Water Use in Santa Fe

A study of residential and commercial water use
in the Santa Fe Urban Area

Water Division
City of Santa Fe, New Mexico

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EXECUTIVE SUMMARY

This report summarizes the results of a 2007/2008 study on water use in Santa Fe, New Mexico and compares them to a 1998 study to determine what impact conservation measures may have had on water use by different types of users in Santa Fe. One purpose of this study is to determine current water use in Santa Fe for residential, commercial and community categories, which will be the basis for estimated water budgets required of all future development requesting connection to the City's water system. An additional purpose of this study is to identify trends in water use over time, and to determine if declines in use can be attributed to comprehensive water conservation programs the City has initiated in the past 10 years.

General results of the study indicate that water use, with some exceptions, has declined in Santa Fe across residential, commercial and community categories.

- Water use has dropped consistently across various residential categories. Annual average water use across lot size fell by 31% between 1998 and 2007/2008.
- Similar to results from the 1998 study, this analysis indicates that in 2007/2008, homes on larger lots continue to use more water than those on smaller or medium lots, though the ostensible reasons for this, including more landscaping and more bathrooms have not been verified.
- The distribution of water use within residential areas generally shows a relatively 'normal' distribution, but with a 'tail' on the high use side. This indicates that a few residents in each subdivision use a disproportionately high amount of water.
- Water use generally declined across commercial categories. Categories that demonstrated particularly large downswings included restaurants and hotels: full-service restaurant average use per seat dropped by 50%, whereas full-service hotel average use per room fell by 58%. Exceptions to the general declining trend in commercial categories include grocery stores, gas stations and limited service carwashes, where average annual water use went up by 13%, 43%, and 26% respectively.
- Results for community categories also demonstrated a general declining trend. The fall in annual water use per acre in some public parks is particularly noteworthy, though the total average fell only by 16%. The decline in average annual water use per 100 students was greater in primary and middle schools at 34% and 48% respectively, than in high schools at 2%. Average annual water use at places of worship without daycare also fell a substantial 67% since 1998.

Though the results of this study are generally encouraging, the study's results highlight where further research and water conservation efforts should be focused, especially in light of Santa Fe's future water needs and uncertainty regarding the impact of climate change on water supplies. It is recommended that conservation efforts be targeted towards high water users identified by the study and that additional improvements to the data and methodology could provide more reliable and detailed results. The following table summarizes the report's recommended basis for updating water budget calculations for new development.

Recommended Budgets by Water Use Category

	1988		2007-08		
Residential	**Ac Ft / Yr**	**Gallons / Yr**	**Ac Ft / Yr**	**Gallons / Yr**	**Percent Change**
Single Family Dwelling Unit	0.26 / d.u.	81,463 / d.u.	0.18 / d.u.	58,653 / d.u.	▼ 31%
lot size < 6,000 sq ft	0.21 / d.u.	65,170 / d.u.	0.15 / d.u.	48,878 / d.u.	▼ 28%
lot size 6,000-10,890 sq ft	0.25 / d.u.	81,463 / d.u.	0.17 / d.u.	55,395 / d.u.	▼ 32%
lot size > 10,890 sq ft	0.32 / d.u.	104,272 / d.u.	0.25 / d.u.	81,463 / d.u.	▼ 21%
Apartment/Condominium	0.21 / d.u.	68,429 / d.u.	0.16 / d.u.	52,136 / d.u.	▼ 24%
Mobile Home	0.20 / d.u.	65,170 / d.u.	0.17 / d.u.	55,395 / d.u.	▼ 15%
Guest House	0.12 / d.u.	39,102 / d.u.	0.09 / d.u.	29,327 / d.u.	▼ 25%
Senior Complex	0.14 / d.u.	45,619 / d.u.	0.12 / d.u.	39,102 / d.u.	▼ 14%
Commercial					
Restaurant, full service	0.04 / seat	13,034 / seat	0.02 / seat	6,517 / seat	▼ 50%
Restaurant, limited service	2.6 / site	847,213 / site	1.63 / site	531,137 / site	▼ 37%
Hotels	0.31 / room	104,272 / room	0.13 / room	42,361 / room	▼ 58%
Motels	0.15 / room	48,878 / room	0.09 / room	29,327 / room	▼ 40%
Grocery Stores	1.1 / 10,000 sq ft	358,436 / 10,000 sq ft	1.27 / 10,000 sq ft	413,831 / 10,000 sq ft	▲ 13%
Large Retail	0.60 / 10,000 sq ft	195,511 / 10,000 sq ft	0.45 / 10,000 sq ft	146,633 / 10,000 sq ft	▼ 25%
Neighborhood Center	1.5 / 10,000 sq ft	488,777 / 10,000 sq ft	0.43 / 10,000 sq ft	140,116 / 10,000 sq ft	▼ 70%
Small Retail	n/a	n/a	0.06 / site	19,551 / site	n/a
Galleries	n/a	n/a	0.6 site	195,511 / site	n/a
Medical Office	1.0 / 10,000 sq ft	325,851 / 10,000 sq ft	0.72 / 10,000 sq ft	234,613 / 10,000 sq ft	n/a
Office - city/state	0.6 / 10,000 sq ft*	195,511 / 10,000 sq ft	.58 / 10,000 sq ft	188,994 / 10,000 sq ft	n/a
Office - non-medical	0.6 / 10,000 sq ft*	195,511 / 10,000 sq ft	.70 / 10,000 sq ft	228,096 / 10,000 sq ft	▼ 30%
R&D Labs	1.5 / 10,000 sq ft	488,777 / 10,000 sq ft	1.18 / 10,000 sq ft	384,504 / 10,000 sq ft	▼ 26%
Manufacturing - goods	n/a	n/a	0.21/ site	68,429 / site	n/a
Manufacturing - consumables	n/a	n/a	2.33 / site	759,233 / site	n/a
Gas Stations	0.5 / site	162,926/ site	0.88 / site	286,749 / site	▲ 43%
Gas Stations w/ Carwashes	7.8 / site	2,541,638 / site	6.56 / site	2,137,583 / site	▼ 16%

* this average is the Office, non-medical (xeriscape) from the 1998 survey

1) d.u. = dwelling unit

	1988		2007-08		
Commercial Cont.	**Ac Ft / Yr**	**Gallons / Yr**	**Ac Ft / Yr**	**Gallons / Yr**	**Percent Change**
Carwash, full service	7.5 / site	2,443,883 / site	5.66 / site	1,844,317 / site	▼ 25%
Carwash, limited service	0.6 / bay	195,511 / bay	0.94 / bay	306,302 / bay	▲ 36%
Commercial Laundromats	n/a	n/a	0.78 / machine	254,166 / machine	n/a
Laundromats - other	n/a	n/a	0.22 / machine	71,688 / machine	n/a
Drycleaners	n/a	n/a	0.41 / site	133,600 / site	n/a
Nurseries	n/a	n/a	0.56 / 10,000 sq ft	182,478 / 10,000 sq ft	n/a
Gyms w/ showers	n/a	n/a	8.94 / site	2,913,107.94	n/a
Gyms w/out showers	n/a	n/a	0.77 / site	250,905.27	n/a
Salons	n/a	n/a	0.21 / site	68,428.71	n/a
Pet Grooming/Boarding	n/a	n/a	0.52 / site	169,442.52	n/a
Pet Daycare	n/a	n/a	0.11 / site	35,843.61	n/a
Auto Repair	n/a	n/a	0.12 / site	39,102.12	n/a
Car Rental	n/a	n/a	0.12 / site	39,102.12	n/a
Car Sales	n/a	n/a	0.07 / 10,000 sq ft	22,809.57	n/a
Self-Storage	n/a	n/a	0.13 / site	42,360.63	n/a
Public Services					
Parks	1.8 / acre	586,532 / acre	1.48 / acre	482,259 / acre	▼ 18%
Schools, Daycare	n/a	n/a	0.85 / 100 kids	276,973 / 100 kids	n/a
Schools, Elementary	0.8 / 100 students	260,681 / 100 students	0.53 / 100 students	172,701 / 100 students	▼ 34%
Schools, Middle	3.2 / 100 students	1,042,723 / 100 students	1.68 / 100 students	547,430 / 100 students	▼ 48%
Schools, High	2.7 / 100 students	879,798 / 100 students	2.64 / 100 students	860,247 / 100 students	▼ 2%
Places of Worship	0.46 / site	195,511 / site	0.15 / site	48,878 / site	▼ 67%
Places of Worship, w/ daycare	1.3 / site	423,606 / site	.95 / site	309,558 / site	▼ 26%

INTRODUCTION

During 1996-2000, and again in 2002 and 2004, Santa Fe and the surrounding area experienced very dry years. With the intent to reduce *per capita* water use, the City of Santa Fe instituted emergency water conservation measures that included, among other provisions, restrictions on residential and commercial outdoor watering as well as water-saving measures in commercial and public spaces. Additionally, the City implemented a comprehensive conservation program, documented in the Water Conservation and Drought Management Plan of 2005[1], which combined a number of different elements including specific water conservation requirements, water rate conservation incentives, water use audits, water offsets for new development, and general conservation education for the public. The primary, non-emergency water conservation measure, implemented in 2003, required all new demand on the water utility to be offset by replacing high flow toilets with 1.6 gallon or less flush toilets.

