CDM

City of Santa Fe

Adopted September 2008

Long-Range Water Supply Plan





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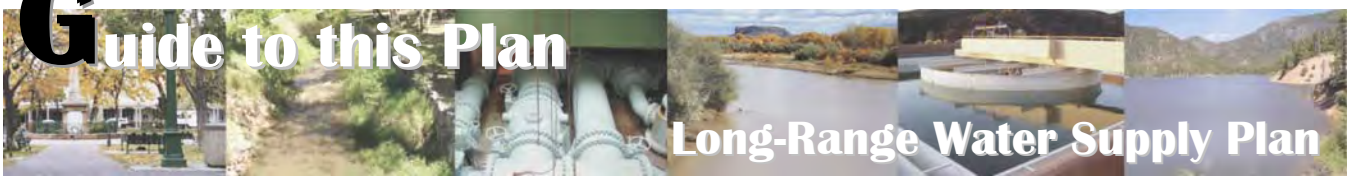
Guide to this Plan



This document presents the findings and underlying analyses of the City of Santa Fe's Long-Range Water Supply Plan (the Water Plan). The main body of the report focuses on the policies and actions needed to meet those needs and documents the most important results of the Water Plan. Detailed background on the analyses, processes, and public and Governing Body input are included in the appendices.

This report is organized as follows:

- **The Executive Summary** encapsulates the essential findings of the Water Plan, including the expected demand, the available supply, and the necessary polices and implementing actions to meet Santa Fe's future water needs.
- **Section 1** presents the Policies and Implementing Actions of the Water Plan.
- **Section 2** provides a synopsis of the process used in developing the Water Plan.
- **Section 3** documents projected long-range water demands through 2045, compares expected demand to current supplies, and discusses the water supply gap.
- **Section 4** identifies the future supplies that will be used to meet demands through 2045.

Appendices are as follows:

- **Appendix A:** References, Acronyms, and Acknowledgements.
- **Appendix B:** Framework for Plan Development.
- **Appendix C:** Development and Weighting of Objectives.
- **Appendix D:** Projected Demands and Gaps in Supply.
- **Appendix E:** Identification and Screening of Supply Options.
- **Appendix F:** Santa Fe's System Simulation Model: WaterMAPS.
- **Appendix G:** Portfolios Development and Evaluation.
- **Appendix H:** Public Outreach and Input.
- **Appendix I:** Potential Financial Impacts of the Water Plan.
- **Appendix J:** Changes since 2005 Water Plan analyses, especially with respect to reduction in the City's water use, the delay in the Buckman Direct Diversion, and climate change considerations.

This Water Plan provides the strategic direction for the City of Santa Fe to meet its current and future water needs. In doing so, however, the Water Plan does not consider how storm water, water quality, growth management alternatives, or water infrastructure (storage, transmission, and distribution) will constrain or enhance future water supply options.

The City of Santa Fe prepared this Water Plan with the assistance of the engineering consulting firm, Camp Dresser & McKee Inc. (CDM). Further information can be obtained by contacting the Water Division at 801 W. San Mateo, Santa Fe, New Mexico 87505 or (505) 955-4203.

Executive Summary

Long-Range Water Supply Plan
July 2008

In 2004, the City of Santa Fe (City) began a Long-Range Water Supply Plan (Water Plan) to secure a sustainable and reliable water supply for the City's residents and water customers. The Water Plan charts the road map for optimizing existing water supplies and for providing new supplies. Implementation of the Water Plan will reduce or eliminate the need for relying on emergency use restrictions like those implemented during the 2002 drought. The Water Plan is based on detailed analyses of needs and options, and incorporates public input and direction from the City Council.

Although the analyses were completed in late 2005, the Water Plan was not finalized because a federal and state permit for the Buckman Direction Diversion (BDD) had not been received. As of mid-2008, the key federal and state permits for the BDD have been obtained.

The 2005 analyses have been modified to reflect the extraordinary degree of water conservation accomplished by the City's customers in the last 3 years. These changes are discussed more fully in Section 3. The continuing additional conservation reduces the future gap between demand and supply, and delays the time when new supplies will be needed, but does not affect the overall results of the Water Plan.

Santa Fe's Water Supply Needs

Growth in the City's service-area population was projected using the principles of the regional water plan. By 2045 the City will need to supply over 18,000 acre-feet per year (AFY) to about 120,000 persons. This projection assumes a demand for potable water of 110 gallons per person per day for normal (non-drought) conditions, plus 12 gallons per person per day for non-potable water use, and includes contractual obligations of the City.

The City's existing and planned sources of supply fall short of meeting projected demands by 2021; the deficit reaches 2,700 AFY by 2045 (Figure ES-1). This is the case even after the BDD is constructed to meet current short-term needs.

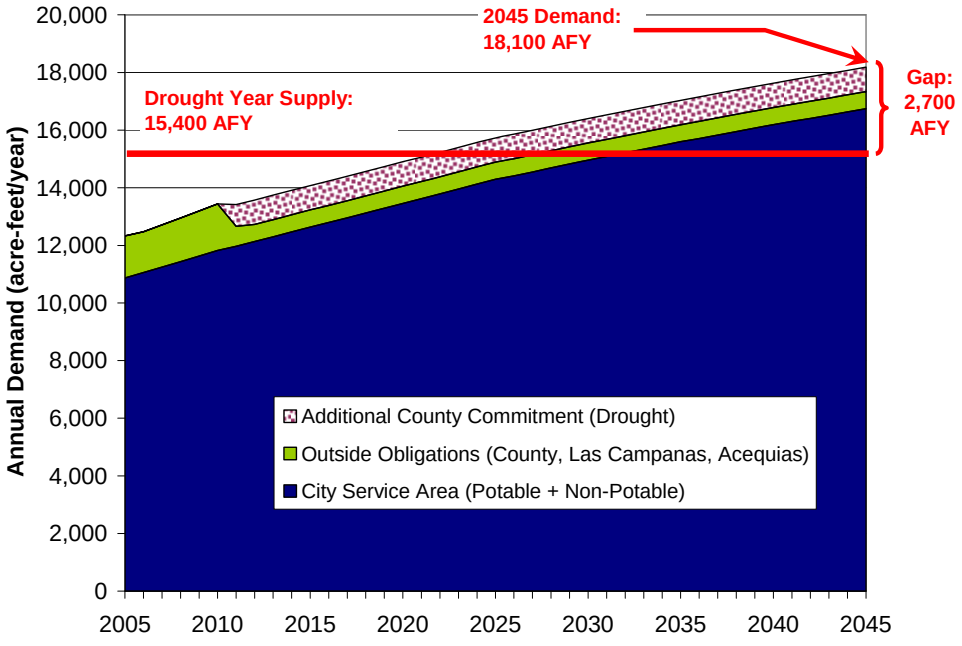


Figure ES-1
Projected Demand and Supply Balance

Through major recent and ongoing investments, and through the community's precedent-setting achievements in water conservation, Santa Fe has established a solid foundation for meeting the City's future water needs. Because of that solid foundation, the estimated cost to supply our future needs are much less.

Recent and Ongoing Accomplishments

- State-of-the-art water conservation programs and progress
- Six new large production wells: Buckman wells 9-13 and the Northwest well
- Upgrades to the Canyon Road Water Treatment Plant
- Buckman Direct Diversion (BDD) project designed to use San Juan-Chama water by 2011
- Water lease agreement with the Jicarilla Apache Nation
- Extension of the City's San Juan-Chama Project water contract into perpetuity
- City's Water Rights Transfer Ordinance

The Buckman Direct Diversion Project

The BDD is designed to provide infrastructure to divert the City's contracted San Juan-Chama (SJC) water, which cannot otherwise be fully used. Intensive and expensive efforts by the City and its BDD partners have been underway since 2001 to obtain the required federal and state permits and environmental approvals, to complete BDD planning and preliminary design, and to hire a design-build contractor. The City expects successful completion of these efforts and groundbreaking in 2008, and initial operation of the BDD in 2011.

This Water Plan builds upon the assumption that the BDD project will be successfully completed. Should mandatory federal and state permits and approvals be denied and the project not implemented, the Water Plan policies and recommendations will need to be reconsidered.

Evaluation of Future Water Supply Options

In developing the Water Plan, the City considered over 30 different water supply and demand management options. Using a structured process, the City developed and compared 11 different supply portfolios (e.g., combinations of supply options) to address the gap between supply and demand that is projected for 2045. The portfolios were compared on the basis of the following six objectives:

- Improve Reliability and Sustainability
- Ensure Technical Implementability
- Manage Costs
- Protect the Environment
- Ensure Acceptability
- Ensure Timeliness

To assist in analyzing the opportunities and complex constraints of the City's existing sources of supply, the City developed a water systems operations model, called Water Management and Planning Simulation (WaterMAPS).

The model reflects the City's current water supply portfolio for operational decisions on source-of-supply, but also facilitates analysis of new water supply and demand management alternatives for long-range planning.

Recommended Water Plan

Santa Fe's projected demand for the next 40 years can be met without a new major infrastructure project using the water supply components listed below.

Future Water Supply Components

- Increase reliance on sustainable surface water
- Use groundwater for peak demands and drought protection
- Enhance the City's conservation programs
- Optimize existing sources
- Acquire and divert additional water (preferably through BDD)
- Maintain a living Santa Fe River through town

Figure ES-2 illustrates how the components will work in concert to achieve a reliable and sustainable annual and peak-season supply despite inherent variability in surface water availability and historic over-reliance on groundwater.

