority and was utilized by 2,000 residential customers in 1998.

The potential of water savings from site reviews in Las Vegas is unknown. The exact percentage of water savings from these programs in the nation is relatively unknown. In Austin,

Texas, site reviews are suspected to reduce outdoor water consumption by up to 15 percent (Gregg and Curry 1995). Other studies suggest that such programs reduce demand in a range of 1.1 percent to 4.0 percent (Michelsen and McGuckin and Stumpf 1999). The effectiveness of the non-price programs appears to exhibit diminishing returns, that is, the per program effectiveness declines with an increasing total number of programs implemented in a city. This study gave insight into the effectiveness of southern Nevada water conservation programs by examining water consumption before and after site visits and by survey methods. These findings supported the effectiveness and the development of this water conservation program. The results of this study provided estimates of water reduction for site reviews, giving water conservationists another tool for making decisions. In addition, many benefits were obtained from this study by surveying each user and their water consumption habits to improve the efficiency and the design of the program

The research project analyzed the impact of residential site reviews on water consumption and evaluated the effectiveness of site reviews on water usage. It was hypothesized that site reviews reduce the water use of participants by up to 15 percent and the decrease would be in most part from the adjustments of the sprinkler clock. Other decreases in water use were attributed to the adjustment of sprinkler heads and repairs to the system after the SNWA representative brought the problems to the attention of the participant. In order for this study to prove that site reviews reduce water consumption significantly, the success of the program must reduce water consumption after the site review.

## Methods and Procedures for Data Collection

The data needed for water consumption of residents that participated in site reviews was obtained from the Las Vegas Water District (LVVWD). The approval to use the data was gained through the Conservation Division of LVVWD and SNWA. Past site reviews of the SNWA files were searched.

The LVVWD computer system was used to store records. The system stored information and records from every site review that was completed by the Southern Nevada Water Authority. Searches that were performed on the computer system gathered both the site review and background information. This data also included the account number of the eligible site reviews.

Once site review information was collected, it was linked to customers' information and to water consumption and assessor's office records. The data collection provided the base for the study. Tables were constructed which included the water consumption before and after every site review.

Surveys were conducted from only the people that participated in site reviews. The survey questions were pertinent in finding information about the persons using the site review program. Question of age, income level, property values, family size, and other data was included (Appendix A). The answers were recorded in a Microsoft Access for analysis. The survey was supported by the SNWA. The survey was conducted by telephone.

Raw water consumption data was measured by reading the residential customer's meter. Ultimately, this information was processed to yield units of gallons per month. To determine if water consumption was decreased, gallons of water used pre-site review and post-site reviews were compared. The year prior to site review was compared to the year after the site review. The

difference in water usage was used as evidence to support the hypothesis that was being tested. Survey results were measured in both qualitative and quantitative terms for analysis. Survey results were used to perform a multivariate regression model. This measurement technique has produced very accurate estimates of actual water savings for some programs, especially those targeting the residential sector (Diegielewski 1992). Survey results were put into graphs to give a visual meaning to the numbers in the survey. (See Appendix B)