In 1998, The City of Santa Fe Planning & Land Use Department, assisted by the City's Public Utilities Department and the Sangre de Cristo Water Company, surveyed a sample of water use records for homes and businesses. The study's purpose was to determine, on average, how much water was consumed by homes and businesses in Santa Fe. The study selectively compiled more than 1,500 water use records. The study's results eventually came to serve as the basis of the water budget of the City of Santa Fe, which was used for determining water needs for new development.

Data were collected in 2007 and 2008 to expand the existing understanding of water use in Santa Fe and to further categorize water use and identify conservation by use category. This report presents an analysis of these more contemporary data. This data update may provide a basis for estimated water budgets required for future development needing connection to the City's water system. Additionally, this study helps to identify trends in water use over time, and to determine if declines in use can be attributed to comprehensive water conservation programs the City has initiated during the past 10 years.

Recent studies of water use in Santa Fe have indicated that *per capita* per day water use has declined in Santa Fe over the past 10 years.[2] Despite methodological differences between the first and second studies, general results seem to indicate that water use, with some exceptions, has indeed been reduced across commercial, residential, and community use categories in Santa Fe.

[1] For a complete listing of the City's Conservation programs, please see Conservation Plan (2005)

[2] See Water Update 2008: http://www.santafenm.gov/DocumentView.asp?DID=4065

METHODOLOGY

In order to generate comparable results between the two studies, an attempt was made to follow the methodology used in the 1998 study and to include current data from as many of the previously used sites as possible. Water use records showing a minimum of 12 months of consumption were collected and analyzed for 2007, 2008 or both. For some individual homes and businesses the first reading of 2009 was also included to ensure twelve months of data for the particular site. In addition to providing the individual averages per year, the tables summarizing this study's results include an average of all of the data points for the years 2007/2008. This average, which represents water use "ten years later", is what is compared to average water use in 1998. The 1998 and 2007/2008 average water use values are also listed side by side in the Water Use Table at the end of the report. Results of the analysis are broken down into three general categories: residential, commercial, and community use (e.g. schools, places of worship, public parks etc.). Average annual water use values are presented in acre feet of water (1.0 acre foot equals 325,851 gallons).

Although information on as many sites as possible was requested, the presence of significant outliers within limited data sets, particularly in commercial categories, can skew average results and could lead to an inaccurate estimate of average water use for those categories. Billing data was used for 1050 out of the total 28,790 single-family residential customers reported in 2008, or 3.6%. For commercial categories, billing data was used for 116 out of a total of 3,497 commercial accounts, or 3.3%. The study assumes that these are representative samples.

The data used for the current study may contain errors. Errors in the source data may result from erroneous meter readings and billing records due to multiple meter readings, multiple meters, and owner versus service address discrepancies. In some cases, billing data was available for only one of the two years for which it was requested. Some of the old sites could not be located in the billing database. In addition, there may be discrepancies in terms of what was being measured in 1998 and 2007/2008. For example, meters may have been added or switched from "multi-meters", accounts with one meter serving multiple customers, to single meters. For multi-meters, the number of customers served by one meter is not always listed in the billing database.

The actual data used for the 1998 study were not readily available, and so no estimates of error were made. Results from that year are cited directly from the report Water Use in Santa Fe, February 2001[3].

Methodology for Residential Categories

The residential land use categories used in the study include the following:

- Single Family Homes;
- Apartments/Condominiums;

[3] Water Use in Santa Fe; A survey of residential and commercial water use in the Santa Fe urban area. Planning Division, Planning and Land Use Department, February, 2001.

- Mobile Homes (in mobile home parks); and
- Senior Residential Complexes.

As mentioned previously, the original study did not follow a random sampling procedure. For housing subdivisions, all of the houses along particular streets considered to be representative were sampled. Although selecting particular streets could potentially lead to biases in terms of selection of a particular lot size and/or water use, this same methodology was used in the current study. Obtaining the data for an entire subdivision for a potentially less arbitrary sampling method proved to be outside the scope of the current study. In order to have some quality assurance/quality control for the data, the distribution curves of residential consumption data were mapped by individual streets. All data sets demonstrated relatively 'normal' distribution curves.

Water use data for individual addresses were used in the sample only when twelve months of actual meter readings appeared on an individual record. An important area where the 2008 methodology differed from that of the 1998 study was the use of records that showed a certain amount of 'absenteeism' in residential categories. In the 1998 study, if the water use records contained highly inconsistent water figures from one month to the next, the record was not included in the sample. In the current study, homes for which there were twelve months of billing data, but which indicated no water consumption for a few months during the year, *were* included, in order to reflect the fact that some homes in Santa Fe are second homes and are not occupied for the entire year. This same change in methodology was also employed for apartment and mobile home categories, which were often more transiently occupied than houses and demonstrate some months when no consumption is recorded.

As in the previous study, housing subdivisions were categorized into three general lot sizes. The assumption carried over from the previous study is that smaller lot sizes reflect lower water use due to reduced area for landscaping and fewer bathrooms. Given that homes on small lots can have high occupancy rates which would increase water use, and homes on large lots may not have irrigated landscapes, this assumption may be incorrect. While there was much discussion on how to accurately reflect water use in homes, obtaining data on a home's square footage, occupancy rate and degree of irrigated landscaping for all housing subdivisions proved to be untenable for the current study. Some of these issues could be addressed in more detailed research study in future.

In the previous study, water use data from housing subdivisions constructed across a range of different dates were included to reflect water use efficiency variation. In the current study, at least one new recently-constructed modern housing subdivision was included in each lot size category to reflect any efficiency improvements from modern appliances and fixtures.

Methodology for Commercial Categories

The current study attempts to include all the previously used commercial sites; however there was some turnover of local businesses. Where an old site was not able to be included, a replacement of a similar type of business was included. The current study also included a number of new types of commercial businesses to reflect categories of development that are increasing in the City of Santa Fe.

Commercial categories include the following:

- Restaurants – Full and Limited Service
- Hotels – Full and Limited Service
- Grocery Stores
- Large Retail
- Neighborhood Center (Mixed commercial)
- Small Retail
- Galleries
- Office – Medical and Other
- Labs / R&D
- Manufacturers – of comestibles and non-comestibles
- Gas stations with and without carwash
- Carwashes
- Laundromats – Commercial and other*
- Dryclean & Laundry Service*
- Plant Nurseries*
- Gyms with and without locker rooms*
- Beauty Salons*
- Pet Grooming and Boarding*
- Pet Daycare*
- Auto Repair Shops*
- Car Rental*
- Car Sales*
- Storage Facilities*

* Categories represent new additions to the study

Some of the general categories listed above were further broken down in order to reflect different uses of water among the larger category. For example, in the general restaurant category, full service restaurants with dishwashing facilities were analyzed separately from limited services restaurants which ostensibly reflect much lower water use. In order to compare annual water use among businesses within the same category, total annual water use for some business was normalized with a factor that affects water use for that type of businesses, such as square footage, maximum seating capacity, number of rooms, etc. For example, annual total water use for each grocery store included in the current study was divided by the square footage (rounded to the nearest thousand square feet) of the commercial space.

Some commercial categories were not included either because they are integral with a larger business service (e.g. spas attached to hotels) or because water consumption is measured through a master meter applying to several businesses in one building complex. Both of these situations make it difficult to link water consumption with a certain business or with one particular element of that business.

Methodology for Community Use Category

This category includes sites such as public parks, schools, and places of worship. In the 2008 study, additional sites were added and were normalized using appropriate factors including acreage, number of students, etc. While an attempt was made to collect accurate information on student numbers attending schools included in the study, in some cases school administrative staff only provided estimates of student enrollment. In both the 1998 and the 2007/2008 study, park data for Salvador Perez did not include water used for gymnasiums and swimming pools.

RESULTS

Residential Use

This next section describes the results that were obtained for analysis of residential categories. Over the past ten years, the City of Santa Fe instituted emergency and non-emergency water conservation measures with the intent to reduce *per capita* water use. The primary, non-emergency water conservation measure with potentially the greatest effect on residential users required all new demand on the water utility to be offset by replacing high flow toilets with 1.6 gallon or less flush toilets. Other measures in the City of Santa Fe Water Conservation Plan, 2005 that particularly affected residential categories included:

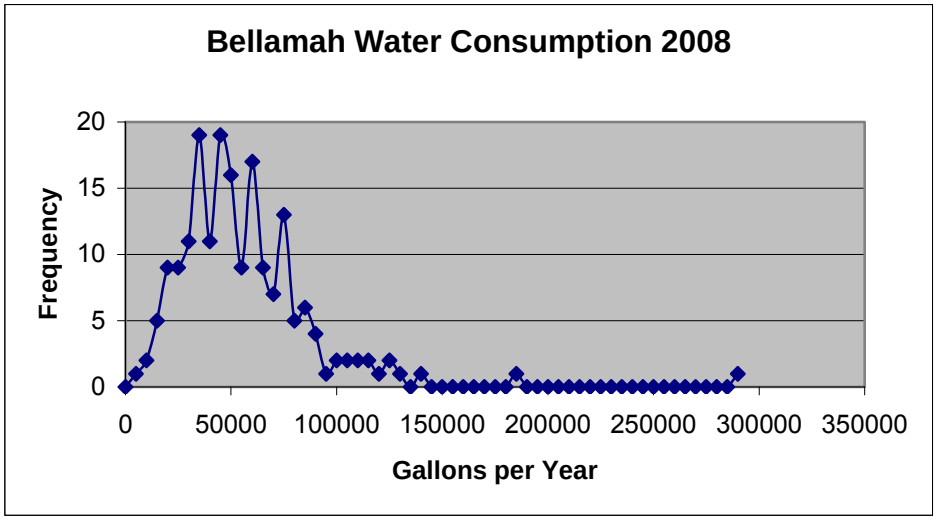
- Water Wise Santa Fe Replacement Toilet Program (gave away 5,508 residential toilets)
- rates and surcharges;
- distribution of water efficient fixtures;
- recommendations for low water use landscaping;
- use of efficient irrigation;
- rain barrel rebate program;
- hot water circulation system rebate program;
- high-efficiency washing machine rebate program; and the
- required use of treated effluent for residential construction purposes (dust control, backfill compaction, etc).