- Santa Fe River surface water from the Canyon Reservoirs (blue) will be fully utilized when water is available, while maintaining a living Santa Fe River
- The completion of the BDD (yellow) allows the City to significantly reduce its reliance on groundwater (greens), and will also allow implementation of the Living River concept; expanded use of the BDD (red) will meet growing needs
- Past conservation (speckled) and recent extra conservation (speckled grey) significantly reduce the water needed over the next 40 years
- The City will continue to use treated effluent (lavender) to reduce demands on potable supplies

The Water Plan calls for substantial reduction in groundwater use, maintaining groundwater production at sustainable levels and preserving the aquifer as a critical drought reserve. At the same time, conservation and reuse of treated wastewater effluent will play an increasingly large role in meeting demands. This projected supply mix was determined to best meet the objectives established as part of the Water Plan.

It is assumed throughout the Water Plan that the BDD will be successfully completed. If the BDD is not constructed, new portfolios would be created and evaluated to meet the City's water supply objectives using a combination of options that do not include the BDD. The supply gap would also need to be increased to account for the unavailability of the anticipated 5,230 AFY from the BDD. While this analysis was not done in this Water Plan, the analysis would use the process, options, and tools developed for this Water Plan.

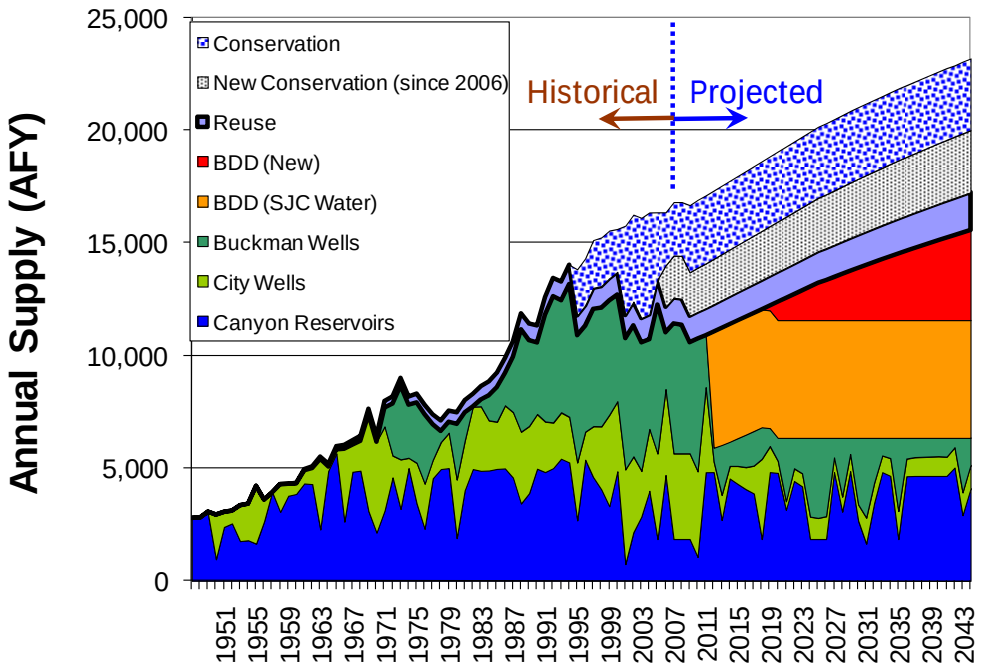


Figure ES-2
Historical and Future Sources of Supply

Long-Range Water Supply Policies

Based on the findings of the Water Plan, the City has established the following eight major policies to meet future water supply needs.

A. The City will continue and improve its aggressive water conservation program.

B. The City will acquire the necessary water and environmental permits to meet the City's future demands.

C. The City will use groundwater sustainably.

D. The City will optimize its use of treated effluent.

E. The City will optimize its use of existing water rights and infrastructure to stretch existing supplies.

F. The City will seek to minimize or eliminate the use of emergency drought restrictions.

G. The City will provide water to maintain a living Santa Fe River, except under drought or emergency conditions.

H. The City will monitor system performance and revisit its water needs, and adjust its actions as necessary to fully meet its demands sustainably, and cooperate in securing a reliable water supply for the region.

Section 1
Long-Range Water Supply Policies and Implementing Actions

The City of Santa Fe (City) has developed and adopted this Long-Range Water Supply Plan (Water Plan) to establish a roadmap for a sustainable and reliable water supply through 2045. This report describes the policies and actions that will secure the City's water future.

The first steps in the Water Plan were to assess the capabilities of the existing water supply and to determine future water needs through 2045. The exceptional conservation achievements of the City's water customers coupled with large investments of public funds in new wells, upgraded treatment, and the planned Buckman Direct Diversion (BDD) Project establish a solid foundation for meeting Santa Fe's future water needs. Even so, based on reasonable projections of population growth within the water system service area, and including commitments to the regional system of Santa Fe County, the City faces a drought-year shortfall in supply of 2,700 acre-feet per year (AFY) by 2045 (and nearly 8,000 AFY if the BDD is not built). Shortages could occur as soon as 2021.

The Water Plan evaluated numerous water supply and management options to erase the gap between current supply and future demands. Because the Water Plan assumes that the BDD will be built, several alternatives examined ways to optimize use of that facility. Using detailed analyses, public input, and Governing Body direction, best options were included in the Water Plan based on criteria such as reliability, sustainability, and measures of economic, environmental, and community performance.

The outcome of the plan will be a water portfolio that includes the following components:

- Maintain and enhance water conservation
- Rely increasingly on surface water, and pump less groundwater (wells will be used primarily at times of peak demand or surface water shortage)
- Use effluent to meet a portion of demands
- Maintain a living Santa Fe River through town

Figure 1-1 illustrates the anticipated transition toward a sustainable water supply, with much less pumping of groundwater, and much more reliance on the Rio Grande; it also shows the benefits of continued and enhanced water conservation.

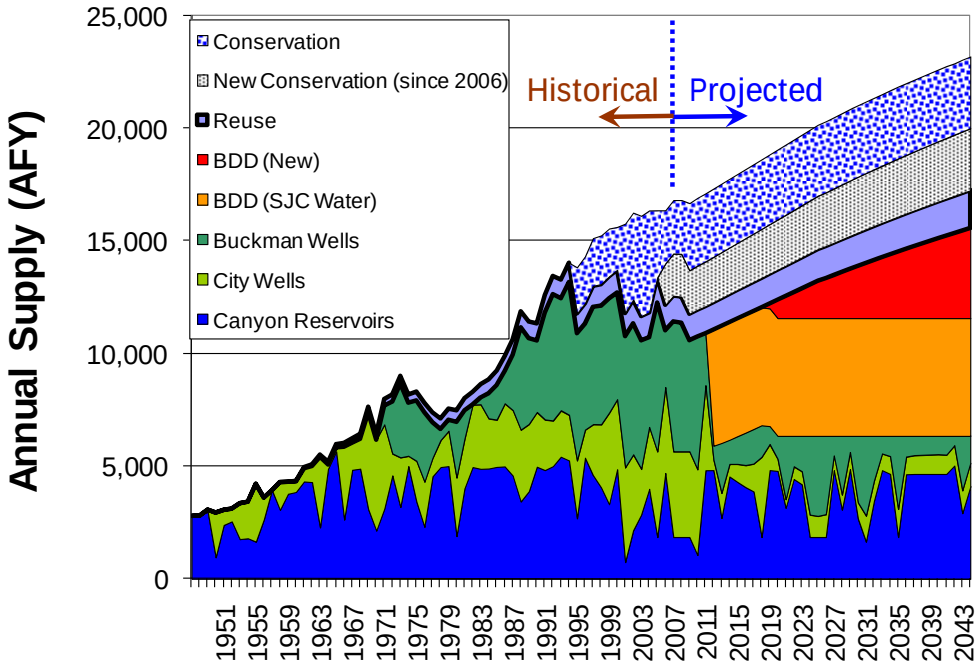


Figure 1-1
Historical and Future Sources of Supply

The policies and actions that are needed to implement and support the Water Plan are discussed in Sections 1.1 and 1.2. A description of aspects of water planning not contemplated in this document is provided in Appendix A.

It is assumed throughout this Water Plan that the BDD will be successfully completed. If the BDD is not constructed, then new portfolios would be created and evaluated to meet City's water supply objectives using a combination of Options that do not include the BDD. The supply gap would also need to be increased to account for the unavailability of the 5,230 AFY that is anticipated from the BDD. While this analysis was not done in this Plan, the analysis would use the process, options, and tools developed for this Plan.

1.1 Long-Range Water Supply Policies

Based on the findings of the Water Plan, the City has established the following eight major policies related to meeting current and future water supply needs (A-H below). Figure 1-2 shows the projected timing of implementing policies and activities.

Most of the policies within this Water Plan are interrelated. In most cases, the interrelationship is implicit, but in some cases, the connection is explicitly described in Section 1.2.