### **Resources Used**

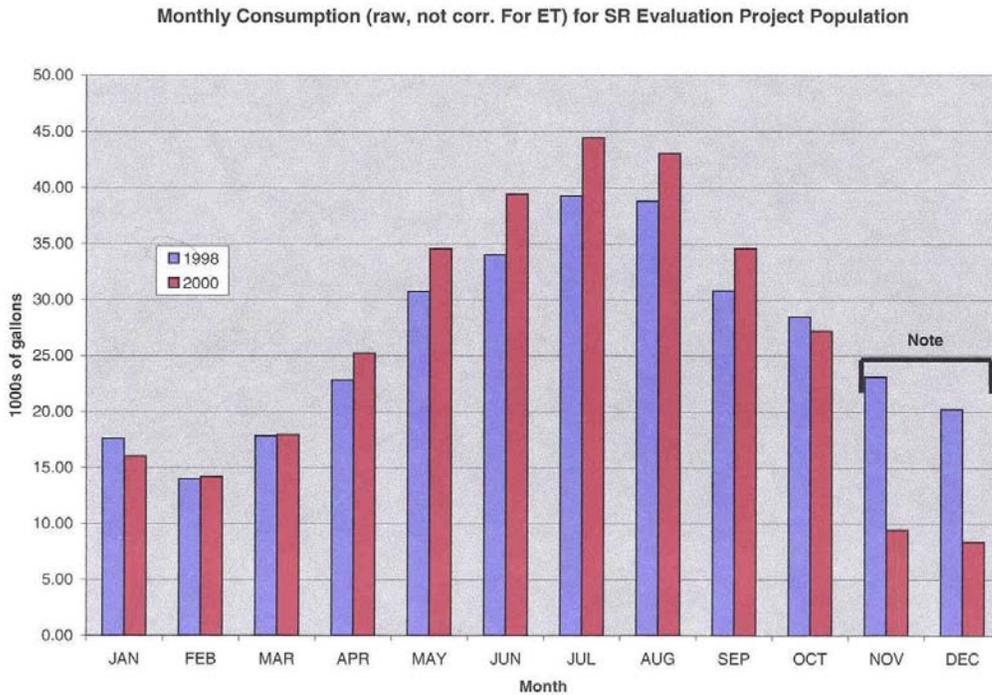
- 1) Computer database and statistical support to process information from the SNWA.
- 2) Data analysis support
- 3) Survey assistants to call site review participants
- 4) Research manager to oversee projects and write analysis of the research results.

# Results

## Consumption Analysis

The study began with the selected LVVWD accounts that had received site visits in the year of 1999. From that data, accounts were pulled with continuous monthly consumption records and those accounts that had not received other products or services from LVVWD/SNWA. The review of the accounts was analyzed to avoid homeowner participation in other known water conservation programs in order that other variables would discredit the results. The analysis also removed the accounts with multiple site visits and those who also got clock adjustments (in a visit from the Site Review). Since a record is made of what service numbers get what treatments, it was a successful evaluation to have the database pull consumption records for those service numbers that received Site Reviews.

Preliminary consumption analyses were run and it necessitated an examination of records to identify if there was any difference between the 1998 and the year 2000. There were 574 account records reviewed and analyzed. Generally, results demonstrated no real difference between the pre-Site Review and the post-Site Review years. (See Graph 1 Below)



*Graph 1*

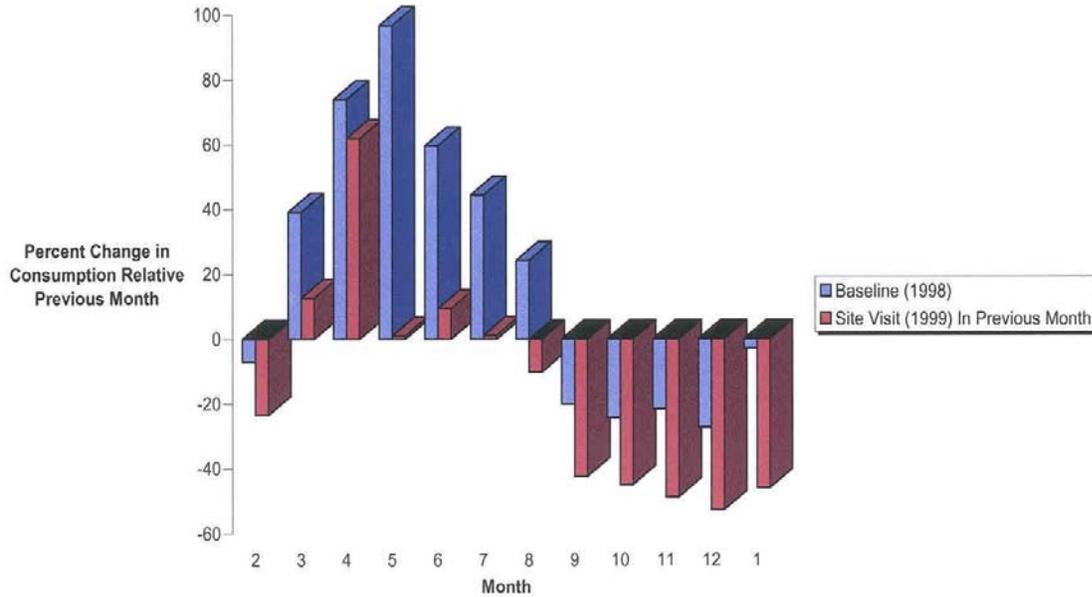
The people appeared to realize little if any differences in their consumption. It should be noted that the year 2000 was an exceptionally hot year with high evapotranspiration rates (ET). On the other hand, preliminary results suggested that the study could see a benefit in the winter months when people were consuming less water than the summer peak consumption. This means that site reviews helped people come down off their high summer consumption in November and December.