These measures, among other factors, contributed to the general reduction in water use across residential categories, discussed in further detail below.

1. Single Family Homes (on subdivided lots)

This residential land use sub-category includes attached and detached single family homes on subdivided lots of three sizes: < 6000 sq ft, 6000-10,890 sq ft, and >10,890 sq ft (10,890 sq ft equals 0.25 acres). The study included 767 homes for 1998, 977 homes for 2007 and 1050 homes for 2008. In some newly constructed housing subdivisions, since homes were not occupied in 2007, water use data is first available in 2008.

The distribution curves of residential consumption data were mapped, both for the sample of the subdivision as a whole and by individual streets, in order to verify that the streets had relatively normal curves. Below is a typical result of that exercise which shows a graph for the whole sample of Bellamah. The curve has a fairly normal distribution, but a longer tail on the high-use side. The data indicate that the top 13 users (those who use over 100,000 gallons per year) use an average of 134,308 gallons per year, or nearly 3 times more than the remaining 175 users who use an average of 47,298 gallons per year.



Housing Subdivisions *		1998		2007		2008	
	# Homes in Subdivision	# Homes	Use/Home (ac ft)	# Homes	Use/Home (ac ft)	# Homes	Use/Home (ac ft)
Small (< 6,000 sq ft)							
Bellamah (60-70s)	873	178	0.24	182	0.17	179	0.16
Nava Ade (90s)	196	20	0.20	56	0.12	57	0.12
Tierra Contenta (90s)	596	150	0.20	159	0.16	164	0.16
Colores del Sol (Phase I)**	35	n/a	n/a	n/a	n/a	31	0.14
El Nido	98	n/a	n/a	9	0.10	23	0.19
Average Use Small Lot			**0.21**		**0.14**		**0.15**
2007/2008 Average				**0.15**			
Medium (6,000-10,890 sq ft)							
Las Acequias (80-90s)	420	113	0.23	123	0.18	126	0.18
Via Caballero (80s)	380	124	0.25	126	0.20	126	0.19
Vista Primera (80-90s)	280	65	0.26	69	0.20	67	0.20
Aldea (Phase 2B)	52	n/a	n/a	29	0.13	45	0.11
Ridge Pointe	39	n/a	n/a	34	0.20	33	0.17
The Hills SF Estates	19	n/a	n/a	21	0.18	26	0.16
Average Use Medium Lot			**0.25**		**0.18**		**0.17**
2007/2008 Average				**0.17**			
Large (> 10,890 sq ft)							
Sol y Lomas (60-70s)	150	40	0.32	152	0.26	152	0.25
Northeast Santa Fe (varies)	500	77	0.32	n/a	n/a	n/a	n/a
Monte Sereno (Phase 3A)	32	n/a	n/a	6	0.27	10	0.32
The Hills at Las Estrellas (Phase II)	17	n/a	n/a	11	0.19	11	0.24
Average Use Large Lot			**0.32**		**0.24**		**0.27**
2007/2008 Average				**0.25**			
Average Across Lot Size* **			**0.26**		**0.18**		**0.20**
2007/2008 Average				**0.18**			

* though sometimes mixed in size, the majority of lots in these subdivisions fall into these categories

** rows in blue are new additions to survey

*** In the 1998 survey, the average per year across categories was calculated as 0.25. The new figure differs possibly due to the averaging method used for small lot use/home.

Similar to results from the 1998 study, this analysis indicates that in 2007/2008, homes on larger lots continue to use more water than those on smaller or medium lots, though the ostensible reasons for this, including more residents, more irrigated landscaping and more water-using appliances and fixtures are not yet verified. Annual water use across lot size fell by 31% between 1998-2007/2008. It is interesting to note that average annual water use in recently built subdivisions, which should be using more water efficient appliances, is not consistently lower than those built 10-50 years ago. This could be attributable to a difference in the types of water users; recent homeowners may be adding new landscaping while older homes may have established landscaping.

Actual reduction of residential water use over the past ten years can be attributed primarily to installation of low flush toilets and other more efficient fixtures, as well as residential water restrictions imposed by the City. Because this current study includes water use records which demonstrated some absenteeism from a significant number of homes, the decline in the annual average water use values reported in this study is further accentuated as compared to values reported in 1998. While there are insufficient data points to indicate a trend, it is important to note that use in the small and large lot categories are higher in 2008 than in 2007, rising 7% and 11% respectively.

2. Apartments / Condominiums

The study included 14 multi-family apartment and condominium complexes with approximately 2,445 dwelling units in 1998, and 16 multi-family apartments and condominium complexes with approximately 2,526 dwelling units in 2007/2008. These complexes have a combination of "master meters" that measure water consumption for the entire residential complex including outdoor irrigation, and individual meters that measure water consumption per dwelling unit. This combination of master and individual meters has changed over the past ten years, and not all master meter billing accounts have information on how many households they are serving. For those master meters which are assumed to be serving all the units that were documented in 1998, the current occupancy rate of the apartments is not known. Not all apartment complexes have extensive irrigated landscaping, contributing to highly variable water use.

Apartment Complexes	1998	2007/2008	1998		2007		2008	
	# Living Units	# Living Units	Use (ac ft)	Use/Unit (ac ft)	Use (ac ft)	Use/Unit (ac ft)	Use (ac ft)	Use/Unit (ac ft)
Coronado Condominiums	188	188	34.3	0.18	21.75	0.12	44.84	0.24
Dos Santos	176	176	40.0	0.23	14.37	0.08	15.32	0.09
Enclave	204	204	29.1	0.14	26.68	0.13	26.53	0.13
Paseo del Sol	80	80	20.0	0.25	21.19	0.26	22.23	0.28
Rancho Vizcaya	212	204	43.5	0.21	26.57	0.13	26.65	0.13
Rustic Ridge	96	96	14.7	0.15	16.69	0.17	18.57	0.19
San Mateo Aparments	160	154	45.4	0.28	18.34	0.12	17.59	0.11
San Raphael	285	285	63.2	0.22	26.75	0.09	21.83	0.08
Shadow Ridge	260	260	62.8	0.24	15.01	0.06	12.15	0.05
Talavera	296	296	56.7	0.19	64.00	0.22	55.43	0.19
Tierra de Zia	137	93	16.8	0.12	5.38	0.06	5.51	0.06
Villa Apartments	32	32	7.3	0.23	4.57	0.14	4.09	0.13
Villa Real	120	120	30.1	0.25	16.03	0.13	14.24	0.12
Vista Linda Apartments	n/a	109	n/a	n/a	25.89	0.24	23.30	0.21
Warren Inn	n/a	30	n/a	n/a	14.41	0.48	13.74	0.46
Zia Vista	199	199	38.0	0.19	19.12	0.10	15.59	0.08
Yearly Average				**0.21**		**0.16**		**0.16**
2007/2008 Average					**0.16**			

The average annual water use per living unit in 2007/2008 was 0.16 acre feet/yr, a drop of 23% from 1998 levels. Some of the declines for individual apartment complexes, such as Shadow Ridge, are quite dramatic. As with single family dwellings mentioned above, some of this drop could be accounted for by the inclusion of records with reads of zero water consumption for several months out of the year. Lower occupancy rates may also play a key role in the decline. In addition, some of the apartments show irrigation meters that have been inactive during 2007/2008. A number of apartment complexes have converted from grass to xeric landscaping.

3. Mobile Homes

The study included four mobile home parks connected to the city's water system. All four have individually metered homes, though some also have master meters.

Mobile Homes	1998		2007		2008	
	# Living Units	Use/Unit (ac ft)	# Living Units	Use/Unit (ac ft)	# Living Units	Use/Unit (ac ft)
Cottonwood Village	246	0.2	158	0.17	143	0.18
Rancho Zia	97	0.19	95	0.17	96	0.16
Atocha	92	0.17	79	0.16	85	0.15
Sierra Vista	185	0.22	151	0.19	159	0.19
Yearly Average		**0.20**		**0.17**		**0.17**
2007/2008 Average			**0.17**			

In 2007/2008, the annual water use per living unit was 0.17 acre feet/yr, a drop of 15% from the 1998 level of 0.20 acre feet/yr. As with the apartments, some of this drop could be accounted for by the inclusion of individual records with no water consumption for several months out of the year.

4. Guest Houses

Guest houses were not separately surveyed in either the 1998 or the 2008 study. In the 1998 report, it was assumed that the water use in a guest house is generally half of that

consumed by the main single-family residence. Based on this assumption, in 1998, average annual consumption would come out to 0.12 acre feet per guest house, annually, whereas in 2007/2008 it would come to 0.09 acre feet per guest house.