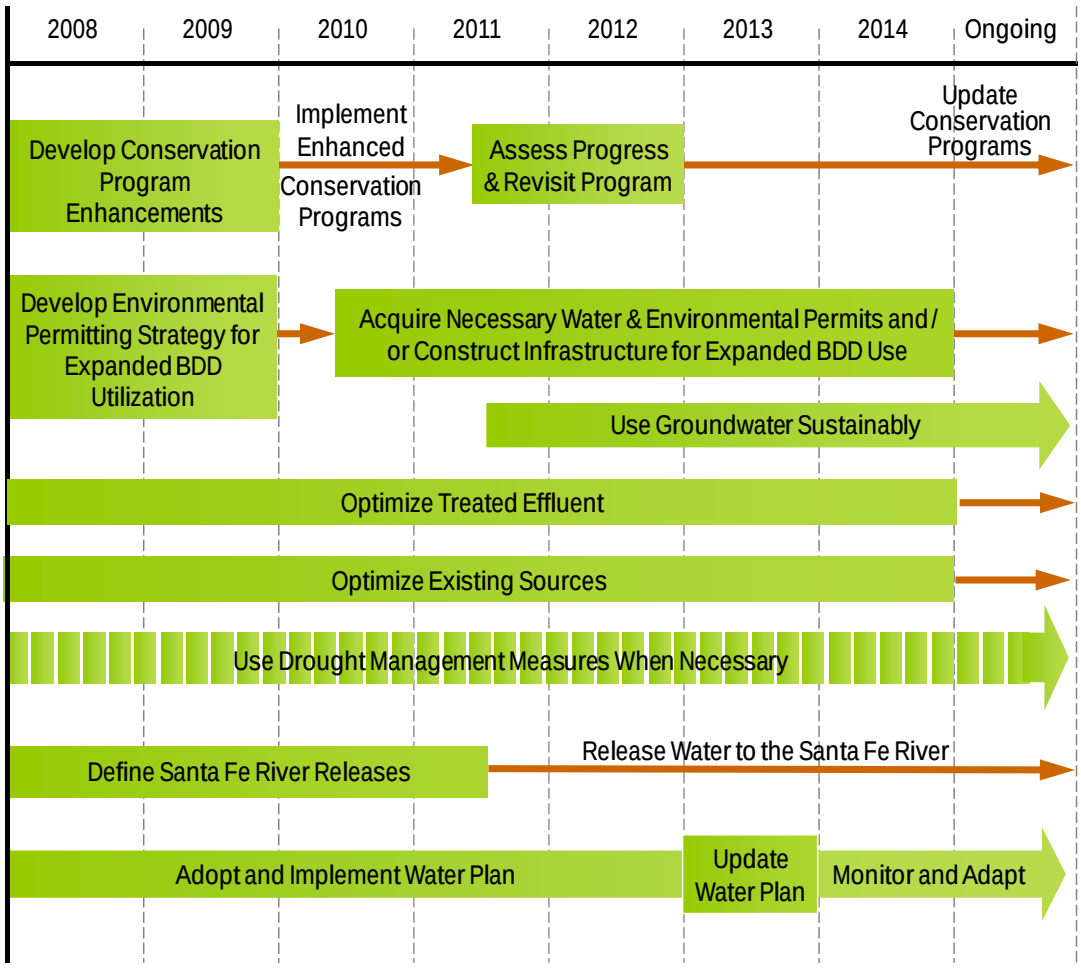


Figure 1-2
Long-Range Water Supply Policies

A. Enhance Santa Fe's State-of-the-Art Conservation Program

The City will continue to implement, monitor, and adjust Santa Fe's aggressive water conservation program, including new technologies, measures, and programs as may be necessary to maintain and reduce demands and increase water use efficiency. Since the completion of the 2005 analysis, significant accomplishments have taken place in reducing the City's per capita water consumption to about 110 gallons per day, one of the lowest rates in the western U.S. (see grey speckled area in Figure 1-1).

B. Acquire Necessary Water and Environmental Permits

The City will acquire the necessary water in order to meet the City's demands beyond about 2021, when water shortages may begin. The City will acquire additional Rio Grande water rights and/or will return treated wastewater effluent to the Rio Grande for exchange, divert and treat the additional water through the BDD system. Water rights acquired through the City's transfer ordinance are an important component of this strategy. The City will also acquire the necessary water rights or otherwise offset the effects of its depletions on the La Cienega area springs, the Rio Grande, the Rio Pojoaque, and the Rio Tesuque.

C. Use Groundwater Sustainably

The City will use groundwater sustainably in order to preserve the aquifer, minimize potential impacts on streams and land, and maintain the groundwater as an effective drought reserve. The City will seek regional aquifer management as necessary to achieve this goal.

D. Optimize Use of Treated Effluent

The City will balance the efficient use of its existing and future treated effluent for irrigation, return flow credits, and benefits to the area downstream of the wastewater treatment plant (WWTP).

E. Optimize Existing Water Supply Sources

The City will optimize the use of its existing water rights and infrastructure to stretch existing supplies. The City will seek to achieve more efficient and economical use of each supply, within the constraints of these Long-Range Water Supply Policies.

F. Apply Water Use Restrictions during Drought and Emergencies

The City will seek to minimize or eliminate the use of drought emergency restrictions through the development of increased system water supplies and preserving the regional aquifer for use in times of drought. However, the City will be prepared to employ drought emergency restrictions as required to mitigate severe drought emergencies or other emergency conditions.

G. Maintain a Living Santa Fe River

The City will release reservoir water to the Santa Fe River, promoting river restoration, ecosystem maintenance and enhancement, and groundwater recharge.

H. Monitor, Adapt, and Cooperate

The City will monitor system performance, determine the schedule for acquiring additional rights and infrastructure, and take other actions necessary to meet its sustainability goals and releases to the Santa Fe River. The water management strategies and operations will be based on lessons learned and new circumstances. The City will also cooperate with other water users in the region to achieve equitable water resource management and use.

1.2 Key Implementing Actions

Key actions necessary to implement the Water Plan policies are identified below.

A. Enhance Santa Fe's State-of-the-Art Conservation Program

- The City will sustain the efforts that have reduced demand to about 110 gallons per capita per day (gpcd).
- The City will adopt future conservation targets recommended by the City's Water Conservation Committee.
- The City will promote year-round conservation.
- The City will analyze water conservation alternatives, considering additional or different conservation strategies, new technologies, and programs for reducing potable water demands. Options may include, but not be limited to:
  - Incentives for water- and energy-efficient appliances
  - Implementation of best management practices in city, state, and federal buildings
  - Setting water efficiency standards for new residential and commercial buildings
  - Revising the water rate structure to further encourage the efficient use of water
- The City will annually monitor, analyze, and adjust the conservation program according to program goals. The City will annually assess per capita rates of water use, excluding demands served with treated effluent, and compare the actual per capita rates and trends against the goal. These data will be made publicly available.
- The City will continue its water and land use policies of requiring new growth to either offset its demand with conserved water or to purchase water rights (Policy B).
- If the target conservation goal is not achieved through the City's conservation programs (or if trends indicate that the goal will not be achieved within 3 years following the assessment), the City will assess whether additional conservation measures should be implemented, or whether additional water should be diverted to satisfy demand. The method and results of this assessment will be documented in a revised Conservation Plan.
- To assure that the regional aquifer is used efficiently, the City will promote regional water conservation through education programs, participation in regional organization and events, and become involved in the Office of the State Engineer (OSE) permitting process for applications that are contrary to the conservation of water.

B. Acquire Necessary Water and Environmental Permits to Increase BDD Use

- The City will investigate the availability and cost of acquiring additional water rights above the permitted 5,230 AFY for future diversion at the BDD via purchase, lease, or other arrangements.
- The City will conduct a feasibility-level evaluation to more closely understand the technical, institutional, environmental, and financial issues associated with an effluent return flow credit pipeline from the City's WWTP to the Rio Grande as a source to be diverted through the BDD.
- On completion of the necessary assessments above, the City will use the resulting information to support a decision regarding how much water to seek from new water rights acquisition (beyond current programs/plans) and how much to seek from return flow credits.
- The City will then pursue all necessary environmental permits to use the BDD in a capacity beyond use identified in the 2006 Final Environmental Impact Statement (FEIS) and begin permitting and implementation of the additional water rights acquisition and/or return flow credit system. If the initial BDD is not implemented as set forth in the EIS, or if additional permits cannot be obtained, other

alternatives set out in the Water Plan will be reconsidered.

- The City will continue the water acquisition program authorized under the Water Rights Transfer Ordinance, requiring development projects with water budgets above threshold sizes to convey water rights to the City.
- The City will seek to stabilize or reduce the cost of purchasing water rights to the region through cooperation.
- The City will acquire water in accordance with the Water Rights Acquisition Ordinance for recognized community priorities like affordable housing, parks, sport fields, medians, open space, and City buildings.
- The City will pursue short- and long-term storage of SJC, Jicarilla Apache Nation (JAN), and native water in accordance to its current position and long-term need.
- The City will evaluate programs to acquire water saved through crop rotation or agricultural efficiency improvements thereby reducing adverse impact of water transfers on rural communities, local food production, and the environment.

C. Use Groundwater Sustainably

- The City will continue studies and development of criteria aimed at defining sustainable levels of withdrawals from the City well field and Buckman well field.
- The City will use groundwater at or below long-term sustainable rates. Higher-than sustainable pumping rates during drought conditions or temporary restraints on the City's other supply sources will be offset by subsequent lower-than-sustainable groundwater withdrawals.
- The City will continue to regulate domestic wells within the City boundaries. The City may pursue additional private well regulations to preserve regional resources and promote equitable water use within the community.
- The City will seek regional cooperation to manage the regional aquifer in a manner consistent with long-term sustainability and for drought reserve.
- The City, in conjunction with regional partners, will develop a system for monitoring the regional hydrologic system. The City will make collected data readily available to the public on the internet.
- The City will monitor water rights transfers and may intervene in water rights transfers deemed contrary to its senior water right use, contrary to the conservation of water, or contrary to the long-term sustainability of the regional aquifer.
- The City will consider the use of storm water to enhance groundwater recharge and increase the long-term groundwater sustainability.