**Short-Term Analysis**

A short-term analysis was prepared by examining the immediate impact of site visits on water consumption patterns versus the previous behavior patterns. The sample size for this comparison was 541 accounts. The short-term analysis reviewed participants' accounts a month before the visit and a month after the visit. Naturally, this analysis demonstrated summer consumption was higher than winter consumption due to the fact of outdoor consumption had increased. (See Graph 1)

To determine a truer comparison, the previous year's consumption (without a site visit between the months) of a baseline was analyzed. A calculation of the percentage change in consumption from the years reviewed was then compared to the baseline versus the site visit year. The findings demonstrated that in every month and on both sides of the yearly curve savings were made. The study of the short-term analysis did not track the behavior of the entire population, but only the behaviors for each respective group of homes associated with a site visit in a particular month. The results indicated that site visits have a strong short-term impact on reducing water consumption. (See Graph 2)

Comparison of Percent Change in Consumption Relative Previous Month

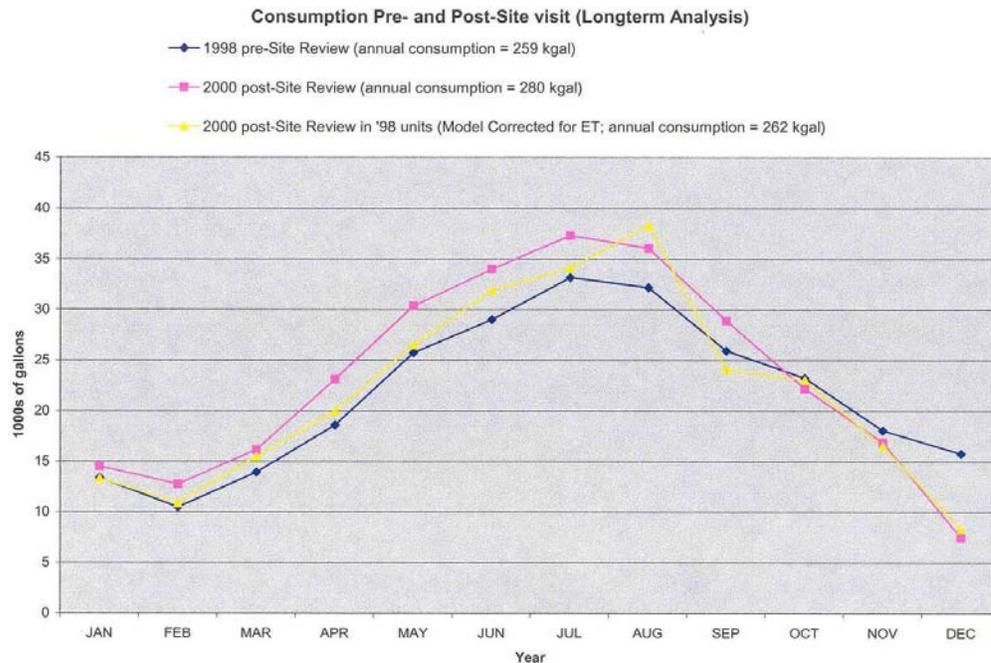


*Graph 2: Short-Term Analysis*

### Long-Term Analysis

A long-term analysis was prepared by examining the consumption in the entire population. A comparison was made of the year before the site visits (1998) and the year after the site visits (2000) for people whom were still account holders. The sample size was 241 accounts. This size was determined after excluding 2,323 accounts, which did not meet the criteria. All accounts were treated the same. For example, a January '99 site visit in which that home's consumption began figuring into the analysis in a month (starting with January 2000). The comparison was disappointing in that the visited homes indicated a much higher annual consumption rate than what they had prior to the visit. (See Graph 3) SNWA attributes the greatest variations in year-to-year consumption to weather differences.