5. Senior Residential Complexes

Three senior residential complexes or retirement facilities with a total of 388 living units were surveyed for annual water consumption figures. All three complexes contain full-service dining facilities and on-site laundry facilities. One of the complexes has a swimming pool and a small health center. Water use for all for all of the complexes is measured by master-meters.

Retirement Homes	# Living Units	1998 Use/Unit (ac ft)	2007 Use/Unit (ac ft)	2008 Use/Unit (ac ft)
El Castillo	150	0.11	0.13	0.14
Kingston	94	0.15	0.12	0.11
Ponce de Leon	144	0.15	0.09	0.11
Yearly Average		**0.14**	**0.11**	**0.12**
2007/2008 Average			**0.12**	

Average annual water use per unit in senior residential complexes dropped 14% from 1998 to 2007/2008.

Commercial Use

This section outlines the analysis of water use by commercial categories. The City's comprehensive and evolving water conservation programs targeting the commercial sector included the following programs;

- Water Wise Santa Fe Replacement Toilet Program (gave away 2,559 commercial toilets);
- mandatory commercial toilet replacement ordinance;
- serving of water upon request only in restaurants;
- posting of advertisements encouraging water wise practices in local businesses;
- low use commercial dishwasher rebate program;
- replacement of hotel towels and sheets only upon request;
- commercial rate surcharges;
- notification of high or irregularly high water use;
- voluntary business water audits;
- low water use landscaping recommendations;
- use of efficient irrigation;
- commercial landscape irrigation audits;
- education (brochures, posters, classes, surveys, booths, public meetings, advertisement); and the
- required use of treated effluent for construction purposes (dust control, backfill compaction, etc).

These programs as well as the recent economic downturn may have contributed to the declines in water use outlined below. The economic downturn would have particularly impacted hotels, restaurants and other sites affected by tourism.

The categories of commercial sites were expanded in the 2007/2008 study to reflect the greater variation of commercial applications of water. Particularly for categories that do not have large sample sizes, these averages should be taken only as a guide for water use budgeting purposes. The specific characteristics of businesses included in the sample may be a more accurate estimate of annual water use. For example, in estimating the water a new art gallery might use, one could determine how similar the gallery would be to either Andrew Smith Gallery, an existing gallery that is small and has no landscaping, or to the Gerald Peters Gallery that is much larger and has extensive landscaping.

1. Restaurants

This category is separated into two types of food service providers: full service and limited service (fast food type) restaurants. Water use values are calculated for each restaurant site, and then for 2007/2008 the data is normalized for maximum seating occupancy as determined by the City's Fire Marshal. There has been a fair amount of turnover in Santa Fe's restaurants, resulting in some substitutions and a more limited sample size for 2007/2008.

Restaurant, full service

This type of restaurant includes at-table service and involves considerable dishwashing in its daily operations.

Full Service Restaurants		1998		2007		2008	
	Max seating capacity	Use (ac ft)	Use/Seat	Use (ac ft)	Use/Seat	Use (ac ft)	Use/Seat
Village Inn Pancake House	196	10.70	0.05	3.88	0.02	3.48	0.02
Blue Corn Café	350	4.40	0.01	4.47	0.01	4.87	0.01
Plaza Café	94	6.00	0.06	3.24	0.03	3.51	0.04
Il Vicino	102	n/a	n/a	1.63	0.02	2.22	0.02
Austin's Steakhouse	n/a	4.50	n/a	n/a	n/a	n/a	n/a
Carrow's	n/a	4.00	n/a	n/a	n/a	n/a	n/a
Peppers Cantina	n/a	5.70	n/a	n/a	n/a	n/a	n/a
Yearly Average			**0.04**		**0.02**		**0.02**
2007/2008 Average				**0.02**			

Based on the seven full service restaurants surveyed, average annual water use per seat in 2007/2008 was down 50% from 1998 levels. It is interesting to note that use levels in 2008 are slightly higher than in 2007 for three of the four restaurants included in the study.

Restaurants, limited service

This type of restaurant includes counter service and generally represents “fast food” chains. In the 1998 study water use figures for each location of a fast food company were divided the total water use for each company divided by the number of locations. In the current study, the water use of each location is listed separately. Because we were unable to get data on seating capacity, average annual water use is by site only.

Limited Service Restaurants	1998		2007		2008	
	Use (ac ft)	Use/Site	Use (ac ft)	Use/Site	Use (ac ft)	Use/Site
Felipe's Tacos	n/a		1.29	1.29	1.92	1.92
McDonald's (St Francis)			1.57		1.92	
McDonald's (Calle Lucia)			1.44		2.03	
McDonald's (Pacheco St)			1.78		1.77	
McDonald's*	11.4	2.9	n/a	1.60	n/a	1.91
Burger King (Llano St)			1.65		2.00	
Burger King (St Francis Dr)			2.72		1.98	
Burger King*	9.1	3.0	n/a	2.18	n/a	1.99
Blake's Lotaburger (Airport Rd)			1.06		1.22	
Blake's (Cerrillos Rd)			1.90		1.68	
Blake's (Guadalupe St)			0.43		0.38	
Blake's (St. Michael's Dr)			0.93		1.11	
Blake's (Zia Rd)	9.3	1.9	2.59	1.38	2.40	1.36
Yearly Average		**2.6**		**1.58**		**1.67**
2007/2008 Average			**1.63**			

*unsure of location used in first survey

Average annual water use per site fell 37% from 1998 levels. Use levels in 2008 are slightly higher than in 2007 primarily brought up by an increase in MacDonald’s use.

2. Hotels

This category is separated into two types of accommodation; hotels with full service and motels with limited service. Average annual water use is listed and then compared on a per room basis. Additional sites were added for the 2008 study.

Hotels, full service
These hotels contain multiple uses for water aside from rooms, including swimming pools, saunas, restaurants, and cocktail bars.

Hotels		1998		2007		2008	
	# rooms	Use (ac ft)	Use/Room	Use (ac ft)	Use/Room	Use (ac ft)	Use/Room
El Dorado	219	89.10	0.41	36.18	0.17	32.85	0.15
Hilton Hotel	157	31.50	0.20	20.18	0.13	19.82	0.13
La Fonda Hotel	153	49.90	0.33	35.14	0.23	38.56	0.25
Hotel Santa Fe*	163	n/a	n/a	4.74	0.03	4.95	0.03
Inn of the Anasazi	58	n/a	n/a	15.09	0.26	13.65	0.24
Holiday Inn	130	n/a	n/a	10.29	0.08	10.76	0.08
Hotel Plaza Real	100	n/a	n/a	5.34	0.05	5.48	0.05
Average			**0.31**		**0.13**		**0.13**
2007/2008 Average				**0.13**			

* rows in blue are new additions to survey

Annual average water use per room in 2007/2008 was 0.13 acre feet/room, a drop of 58% from 1998 levels. Use levels in 2008 are slightly higher than in 2007 for four out of seven hotels included in the study. Reasons for the overall dramatic drop in water use warrant further investigation. Potential causes may have to do with changes in laundering services, changes in occupancy rates, and/or installation of low flow toilets and other appliances.

Motels, limited service
Originally termed "motorist hotels", these may have some amenities such as swimming pools, but generally offer much more limited service.

Motels		1998		2007		2008	
	# rooms	Use (ac ft)	Use/Room	Use (ac ft)	Use/Room	Use (ac ft)	Use/Room
Comfort Inn	84	13.2	0.16	9.30	0.11	8.77	0.10
Motel 6	121	20	0.17	5.54	0.05	4.80	0.04
Holiday Inn Express	79	13.1	0.17	7.19	0.09	6.95	0.09
Super 8	96	11.7	0.12	6.84	0.07	6.45	0.07
Best Western	97	12.3	0.13	9.50	0.10	8.38	0.09
Econo Lodge	76	n/a	n/a	9.93	0.13	7.25	0.10
Average			**0.15**		**0.09**		**0.08**
2007/2008 Average				**0.09**			

* rows in blue are new additions to survey

Annual water use per room for motels in 2007/2008 fell 40% from 1998 levels, while water use between 2007 and 2008 remained relatively unchanged.

3. Retail Stores

A variety of retail locations were surveyed for annual water use. For grocery stores, large retail stores and neighborhood centers, water use is stated in terms of use per 10,000 square feet of gross floor area within the store, allowing comparisons of water use by stores of varying size. For small retail stores and galleries, water use is stated in terms of annual use only; most of these businesses are relatively small and water use is for restrooms only.

Grocery Stores

In the 1998 study, a total of four grocery stores were surveyed. For 2008, one Albertson's location (La Entrada) and Furr's were replaced with two alternate Albertson's locations (Guadalupe and St. Francis) and Whole Foods.