D. Optimize Use of Treated Effluent

- The City will use treated effluent for irrigation at the current rate of approximately 12 gpcd (or about 10 percent of total water supply and approximately 17 percent of produced effluent). Thus, as the City's water supply increases, additional effluent will be available for new uses. The reuse of effluent reduces irrigation reliance on potable supplies.
- The City will determine the value of treated effluent and price the resource accordingly.
- The City will develop and apply a policy specifying the criteria and procedure by which major non-potable demands are to be served by potable water or treated effluent. The City will evaluate existing and potential new uses of treated effluent annually.
- The City will make effluent available to the Santa Fe River downstream of the WWTP for irrigation and environmental benefits, as also recognized in the Treated Effluent Management Plan (TEMP), which was adopted by the Governing Body in 1998.
- On completion of the necessary assessments, the City will use the information to support a decision regarding whether and how much

return flow credits to seek. The City will then begin permitting and implementation of the additional return flow credit system (see Policy B).

E. Optimize Existing Water Supply Sources

- The City will optimize its existing water sources and water rights. The City will maximize the production capacity of the City well field, considering, among other factors, the best locations for the wells to distribute the hydrologic impact on the aquifer.
- The City will optimize use of the St. Michael's Well in context of the conjunctive Santa Fe River water rights permit and sustainable groundwater use.
- The City will seek to re-permit the Northwest Well before its expiration in a manner that restores full use of the City well field water rights.
- The City will seek NTP and La Cienega water resource strategies that allow for flexible use of the Buckman well field.
- The City will seek to complete the Santa Fe River adjudication with terms acceptable to the City.
- Within the City's existing OSE permits, the City will conjunctively manage its water resources, relying on surface water when it is available, and preserving local groundwater supplies for drought and emergency reserves.
- The City will investigate, in consultation with the OSE, the potential merits of a conjunctive use permit for its Santa Fe River supplies to use more local surface waters in wet years, and more local groundwater in dry years. If appropriate, the City will take the necessary actions to implement conjunctive use of its local surface and groundwater supplies.
- The City will consider what water supply mix best meets all drinking water quality requirements.
- The City will consider cost and energy efficiency in choosing its annual and peak day water supply mix.
- The municipal water utility will optimize its ability to store, transmit, distribute, and conserve water supplies with periodic water utility transmission, distribution, and storage analyses and master planning.
- The City will continue to use the current percentage use of treated effluent for major non-potable demands (see Policy D).
- The City will monitor surface and groundwater rights transfers and may intervene in water rights transfers deemed contrary to its senior water right use, contrary to the conservation of water, or contrary to the long-term sustainability of the regional aquifer (see Policy H).
- In coordination with its water acquisition strategy (see Policy B), the City will use stored SJC water via the BDD in times of drought, and make provisions to ensure that adequate SJC water storage facilities are available to facilitate such use.

F. Apply Water Use Restrictions during Drought and Emergencies

- The City will seek to minimize or eliminate the use of drought or emergency restrictions through the development of a reliable, resilient, and diverse water supply system, which includes preserving the regional aquifer for use in times of drought (Policy C).
- The City may implement and enforce drought emergency restrictions in the event of climatic events more severe than historically experienced or other major supply interruptions, shortages, and emergencies.
- The City will periodically revisit the revised criteria defining the specific conditions under which drought and emergency restrictions will be invoked. The City will also periodically revisit the specific requirements of the drought restrictions to be employed under varying levels of drought severity and other emergency conditions, and

will define the specific water use reduction goals for each.

- The City will develop a plan that prioritizes water resources uses for public purposes during drought and emergency restrictions.

G. Maintain a Living Santa Fe River

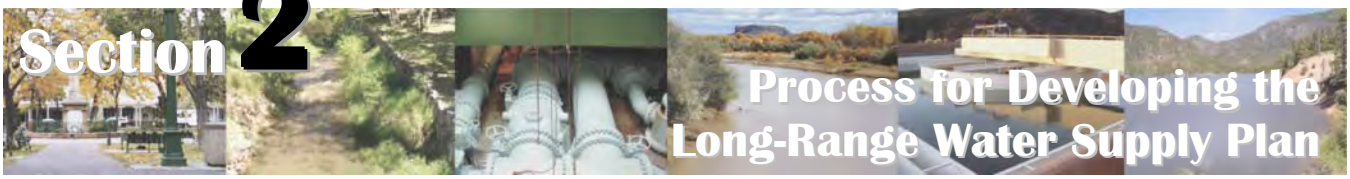
- The City will analyze the legal, water rights, and Rio Grande Compact implications of the proposed releases of canyon reservoir water to the Santa Fe River for aesthetic, ecological, and recreational purposes.
- After the BDD is online in 2011 and barring legal restrictions, the City will, in accordance with public input, initially release approximately 1,000 AFY of water from the Santa Fe River canyon reservoirs to the Santa Fe River, except under drought or emergency conditions.
- To determine the living Santa Fe River program goals, the daily and seasonal schedule of releases, target flow rates, operational considerations and constraints, definition of drought or emergency conditions during which releases may be curtailed or ceased, and water sharing proposals among surface water users, the City will develop and adopt a River Management Plan (RMP). The release schedule in the RMP will take into account the availability of other sources of supply, demands, amount of water stored vs. storage capacity, and other factors.
- The RMP will also consider additional ways to achieve and augment a living river including conservation initiatives for the river, use of water rights leased or purchased through the Santa Fe River Fund, using Two-Mile Reservoir for regulation of the high flows, neighborhood-scale wastewater treatment systems, watershed management, and storm water management.
- The City will analyze the potential to use river releases for its water supply needs, including recharge benefits to the City well field, meeting Rio Grande Compact requirements, diverting water for treatment at the new BDD water treatment plant (WTP), aquifer storage and recovery (ASR), or installation of new shallow production wells.
- The City will promote activity along the Santa Fe River that maintains a healthy river corridor including river restoration, recreation, watershed management, and storm water flow infiltration.

H. Monitor, Adapt, and Cooperate

- The City will monitor its water resource environment (e.g., stream flow, groundwater behavior, reservoir storage, water quality, SJC inflow, and storage) and water utility use (e.g., production, water use efficiency, conservation effectiveness, non-revenue water use, and water acquisition) and report relevant information to the governing body annually. Reports will be made available for the public on the City's web page.
- The City will adapt its management of its water resources when and as needed, based on new information (lessons learned) and new circumstances (e.g., changes in the regulatory environment and impacts from climate change).
- The City will update the Water Management and Planning Simulation Model (WaterMAPS) system simulation model as needed so that the model will be useful to analyze water supply actions and policies considered within this Water Plan and new sources of supply proposals brought to the City.
- In a publicly open process, the City will update the Water Plan approximately once every 5 years, or as needed, to reflect changes in rates of water use, water rights availability and costs, science and research regarding climate change, energy conditions, increased local food production, and its potential effects on water supplies, and public and political priorities. Future Water Plans will consider how captured rainwater can be used as a source of potable or non-potable supply. The policy statements and

actions with the Water Plan will be updated as necessary.

- The City will cooperate with regional water users, including acequias, Santa Fe County, Native Americans, neighboring community water systems, domestic well owners, and other relevant parties in being stewards of our regional water resources. Both this Water Plan planning process and the WaterMAPS system simulation model could be modified to address water resource issues beyond the City's service area.
- The City will participate in regional and state-wide water planning efforts including the Jemez y Sangre Regional Water Planning Council, the "Upstream-Downstream" initiative (a planning group addressing inter-regional water plans in the Middle Rio Grande Valley), the State Water Plan, and state water planning legislative initiatives.



Section 2 Process for Developing the Long-Range Water Supply Plan

This section describes the overall process by which future supply options and portfolios were developed and evaluated. Additional detail on each component of the process is provided in the appendices of this report as specified in the text and figures within the following section.

2.1 Approach

The Water Plan applied an integrated, multi-objective approach to developing and evaluating "portfolios" (or groups) of water supply alternatives that could meet the City's projected 2045 demands. This approach reflects the diverse array of options potentially available to Santa Fe, and the complex nature of satisfying multiple and potentially conflicting objectives in meeting future water demands. Evaluations of water supply portfolios were conducted in an open and collaborative manner, including the integration of public input received at several key points throughout the Water Plan planning process (Appendix H).

A numeric evaluation process was employed to guide the evaluation of alternative supply portfolios, not to *choose* the top ranked portfolio. The strategies common to the highest ranked portfolios were considered independently, allowing the decisionmakers and the public to examine the tradeoffs between the top ranked alternative portfolios. The process eliminated less promising portfolios and provided information for discussion and decisionmaking.

Terminology used throughout this process includes:

- **Objectives:** The overarching criteria by which the alternative supply portfolios are compared (Section 2.2 and Appendix C)
- **Objective weighting:** The process of identifying the importance of each objective relative to the others (Appendix C)
- **Options:** Individual water supply components that can be implemented alone or in combination to meet future water needs (Appendix E)
- **Portfolios:** Combinations of individual options that together meet the projected 2045 water demand (Appendix G)

Initial elements of developing the Water Plan (Figure 2-1) focused on developing the information and evaluation tools necessary to construct and evaluate the alternative water supply portfolios. Figure 2-1 also indicates the appendices of this report where additional detail on each item can be found.

As indicated in Figure 2-1, the Water Plan developed and used a systems simulation model called the Santa Fe Water Management and Planning Simulation model, or "WaterMAPS." WaterMAPS is described in more detail in Appendix F and in the October 2005 WaterMAPS Model User Manual (CDM 2005). Outreach to the public and integration of public input was common to each step of the Water Plan, as further described in Appendix H.