### Graph 3: Long-Term Analysis



they had prior to the visit. (See Graph 3) SNWA attributes the greatest variations in year-to-year consumption to weather differences.

### Survey Analysis

There were 21 questions on the survey for the customers participating in a Site Review. . (See Appendix A)

The results are as follows:

- (1) Eighty-six percent of the participants requested the site review program.
- (2) One hundred percent of the participants have never participated in a water conservation in

another water conservation.

(3) Sixty-three percent of the participants maintained the lawn and adjusted the sprinkler clock.

(4) Forty -six percent who responded “no” to maintaining their lawn and adjusting their clock, seventy-one percent who said “yes” used a lawn maintenance service.

(5) Fifty-one percent of the participants understand how to set their irrigation clock.

(6) Seventy-five percent responded that they would like to understand how to set the sprinkler irrigation clock.

(7) Fifty-four percent of the participants said the site review program helped them understand how to set the irrigation clock.

(8) Ninety-four percent of the participants said that their plants stayed healthy or improved after the site review.

(9) Not applicable- See Appendix B.

(10) The participants changed their watering schedule 3.4 times on an average each year.

## DISCUSSION

The results of the long-term consumption data determined no difference in annual consumption of participants after the site review. However, it is important to understand that SNWA attributes the greatest variation of year-to-year consumption to weather differences. These two years exhibited very different weather patterns that affect the evapotranspiration rate. Evapotranspiration (ET) is defined as the sum of the water lost from the soil surface (evaporation) and the water used by the plants (transpiration). There are many factors that affect the rate of ET, including plant species, weather factors, and quality of water available to the plant. It just so happens that the year 2000 was one of the worst years ever for ET demand. (See Figure 1 below)

The study recognized how water usage in November and December showed an improvement in decreasing water consumption. It could be possible that Site Reviews played a role in coming down off the peak usage months. The study should recognize that the August anomaly (mini peak almost) is not true to increased consumption but rather to homeowners' collective failure to respond immediately to the drastically dropping ET values and rainfall associated with the monsoon time of the year. In other words, water consumption fails to go down. For instance, water consumption of a really hot June month and back to a more typical ET does not happen. Some critics believe that this effect in the general population is part of the reason why SNWA fails to meet its conservation goal.

**Table 1**

**Evapotranspiration Rates  
Las Vegas, NV\***

	Year								Average
	1993	1994	1995	1996	1997	1998	1999	2000	
January	1.08	3.03	1.39	3.25	2.33	2.52	3.86	2.87	2.54
February	1.62	3.02	3.40	3.68	3.81	2.85	3.88	3.64	3.24
March	4.61	6.35	4.92	6.70	6.05	5.86	7.21	6.28	6.00
April	8.63	8.08	7.28	8.97	7.13	7.98	7.68	9.85	8.20
May	10.39	10.21	8.46	10.83	10.66	11.18	11.53	13.01	10.78
June	11.93	12.85	11.04	10.61	11.82	12.31	13.08	13.30	12.12
July	13.55	12.23	11.51	11.54	11.44	12.85	11.65	14.28	12.38
August	11.15	11.03	10.97	11.73	10.21	11.88	11.01	10.96	11.12
September	8.56	8.31	8.22	8.31	6.95	7.67	9.11	9.51	8.33
October	5.39	5.20	5.54	5.74	5.29	6.11	6.79	5.74	5.73
November	3.05	3.25	3.19	3.00	2.88	3.20	3.60	3.30	3.17
December	2.17	1.99	2.42	1.80	2.55	2.92	2.83	2.47	2.38
Total	82.13	85.55	78.34	86.16	81.12	87.33	92.23	95.21	85.98