Grocery		1998		2007		2008	
	sq ft	Use (ac ft)	Use/10,000 Sq Ft	Use (ac ft)	Use/10,000 Sq Ft	Use (ac ft)	Use/10,000 Sq Ft
Albertson's (Zafrano)	50,000	5.30	1.10	4.33	0.87	3.88	0.78
Albertsons's (La Entrada)	53,000	4.60	0.90	n/a	n/a	n/a	n/a
Furr's (Plaza del Sol)	55,000	2.90	0.50	n/a	n/a	n/a	n/a
Wild Oats	20,000	6.40	3.20	5.18	2.59	3.40	1.70
Albertson's (Guadalupe)	63,000	n/a	n/a	5.95	0.94	5.01	0.80
Albertson's (St. Francis)	48,000	n/a	n/a	3.69	0.77	4.90	1.02
Smiths (Cerrillos)	55,000	n/a	n/a	2.00	0.36	2.10	0.38
Whole Foods	44,000	n/a	n/a	11.14	2.53	10.90	2.48
Average			**1.10**		**1.34**		**1.19**
2007/2008 Average					**1.27**		

* rows in blue are new additions to survey

Average annual water use per10,000 square feet was 13% higher in 2007/2008 than in 1998. Part of the increase in water use could be attributable to the new stores that were included in the sample – Whole Foods, in particular, has high water use (possibly due to more food preparation) and a relatively low square footage, which raised this category's average.

Large Retail

In the 1998 study, a total of four large retail stores were surveyed.

Large Retail		1998		2007		2008	
	sq ft	Use (ac ft)	Use/10,000 Sq Ft	Use (ac ft)	Use/10,000 Sq Ft	Use (ac ft)	Use/10,000 Sq Ft
K-Mart	92,000	3.60	0.40	1.54	0.17	1.38	0.15
Premium Outlets	125,000	8.60	0.70	3.95	0.32	2.71	0.22
Villa Linda Mall	565,000	29.00	0.50	30.85	0.55	23.02	0.41
Wal-Mart	142,000	11.20	0.80	18.71	1.32	8.23	0.58
Home Depot	150,000	n/a	n/a	4.67	0.31	5.09	0.34
Lowe's	122,000	n/a	n/a	6.87	0.56	6.05	0.50
Average			**0.60**		**0.54**		**0.36**
2007/2008 Average					**0.45**		

Average annual water use per10,000 square feet fell 25% in 2007/2008. The large decrease in 2007/2008 levels can be attributed in part to a sizable drop in water use by Walmart. Drops in the average annual water use in places such as Premium Outlets and

Villa Linda Mall could also reflect a decline in the number of businesses included, or the impacts of the weaker economy, particularly in 2008.

Neighborhood Center

In 1998, Rodeo Plaza and the Agora in El Dorado were surveyed as prototype neighborhood centers envisioned for the future by the city general plan in terms of size and mix of commercial uses. The centers include restaurants, small grocery stores and other retail and office tenants. In the 2008 study, the Agora center was replaced with Pacheco Park.

Neighborhood Center		1998		2007		2008	
	sq ft	Use (ac ft)	Use/10,000 Sq Ft	Use (ac ft)	Use/10,000 Sq Ft	Use (ac ft)	Use/10,000 Sq Ft
Rodeo Plaza	58,000	8.3	1.7	3.30	0.57	3.90	0.67
Pacheco Park	28,000	n/a	n/a	0.70	0.25	0.68	0.24
Agora (Ave. Vista Grande, El Dorado)	32,000	3.9	1.2	n/a	n/a	n/a	n/a
Average			**1.45**		**0.41**		**0.46**
2007/2008 Average				**0.43**			

Average annual water use per 10,000 square feet appears to have dropped dramatically by 70% from 1998 levels. These results should be interpreted with caution given the small sample size. The drop in water use could potentially have to do with the mix of businesses located in the centers, a change in the number of businesses surveyed, or it could be attributed to the unintentional omission of certain types of readings such as those for landscape irrigation. For example, in the 2007/2008 study, the Rodeo Plaza figure derives from the billing records for 10 businesses; several additional meters known to be located there are currently out of service, including a supermarket which closed in 2007.

Small Retail

This is a new category of commercial site that was added for the 2008 study. Most of these are small businesses whose main form of water use would be for staff restrooms and potentially some landscape irrigation.

Small Retail	2007 Use (ac ft)	2008 Use (ac ft)
Maya Clothing	0.05	0.06
Cato's	0.04	0.02
Santa Fe Goldworks	0.06	0.07
The Chile Shop	0.06	0.06
Tin-Nee-Ann	0.12	0.07
Average	**0.07**	**0.06**
2007/2008 Average	**0.06**	

Average annual water use for small retail shops came to 0.06 acre feet for 2007/2008. For future water budgeting purposes, it would be advisable to match the type of proposed business with a similar one included in the study.

Galleries

This category was added in 2008, in recognition of the large role that tourism and art sales contribute to the Santa Fe economy. Water use in this category consists primarily

of bathroom use and landscape irrigation. This category was broken down into galleries with extensive landscaping, and those with minimal landscaping.

Galleries w/ landscaping	2007 Use (ac ft)	2008 Use (ac ft)
Gerald Peters Gallery	**1.58**	**1.87**
2007/2008 Average	**1.72**	

Galleries w/out landscaping	2007 Use (ac ft)	2008 Use (ac ft)
Chiaroscuro Contemporary Art	0.08	0.03
Andrew Smith Gallery	0.02	0.02
Average	**0.05**	**0.02**
2007/2008 Average	**0.04**	

The average annual water use for galleries with landscaping is 1.72 acre feet. For galleries without landscaping, average annual water use is much lower at 0.04 acre feet. In considering water budgets for new galleries, it again is advisable to match the characteristics of the proposed business to a similar gallery included in the study.

4. Office / Research

In the 1998 study, this category was broken down between medical and non-medical (primarily government). This categorization has been rearranged and expanded to include three types of categories; medical/dental offices, non-medical offices, and R&D labs.

Medical/Dental Offices
This category includes four medical and dental offices.

Medical Office		1998		2007		2008	
	sq ft	Use (ac ft)	Use/10,000 Sq Ft	Use (ac ft)	Use/10,000 Sq Ft	Use (ac ft)	Use/10,000 Sq Ft
Neurological Associates	1,800	n/a	n/a	0.04	0.23	0.04	0.23
New Mexico Cancer Care Assoc.	38,500	n/a	n/a	3.70	0.96	2.66	0.69
Santa Fe Pediatric Associates	5,100	n/a	n/a	0.20	0.39	0.19	0.38
Santa Fe Dental Arts	1,100	n/a	n/a	0.13	1.18	0.19	1.73
Calle Medico (4 buildings)	30,000	4.1	1.4	n/a	n/a	n/a	n/a
Average					**0.69**		**0.76**
2007/2008 Average				**0.72**			

Average annual water use per 10,000 square feet for dental offices was at 0.72 acre feet.

Office, Other
In 1998, this category was focused mostly on government offices and was divided up between those with non-native landscaping and those with limited landscaping. For the 2008 study, this category was expanded to cover government and non-government offices, while no distinction was made between landscaped and non-landscaped offices.

City/State Offices	sq ft	1998 use/10,000 sq ft	2007 use/10,000 sq ft	2008 use/10,000 sq ft
City Hall	43,000	1.00	0.78	0.85
Joseph Montoya Bldg.	133,000	1.00	0.43	0.52
Manuel Lujan Bldg.	76,000	1.00	0.54	0.54
San Mateo Plaza	30,000	0.30	0.12	0.12
Water Division Building	11,800	n/a	0.99	0.94
Average		**0.83**	**0.57**	**0.59**
2007/2008 Average			**0.58**	

Average annual water use per 10,000 square feet fell by 30% in 2007/2008.

Non-medical Office		2007		2008	
	sq ft	Use (ac ft)	Use/10,000 Sq Ft	Use (ac ft)	Use/10,000 Sq Ft
Aspen Plaza	24,000	0.39	0.16	0.33	0.14
First Community Bank	2,100	0.07	0.33	0.06	0.30
Santa Fe Reporter, Main Office	8,700	0.12	0.14	0.11	0.13
Denman and Associates	1,800	0.16	0.91	0.22	1.23
Barraclough and Associates, PC	5,000	0.80	1.59	1.01	2.03
Average			**0.63**		**0.76**
Yearly Average 2007/2008		**0.70**			

The annual average water use per 10,000 square feet for non-medical offices was 0.7 acre feet for 2007/2008.

Research and Development Laboratories

This category includes medical research laboratories. In 1998, both Genzyme and Calle Medico were surveyed. In 2008, only data for Genzyme was available.

Labs/ R&D		1998		2007		2008	
	sq ft	Use (ac ft)	Use/10,000 Sq Ft	Use (ac ft)	Use/10,000 Sq Ft	Use (ac ft)	Use/10,000 Sq Ft
Genzyme Genetics	55,000	9.0	1.6	6.77	1.23	6.23	1.13
				1.18			

Average annual water use per 10,000 square feet at the Genzyme facility decreased by 26% from 1998 levels. Given that only one business for this particular category was included in the current study, further research is required to obtain a more accurate estimate for average water use by R&D labs in Santa Fe.

5. Manufacturing

In the 1998 study, 0.4 ac/yr was reported as the average water use for warehouses, and no average was given for manufacturing. In 2008, the manufacturing category was expanded and separated into two categories – manufacturing of goods and manufacturing of consumables.

Manufacturing Goods	2007 Use (ac ft)	2008 Use (ac ft)
Clean Air Systems (4379 Center)	0.13	0.15
Clean Air Systems (4363 Center)	0.08	0.07
Nambe Mills (Alameda)	0.08	0.08
Nambe Mills (Cooks Rd)	0.26	0.24
ABC Supply Company	0.57	0.47
Average	**0.22**	**0.20**
	0.21	

Manunfacturing Consumables	2007 Use (ac ft)	2008 Use (ac ft)
Water Boyz (warehouse only)	1.80	1.84
Coca-Cola Bottling Co.	3.22	2.45
Average	**2.51**	**2.15**
	2.33	

Based on the results above, the manufacturing of goods generally requires a great deal less water than the manufacturing of consumables. Average annual use for manufacturing goods was 0.21 acre feet, while average annual use for manufacturing consumables was 2.33 acre feet.