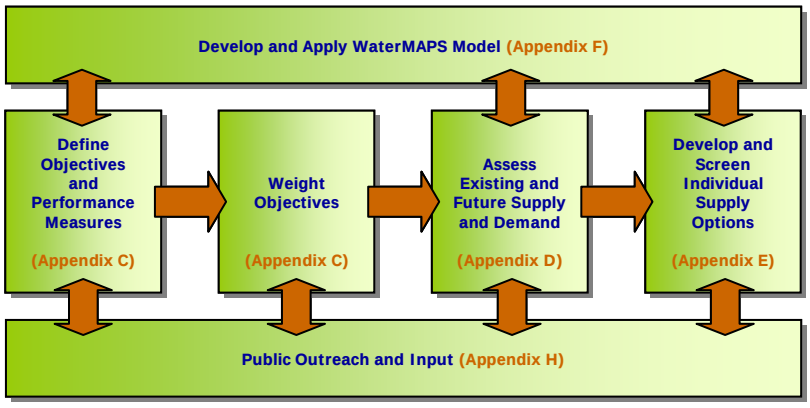


Figure 2-1 Initial Elements of Water Plan Development

Once the objectives, demand analyses, and individual supply options had been developed, water supply portfolios were developed and analyzed as indicated in Figure 2-2. Again, the figure indicates the location in this report where each element is described.

Specific "performance measures" were developed to quantitatively describe the degree to which each portfolio achieves the objectives. Details on the objectives, their components and weighting, and the specific performance measures are provided in Appendix C.

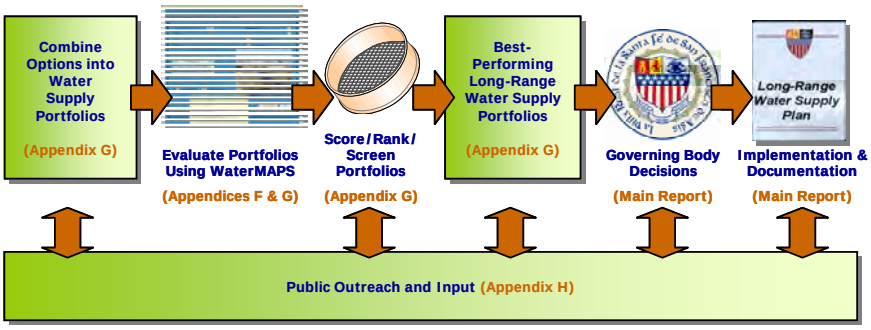


Figure 2-2 Development and Evaluation of Portfolios

2.2 Objectives

Six major water supply objectives were identified and used extensively in the development and evaluation of water supply portfolios in the Water Plan. The objectives are the underlying criteria by which the portfolios were described and compared.

Table 2-1 shows the objectives and their relative order of importance, as expressed by the Governing Body participants who completed a "paired comparison" weighting exercise in mid-2005. These results indicate that improving reliability and sustainability and protecting the environment are the qualities most important to the surveyed group in choosing a long-range water supply strategy.

Table 2-1 Relative Importance of Objectives from Paired Comparison Exercise*

Objective	Relative Importance
Improve Reliability and Sustainability	1
Protect the Environment	2
Manage Costs	3
Ensure Technical Implementability	4
Ensure Acceptability	5
Ensure Timeliness	6

** Ranking from 1 to 6 indicates decreasing order of importance, as indicated by Governing Body participants.*

2.3 Supply Options Considered

A broad range of supply options was considered as part of the Water Plan. Of particular import was that any future supply options integrate well with the strong existing supply foundation and recent improvements. Significant among the latest improvements are:

- State-of-the-art water conservation programs and participation
- Supplemental Buckman Wells 9-13
- Northwest Well
- Upgrades to the Canyon Road Water Treatment Plant (CRWTP), thereby increasing treatment capability to its original capacity of 9 million gallons per day (mgd)
- BDD
- Securing 3,000 AF SJC water lease with the JAN for 50 years
- Securing the City's SJC project water in perpetuity by amending the agreement with the Bureau of Reclamation to a repayment contract

Building on the findings of the City's 2003-2004 Coarse Screening analysis, the Water Plan investigated over 30 different supply options, representing the following ways of meeting future demands:

- Demand management including conservation
- Expand or modify use of existing surface water resources

- Expand or modify use of existing groundwater resources
- New sources of supply

Screening of individual supply options, described in Appendix E, removed many of the options from further consideration, for reasons such as cost, impact, or concerns over reliability. The evaluation and screening of options was a refinement of the options analyzed as part of the City's "coarse screening" analysis (Long-Range Water Supply Program Coarse Screening of Alternatives – Final Report, 2005 TetraTech).

Eighteen supply options were considered in more detail. Those options, their estimated yield (in AFY), and their estimated costs (expressed in terms of dollars per acre-foot [$/AF] in 2005 dollars) are listed in Table 2-2. The 5,500 AFY gap estimated in 2005, together with peak day and seasonal demands, was used as the target value for developing future water supply portfolios.

Table 2-2 Supply Options Considered in Detail

Option		Water Yield (AFY)	Unit Cost ($/AF)
1	Reduce Per-Capita Demand to 132 gpcd with More Aggressive Conservation Measures	1,367	$805
2	Reduce Per-Capita Demand to 122 gpcd via Temporary Emergency Drought Restrictions	2,734	$146
3	Increase Storage Capacity in Santa Fe River Canyon	100 (est.)	$3,772
4	Increased Use of BDD with No New Infrastructure	5,500	$960
5	Create Living Santa Fe River with Canyon Reservoir Releases	0	*
6	Conjunctive Use of Local Surface and Groundwater Rights	640	$672
7	Recharge and Recover Groundwater Using Rio Grande Water from BDD with No New BDD Infrastructure	5,500	$1,864
8	Increase Use of Existing St. Michael's Well Capacity	244	$121
9	Intensive Pumping of Existing Buckman Wells	5,000	$124
10	Rehabilitate City Well Field to Increase Production	1,865	$484
11	Purchase and Rehabilitate Existing Private Wells	150	$1,592
12	Additional Landscape Irrigation with Effluent	523	$2,962
13	Recharge City Well Field with Effluent via Injection Wells	1,000	$1,576
14	Augment Santa Fe River Flow through Town with Effluent	1,358	$1,910
15	Return Flow Credit and Increased Use of BDD with No New BDD Infrastructure	5,500	$734
16	Collector Wells at San Ildefonso	5,500	$1,423
17	Deep Wells in Caja del Rio Area	3,000	$1,541
18	Imported Water Requiring Treatment	5,500	$2,154

* The cost of this option would be the cost of the supply used to replace the reservoir release.

2.4 Development and Evaluation of Supply Portfolios

Portfolios of future water supply were developed by adding one or more of the supply options from Table 2-2 to the City's existing or planned (i.e., BDD) supply sources. Portfolios were developed with the overall goal of meeting the projected 2045 dry-year gap between supply and demand (5,500 AFY based on the 2005 analysis) and also to explore opportunities for the City to better meet future water demands according to the objectives of this Water Plan (see Section 3 and Appendix D).

Seven initial water supply portfolios (Table 2-3) were developed, each with a different area of emphasis, for comparison against the objectives. These portfolios included:

- Maximize use of existing infrastructure (Portfolios 1 through 3)
- Objective-based portfolios (seeking to identify the portfolios that would score best for specific objectives; Portfolios 4 through 6)
- Source-based (to demonstrate performance of a portfolio that includes return flow credits; Portfolio 7)

These initial seven portfolios were scored and ranked using the evaluation process described in Appendices B and G.

Based on the results of that evaluation, four additional "hybrid" portfolios were developed, scored, and ranked, each combining certain aspects of the best-performing initial portfolios. Additional detail on the portfolios' components and their performance relative to the objectives and performance measures is provided in Appendix G. The WaterMAPS model was used extensively in the characterization and evaluation of the portfolios, as described in Appendix F.

In general, portfolios that perform better rely on additional conservation, surface water (given its renewable nature), optimizing existing and planned sources, and consider releases from the canyon reservoirs to the Santa Fe River. This is described in more detail in Section 4 and Appendix G.

Table 2-3
Portfolio Quick Reference

Option		Water Yield (AFY)	Unit Cost ($/AF/Yield)	Option Cost Rank (1=low cost)	Portfolio							Hybrid Portfolio			
					1: Buckman Wells	2: Demand Mgt.	3: Increase BDD Use w/new Rights	4: Low Cost	5: Max. Water in Santa Fe Basin	6: High Reliability/ Sustain-ability	7: Increase BDD Use w/Return Flow Credits	A: Maximize Existing	B: BDD w/New Rights & Return Flow Credits	C: Max. Water in Santa Fe Basin	D: Max. Existing plus Santa Fe River Releases
					Max. Use of Existing Infrastructure			Objective-Based Portfolios			Source-Based	Based on Port. 2	Based on Port. 3 & 7	Based on Port. 5 & 6	Port. A + Resv Releases
Demand Management															
1	Reduce Per-Capita Demand to 120 gpcd with More Aggressive Conservation Measures	1,367	$805	7		✓						✓			✓
2	Reduce Per-Capita Demand to 110 gpcd via Temporary Emergency Drought Restrictions	1,367 - 2,734	$146	3		✓		✓				✓			✓
Expand or Modify Use of Existing Surface Water Resources															
3	Increase Storage Capacity in Santa Fe River Canyon	100 (est.)	$3,772	17											
4	Increased Use of BDD with No New Infrastructure	5,500	$960	9			✓		✓				✓	✓	
5	Create "Living" Santa Fe River with Canyon Reservoir Releases	0	--	--					✓					✓	✓
6	Conjunctive Use of Local Surface and Groundwater Rights	640	$672	5					✓					✓	
7	Recharge Groundwater Using Rio Grande Water from BDD with No New BDD Infrastructure	5,500	$1,884	13						✓				✓	
Expand or Modify Use of Existing Ground Water Resources															
8	Increased Use of Existing St. Michaels Well Capacity	244	$121	1				✓	✓			✓	✓	✓	✓
9	Intensive Pumping of Existing Buckman Wells	5,000	$124	2	✓			Partial				✓			✓
10	Rehabilitate City Wells to Increase Production	1,865	$484	4											
11	Purchase and Rehabilitate Existing Private Wells	150	$1,592	12											
Expand Reuse of Wastewater Effluent															
12	Additional Landscape Irrigation with Effluent	525	$2,962	16											
13	Recharge City Wells with Effluent via Injection Wells	1,000	$1,575	11											
14	Augment Santa Fe River Flow through Town with Effluent	1,358	$1,910	14											
15	Return Flow Credit and Increased Use of BDD with No New BDD Infrastructure	5,500	$734	6							✓		✓		
	Effluent Contracts at Existing Levels of Use	1,050	--	--	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
New Sources															
16	Collector Wells at San Ildefonso	5,500	$1,423	9											
17	Deep Wells in Caja del Rio Area	3,000	$1,541	10											
18	Imported Water Requiring Treatment	5,500	$2,154	15											
Additional Options Used in Hybrid Portfolios															
	Expanded BDD Use in Dry Year Pulling Water from SJC Storage	Portfolio Dependent	--	--								✓	✓		✓
	Additional Effluent Contracts for Major Nonpotable Users, up to a total of 12 gpcd	580	--	--								✓	✓		✓