	Percentage Difference from Average							
	93	94	95	96	97	98	99	2000
January	-58%	19%	-45%	28%	-8%	-1%	52%	13%
February	-50%	-7%	5%	14%	18%	-12%	20%	12%
March	-23%	6%	-18%	12%	1%	-2%	20%	5%
April	5%	-1%	-11%	9%	-13%	-3%	-6%	20%
May	-4%	-5%	-22%	0%	-1%	4%	7%	21%
June	-2%	6%	-9%	-12%	-2%	2%	8%	10%
July	9%	-1%	-7%	-7%	-8%	4%	-6%	15%
August	0%	-1%	-1%	6%	-8%	7%	-1%	-1%
September	3%	0%	-1%	0%	-17%	-8%	9%	14%
October	-6%	-9%	-3%	0%	-8%	7%	19%	0%
November	-4%	3%	1%	-5%	-9%	1%	14%	4%
December	-9%	-16%	2%	-24%	7%	23%	19%	3%
Total	-4%	-1%	-9%	0%	-6%	2%	7%	11%

\* Data provided by the weather station located at Freedom Park & administered by the City of Las Vegas

Revised 11/21/00

The study is only a consumption analysis and it missed other potential positive attributes of the program. Future studies are planned to examine other methods of comparing participant's water consumption. It is SNWA's intent to measure consumption changes in non-contacted homes in similar neighborhoods. It may be that everyone's consumption increased in 2001, but possibly 1999 Site Review participant's consumption increases were not as high. This would prove to be valuable information that could support site reviews efficiency on long-term water consumption.

It is hypothesized that many of the site review participants that received more than multiple site review had lower consumption the following year but were excluded from the study. This exclusion may have reflected a percentage of water savings that was not analyzed.

Customer service provided during site reviews is not measured in the study. This program may have an increased impact for improving SNWA credibility with its customers. This would serve to enhance SNWA's relationship with customers in a positive manner, while simultaneously educating the customer in water conservation methods.

It is possible the program has an effect on higher efficiency for the same amount of water used. The program corrects water leaks and broken irrigation parts that have lead to inefficient water and surface run-off. After the site review, the resident may experience greener grass for the same amount of water used, and proper application of water to the landscape.

Recruitment value for xeriscape and other SNWA conservation programs are not measured into the study. However, this program gives the SNWA an opportunity to promote other water conservation programs directly to the customers during site reviews. Recruitment for the irrigation clock rebate program is very successful during site reviews. The site review allows the SNWA representative to enroll the participant into the Irrigation Clock Rebate Program (ICR)

immediately if the customer's clock qualifies. SNWA offers a rebate to upgrade the single-program sprinkler clock to a more efficient dual or multi-program clock. Without the site review, the customer may have not changed the clock to a more efficient one and ultimately wasted water for many more years.

The site review allows SNWA representatives to point out areas of a customer's lawn that are not water efficient, and then explain the xeriscape rebate and how it would apply to the area. This is effective because it informs the customer of an alternative and of the incentives that the SNWA has established to help the participants.

Concluding, the site review program has changed since 1999. New procedures have been designed to improve water conservation during the site review. Customers' water meters are checked for movement, which is an indicator of a water leak on the property. Flow rates are recorded from the irrigation system, calculating the system's water usage and then the customer is notified of high consumption or over irrigation of their landscape. These new procedures act to inform the participant of unnecessary water usage in order to promote water efficiency.

It is important to understand that this program was established to provide residential customers a service. However, as time has progressed other benefits have been acknowledged in the site review process. It gives water utilities an opportunity to educate customers in residential water conservation awareness. The water supplies of tomorrow are shrinking with the growth of the southwest and it is important to advocate water conservation programs to protect the environment and the region from shortages. Site reviews will give people additional tools and motivation to take the initiative to make a difference in the future.

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