6. Gas Stations and Carwashes

Gas Stations without Carwashes
This type of gasoline station contains only standard limited food and beverage and reflects a "gas-mart" without car wash facilities.

Gas Station	1998 Use (ac ft)	2007 Use (ac ft)	2008 Use (ac ft)
Giant Service Station (St Michael's Dr)	0.3	0.43	1.30
Giant Service Station (St Francis)	n/a	2.45	2.53
Giant Service Station (Sawmill Rd)	n/a	1.62	2.03
Giant (Cerrillos Rd)	0.6	0.37	0.37
Chevron	0.4	0.16	0.19
Allsup's (Cerrillos)	0.8	0.50	0.56
Allsup's (Calle Lorca)	n/a	1.03	0.45
Allsup's (Agua Fria)	n/a	0.68	0.72
Allsup's (St Michaels)	n/a	0.25	0.31
Texaco Amigo-Mart	0.5	n/a	n/a
Average	**0.5**	**0.83**	**0.94**
2007/2008 Average		**0.88**	

Average use by gas stations has increased from 1998 levels by 43%. Use went up in 7 out of 9 stations for which data was available for all three years. The data for this category of use exhibits relatively high variability.

Gas Stations with Carwashes
This type of gasoline station not only contains limited food and drink, but also has an automated conveyor car wash facility on site.

Gas station/Carwash	# washbays	1998 Use (ac ft)	2007 Use (ac ft)	2008 Use (ac ft)
Brewer's Shell Station	1 tunnel	12.5	5.95	7.02
Quick Stop (Conoco) - (Sawmill)	1 tunnel	5.7	11.49	7.67
Quick Stop - Conoco (St. Francis)	1 tunnel	5.3	3.66	3.58
Average		**7.83**	**7.03**	**6.09**
2007/2008 Average			**6.56**	

Water use in gas stations with carwashes has actually decreased by 16% over the past ten years. The average is affected by the dramatic changes in water use for the Brewer's Shell Station and the Quick Stop on Sawmill Rd. – causes of this variability require further investigation.

The above tables suggest that there is a significant difference in water use between gasoline stations sites with and without car wash facilities. Adding an automated conveyer car wash to a gasoline site accounted for an additional 6 acre feet/yr, or 87% more water use, in 2007/2008.

Carwashes, full and limited service

In addition to carwashes linked with gas stations, this report also surveyed businesses that were primarily car washes. These fell into two categories – full, service automated car washes and self service, manual car washes. Full service car washes have automated conveyors and usually include on-site personnel to help wash and dry cars. Limited service car washes include wash bays with manual sprayer guns used by customers.

Carwash, Full Service	# washbays	1998 Use (ac ft)	2007 Use (ac ft)	2008 Use (ac ft)
Squeaky Clean (1900 Cerrillos)	1 tunnel	5.3	6.69	5.16
Squeaky Clean (3931 Cerrillos)	1 tunnel	8.7	6.69	6.22
Santa Fe Car Wash	7 + 1 tunnel	8.6	5.09	4.13
Average		**7.5**	**6.15**	**5.17**
2007/2008 Average			**5.66**	

Average annual water use by full-service carwashes has decreased 25% from 1998 levels. All three carwashes sampled practice some water recycling, which lowers average annual water use at each facility. Santa Fe carwash has the lowest use, potentially reflecting the combined use of self-service and automated facilities.

Carwash, Limited Service		1998		2007		2008	
	# washbays	Use (ac ft)	Use/Bay	Use (ac ft)	Use/Bay	Use (ac ft)	Use/Bay
Quick Stop (Rodeo Rd)	4	4	1	5.42	1.36	5.49	1.37
Cordova Power Wash	7	3	0.4	3.81	0.54	3.51	0.50
Average			**0.7**		**0.95**		**0.94**
2007/2008 Average				**0.94**			

Average annual water use by limited-service carwashes increased 26% from 1998 levels. At 4.56 acre feet, average water use for limited-service carwashes was about 19% lower than average water use for full service carwashes. Quik Stop does not practice any water recycling while Cordova Power Wash recycles up to 5% of their water.

7. Additional Commercial Sites

The remaining sites represent new categories of businesses deemed to be important both in terms of current water use and in terms of future commercial growth in Santa Fe.

Laundromats and Drycleaners

The laundromat category is divided between commercial laundromats and an "other" category, which includes the various permutations such as coin-op laundromats only, and coin-op plus limited washing services etc.

Commercial Laundromat		2007		2008	
	# washing machines	Use (ac ft)	Use/Machine	Use (ac ft)	Use/Machine
Luna Laundry	**6**	**6.08**	**1.01**	**3.25**	**0.54**
2007/2008 Average		**0.78**			

Laundromat - other		2007		2008	
	# washing machines	2007 Use (ac ft)	2007 Use/Machine	2008 Use (ac ft)	2008 Use/Machine
St. Michael's Laundry and Cleaners	49	9.71	0.20	9.62	0.20
Solana Laundromat	37	9.08	0.25	8.52	0.23
La Princesa Laundromat	30	7.07	0.24	5.98	0.20
Average		**8.62**	**0.23**	**8.04**	**0.21**
2007/2008 Average		**0.22**			

Only Luna Laundry is a purely commercial facility and average water use for 2007/2008 was 0.78 acre feet per machine. In October of 2007, Luna began a water recycling program that cut their water use almost in half – this dramatic reduction in water use is obscured by the use of the 2007/2008 average. Water use in other laundromats has stayed relatively consistent at 0.22 acre feet/machine per year.

In addition to using steam to press clothing, dry cleaners also frequently have some washing machines on their premises, contributing to higher water use.

Dry Cleaners	2007 Use (ac ft)	2008 Use (ac ft)
Martinizing GreenEarth Cleaning (Guad)	0.03	0.03
Martinizing (Old Pecos Trail)	0.16	0.06
Martinizing (Rodeo Rd)	0.51	0.92
La Unica Dry Cleaners	0.70	0.70
Aspen Dry Cleaners	0.62	0.55
Average	**0.40**	**0.45**
2007/2008 Average	**0.41**	

Average annual water use by drycleaners in 2007/2008 was 0.41 acre feet.

Nurseries

Nurseries		2007		2008	
	sq ft	Use (ac ft)	Use/S10,000 Sq Ft	Use (ac ft)	Use/10,000 Sq Ft
Agua Fria Nursery	40,000	4.03	1.01	2.84	0.71
Payne's Nurseries (St Michaels)	47,000	2.45	0.52	2.47	0.52
Payne's (Camino Alire)	111,000	3.66	0.33	3.65	0.33
Santa Fe Greenhouses Inc	209,000	10.80	0.52	11.31	0.54
Average			**0.59**		**0.53**
2007/2008 Average		**0.56**			

Average annual water use per 10,000 square feet was 0.56 acre feet.

Gyms

This category was divided between gyms with and without showers. Those with showers were expected to have much higher water use.

Gyms w/ showers	2007 Use (ac ft)	2008 Use (ac ft)
Santa Fe Spa	**10.67**	**7.21**
2007/2008 Average	**8.94**	

Gyms w/out showers	2007 Use (ac ft)	2008 Use (ac ft)
Tai Chi Chuan Institute	0.03	0.03
Pilates Santa Fe	1.62	1.39
Average	**0.83**	**0.71**
2007/2008 Average	**0.77**	

Only one site was found for gyms with showers. Annual average water use at this site was high at 8.94 acre feet. High water use has consistently been documented for this particular site, and given the limited sample size, this average should not be generalized to all gyms with showers. For gyms without showers, average annual water use was much lower at 0.77 acre feet.

Salons

This category includes hair salons with very basic beauty services. This category does not represent spas with massage treatments, etc., or salons with more extensive beauty services.

Salons	2007 Use (ac ft)	2008 Use (ac ft)
Wavelengths Hair and Nail Salon	0.24	0.27
Antonio's Hair Studio	n/a	0.30
Supercuts	0.16	0.17
Average	**0.20**	**0.25**
2007/2008 Average	**0.21**	

Average annual water use for salons in 2007/2008 was 0.21 acre feet.

Pet Grooming/Boarding and Daycare
This category is broken down in to the categories of grooming/boarding and daycare. Daycare should hypothetically demonstrate much less water use than other activities.

Pet Grooming and Boarding	2007 Use (ac ft)	2008 Use (ac ft)
Pet Suites and Critter Sitters	0.47	0.53
Z Pet Hotel	0.52	0.54
Average	**0.49**	**0.54**
2007/2008 Average	**0.52**	

Pet Daycare	2007 Use (ac ft)	2008 Use (ac ft)
Lucky Dawg Daycare	**0.12**	**0.10**
2007/2008 Average	**0.11**	

Average annual water use for pet grooming was 0.52 acre feet, or 79% higher than that for pet daycare at 0.11 acre feet. The limited sample size for pet daycare suggests that further research needs to be done to come up with a more accurate estimate for annual average water use.

Auto Services
This category includes auto repair, auto rental and auto sales. The majority of water used by these businesses would be relatively low compared to other business categories; mainly for restrooms in offices and for washing cars. The water use information for car sales is normalized over lot size.