One step in developing the Water Plan was identifying the City's projected future demand through 2045. The projected demand includes the City's current and future customer base and its other obligations for water service. The projected demands were compared to available supplies under varying hydrology conditions using the WaterMAPS model. This information was then used to develop estimates of the anticipated gap between the demands and the City's current sources of supply (as constrained by water rights, wet water availability, infrastructure, sustainability considerations, and operations).

3.1 Projections of Demand

Demand projections in the Water Plan were developed by:

- Projecting population within the City's service area
- Multiplying the projected population by a per capita water use rate to calculate the total potable demand within the City's service area
- Adding demands that are currently met with treated wastewater effluent or that could be met in the future with treated wastewater effluent
- Adding demands associated with the City's agreements with and obligations to other entities

Population projections for the City's service area were derived from estimates prepared for the Santa Fe subbasin by the New Mexico Bureau of Business and Economic Research, as used in the 2003 Jemez y Sangre Regional Water Plan. Based on these data, the City's service area population is expected to increase from about 78,800 in 2005 to about 122,000 in 2045 – an increase of 55 percent. The regional water plan projections adopted by the City assume a decrease in the annual growth rate from 1.7 percent in 2006 to 0.68 percent by 2045 (annual growth projections are in Appendix D).

The per capita rate of water use has a significant effect on the overall water demands for any major water supply system such as the City's. Per capita water rates, as calculated by the City's Water Division, encompass the total water delivered within the City's service area, divided by the estimated service area population:

$$\text{Per capita demand} = \frac{\text{(Gallons Produced) - (Wholesale Deliveries)}}{\text{Estimated Service Area Population*}}$$

* The estimated population is adjusted according to household occupancy outside the municipal boundary and by subtracting a population within the City estimated to be served by domestic wells only.

This amount includes the water used not only by residential users, but also by commercial and industrial users, and non-revenue water (about 10 percent) in the overall per capita rate. For example, tourism in Santa Fe is included in the calculated per capita rate, since our visitors use water during their visit.

Figure 3-1 provides an overview of historical per capita demands and those used in the Water Plan based on the 2005 analyses. Per capita rates used in the 2005 analyses (130 gpcd potable) reflect the significant progress Santa Feans have made in conserving water. Since 2005, even though the City has repealed mandatory water use restrictions, the City's per capita water use continues to drop (Appendix J).

For this Water Plan, the projected water use included both potable and non-potable water use. Non-potable use is estimated at 12 gpcd. The analyses conducted in 2005 assumed a potable demand of 130 gpcd. Given the success of conservation programs that have continued to lower the per capita consumption, a new demand projection is now possible based on 110 gpcd potable use (Figure 3-1). Additional information on

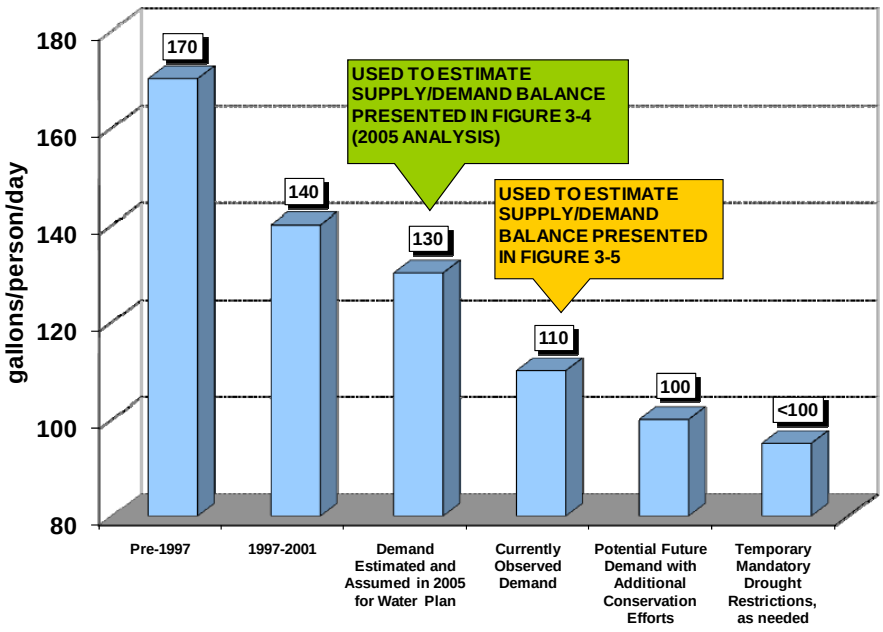


Figure 3-1 Historical and Projected Per Capita Potable Water Demands

this revision is included in Appendix J. It is important to note that the plan will assume that the potable demand of 110 gpcd could be further lowered through additional conservation efforts (100 gpcd in Figure 3-1) and temporarily lowered even more under mandatory drought restrictions (Figure 3-1). However, the temporary drought reductions become increasingly difficult as the permanent per capita use is decreased due to demand hardening.

Per capita demands used in the Water Plan are significantly lower than the 2003 Jemez y Sangre Regional Water Plan of 163 gpcd, reflecting a savings of more than 25 percent as compared to that plan's assumptions. The revision to the Jemez y Sangre Regional Water Plan Update (under review, 2008), uses a much lower value of 116 gpcd for the Santa Fe subbasin.

3.2 Available Supply

Santa Fe is fortunate to have a diverse portfolio of existing supplies that include both surface water and groundwater. Details of the existing system can be found in the City's 2001 Water Supply Analysis report. The existing sources are shown graphically in Figure 3-2.

Assuming the BDD is diverting SJC water, the City's typical and drought-year supply capacity were approximated including constraints related to water rights, infrastructure, and "wet water" availability using the WaterMAPS model. If no projects are implemented in addition to the BDD, the City's typical supply capacity will be approximately 19,900 AFY, assuming that:

- The City's SJC full water allocation of 5,230 AFY would be available for diversion at the BDD
- Approximately 5,000 AFY would be available from the Santa Fe River Water System (including St. Michael's well)
- The City well field will produce a maximum of 3,585 AFY, but there will be less pumping if other supplies are adequate
- Buckman Well Field will produce a pumping goal of 5,000 AFY maximum, but there will be less pumping if other supplies are adequate
- Effluent contractors will use about 1,100 AFY (2007 use)
- Any major supply emergency (e.g., fire in the watershed) would reduce available supplies

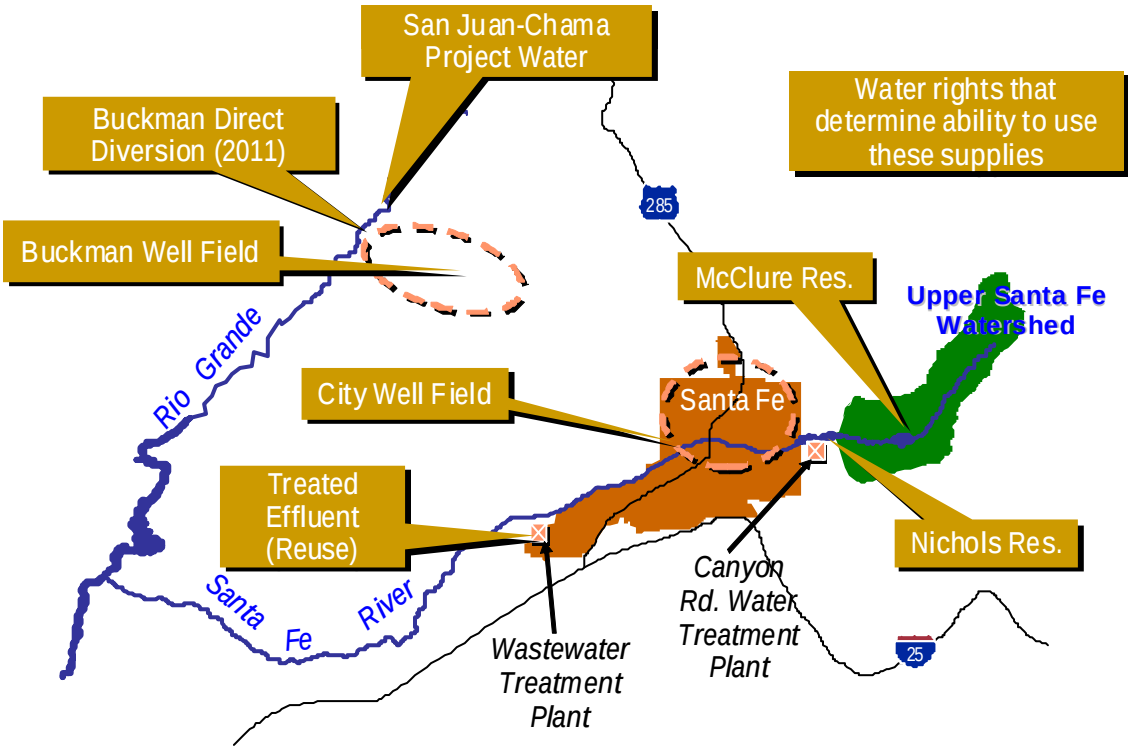


Figure 3-2 The City's Existing and Planned Sources of Supply Prior to this Plan

The City's drought-year supply capacity is estimated at 15,400 AFY (Figure 3-3). This drought-year supply estimate (15,400 AFY) differs from the normal year in that:

- Water would not be available for diversion at the BDD in 1 month of the year
- Only 800 AF would be available from the Santa Fe River Water System, including St. Michael's well (based on WaterMAPS output)

The available drought supply has not been reduced for any major supply emergency, such as a fire in the watershed or failure to the Buckman Well Field transmission trunkline.