Auto Repair	2007 Use (ac ft)	2008 Use (ac ft)
Pep Boys	0.16	0.23
Midas Auto Service Experts	0.07	0.07
Tech-net Professional Autoservice	0.03	0.03
Foreign Auto Service Technicians	0.20	0.14
Average	**0.11**	**0.12**
2007/2008 Average	**0.12**	

Average annual water use by Auto Repair businesses was 0.12 acre feet.

Car Rental	2007 Use (ac ft)	2008 Use (ac ft)
Enterprise Rent-A-Car	0.11	0.09
Budget Truck Rental	0.13	0.16
Average	**0.12**	**0.12**
2007/2008 Average	**0.12**	

Average annual water use by Car Rental businesses was also 0.12 acre feet.

Car Sales		2007		2008	
	lot size - sq ft	Use (ac ft)	Use/10,000 Sq Ft	Use (ac ft)	Use/10,000 Sq Ft
Don Macrey Nissan	107,000	0.25	0.02	0.27	0.03
Volkswagen Premier Cars	177,000	2.76	0.16	2.46	0.14
Buick-Pontiac GMC	95,000	0.09	0.01	n/a	n/a
Average			**0.06**		**0.08**
2007/2008 Average		**0.07**			

Average annual water use per 10,000 square feet was 0.07 for 2007/2008.

Self-Storage Facilities

Water use in self-storage facilities would also be expected to be low, given that most water use would be for bathrooms and/or landscape irrigation.

Self-Storage	2007 Use (ac ft)	2008 Use (ac ft)
A-1 Self-Storage (Clark Rd)	0.04	0.04
A-1(Rodeo Rd)	0.22	0.21
A-1 (Pinon St)	0.09	0.08
Extra Space Storage (San Mateo)	0.13	0.28
Adobe Self Storage	0.10	0.16
Average	**0.12**	**0.15**
2007/2008 Average	**0.13**	

Average annual water use for self-storage facilities was 0.13 acre feet.

Community Use

This section discusses the decline in average annual water seen across community categories. One of the most significant conservation programs in the community sector over the past ten years was the establishment of a maximum budget for turf, or grass-covered areas, in parks; park turf will not exceed amounts existing in 2001. The areas converted from turf to artificial turf or other xeric ground covers go into a bank so that additional turf can be planted elsewhere.

In addition, the parks sector is involved with coming up with a budget for water required per acre of turf, as other conservation programs particularly targeting the community sector included the following programs;

- replacement of irrigation equipment with more efficient technology
- replacement of grass playing fields with artificial turf in areas where grass is not needed for active or passive play;
- separation of irrigation systems by zones with different water demand ; and
- education (brochures, posters, classes, surveys, booths, public meetings, advertisement).

1. Parks

City parks were surveyed to better understand the amount of water used annually to keep parks in adequate condition. Parks often contain large amounts of non-native grass. City park water use is based on a per acre comparison. Fort Marcy was not part of the 2007/2008 sample because it underwent park restoration which meant that there was no irrigation data until March 2008.

City Parks	Acres	1998 use/acre	2007 use/acre	2008 use/acre
Franklin Miles	27.9	1.86	1.80	1.58
Salvador Perez	14.2	2.30	0.92	0.77
Herb Martinez	6.8	2.40	1.68	1.53
Patrick Smith	4.5	1.00	1.84	1.72
Fort Marcy	28.0	1.30	n/a	n/a
Average		**1.77**	**1.56**	**1.40**
2007/2008 Average			**1.48**	

Average annual use per acre fell 16% in 2007/2008 for all parks for which data was collected in 2007/2008. The only park that did not show declining water use was Patrick Smith Park. In both the 1998 and 2007/2008 studies, park data for Salvador Perez and Fort Marcy did not include water used for gymnasiums and swimming pools. Average annual water use per acre for Salvador Perez fell by 63%. This could be attributed partially to the fact that one of the soccer fields at the park was replaced by artificial turf during this time period.

2. Schools

Four categories of schools were surveyed – daycare, elementary schools, middle or junior high schools, and senior high schools. Water use was normalized across use per 100 students.

Daycare	max # kids	use/100 kids 2007	use/100 kids 2008
Gentle Nudge School	41	1.10	1.54
Dandelion Preschool	60	0.54	0.69
Garcia St. Club	46	0.66	0.58
Average		**0.77**	**0.93**
2007/2008 Average		**0.85**	

Schools - Elementary	1998/99		2007/08		2008/09	
	# students	use/100 students	# students	use/100 students	# students	use/100 students
Cesar Chavez Elementary	507	0.90	650	0.40	550	0.58
EJ Martinez	423	0.80	374	0.41	367	0.38
Nava School	229	1.10	236	0.24	236	0.51
Pinon School	610	0.50	712	0.88	708	0.21
Robert Sweeney Elementary	677	0.80	562	1.29	700	0.46
Average		**0.80**		**0.64**		**0.43**
2007/2008 Average			**0.53**			

Schools - Middle	1998/99		2007/08		2008/09	
Alameda Junior High/	# students	use/100 students	# students	use/100 students	# students	use/100 students
Carlos Gilbert	484	2.80	475	1.90	475	1.71
Capshaw Junior High	512	3.80	450	1.85	450	2.33
De Vargas Junior High	535	3.40	535	0.43	535	0.26
Ortiz Middle School	581	2.90	545	2.67	580	2.28
Average		**3.23**		**1.71**		**1.64**
2007/2008 Average			**1.68**			

Schools - High Schools	1998/99		2007/08		2008/09	
	# students	use/100 students	# students	use/100 students	# students	use/100 students
Capitol High School	1,320	1.60	1024	2.17	1045	3.84
Santa Fe High School	1,983	3.40	1659	1.81	1546	2.00
St. Michael's High School	750	2.80	840	3.24	840	2.81
Average		**2.70**		**2.47**		**3.24**
2007/2008 Average			**2.64**			

Annual water use per 100 kids in daycare was 0.85 acre-feet in 2007/2008. For primary, middle, and high schools, average annual water use per 100 students declined over the last ten years. For primary schools, annual water use per 100 students fell by 34%, in middle schools it fell by 48% and in high schools, it fell by 2%. While middle schools showed the highest rate of water use in 1998, high schools showed the highest rate in the most recent study. The average annual water use of middle schools was brought down considerably by the decline in water use by De Vargas Junior High.

3. Places of Worship

Place of worship were divided into two categories: those with on-site daycare or schools during the weekday and those that do not provide these services.

Worship/ Daycare & school	1998 water use (ac ft)	2007 water use (ac ft)	2008 water use (ac ft)
St. John's Methodist Church	1.40	0.63	0.59
First Presbyterian Church	n/a	0.54	1.27
Temple Beth Shalom	n/a	1.85	1.43
Santa Maria de la Paz	1.20	1.10	1.16
Christ Church (previously Capital Christian)	1.30	0.15	1.40
Immanuel Lutheran	1.20	0.67	0.65
Average	**1.28**	**0.82**	**1.08**
2007/2008 Average		**0.95**	

Places of Worship	1998 water use (ac ft)	2007 water use (ac ft)	2008 water use (ac ft)
Rodeo Rd. Baptist Church	0.15	0.14	0.13
St Bede's Episcopal Church	0.23	0.21	0.16
Unitarian Church of Santa Fe	1.00	0.24	0.14
Chabad Jewish Center	n/a	0.14	0.22
Tikva Beit	n/a	0.02	0.18
Ibn Asheer Institute	n/a	0.12	0.10
Average	**0.46**	**0.14**	**0.16**
2007/2008 Average		**0.15**	

Annual water use for places of worship with daycare fell 26% in 2007/2008 while annual use for places of worship without daycare fell by 67%. As could be expected water use by places of worship with daycare and schools is roughly 84% higher than in places of worship without daycare.

CONCLUSIONS

General results of the study indicate that water use, with some exceptions, has gone down in Santa Fe across both commercial and residential categories. Though the results of this study are generally encouraging, the study's results highlight where further research and water conservation efforts should be focused, especially in light of Santa Fe's future water needs and uncertainty regarding the impact of climate change on water supplies.

Water use has dropped consistently across various residential categories. Average annual water use for single family residences across lot sizes fell by 31% between 1998 and 2007/2008. Periodic monitoring of water use in these categories could determine whether or not this is an indication of a longer-term trend. Some of this decline could be attributed to the impact of methodological differences between the first and second rounds of the study, and the inclusion of records that indicate absenteeism. In addition, the City's program requiring the replacement high flow toilets likely played an important role in the reduction of water use. The previous study correlated water use with lot size. The current study results suggest that average annual water use for homes on larger lots is higher, however further research is required in order to identify the determining factors in terms of water consumption. For future studies, correlating data on water use to a home's square footage, occupancy rate and degree of irrigated landscaping for all housing subdivisions could provide greater insight into which factors affect water use in residential areas.

The distribution of water use within residential areas generally shows a relatively 'normal' distribution, but with a 'tail' on the high use side. This indicates that a few residents in each subdivision use a disproportionately high amount of water.