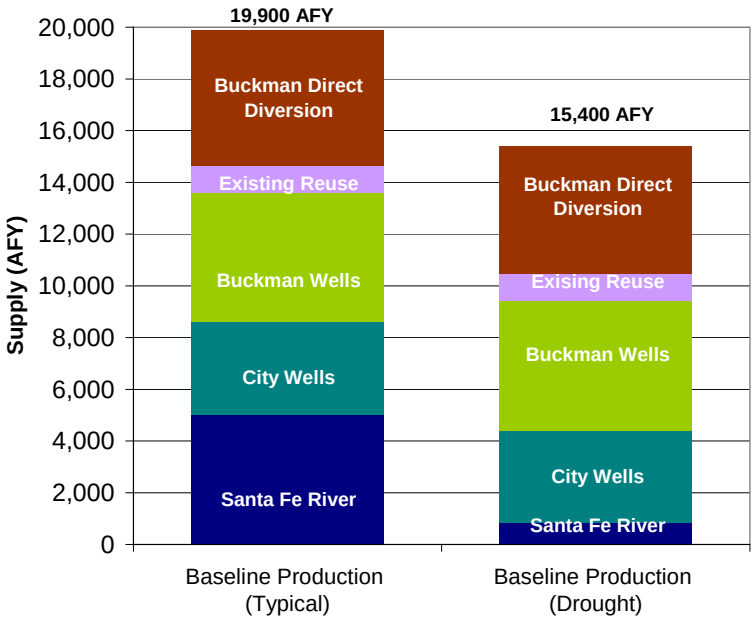


Figure 3-3 Effect of Drought on Existing Supply Reliability

3.3 The Water Supply Gap

As shown in Figure 3-4, using demand projections based on 130 gpcd developed in 2005 for the Water Plan, comparison of the 15,400 AFY drought year supply against the projected demands indicates that supply deficits could appear as early as about 2015 under drought conditions or about 2035 under typical precipitation conditions when the supply is 19,900 AFY. Deficits could grow to as much as 5,500 AFY in 2045 in a drought, but would be minimal – about 1,000 AFY – in typical precipitation conditions.

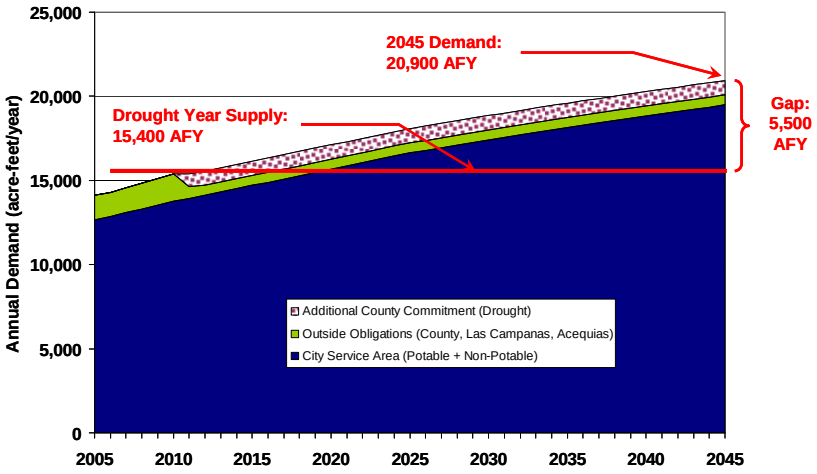


Figure 3-4 Summary of Projected Demands Based on 130 gpcd Estimates in 2004, Compared to Available Dry-Year Supply

The same analysis performed with demand estimates based on 110 gpcd (currently observed demand in the City) shows that the initial timing of the supply deficit shifts to 2021, as indicated in Figure 3-5, and the deficit in 2045 is reduced to 2,700 AFY.

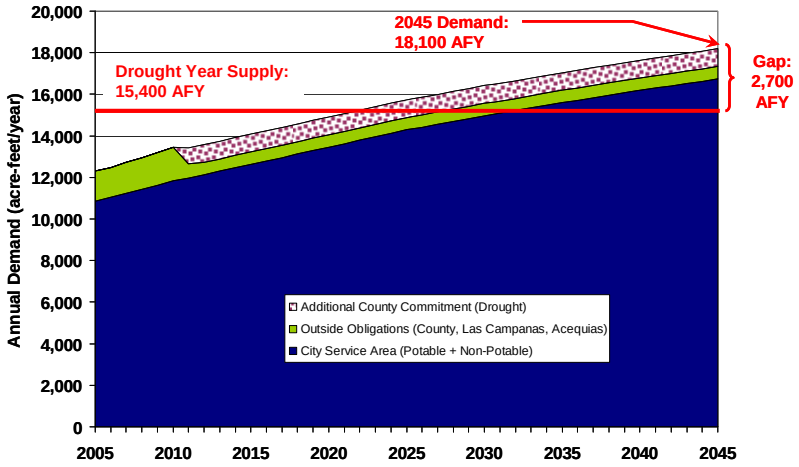


Figure 3-5 Summary of Projected Demands Based on 110 gpcd Estimates, Compared to Available Dry-Year Supply

The 5,500 AFY gap estimated in 2005, together with peak day and seasonal demands, was used as the target value for developing future water supply portfolios. Details of the water demand and gap analyses are included in Appendix D.

3.4 Planning for Uncertainty

Significant public input was received during the Water Plan development regarding growth in Santa Fe and the assumptions about future populations and water demands. Water supply planning inherently includes uncertainty. Population growth, future use patterns, energy conditions, increased local food production, timing and magnitude of droughts, and other changing hydrologic conditions (e.g., global warming) are unknown. Although the Water Plan anticipates water supply needs based on current policies and available population projections, the implementation of the strategies included in this Water Plan will provide the City the ability to withstand and adapt to a range of potential future conditions.

Reliability is accomplished through diversification and redundancy. During the analysis, a portfolio's reliability was measured by its reserve capacity (e.g., unused groundwater capacity, available water in storage, ability to reduce demands through temporary drought emergency measures, etc.; Appendix G). By securing two surface water supplies and by preserving the reserve capacity of its groundwater supplies, the City of Santa Fe is in a better position to deal with an uncertain future. Details of the drought reserve capacity estimated for each portfolio are provided in Appendix G.

Other uncertainty, such as the variation between the demand projections developed in the Water Plan and what actually occurs in the future will likely only affect the *timing* of the actions taken to meet increasing demands. That is, should growth in demands occur at a slower pace than anticipated in the Water Plan (whether due to slower population growth, a change in City growth management policies, or in lower per capita demands), new supplies or other actions will simply need to occur later as demands warrant. The reverse is also true. The shift in need for a new source of supply from 2015 in Figure 3-4 to 2021 in Figure 3-5 by the per capita water use reduction illustrates this point.

Supply enhancements typically need to be initiated 5 to 10 years prior to the time of their need, and thus can be timed according to actual growth rates and updated projections as appropriate.

The Water Plan used a comprehensive approach to develop, evaluate, and refine alternative water supply portfolios to meet projected 2045 demands. As part of the comprehensive planning effort that involved the City staff and its citizens, the WaterMAPS model (Figure 4-1) was used extensively in the technical evaluation and characterization of the alternative portfolios. Appendix G describes the process followed to develop portfolios, evaluate those portfolios, and identify the ones that best meet the objectives of the Water Plan.

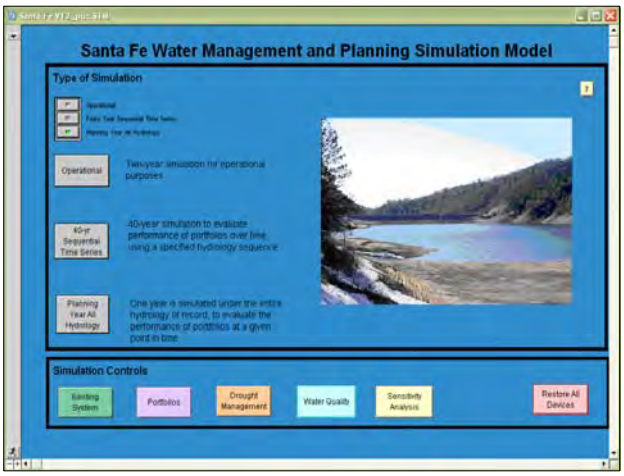


Figure 4-1 The Santa Fe Water Management and Planning Simulation ("WaterMAPS") Model

4.1 Top Performing Portfolios

Generally, the portfolios that scored the best included those that:

- Maximize the use of existing infrastructure and supply sources, thus reducing the need for new investments
- Use groundwater sustainably, thus protecting the City's most effective drought reserve

These characteristics are interwoven with several of the most important (most highly weighted) objectives, including reliability and sustainability, cost-effectiveness, and environmental protection.