Several of the results in commercial categories also deserve to be highlighted. Notable exceptions to the general declining trend in commercial categories include grocery stores, gas stations, and limited service carwashes whose average annual water use went up by 13%, 43%, and 26% respectively. On the other hand there were categories that demonstrated relatively large reductions – these included restaurants and hotels. Full-service restaurant use per seat dropped by 50% whereas full-service hotel average use per room fell by 58%. Although these declines can in part be attributed to the City's conservation programs, additional reasons for these declines require further investigation. Low occupancy rates and declining levels of tourism may also have contributed. Finally, several commercial categories require further data collection due to the very limited sample size that was obtained for the study. These include neighborhood centers, R&D labs, gyms with showers, and pet daycare.

Results for the various Community Use categories also demonstrated a general declining trend. The fall in average annual water use per acre in some of the parks was particularly noteworthy. The decline in water use per 100 students was higher in primary and middle schools than in high schools. Water use by places of worship without daycare also fell a substantial 67%.

Recommendations

Based on the conclusions of the 2007/2008 study, the following recommendations are made regarding both conservation measures and future research.

1) Distribution curves of water use in housing subdivisions exhibit consistent patterns of high-use outliers. Several commercial categories also have high and increasing water use. Conservation programs should target high residential users and the commercial categories that exhibit increasing use.

2) High water use reports should be generated regularly and targeted audits could be required for water users if consumption grows by a certain designated amount.

3) The City should make increased use of firefly data for research and conservation purposes.

4) Continued efforts should be made to make water efficiency improvements to state and government buildings.

5) In future iterations of this study, improvements to data could lead to more statistically reliable results and greater understanding of the factors linked to water use. Some examples include:
    - Assurance/quality control of utility billing data
    - sampling for housing subdivisions with a statistically significant sampling methodology
    - correlation of factors such as square footage, occupancy rates, and degree of landscaping on water use
    - comparing water use from individually-metered residences to water use by master-metered residences to assess awareness of water use
    - increasing sample sizes for commercial categories where possible
    - inclusion of data from private sub-meters in order to be able to assess water uses by businesses in a complex with a master meter

6) In the case of new developments which fall into categories of businesses with a limited sample size, it is recommended that the developer come up with an "Option B" plan or self-calculated estimate, which can then be compared to the number in the water budget table. This would apply particularly to businesses such as neighborhood centers, R&D labs, gyms with showers, and pet daycare.

7) Compare cost effectiveness of water efficiency programs and implement the most cost effective ones.

8) Continue rebate programs and assist those businesses that rely heavily on water (carwashes, laundromats) to retrofit their facilities for water recycling and efficient appliances.

9) Due to the observed fluctuation in water use as well as the expected increase in water users, it is recommended that this study be updated on a regular basis. The first update should be within five years (at most) of the completion date of this study and it should include an appropriate statistical analysis with comparisons of the 1998, 2009 and the then current groups. Additionally, with appropriate statistical analysis, the City will be in a better position to be able to analyze water use and abuse, thereby placing itself in a more knowledgeable regulatory posture.

10) Targeted questionnaires and or surveys should be developed to better understand why and how water reduction has occurred in certain water use sectors and remained high in others.

The following table summarizes this report's recommended basis for water budgets. It includes average acre feet per year in 1998 and 2007/2008. All applications for new development include an additional water contingency that covers water utility delivery. This contingency water is used for community health and safety purposes, such as fire fighting, fire hydrant testing, as well as for flushing of water distribution and sewer lines, use in production, meter errors, line leaks, and losses from water main breaks.

Recommended Budgets by Water Use Category

	1988		2007-08		
Residential	**Ac Ft / Yr**	**Gallons / Yr**	**Ac Ft / Yr**	**Gallons / Yr**	**Percent Change**
Single Family Dwelling Unit	0.26 / d.u.	81,463 / d.u.	0.18 / d.u.	58,653 / d.u.	▼ 31%
lot size < 6,000 sq ft	0.21 / d.u.	65,170 / d.u.	0.15 / d.u.	48,878 / d.u.	▼ 28%
lot size 6,000-10,890 sq ft	0.25 / d.u.	81,463 / d.u.	0.17 / d.u.	55,395 / d.u.	▼ 32%
lot size > 10,890 sq ft	0.32 / d.u.	104,272 / d.u.	0.25 / d.u.	81,463 / d.u.	▼ 21%
Apartment/Condominium	0.21 / d.u.	68,429 / d.u.	0.16 / d.u.	52,136 / d.u.	▼ 24%
Mobile Home	0.20 / d.u.	65,170 / d.u.	0.17 / d.u.	55,395 / d.u.	▼ 15%
Guest House	0.12 / d.u.	39,102 / d.u.	0.09 / d.u.	29,327 / d.u.	▼ 25%
Senior Complex	0.14 / d.u.	45,619 / d.u.	0.12 / d.u.	39,102 / d.u.	▼ 14%
Commercial					
Restaurant, full service	0.04 / seat	13,034 / seat	0.02 / seat	6,517 / seat	▼ 50%
Restaurant, limited service	2.6 / site	847,213 / site	1.63 / site	531,137 / site	▼ 37%
Hotels	0.31 / room	104,272 / room	0.13 / room	42,361 / room	▼ 58%
Motels	0.15 / room	48,878 / room	0.09 / room	29,327 / room	▼ 40%
Grocery Stores	1.1 / 10,000 sq ft	358,436 / 10,000 sq ft	1.27 / 10,000 sq ft	413,831 / 10,000 sq ft	▲ 13%
Large Retail	0.60 / 10,000 sq ft	195,511 / 10,000 sq ft	0.45 / 10,000 sq ft	146,633 / 10,000 sq ft	▼ 25%
Neighborhood Center	1.5 / 10,000 sq ft	488,777 / 10,000 sq ft	0.43 / 10,000 sq ft	140,116 / 10,000 sq ft	▼ 70%
Small Retail	n/a	n/a	0.06 / site	19,551 / site	n/a
Galleries	n/a	n/a	0.6 site	195,511 / site	n/a
Medical Office	1.0 / 10,000 sq ft	325,851 / 10,000 sq ft	0.72 / 10,000 sq ft	234,613 / 10,000 sq ft	n/a
Office - city/state	0.6 / 10,000 sq ft*	195,511 / 10,000 sq ft	.58 / 10,000 sq ft	188,994 / 10,000 sq ft	n/a
Office - non-medical	0.6 / 10,000 sq ft*	195,511 / 10,000 sq ft	.70 / 10,000 sq ft	228,096 / 10,000 sq ft	▼ 30%
R&D Labs	1.5 / 10,000 sq ft	488,777 / 10,000 sq ft	1.18 / 10,000 sq ft	384,504 / 10,000 sq ft	▼ 26%
Manufacturing - goods	n/a	n/a	0.21/ site	68,429 / site	n/a
Manufacturing - consumables	n/a	n/a	2.33 / site	759,233 / site	n/a
Gas Stations	0.5 / site	162,926/ site	0.88 / site	286,749 / site	▲ 43%
Gas Stations w/ Carwashes	7.8 / site	2,541,638 / site	6.56 / site	2,137,583 / site	▼ 16%

* this average is the Office, non-medical (xeriscape) from the 1998 survey

1) d.u. = dwelling unit

	1988		2007-08		
Commercial Cont.	**Ac Ft / Yr**	**Gallons / Yr**	**Ac Ft / Yr**	**Gallons / Yr**	**Percent Change**
Carwash, full service	7.5 / site	2,443,883 / site	5.66 / site	1,844,317 / site	▼ 25%
Carwash, limited service	0.6 / bay	195,511 / bay	0.94 / bay	306,302 / bay	▲ 36%
Commercial Laundromats	n/a	n/a	0.78 / machine	254,166 / machine	n/a
Laundromats - other	n/a	n/a	0.22 / machine	71,688 / machine	n/a
Drycleaners	n/a	n/a	0.41 / site	133,600 / site	n/a
Nurseries	n/a	n/a	0.56 / 10,000 sq ft	182,478 / 10,000 sq ft	n/a
Gyms w/ showers	n/a	n/a	8.94 / site	2,913,107.94	n/a
Gyms w/out showers	n/a	n/a	0.77 / site	250,905.27	n/a
Salons	n/a	n/a	0.21 / site	68,428.71	n/a
Pet Grooming/Boarding	n/a	n/a	0.52 / site	169,442.52	n/a
Pet Daycare	n/a	n/a	0.11 / site	35,843.61	n/a
Auto Repair	n/a	n/a	0.12 / site	39,102.12	n/a
Car Rental	n/a	n/a	0.12 / site	39,102.12	n/a
Car Sales	n/a	n/a	0.07 / 10,000 sq ft	22,809.57	n/a
Self-Storage	n/a	n/a	0.13 / site	42,360.63	n/a
Public Services					
Parks	1.8 / acre	586,532 / acre	1.48 / acre	482,259 / acre	▼ 18%
Schools, Daycare	n/a	n/a	0.85 / 100 kids	276,973 / 100 kids	n/a
Schools, Elementary	0.8 / 100 students	260,681 / 100 students	0.53 / 100 students	172,701 / 100 students	▼ 34%
Schools, Middle	3.2 / 100 students	1,042,723 / 100 students	1.68 / 100 students	547,430 / 100 students	▼ 48%
Schools, High	2.7 / 100 students	879,798 / 100 students	2.64 / 100 students	860,247 / 100 students	▼ 2%
Places of Worship	0.46 / site	195,511 / site	0.15 / site	48,878 / site	▼ 67%
Places of Worship, w/ daycare	1.3 / site	423,606 / site	.95 / site	309,558 / site	▼ 26%