The three portfolios that scored best in the multi-objective evaluation process were presented to a January 2006 study session of the City's Public Utilities Committee (PUC) for discussion with and direction from the City's Governing Body. Key components of those three portfolios include:

- Portfolio 3: Increased annual use of the planned BDD capacity by acquiring and diverting additional water rights on the Rio Grande
- Portfolio 5: Expansion of Portfolio 3 plus releases of water from the Canyon Reservoirs to the Santa Fe River, conjunctive use of local surface water and groundwater, and increased use of existing St. Michael's Well capacity
- Hybrid Portfolio D: Increased conservation, use of drought emergency management measures, releases of water from the canyon reservoirs to the Santa Fe River, and intensive use of the Buckman Well Field during drought

4.2 Chosen Future Water Supplies

In its January 2006 study session on the Water Plan, the PUC was asked to make a fundamental choice between increasing conservation and using drought management, versus intensive pumping of the Buckman Wells (e.g., Hybrid Portfolio D) and diverting additional water supply via the BDD (e.g., Portfolio 3). The PUC also was asked to determine the priority for options that include a living river (e.g., Portfolio 5).

Direction from the PUC to Water Division staff at that study session was to pursue increased conservation and diverting additional water supply via the BDD. That is, the City should implement additional conservation program enhancements and acquire additional water to divert through the BDD. Additionally, PUC directed staff to incorporate the "living" Santa Fe River into the City's Water Plan.

Thus, the resulting strategy for long-range water supply in Santa Fe includes the existing sources of supply in addition to the planned BDD facilities, and:

- Enhancements to the City's state-of-the-art conservation program to further reduce demands
- Use of emergency drought management measures in extreme circumstances
- Permitting and diversion of additional water through the planned BDD facilities without expanding them, either through acquisition of new rights on the Rio Grande or through a return flow credit pipeline
- Releases from the canyon reservoirs to the Santa Fe River
- Optimization of existing supplies

4.3 Effects of Implementing the Chosen Water Supply Strategies

Figure 4-2 illustrates the historical and projected use of Santa Fe's water supply and the significant changes in future use patterns that result from implementing this Water Plan.

- The completion of the BDD (yellow and red) reduces the City's reliance on groundwater (greens) and increases the use of renewable surface water
- Conservation (speckled blue) from current and future programs significantly reduces future demand
- Conservation (speckled grey) achieved between 2005 to 2007 has significantly reduced the water needed over the next 40 years
- The reduction in 2045 demand resulting from conservation is on the order of 6,000 AFY or more than 20 percent (from about 23,000 AFY in 2045 if conservation had not occurred, to about 17,000 AFY with conservation)
- The City will use treated effluent (lavender), as available and effective, to reduce additional demands on potable supplies
- The water available from the Canyon Reservoirs has been reduced to provide for the Santa Fe River
- The diverse portfolio of water sources allows the City to meet projected demand despite inherent variability in surface water supplies (blue) by using the Canyon Reservoirs when water is available, and by relying on the groundwater when surface supplies are limited

Ultimately, Figure 4-2 illustrates how the Water Plan achieves a diverse, robust, water supply portfolio for the City that includes groundwater reserves for drought protection and provides for a living river.

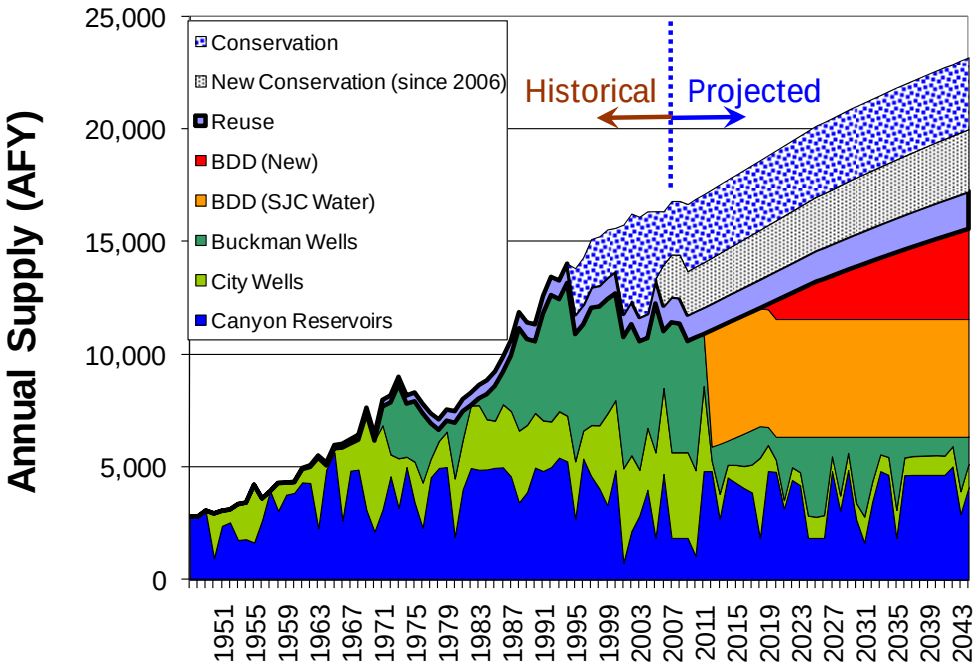


Figure 4-2
Historical and Future Sources of Supply

4.4 The Water Plan's Effect on Future Rates

Although the Water Plan determined that the City's water needs could be met through 2045 without a major infrastructure project, securing the City's water supply for the next 40 years will require additional investments beyond those being made by the City and its regional partners in the BDD. Money will be needed for:

- Costs associated with enhanced conservation and reuse programs
- Purchasing additional Rio Grande rights, and/or constructing an effluent return flow credit pipeline, for diversion and treatment through the BDD system
- Offsetting the reduction in raw water supply associated with Canyon Reservoir releases to the Santa Fe River

The Water Plan analyzed how the capital and operations and maintenance (O&M) cost of implementing two likely water supply portfolios would affect user rates over time. The two supply scenarios were:

- **Scenario A:** Optimization of existing sources, enhanced conservation, and purchase of new Rio Grande rights for diversion and treatment through the BDD
- **Scenario B:** Same as Scenario A, except instead of purchasing new Rio Grande rights, the City would construct and use an effluent return flow credit pipeline and divert/treat additional exchanged water through the BDD

The assumption was that purchasing Rio Grande water rights would cost $58 million in capital and $2.3 million/year in O&M cost, while building a return flow pipeline would cost $27 million in capital and $2.7 million/year in O&M cost.

For the financial analysis, the two scenarios above were added to the pre-existing projection of future capital and O&M costs from the City's water utility financial planning model. Figure 4-3 summarizes the results (Scenario A in maroon and Scenario B in cream) and compares them with the 2006 financial plan baseline (lavender).

While all three options will require a 1.5 to 2 percent annual rate increase overall, in the short term, both scenarios will cause the projected increases to outpace those projected in the current 2006 plan. Scenario A, because of the larger capital investment, shows a bigger potential impact on user rates. The large one-time rate adjustment in year 2010 could be smoothed into the rate increases in a number of ways. Because of the delay in the BDD and this Water Plan (see Appendix I), the timeline along the x-axis would also show a delay and adjustment.

Additional details, assumptions, the distribution of costs, and capital and O&M costs are included in Appendix I.

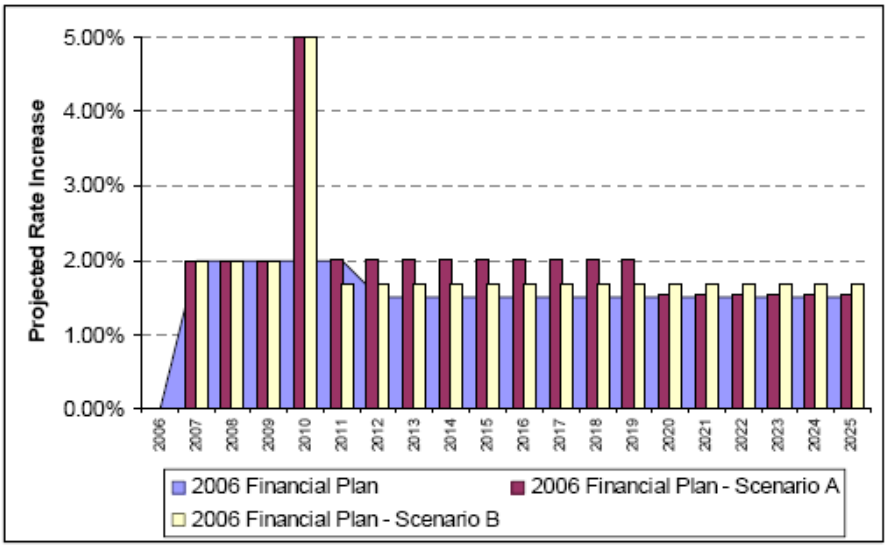


Figure 4-3 Comparison of Rate Increases

Scenario A will likely require the City to issue additional debt sometime around 2018 to help offset the higher capital costs inherent in that supply option. The financial model sized the 2018 bond issue at approximately $22 million. Based on assumptions as to term structure and interest rates, it is estimated that the additional debt will increase the City's then outstanding debt service obligation from $6.4 million/year (includes debt service from revenue bonds only) to $7.8 million/year. Scenario B will likely not require the City to borrow additional money.


CDM